Development of a System of Indicators for a Resource efficient Europe	SEVENTH FRAMEWORK PROGRAMME

DESIRE

Development of a System of Indicators for a Resource Efficient Europe

D5.3

Integrated report on EE IO related macro resource indicator time series

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About DESIRE

DESIRE is a FP7 project that will develop and apply an optimal set of indicators to monitor European progress towards resource-efficiency. The project runs from September 2012 to February 2016. We propose a combination of time series of environmentally extended input output data (EE IO) and the DPSIR framework to construct the indicator set. Only this approach will use a single data set that allows for consistent construction of resource efficiency indicators capturing the EU, country, sector and product group level, and the production and consumption perspective including impacts outside the EU. The project will:

- Improve data availability, particularly by creating EE IO time series and now-casted data
- Improve calculation methods for indicators that currently still lack scientific robustness, most notably in the field of biodiversity/ecosystem services and critical materials. We further will develop novel reference indicators for economic success.
- Explicitly address the problem of indicator proliferation and limits in available data that have a 'statistical stamp'. Via scientific analysis we will select the smallest set of indicators giving mutually independent information, and show which shortcuts in (statistical) data inventory can be made without significant loss of quality.

The project comprises further Interactive policy analysis, indicator concept development via 'brokerage' activities, Management, and Conclusions and implementation including a hand over of data and indicators to the EU's Group of Four of EEA, Eurostat, DG ENV and DG JRC.

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Executive Summary

A key working hypothesis of DESIRE is that an Environmental Extended Multi Regional Input Output database (EE MRIO) is a very powerful way to store environmental, social and economic data for further analysis and indicator construction. The overall objective of work package 5 within DESIRE was to compile such a database assembling multiple data sources into one comprehensive description of the global economy and its environmental impacts. This report covers the development of this database: EXIOBASE 3. The report documents the compilation of the time series of Supply-Use tables (SUT), the data processing of the social and environmental satellite accounts and the assembly of the Multi Regional Supply-Use (MR SUT) and EE MRIO.

EXIOBASE 3 builds upon existing databases, which were developed in previous projects (EXIOBASE 1 - EXIOPOL, fp6: A. Tukker et al. 2013; EXIOBASE 2 - CREEA, fp7: Wood et al. 2014). In EXIOBASE 3, the level of detail in the description of the economy is consistent with the previous version EXIOBASE 2, as is the implementation of the economic and environmental accounting principles proposed in the UN System of Economic and Environmental Accounts (European Commission et al. 2012). The geographic focus of EXIOBASE 3 is kept at the country level of the EU (now including the new member state Croatia), with adequate description of major non-EU economies. That ensures that reasonable estimates of resource efficiencies under consideration of upstream resource use of imports and exports can be provided.

EXIOBASE 3 pushes the state of the art in the field of global EE MRIOs. EXIOBASE exhibits a consistent sector classification of 200 products and 163 industries for all included countries and regions. The historic time series, ranging from 1995 to 2012, provide a description of the global economy consistent with international databases ("United Nations Statistics Division - National Accounts" 2013; FAO Statistics Division 2012; International Energy Agency 2012 etc.). To date, EXIOBASE 3 is the only now-casted EE MRIO database, with time series running to 2016. Economic parameters of the now-casted years follow the estimates given by the International Monetary Fund ("IMF World Economic Outlook Database List" 2015). Trends in the change of the economic structure of SUT data are extrapolated from observed trends in the historic time series and resource usage is now-casted based on latest available resource efficiency data.

The new version of EXIOBASE provides policy-makers with a unique tool to assess the outcome of policies set in place to reduce environmental impacts and increase resource efficiency. With its high sectorial detail and the wide spectrum of environmental data consistently included in EXIOBASE, the now-casted EXIOBASE provides a very valuable tool for a range of environmental-economic assessments. Most importantly, EXIOBASE can assist in the implementation of the Resource Efficiency Roadmap (European Commission 2011a) both with economy-wide assessments, e.g. to produce aggregated headline indicators, as well as on assessments of the Roadmap's priority areas, such as energy, food, buildings and mobility. EXIOBASE is also of high importance for assessments in the context of the transformation towards a competitive, low-carbon, economy (European Commission 2011b), as well as specific environmental strategies such as the EU Blueprint to safeguard Europe's Waters (European Commission 2012) or EU's biodiversity strategy (European Commission 2011c).

1 Introduction

Effective policies to reduce the environmental impacts of our society require a consistent accounting framework to assess these impacts. Such a framework should not only account for environmental pressures occurring within the borders of a country and linked to ongoing production activities (production based accounting) but should also allow to consider environmental pressures embodied in imports and exports. The latter facilitate the tracing of environmental pressures from the place of production through the global supply chain to the final consumer (consumption based accounting). Indicators based on consumption based accounting are also known as various types of 'footprints' and are increasingly used for informing policy makers as well as the public about ongoing environmental (Arnold Tukker et al. 2014; Steen-Olsen et al. 2012; Kanemoto et al. 2013; United Nations University and International Human Dimensions Programme on Global Environmental Change 2012) and social problems (Simas et al. 2014; Alsamawi, Murray, and Lenzen 2014).

Environmentally Extended Multi Regional Input Output tables (EE MRIOs) emerged as the main framework to provide a comprehensive description of the global economy and its effects on the environment. Several EE MRIOs have been compiled recently (A. Tukker and Dietzenbacher 2013); often with a specific focus (economy: WIOD, global country coverage: EORA). The EE MRIO EXIOBASE (A. Tukker et al. 2013; Wood et al. 2014) stands out by (1) providing the highest level of sector detail as well as for environmental interventions and (2) being consistent with the guidelines laid out by the UN System of Environmental-Economic Accounting (European Commission et al. 2012).

In the latest version of EXIOBASE (v2.2) the global economy is described by:

- 43 explicitly modelled countries (EU 27 plus 16 major economies)
- 5 rest of the world (RoW) regions (per continent)
- 200 products
- 163 industries (including 12 different electricity generation technologies)
- over 700 extension (28 different types of air emissions, Nitrogen and Phosphorous emissions to water and in water, usage a large number of products are covered and an especially high level of spatial detail is provided with regard to agricultural water consumption)

The development of EXIOBASE aimed to provide a database that captures the interconnections between major economies with the high resolution necessary to assess the multidimensional environmental problems we are currently facing.
This implies a high sector disaggregation especially for those sectors connected to resource extraction (as for example analysed in Huysman, Schaubroeck, and Dewulf 2014) and energy sectors (to assess the impacts associated with the different renewable energy sources as for example in Hertwich et al. 2014). As such, EXIOBASE forms the backbone for the indicator development and assessment within DESIRE.

One necessity for policy relevant indicators is to track performance over time and to estimate indicator values close to the time of policy decision making. In contrast, one major drawback of EXIOBASE 2 is the single data point for 2007. Therefore, a major effort in DESIRE consisted of developing a time series of EE MRIO tables based on EXIOBASE 2. This new EXIOBASE 3 inherits the high level of sector and environmental stressor detail from its precursor. To account for the expansion of the EU, EXIOBASE 3 was developed with the full EU28 country set (including the new EU member Croatia). To further improve the usefulness for evidence based policy making, the EXIOBASE 3 time series was now/fore-casted to the year 2016.

The report is structured as follows. Section 2 summarises the methodology for compiling EXIOBASE 3. The individual subsections are linked to detailed descriptions provided in the annex reports tied to this deliverable. Section 3 presents some initial results from the analysis. This aspect of the work will be further elaborated in another work package of DESIRE (wp9). Section 4 concludes this deliverable and the whole work package 5.

2 Methods

2.1 Monetary time series

The compilation of the MSUT time series followed a top-down approach. At the top level, macro-economic parameters were obtained from the United Nation (UN) National Accounts Main Aggregates Database ("United Nations Statistics Division - National Accounts" 2013), including value added per broad sector, GDP, and total import and exports. Only minimal refining steps were necessary to obtain consistent macro-economic data, and the refined data were kept as an overall constraint for all further processing steps, ensuring that the full time-series is benchmarked to this dataset. Global trade imbalances at the country level were resolved at this step.

Detailed industry and product output values were gathered from various national account databases and some international databases such as FAOSTAT and IEA energy balances, (FAO Statistics Division 2012; International Energy Agency 2012). Product and service level trade data originated from the BACI database (balanced product trade data based on the UN Comtrade database, Gaulier and Zignago 2010), the energy trade data (given by the International Energy Agency, IEA, "International Energy Agency Data Services" 2015) and the UN services trade database ("UN Service Trade Database" 2015). These three data sources were combined and reconciled against product output in EXIOBASE 3 classification, with explicit control for international transport margins and re-exports based on the previous EXIOBASE 2 (Wood et al. 2014). The resulting bilateral trade-cube (product by exporter by importer) was reconciled against the macro-account trade data and balanced in order to match the top level trade data.

Economic structural information was collected in form of technical coefficients of Supply and Use tables and/or Input-Output tables from national statistical offices. This data were converted into the EXIOBASE classification and served as the basis for informing about structural change in the economies starting from the EXIOBASE 2 base year 2007. Data on temporal structural change was used in preference to directly using individual country MSUT data, because it allowed for explicit control of "conceptual" breaks in data series common in MSUT data produced over time and under different classifications and versions of the System of National Accounts. As such, MSUT estimates for years except 2007 are based on structural change, and are not guaranteed to match the individual country MSUT tables in other years.

In a final step, the technical coefficient and the industry output data were combined and the resulting Supply-Use tables were balanced respecting the balanced trade data and macro-economic parameters. A mathematical programming approach, minimizing information gain between the initial and final system, was chosen for balancing.

The resulting multi-regional MSUT time series ranges from 1995 to 2012 for 44 countries (28 EU member states plus 16 major economies) and five rest of the world regions (Europe, Asia, Africa, America, Middle East). MSUTs exhibit a consistent sector classification of 200 products and 163 industries.

2.2 Energy accounts

Physical energy flows play an important role as environmental extension in EXIOBASE. In the database this group of extensions depicts the supply and use of around 60 primary and secondary energy products. Likewise, the database includes the emission relevant energy use, which provides the basis to calculate the air emissions of 27 substances arising from combustion processes. This type of emissions represents one of the main flows covered in air emission accounts.

The overall approach used to calculate the energy supply and use tables (ESUTs) is very similar to the one applied in previous versions of the database (Wood et al. 2015; Arnold Tukker et al. 2013). Thus, energy balances are first aligned with the system boundaries followed in the System of Economic-Environmental Accounting (SEEA) and then physical flows of energy supply and uses are allocated to the EXIOBASE industries, final consumption categories and products. In doing so, the accounting rules provided by recognised international institutions are followed (UNDESA 2013; Eurostat 2014). In the last step, natural inputs and energy residuals are added to the energy flows taking place within the economic system, thereby generating complete energy accounts.

The International Energy Agency's extended energy balances (IEA 2013a; IEA 2013b) are the starting point to generate energy accounts. Energy balances and energy statistics follow the territory principle, i.e. they account for the supply and use of energy within the borders of a territory. In contrast, the SEEA, and by extension the physical energy flow depicted in ESUTs, follow the resident principle, i.e. covers the activities carried out by the resident units of a country, independent from where these activities take place. Thus, the gap between the territory and residence principles has to be bridged in order to comply with the system boundaries of the SEEA. International transport activities are the main elements affected by this boundary issue and therefore have to be adapted to the SEEA rules. To do so, several transport models have been built to properly allocate the use of fuels from international marine, fishing and air transport activities. Additionally, data from Eurostat and other assumptions have been used to estimate the amount of fuel imported through tank tourism both from households as well as from road freight and passenger transport.

Once energy supply and use tables are aligned with the residence principle and consolidated following the energy flow and energy product classification of the International Energy Agency, these flows and energy products are allocated to EXIOBASE industries, final consumption categories and products by means of a variety of auxiliary datasets. The resulting physical energy flow accounts contain separate matrices depicting the supply and use of natural inputs, products and energy residuals in accordance with the overall scheme described in the SEEA.

2.3 Emission accounts

Emissions to air are one of the main extensions in EXIOBASE. These have been calculated at the global level in a consistent way for all countries and sectors to the extent possible, covering each country individually and the full time series for 1995-2011 (annual totals). The approach is similar to the earlier approaches applied in EXIOBASE 1 (Arnold Tukker et al. 2013) and EXIOBASE 2 (Wood et al. 2014).

Several datasets exist which have complete or partial sets of global emissions to air on a territorial basis (e.g. IIASA GAINS, JRC EDGAR, as well as official reported air emissions by individual countries to International Conventions), and also the environmental accounts reported to Eurostat. Many of these datasets may not always be as detailed, complete, transparent and methodologically consistent as we would like to have for providing a comprehensive picture of the air emissions connected to economic input-output databases.

The calculation of air emissions has been conducted by combining activity data with consolidated emission factors retrieved from the TEAM model (Pulles et al. 2007). This model has been filled with emission factors from various sources, including from the Guidelines for national Greenhouse Gas and Air Pollutant Inventories (IPCC 2015; European Environment Agency 2009) and from the GAINS model (Amann 2009; IIASA 2013). The model chooses for each activity the most appropriate technology or set of technologies. The main advantage of using this model is that it allows for the introduction of new (mostly cleaner) technologies over time, thus changing the emission factors associated with certain activities.

For emissions arising from combustion processes energy use data is combined with emission factors obtained from the TEAM model. In order to do so, the energy balances from the International Energy Agency (IEA 2013a; IEA 2013b) have to be aligned with the system boundaries described in the System of Environmental-Economic Accounting (SEEA), which follows the so-called residence principle. Thus, the balances have to be bridged between the territory principle (on which the energy balances are based) and the residence principle. As a result, the international transport activity data has to be reallocated in the system following internationally agreed guidelines (UNDESA 2013; Eurostat 2014). This consolidated activity data is combined with emission factors that have been previously checked as explained in the annex report. The resulting emissions are then allocated to the EXIOBASE 3 industries, final consumption categories and product groups based on auxiliary datasets.

For emissions resulting from non-combustion activities, activity data are collected from various sources (e.g. UN Statistics, USGS, BGS, FAOSTAT, etc.) and combined with one or more chosen technologies, similar to the combustion emissions. The non-combustion emissions are then each associated to one or more DESIRE products, either in the supply or the use of these products.

2.4 Water accounts

For the compilation of the environmental extensions in the areas of water use and water consumption for the EXIOBASE 3 the two basic data sources used were the Water Footprint dataset (Mekonnen and Hoekstra 2011) for agricultural water consumption based on FAO data and the WaterGAP model (Flörke et al. 2013) for industrial water use and water consumption. These databases are currently among the most comprehensive global databases with the agricultural water consumption datasets. They encompass a vast amount of agricultural categories and the WaterGAP data set covers a large number of livestock categories as well as electricity producing and manufacturing sectors; the latter being an area where special requirements of an MRIO system meet the general poor data coverage situation. The extensions on water use and water consumption in the EXIOBASE encompass 13 categories for water consumption in agricultural activities for both green and blue water, 12 categories of blue water consumption in livestock production, 7 blue water consumption categories in aggregated manufacturing sectors and 2 related to electricity production. For the 7 manufacturing and the 2 electricity production sectors, also data on withdrawal of blue water are provided. The WaterGAP model currently covers a time period 1950-2010. Values for 2011 were extrapolated. Currently published Water Footprint data cover the period 1996-2005 – with an average value provided for 2007 being used to up- and downscale data on agricultural production for the years 1995-2011. Furthermore, the data were extended in the area of water requirements for grazing.

2.5 Material accounts

For the compilation of the material extensions in EXIOBASE 3, the main basic data source for the environmental extensions related to material extraction was the SERI/WU Global Material Flow Database (available at www.materialflows.net, SERI and WU, 2014). This database currently covers more than 300 different types of biotic and abiotic raw materials and more than 200 countries.

In the course of DESIRE's WP 5 work, updates of this database were performed to include the years 2010 and 2011. In addition to the data update, various improvements of the underlying data and calculation routines were performed, for example, a split between industrial roundwood and firewood, in order to be in line with the land use data; and a completion of minerals data using various geological data sources.

Compared to earlier versions of EXIOBASE, the list of material extensions has been significantly extended. The list of material extensions now covers 222 items, of which 193 are extensions related to biomass extraction (i.e. the full FAO product list), 12 refer to metal ore extraction, 8 categories related to industrial and construction minerals, and 9 categories cover the extraction of fossil fuels (i.e. the full IEA list of primary products).

Significant work in DESIRE was also devoted to improve the concordance between various parts of EXIOBASE and the allocation of extensions to the EXIOBASE sectors. A new concordance table between FAO, CPA and EXIOBASE was developed, which is now applied across all parts of EXIOBASE (MSUTs, PSUTs and extensions) and thus ensures high consistency of data related to biomass flows.

In EXIOBASE 3, the extraction categories of fodder crops, grazing and crop residues were taken out of the sector "crops nec" and were allocated directly to the respective animal production sectors. In order to implement this approach, a new allocation scheme was developed using detailed data on fodder crop use by various animal production sectors from the AgroSAM database.

2.6 Land accounts

Land-use data are integrated into the EXIOBASE 3 model in a time series for every year from 1995 to 2011. The scope was to develop a consistent land-use framework based on a combination of statistical data (e.g., FAOSTAT 2014) and spatially-explicit datasets (e.g. Erb et al. 2007; Hansen et al. 2013). In the EXIOBASE extension the land-use data for each nation or region will add up to country's/region's total area. Additionally, the presented land-use framework and the specific allocations to 20 industrial sectors (also named extraction types) are consistent with a spatially-explicit land use dataset for the year 2000 that was developed in parallel for WP 7. These spatially-explicit data are used to establish relationships between biodiversity loss and the EXIOBASE sectors. The land use data is also fully consistent with the material flow data in the EXIOBASE model.

The main data source for the land use extensions in EXIOBASE 3 is the FAO's online statistical database FAOSTAT (2014). The FAOSTAT database is the most comprehensive database with regard to national level statistics on agricultural production and land use. FAOSTAT data are available for about 250 countries on a yearly basis from 1961 onwards. In addition to the FAOSTAT data, we used country specific information from various sources (e.g., Council of Agriculture 2011; Krausmann et al. 2013; Erb et al. 2007) to complete missing data points or to account changes in country boarders during the time series.

The land-use accounts are compiled along five major land-use categories: cropland, grazing land/pasture, forest land, settlement areas and other land. Cropland data is further split up into eight subcategories, in line with the sectors available in EXIOBASE: two sectors corresponding to a single crop (rice, wheat) and five sectors representing aggregates of crop types (e.g., other cereals and oil crops). In our data we also account for national-level differences in cropping frequencies: a plot of land may be harvested more than once per year (in multi-cropping systems) or less than once (in fallow systems). The FAOSTAT provides data on annually harvested areas, thus counting double-cropped areas twice and omitting fallow areas. We developed a procedure to correct for multi-cropping and fallow and arrive at values matching the reported overall agricultural cropland areas at the national level: for fallow land we assume regionalised crop rotations and allocate the fallow land to crops cultivated within the rotations. In case of multi-cropping, we lower the areas of crop types typically cropped more than once a year in the respective regions and countries.

To match land area used for the cultivation of fodder crops and for livestock grazing with the EXIOBASE sectors, we develop a procedure to allocate these land-use types to five livestock sectors: raw milk, cattle meat, pig meat, poultry and other meat. The same procedure is applied to the material flow data.

The land-use category forest is divided into used forest and unused forest. While the latter land area is not integrated into the EXIOBASE 3 model, used forest areas are further differentiated into land used for the production of industrial roundwood and for wood fuel. These two different wood removals are both allocated to EXIOBASE's forestry sector. However, in a later version "wood fuel land" could be directly allocated to final household consumption (based on statistics on the share of wood fuel consumed by households). The category settlement areas includes land used for transportation infrastructure and for human settlements based on data provided by Krausmann et al. (2013) and is directly allocated to the final demand sector.

2.7 Waste accounts

Waste is assumed to be the materials, processed or not, that enter into the activities but that are not incorporated in their outputs, neither discharged as emissions. In this way, the waste is what assures that the law of the conservation of the mass is respected within each and any activity of national economies. Therefore, in DESIRE waste has a wider meaning than that commonly used because it includes both waste residuals and waste products (UNDESA 2013; Schmidt et al. 2012). As in CREEA (Wood et al. 2014), waste is defined as 'material for treatment' (Schmidt et al. 2012) that includes all the materials that need further re-processing in order to be turned into new products, emissions or stock addition in landfills. This treatment may be re-processing of scrap into new materials that can substitute virgin materials, it may be waste incineration, landfill, waste water treatment, composting, or just storage of uncontrolled discharged waste in the environment involving emissions from degradation.

The idea behind the adoption of this definition is that the 'recycling' can be properly modelled. Indeed, the recycling is the processing of waste and scrap and other articles, whether used or not, into secondary raw material. A transformation process is required, either mechanical or chemical. This definition of waste is fully in line with the technical principle widely used in the LCA's community (Weidema et al. 2011, 30). Instead, this definition diverges from an economic perspective that considers, for example, homogenous scraps with a positive economic value as products and not as waste (UNDESA 2013). Figure 2.1 shows the approach adopted.

Figure 2.1 Input- and output flows for a generic activity. The output of 'materials for treatment' is the calculated balancing item from which waste accounts are derived.

Waste accounts are divided into two sets. The first one relates to the users of waste, while the second one with the producers. Waste treatment activities are essentially filling the first account, while all the activities and final consumers encompass the second one. Trade of waste is also taken into account. In practice, a third account is produced showing the unregistered waste, which equals the supply of waste less the use of waste. This third account contains residual values.

Waste accounts are resulting from a general procedure determining PSUTs, or better the Hybrid SUTs (HSUTs) which includes the physical layer. The module of the HSUTs-generation procedure that concerns the determination of the waste accounts is based on what was developed within the Forwast project (Schmidt, Weidema, and Suh 2010) plus further developments for EXIOBASE 2 within the CREEA project (Merciai et al. 2013; Schmidt et al. 2012).

In the Forwast project time-series of waste accounts were determined; hence in the DESIRE project that methodology is fully applied. In EXIOBASE 2 only one accounting period, i.e. 2007, was considered; hence it was not possible to develop the full Forwast procedure.

The Forwast procedure (Schmidt, Weidema, and Suh 2010) includes the account of stock addition to which is applied a degradation function to estimate the delayed production of waste. As a consequence, the supply of waste in an accounting period is the sum of the commodities purchased and discharged within the accounting period, plus what was traded in previous periods and has become obsolete. The use of waste is what emerges from statistic sources plus some own estimations for detailing or extending the data coverage.

The final version of waste accounts will be provided when the PSUTs, or better the Hybrid SUTs (HSUTs) which includes the physical layer, are completed, as they result from the same algorithm. The HSUTs algorithm needs the finalized version of MSUTs to start running, hence only after few months from the final delivery of MSUTs the hybrid version can be ready. The estimated delivery date is set to June 2015.

However an estimation of the use of waste accounts is introduced in the final version of MSUTs. This estimation is expected not to change considerably from the final version determined within the HSUTs generation procedure.

2.8 Labor accounts

The socioeconomic accounts are comprised of total employment and of vulnerable employment, both in persons and in hours. For total persons in employment and for hours in total employment, the indicators were further disaggregated in gender and skill levels. These indicators represent an expansion of the labor indicators in EXIOBASE 2. The labor data was extended from availability by skill levels in the previous version to the availability by both skill levels and gender. Vulnerable employment is also a new addition to the socioeconomic indicators in EXIOBASE 3.

Labour and hours worked accounts were collected from the International Labour Organization (ILO)'s LABORSTA and ILOSTAT databases (ILO 2014; ILO 2013) and from the OECD's Statistics (OECD 2014). Vulnerable employment consists of self-employed persons and unpaid family workers. Skill levels – high-, medium-, and low-skilled work – correspond to that of the International Standard Classification of Occupations (ILO 2012). Collected socio-economic indicators correspond to the period from 1995 to 2012.

Socioeconomic indicators were collected for the period from 1995 to 2012. Adjustments were made to disaggregate and combine different data sources and industry classifications throughout the period. Those adjustments are detailed on the annex report for labor accounts.

2.9 Now casting

The monetary supply use tables (MSUTs) of the historic EXIOBASE 3 time series were now-casted based on the macro-economic estimates of the World Economic Outlook Database of the International Monetary Fund ("IMF World Economic Outlook Database List" 2015). This entails, that macro-economic growth rates in the now-casted EXIOBASE years are consistent with the estimates of the IMF. Structural changes in the economy were projected by forecasting the last available data point with the estimated mean change for each technical coefficients of the MSUTs. Resource usage for the now-casted years was estimated based on the last available data point on resource efficiency in the historic time series and overall activity level in the nowcasted MSUT account. The impact of these or alternate assumptions are still to be explored. Emissions were recalculated using the emission factors for the last available year and the now-casted emission relevant energy use. The now-casted years were incorporated in the new EXIOBASE 3 database, providing a time series of EE MRIOs ranging from 1995 to 2016 with a consistent level of detail.

2.10 Compilation

Integrating all the monetary supply-use tables, physical supply-use tables, trade data and economic and environmental extensions into a single consistent format that can be readily exported in the form of multi-regional supply – use tables and/or different types of multi-regional input-output tables requires a rigorous approach.

The rigorous framework to integrate all the data is based on the EXIOBASE database and the three EXIOBASE application modules that were developed in the EXIOPOL and CREEA projects. The EXIOBASE database is a relational database that guards the integrity of the data. The three application modules are small JAVA programs that import, transform and export the data in the database. The database and the application modules all received small updates to make them suitable for the requirements posed by the DESIRE project. Particularly the trade-linking routine has been overhauled.

The EXIOBASE application modules were originally developed assuming that the data handling was an interactive process. In the EXIOPOL and CREEA project where data for a single year need to be handled, this user interaction was not an issue. However, in the DESIRE project a time series from 1995 to 2016 was processed. While EXIOBASE itself could easily handle this amount of data the required user interaction became a nuisance. Further development of the EXIOBASE programs should focus on further automation and (partly) stepping away from graphical user interfaces as a means to handle the data. The framework that is already available provides a very good basis for that.

3 Results

Access to the resulting database is available on request, and publication of the data will be explored during the remainder of this project. Suffice to say, that with several hundred million data points in the database, a short summary of the characteristics of the data, and select results are shown here.

3.1 EXIOBASE 3

	EXIOBASE 2	**EXIOBASE 3**
Base year(s)	2007	**1995 – 2016** *)
Products	200	**200**
Industries	163	**163**
Countries	43 (27 EU member plus 16 major economies)	**44** (28 EU member plus 16 major economies)
Rest of the world regions	5 (Europe, Asia, Africa, America, Middle East)	**5** (Europe, Asia, Africa, America, Middle East)
Water accounts	172 (Water blue and green per source, including final demand)	**172** (Water blue and green per source, including final demand)
Material accounts	48 (Used extractions) 48 (Unused extractions)	**189** (Energy products, including final demand) **222** (Used extractions) **222** (Unused extractions)
Land accounts	15	**13** (Including build up land for final demand)
Social accounts	6	**14** (Employment per skill level and gender; vulnerable employment)
Emissions	26 (from combustion including final demand) 11 (non-combustion) 3 (HFC, PFC, SF6)	**26** (from combustion including final demand) **11** (non-combustion) **3** (HFC, PFC, SF6)

Table 3.1: Comparison of the characteristics of EXIOBASE 2 and EXIOBASE 3. *) Historic time series for up to 2012, the rest of the years has been now-casted.

3.2 Country data

Production and consumption based accounts for all extension can easily be compared based on EXIOBASE 3. Here we present a selection of stressor per country and region, using the case of industrial roundwood use as an example. A full analysis of EXIOBASE 3 will be undertaken in the forthcoming work package 9.

3.2.1 Forest land – industrial roundwood use

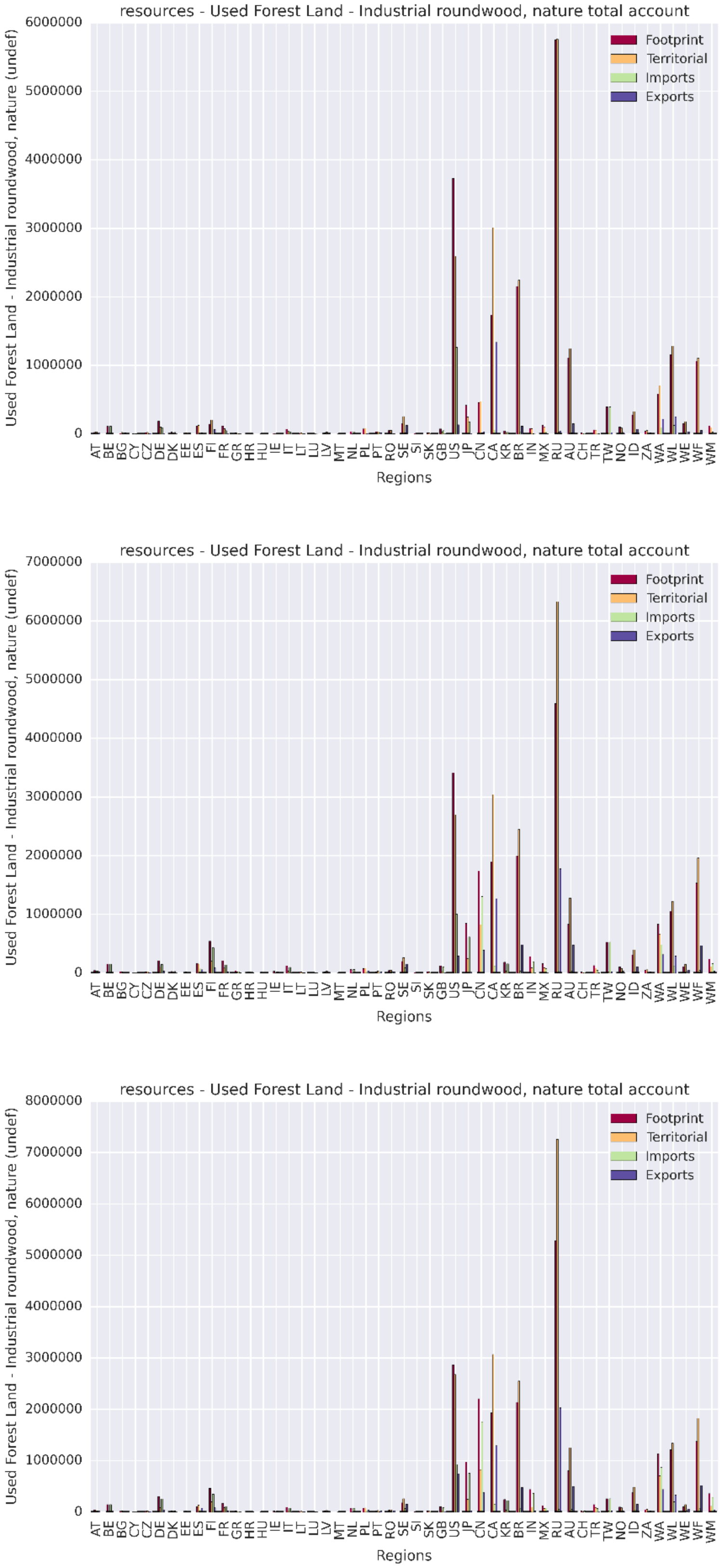

Fig 3.1: Industrial roundwood from forest use – 1995 (top), 2007 (middle), 2011 (bottom)

4 Discussion

This report describes the compilation of the Environmental Extended Multi Regional Input Output (EE MRIO) database EXIOBASE 3. EXIOBASE 3 builds upon EXIOBASE 2 (Wood et al. 2014), most importantly it inherits the high sector level detail and the SEEA consistency from its precursor. It goes beyond the data gathered in EXIOBASE 2 by providing a time series of EE MRIOs and incorporating further detail in regard to material extraction data.

4.1 Task execution

The description of work (DoW) states four main objectives (and connected tasks) for this work package (wp5: EE IO time series and related 'macro-resource' indicators):

- **Objective 1: Specify EE IO related 'macro resource' indicators including tentative natural targets/constraints**

  This objective builds upon the recommendations established in work package 4 (wp4: Framework for indicators on resource efficiency). There, the following headline indicators were proposed to track resource usage:

	Resource efficiency	Resource use	Environmental impacts	Disaggregation
Energy	GDP / []	TPES GIEC	DE fossil fuels / stocks Bioenergy / area etc.	Coal, Oil, Gas, unconventional Renewables (biomass, biogas, wind, water, solar, PV, etc.) Nuclear
Material	GDP / DMC GDP / RMC	DMC RMC	HANPP DE / min. stocks	Biomass, Fossil fuels, Metals, Non-metallic Minerals
Water	GDP / water appropriation	Water appropriation and footprint	Water exploitation index	Blue and green water Agricultural and industrial
Land	GDP / land use	Land use Land footprint	Used land / total Artificial land / total	Cropland, Grassland, Forest land, Wetland, Settlements and other land
Carbon	GDP / C	C emissions – territorial Carbon footprint	C emissions / C concentration	
Wastes	GDP / wastes	Waste accumulation		
Emissions	GDP / emissions	Other emissions to land, air, soil		

Table 4.1: Indicator list on resource use and resource efficiency (outcome of WP4)

Guided by these recommendations, data was gathered during the compilation of EXIOBASE 3 to enable the calculation of these indicators. Noteworthy, the data now available in EXIOBASE 3 exceeds the minimal requirements set up by wp4.

- **Objective 2: Systematically use and expand Multi-regional Environmentally Extended Input-Output data to time series as a basis for indicator calculation.**

  In order to achieve that objective, we built upon the two previous versions of EXIOBASE (EXIOBASE 1 - EXIOPOL, fp6: A. Tukker et al. 2013; EXIOBASE 2 - CREEA, fp7: Wood et al. 2014). To a large extent, data gathering and refining routines established in the previous projects could be reused. Further automation of these routines was undertaken in order to facilitate the compilation and checking process as far as possible, resulting in a more internally self-consistent database. The annex reports attached to this text (annex report monetary supply-use tables) describe the compilation in full detail.

- **Objective 3: Create now-casted EE IO data**

  As required in the DoW, options for now-casting EXIOBASE and the indicators based on the database were explored. The now-casting requires routines for extrapolating structural changes in the economy based on the existing time series and to incorporate information on ongoing decoupling between economic activity and resource usage.
  After investigated various approaches we established a routine for now-casting EXIOBASE consistent with the macro-economic outlook of the International Monetary Fund (“IMF World Economic Outlook Database List” 2015). We refer to the annex report now-casting for further details.

- **Objective 4: Calculate EE IO based "macro resource" indicators**

  The final objective consists of calculating the "macro resource" indicators which are defined as indicators easily computable using standard input-output calculations. For doing so we developed an open-source tool which can also be used for other MRIO databases (https://github.com/konstantinstadler/pymrio) and which follows best practice guidelines for scientific computing (Pauliuk et al. 2015). The calculated results are available on the cloud based service and will be published after the end of DESIRE (February 2016).

4.2 Progress beyond the state of the art

DESIRE strives to push the state of the art in environmental accounting and analysing progress towards resource-efficiency. Providing a comprehensive description of global economic activity and its environmental impacts constitutes the cornerstone for achieving that goal.

EXIOBASE 3 goes beyond the state of the art in current EE MRIO analysis for several aspects:

1) To date, EXIOBASE 3 is the only now-casted EE MRIO database. Other published EE MRIOs show a time gap of at least two years (see annex report now-casting and A. Tukker and Dietzenbacher 2013).
2) Already EXIOBASE 2 provided the most detailed EE MRIO in regard to consistent industry/product classification and environmental interventions. EXIOBASE 3 was further improved by adding detail in regard to resource extraction and now incorporates the full detail of resource extraction for agricultural commodities from FAO data.
3) The monetary version of EXIOBASE 3 will be accompanied with a physical EE MRIO.
4) Macro-economic parameters of EXIOBASE 3 (GDP, value added and final demand per broad sector/category, total trade per country) are almost fully consistent with international macro-economic databases. For the time series up to 2011 macro-economic values are consistent with the data given in the UN National Accounts Main Aggregates Database ("United Nations Statistics Division - National Accounts" 2013), the now-casted data are consistent with the estimates from the IMF)

5 Conclusion

A key working hypothesis of DESIRE is that an Environmental Extended Multi Regional Input Output database is a very powerful way to store environmental and economic data for further analysis and indicator construction. The overall objective of work package 5 within DESIRE was to compile such a database assembling multiple data sources into one comprehensive description of the global economy and its environmental impacts. This database, EXIOBASE 3, forms the basis for the following work packages within DESIRE.

The geographic focus of EXIOBASE is at the country level of the EU (including the new member state Croatia), with adequate description of major non-EU economies so that reasonable estimates of resource efficiencies under consideration of embodied resource use of imports and exports can be incorporated.

First indicator results providing information about resource use and emissions on the country level were already undertaken and are presented in the report. The next steps, carried out in the following work packages, include the assessment of resource efficiency over time based on various indicators provided by EXIOBASE and to suggest a minimum set of indicators needed for this assessment. A structural analysis of the time series will identify key drivers behind changes in resource efficiency. In addition, a systematic analysis of EXIOBASE will provide insights into the possibility of simplification (in terms of sectorial and regional aggregation) maintaining the indicator accuracy and the role of assumption in compilation of the database. Finally, results of the work packages investigating biodiversity loss and GDP alternatives will be integrated into the EXIOBASE database. This will provide a comprehensive framework with a set of readily available indicators for policy makers.

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Development of a System of Indicators for a Resource efficient Europe

DESIRE

Development of a System of Indicators for a Resource Efficient Europe

D5.3 Integrated report on EE IO related macro resource indicator time series

Annex – Monetary Supply-Use tables

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About DESIRE

DESIRE is a FP7 project that will develop and apply an optimal set of indicators to monitor European progress towards resource-efficiency. The project runs from September 2012 to February 2016. We propose a combination of time series of environmentally extended input output data (EE IO) and the DPSIR framework to construct the indicator set. Only this approach will use a single data set that allows for consistent construction of resource efficiency indicators capturing the EU, country, sector and product group level, and the production and consumption perspective including impacts outside the EU. The project will:

- Improve data availability, particularly by creating EE IO time series and now-casted data
- Improve calculation methods for indicators that currently still lack scientific robustness, most notably in the field of biodiversity/ecosystem services and critical materials. We further will develop novel reference indicators for economic success.
- Explicitly address the problem of indicator proliferation and limits in available data that have a 'statistical stamp'. Via scientific analysis we will select the smallest set of indicators giving mutually independent information, and show which shortcuts in (statistical) data inventory can be made without significant loss of quality.

The project comprises further Interactive policy analysis, indicator concept development via 'brokerage' activities, Management, and Conclusions and implementation including a hand over of data and indicators to the EU's Group of Four of EEA, Eurostat, DG ENV and DG JRC.

Partners are:

1. The Netherlands Organisation for Applied Scientific Research (TNO), Delft, Netherlands
2. Wuppertal Institute (WI), Wuppertal, Germany
3. Alpen Adria University - Institute of Social Ecology (UNI-KLU), Vienna, Austria
4. Institute of Environmental Sciences, University of Leiden (UL-CML), Leiden, Netherlands
5. Sustainable Europe Research Institute (SERI), Vienna, Austria
6. Norwegian University of Technology (NTNU), Trondheim, Norway
7. Radboud University (RU), Nijmegen, Netherlands
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Summary

This annex report covers the data gathering and processing for the monetary Supply-Use table (MSUT) time series for EXIOBASE 3. The report covers the general approach taken, the specific data used in the approach, and the expected validity of the estimated time series. The report focuses on the historical time-series from 1995 to 2012.

The compilation of the MSUT time series followed a top-down approach. At the top level, macro-economic parameters were obtained from the United Nation (UN) National Accounts Main Aggregates Database ("United Nations Statistics Division - National Accounts" 2013), including value added per broad sector, GDP, total import and exports. Only minimal refining steps were necessary to obtain consistent macro-economic data, and the refined data were kept as an overall constraint for all further processing steps, ensuring that the full time-series is benchmarked to this dataset. Global trade imbalances at the country level were resolved at this step.

Detailed industry and product output values were gathered from various national account databases and some international databases such as FAOSTAT, IEA energy balances, (FAO Statistics Division 2012; International Energy Agency 2012) etc. Product and service level trade data originated from the BACI database (balanced product trade data based on the UN Comtrade database, Gaulier and Zignago 2010), the energy trade data (given by the International Energy Agency, IEA, "International Energy Agency Data Services" 2015) and the UN services trade database ("UN Service Trade Database" 2015). These three data sources were combined and reconciled against product output in EXIOBASE3 classification, with explicit control for international transport margins and re-exports based on the previous EXIOBASE 2 (Wood et al. 2014). The resulting bilateral trade-cube (product by exporter by importer) was reconciled against the macro-account trade data and balanced in order to match the top level trade data.

Economic structural information were collected in form of technical coefficients of Supply and Use tables and/or Input-Output tables from national statistical offices. This data were converted into the EXIOBASE classification and served as the basis for informing about structural change in the economies starting from the EXIOBASE 2 base year 2007. Data on temporal structural change was used in preference to directly using individual country MSUT data, because it allowed for explicit control of "conceptual" breaks in data series common in MSUT data produced over time and under different classifications and versions of the System of National Accounts. As such, MSUT estimates for years expect 2007 are based on structural change, and are not guaranteed to match the individual country MSUT tables in other years.

In a final step, the technical coefficient and the industry output data were combined and the resulting Supply-Use tables were balanced respecting the before balanced trade data and macro-economic parameters. A mathematical programming approach, minimizing information gain between the initial and final system, was chosen for balancing.

The resulting MSUT time series ranges from 1995 to 2012 for 44 countries (28 EU member plus 16 major economies) and five rest of the world regions (Europe, Asia, Africa, America, Middle East). MSUTs exhibit a consistent sector classification of 200 products and 163 industries.

1 Introduction

The development of an Environmental Extended Multi Regional Supply Use and Input Output database (EE MRSUT and EE MRIO) constitutes one of the cornerstones of DESIRE. This database, EXIOBASE 3, builds upon existing databases, which were developed in previous projects (EXIOBASE 1 - EXIOPOL, fp6: A. Tukker et al. 2013; EXIOBASE 2 - CREEA, fp7: Wood et al. 2014). Among other points, the level of detail in the description of the economy is consistent with the previous version EXIOBASE 2, as is the implementation of the economic and environmental accounting principles proposed in the UN System of Economic and Environmental Accounts (European Commission et al. 2012). On the county level, the focus is still on the EU, but EXIOBASE 3 now includes the new member state Croatia.

The procedures developed in the past projects provide also the foundation for the automated routines used in DESIRE. As in CREEA, Supply-Use tables (SUTs) are used as the basic building blocks for the database. Using SUTs as basis for building up an IO framework accommodates both flexibility of modelling in terms of both products as well as industries; whilst keeping tractability of data – which is usually collected for supply and use of products, by industries or activities. As such, modelling and data inventory can be kept separate. SUTs are than combined into MRSUTs which are subsequently converted in MRIOs for each year of the time series.

The rest of this report unfolds as follows. The next chapter provides some background information about the SUT and IO framework. In chapter 3 we give a detailed description about the methodology used for building the SUT time series. We conclude by presenting the characteristics of the final SUT time series.

2 Backgrounds on EE SUT and IOT

MRIO analysis is a rapidly developing field (A. Tukker and Dietzenbacher 2013). While regional IO analysis has been around for some time (Miller and Blair 2009), its use in the calculation of environmental footprints (Arnold Tukker et al. 2014; Steen-Olsen et al. 2012) and its relevance to climate policy issues, particularly with regard to carbon leakage (Peters and Hertwich 2008; Davis and Caldeira 2010; Kanemoto et al. 2013) has significantly advanced the field's development in the last decade. Now a considerable number of environmental and socio-economic issues that concern consumer behavior and that span global production networks use MRIO in order to fully account for demand-side pressures (T. Wiedmann et al. 2011; Weinzettel et al. 2013; Simas et al. 2014; Lenzen et al. 2012).

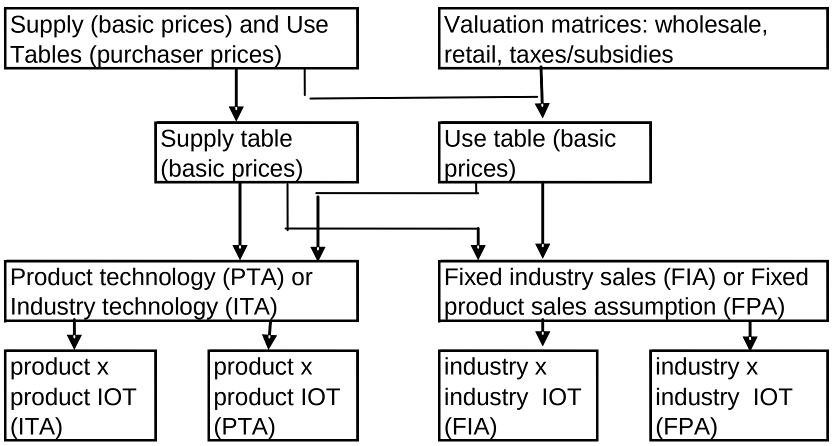

Figure 1.1: Simplified input-output framework (modified from Rueda-Cantuche et al. 2007)

The input-output framework as exemplified by the European System of Accounts (ESA95) consists of three types of table: supply and use tables (SUT) and symmetric input-output tables (IOT) (EUROSTAT 2008; United Nations et al. 2009).

The supply table shows the supply of goods and services, both domestic and imported, by product and type of supplier in basic prices, while the use table shows the use of goods and services by product and type of use in purchase prices, i.e. as intermediate consumption by industries, final use (consumption, gross capital formation) and exports. The use table also contains the components of the value added by industry, i.e. compensation of employees, other taxes less subsidies on production and gross operating surplus. The use table can be converted to basic prices with the help of valuation matrices reflecting retail, wholesale and taxes/subsidies per product used per industry. If necessary, the SUT can be broken down into a domestic and import (use) and an export (supply) part.

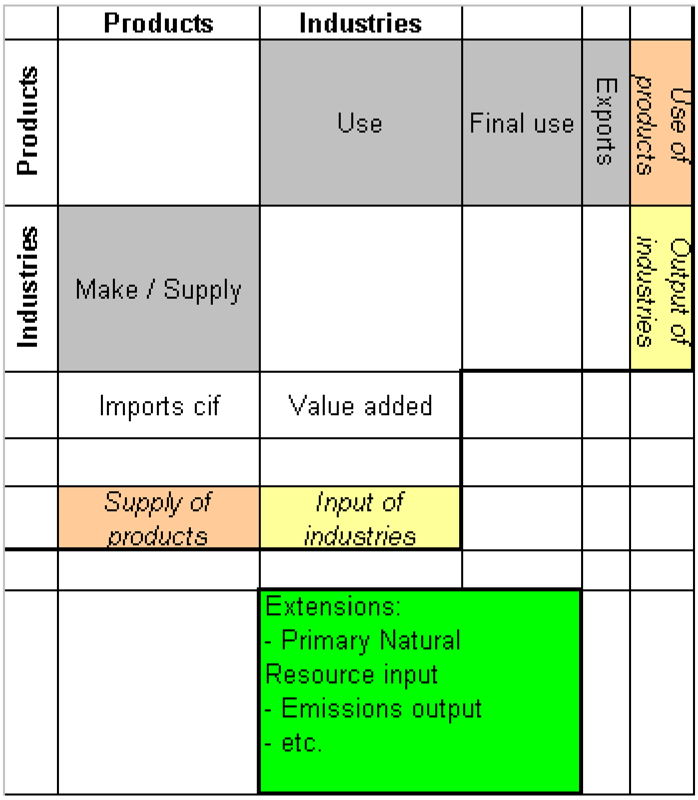

Figure 1.2: Schematic SUT with environmental extensions

Most analytical applications and models used (e.g. CGE) are based on IOTs rather than SUT. Using various assumptions about technology, IOTs can be derived from the SUT in basic prices. The tables can be of a product by product type or an industry by industry type (Figure 1.1, see also Majeau-Bettez, Wood, and Strømman 2014).

SUT and IOT can be expanded with satellite accounts to indicate an industry's resource inputs from and emission outputs to the environment (Figure 1.2.). Note that Fig. 1.2 shows an EE SUT for a single country. This leads to the problem of how to deal with imports and exports. In some cases, apparent decoupling of CO_2 emissions or primary material use from GDP growth is in fact the result of the relocation of material and energy-intensive production to other countries (T. O. Wiedmann et al. 2013; Davis and Caldeira 2010; Weinzettel et al. 2013; Hertwich and Peters 2009). Practitioners have sought to resolve this problem by using a multi-regional approach, in which different country EE SUT or EE IOT are linked via trade to a multi-regional SUT or IOT with environmental extensions (MR EE SUT or MR EE IOT). Figure 1.3 visualizes an MR EE SUT.

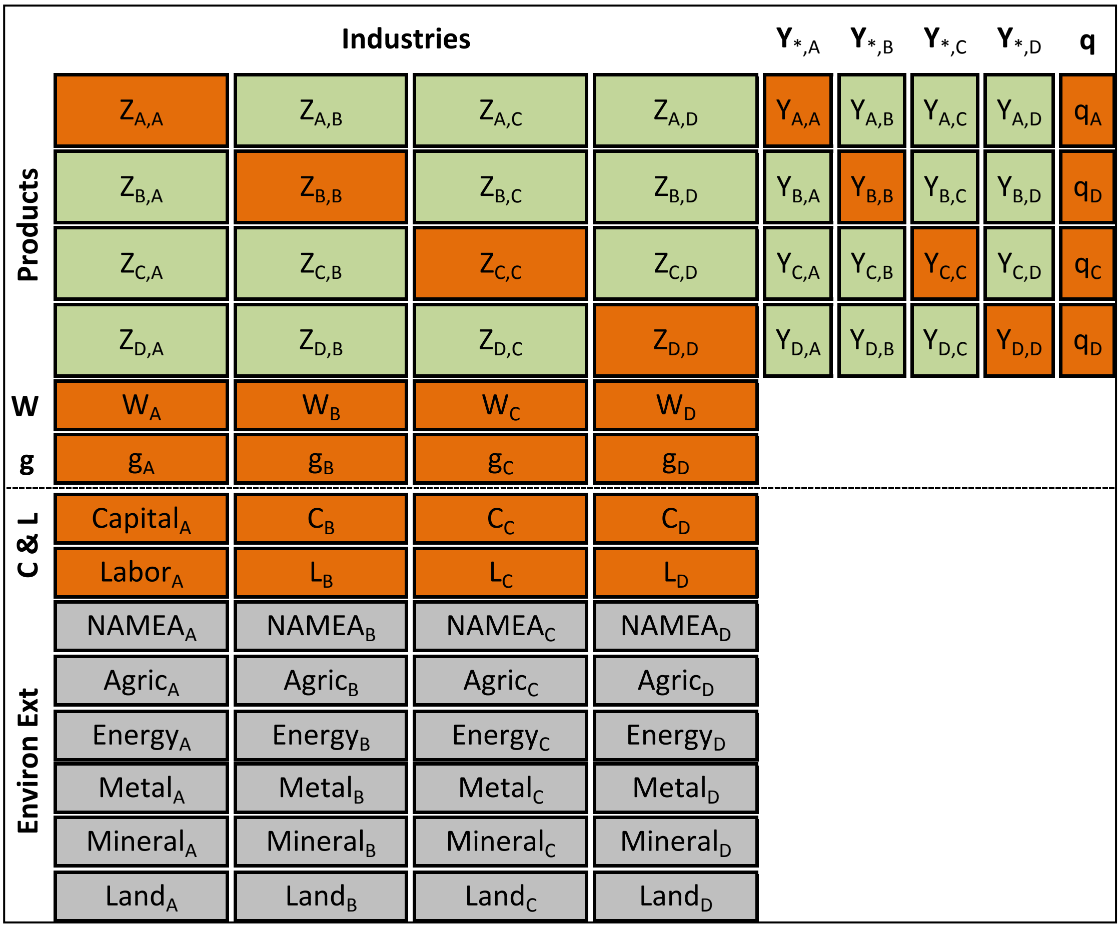

Figure 1.3: Example of a MR EE SUT for 4 countries

3 Method

3.1 Outline of the approach

The compilation of the monetary Supply-Use tables (SUTs) in DESIRE follows a top down approach starting at global economic estimates and aggregated official country data (see Figure 3.1 for a complete overview). The top level data implements as much as possible the UN National Accounts Main Aggregates Database ("United Nations Statistics Division - National Accounts" 2013) plus additional data from certain National Statistical Agencies (for missing countries as Taiwan). Minor adjustments were necessary to provide a balanced data set (see 3.2).

The macro economic data was disaggregated to obtain industry output data in EXIOBASE classification (see 3.4). Auxiliary data used for the disaggregation included industry output statistics of the UN and national statistical agencies as well as physical and energy production data (FAO, material flow database, IEA). In addition, a trade cube representing bilateral imports and export of products and services was constructed using the macro economic data together with the BACI database and the UN database on service trade (Gaulier and Zignago 2010; "UN Service Trade Database" 2015). The bilateral trade data provides the link between the individual country SUT data, and in order to re-concile both trade data and SUT data semi-independently, the bilateral trade data was reconciled to relevant MSUT constraints and fixed prior to usage in the MSUT estimation.

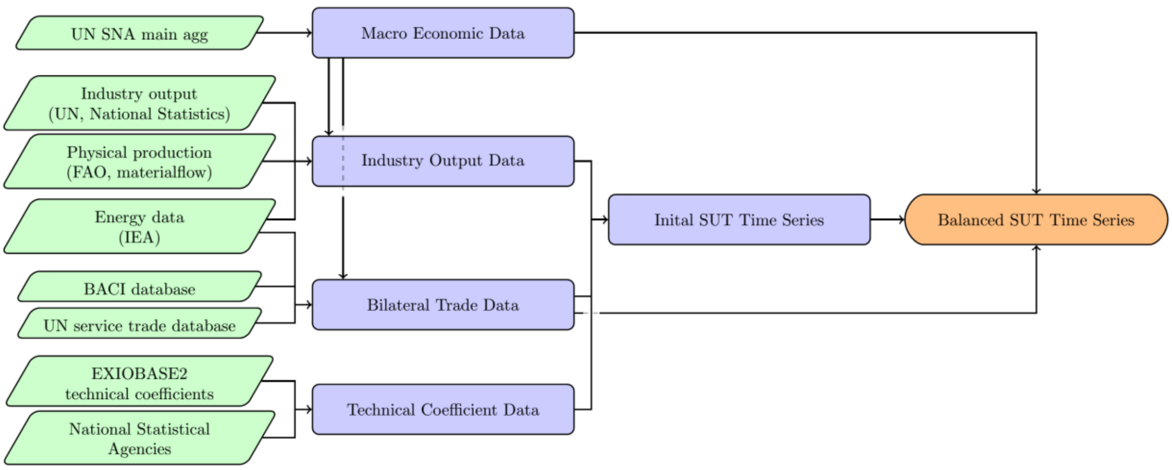

Figure 3.1: Compilation steps (blue) and main data sources (green) for the compilation of the monetary SUT time series.

We used the technical coefficients estimated in the fp7 project CREEA (EXIOBASE2 : Wood et al. 2014) as a basis for the SUT coefficients in DESIRE. EXIOBASE 2 provides these data for the base year 2007. Information on structural change within a domestic economy was obtained from national statistics (see 3.5). This information was than imposed on the EXIOBASE 2 data to estimate a technical coefficient SUT time series.

An initial SUT time series combining all the aforementioned data was subsequently balanced respecting bilateral trade flows and macro-economic data. This data set forms the backbone of EXIOBASE 3. The subsequent steps of estimating the Multi Regional SUT table and the conversion to the Multi Regional Input Output Table are performed by the EXIOBASE software as documented in Tukker et al (2013) and Wood et al (2014) . The rest of this chapter provides an in detail description of the processing steps to obtain the SUT time series.

3.2 Macro-Economic Data

Macro-economic estimates for all countries constitute the top level data for all subsequent compilation steps of the monetary SUT system of DESIRE. In order to do so, a balanced macro - economic database (following the DESIRE country and region classification) had to be constructed. This dataset is based on the UN National Accounts Main Aggregates Database ("United Nations Statistics Division - National Accounts" 2013) plus additional data from the National Statistics – Republic of China (Taiwan). We used the global total entry in the UN main agg. as overall constraint. This data was balanced to ensure equal imports and exports for each year and consistent accounting for value added per kind of economic activity. We aimed to minimize deviations in the DESIRE countries and distributed necessary changes to the Rest of the World regions.

Main characteristics:

1) Balanced macro-economic data for 213 countries
2) Data for GDP, final demand per category and value added for several industry sectors
3) Global imports and exports balanced (f.o.b)
4) Available in constant and current purchaser prices

3.2.1 Data source

3.2.1.1 UN National Accounts Main Aggregates Database

The main data source used is the United Nations Statistics Division (UNSD) - National Accounts Statistics: Main Aggregates and Detailed Tables ("United Nations Statistics Division - National Accounts" 2013). These tables provide a complete and consistent set of time series from 1970 onwards of main national accounts aggregates for more than 200 countries/regions (http://unstats.un.org/unsd/snaama/). The tables are available in current USD and constant USD for 2005 (converted from data in constant prices in national currency using the annual period-average market exchange rate of the base year for all years and adjusted with price-adjusted rates of exchange in case of considerable distortion, exports and imports f.o.b.). By October 2013 data was available up to 2011. However, the Methodology report of the UN main agg. states that the figures of the last available year should be regarded as provisional.

The main aggregates available are:

- Final consumption expenditure,
- Household consumption expenditure (including Non-profit institutions serving households),
- General government final consumption expenditure,

- Gross capital formation,
- Gross fixed capital formation (including Acquisitions less disposals of valuables),
- Changes in inventories,
- Exports of goods and services (f.o.b.),
- Imports of goods and services (f.o.b),
- Gross Domestic Product (GDP),
- Agriculture, hunting, forestry, fishing (ISIC A-B),
- Mining, Manufacturing, Utilities (ISIC C-E),
- Manufacturing (ISIC D),
- Construction (ISIC F),
- Wholesale, retail trade, restaurants and hotels (ISIC G-H),
- Transport, storage and communication (ISIC I),
- Other Activities (ISIC J-P),
- Total Value Added

3.2.1.2 Taiwan official country data

Taiwan does not appear in the country list of the UN main agg database but the Taiwanese economy is included in the global entry (pers. Comm. With Mr. Souza - National Accounts Section of the United Nations Statistics Division). The National Statistics - Republic of China (Taiwan) provides value added and final demand categories in a higher level of detail than the UN SNA main agg (http://eng.stat.gov.tw/). These official data has been aggregated to the UN main agg database classification. Whereas the later includes constant price data with the base year 2005, Taiwan uses 2006 as base year. This data has been rescaled to 2005 base year with the price deflator per category available from the National Statistic office.

3.2.2 Building the macro - economic database

Data from the UN main agg database (Fig 3.2 – step 1) and the Taiwanese statistical office (Fig 3.2 – step 2) was read in Matlab. The Taiwanese data had to be converted as described above. The UN main agg database also provides data on a regional level, including global totals for all categories. These values were used as overall constraints for the whole dataset. Checking the sum of countries from the UN main agg database against the global entry shows differences of about 1 percent. These differences disappear almost completely after including Taiwan into the country list (Fig 3.2 – step 3), confirming the information from the UN statistical office (see Fig 1 in Appendix 6.1).

The initial data was reconciled for:

1) Negative values were set to zero (very few entries for minor countries in gross capital formation, see 6.1.2.1)
2) Subcategories higher than the aggregate value were down-scaled to the aggregate value
3) Missing subcategories were estimated based on global shares (only necessary for Democratic People's Republic of Korea and Swaziland)

In general, reconsolidation was not necessary for major economies (see Appendix).

To ensure a balanced IO system per year global imports and exports were set equal for each year (Fig 3.2 – step 4). Global trade was set to the higher amount of imports or exports. The maximum change occurring was below 5.1 % (Figure 2 in Appendix 6.1).

Gross capital formation was changed accordingly in order to keep overall GDP fixed. Gross value added by kind of economic activity in the UN main agg database is given in different price systems (e.g. in 'producer prices' for the US). To avoid inconsistencies in the dataset, gross values added was rescaled to GPD for the global entry as well as all countries (therefore value added now includes taxes and subsidies per sector). Gross fixed capital formation and changes in inventories were removed from the dataset because of missing/inconsistent data for several countries.

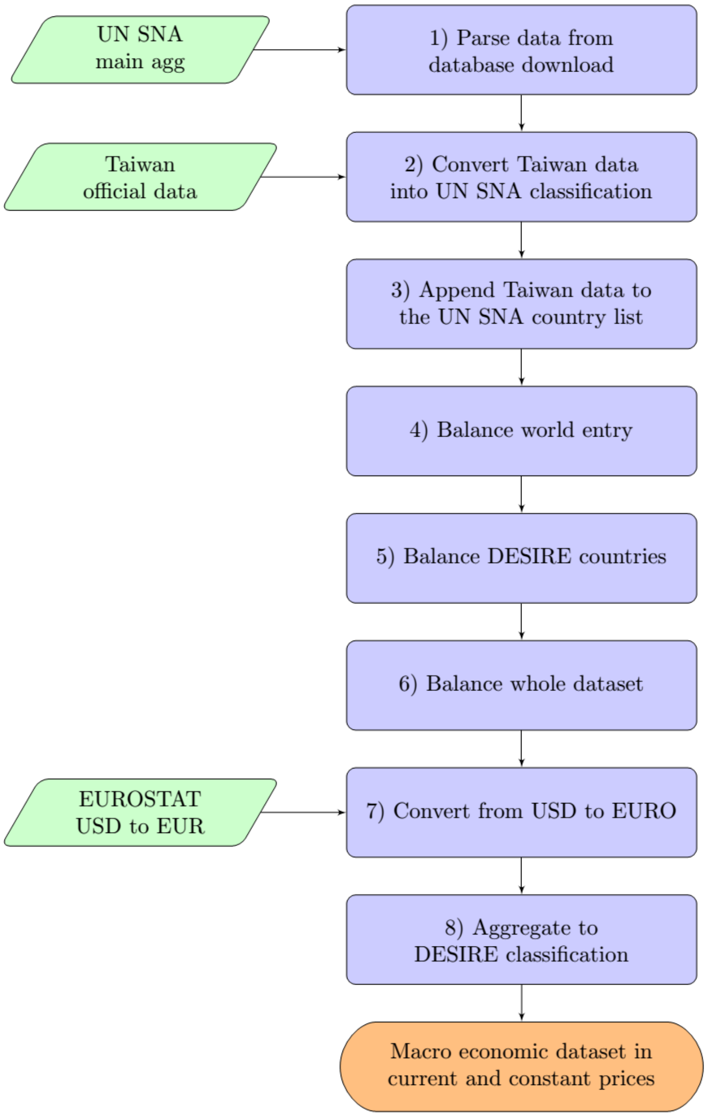

Figure 3.2: Building the Macro Economic Dataset for DESIRE

In the next step (Fig 3.2 – step 5), inconsistencies in the economic data of the DESIRE countries were reconciled. In general, changes required were minimal (apart from the rescaling of the gross value added per economic activity as explained above – see Appendix 6.1 for further details). Subsequently, the whole dataset was balanced (Fig 3.2 – step 6) in GAMS (GAMS Base Module, GAMSIDE build 32351/32372,). The reconciled global entry was set as overall constraint and the pre-checked DESIRE countries were fixed. We used a weighted quadratic programming approach for the balancing routines and set high weights on small initial values to preserve economic structure also in small countries. As far as possible, necessary changes were distributed to gross capital formation by reducing the weight for that entry (see Appendix 6.1 for the resulting deviations).

In the final step (Fig 3.2 – step 7), exchange rates from eurostat (http://epp.eurostat.ec.europa.eu/portal/page/portal/exchange_rates/data/database) were used for the conversion from USD to EURO. The final macro-economic dataset provides data for:

- Final consumption expenditure,
- Household consumption expenditure (including Non-profit institutions serving households),
- General government final consumption expenditure,
- Gross capital formation,
- Exports of goods and services,
- Imports of goods and services,
- Gross Domestic Product (GDP),
- Agriculture, hunting, forestry, fishing (ISIC A-B),
- Mining, Manufacturing, Utilities (ISIC C-E),
- Manufacturing (ISIC D),
- Construction (ISIC F),
- Wholesale, retail trade, restaurants and hotels (ISIC G-H),
- Transport, storage and communication (ISIC I),
- Other Activities (ISIC J-P),

The dataset is available in current USD and EURO as well as constant 2005 prices. The dataset was aggregated to the DESIRE country/region classification (44 countries and 5 Rest of the World regions).

3.3 Bilateral Trade Data

The main trade data used in DESIRE originates from the UN Comtrade database (United Nations Statistics Division 2012a) and the UN services trade database (United Nations Statistics Division 2012b). The Comtrade data whilst of reasonably high quality is not reconciled to itself, such that bilateral exports are not consistent with the mirror of bilateral imports. The BACI database (Gaulier and Zignago 2010) is based on UN Comtrade, but is reconciled, such that for a single year, every trade flow is recorded as a single bilateral trade flow in both physical units and in f.o.b. monetary valuation.

We hence start with the BACI database in both physical and monetary values for each year of the time series and aggregate the 5000 or so products of the HS classification into the EXIOBASE2.0 classification. Whilst this is usually a simple aggregation, for energy and waste flows, the EXIOBASE 2.0 classification is more detailed than the HS classification such that disaggregation is also required. Estimated energy exports (from the IEA database) or else estimated domestic production is used to disaggregate these HS codes. A similar process is done for the UN services trade database. The services trade database is complicated by much missing data, the multiple levels of aggregation and the partial reporting of bilateral trade flows, and total import/export flows. A bottom-up process is used to utilise as much information as possible in maintaining detailed product and bilateral flows scaled to aggregate product and total import/export flows. Where the product detail is not high enough in the services trade data, the export flows are split by the shares of domestic production.

Once the bilateral commodity trade and services trade data is in the EXIOBASE2.0 classification, a reconciliation approach is undertaken at the bilateral trade level to match to firstly import/export data from the IEA and secondly, to aggregate trade data from the UN National Accounts (Section 1.1) (Fig. 1.3). We define the bilateral trade data matrix **B** with dimensions *i,r,s* where *i* refers to products, *r* refers to exporters and *s* refers to importers measured in free on board (f.o.b.) prices (Gaulier and Zignago 2010). We define IEA import and export data as $\mathbf{B}_{IEA}^{exp}$ for dimensions *i**, *r* and import data as $\mathbf{B}_{IEA}^{imp}$ for dimensions *i*,s* where *i** is the subset of energy carriers in the product classification *i.* Additional data was used for the estimation of international transport margins to give a bilateral margin matrix $\mathbf{B}^{marg}$ that shows the transport and insurance costs of each trade flow derived from the TRANS TOOLS model (http://energy.jrc.ec.europa.eu/transtools/).

We use a flexible mathematical programming approach where information gain on the starting values of the f.ob. bilateral trade cube $\mathbf{B}^0$ is minimised,

$$\min \quad t(B, B^0)\ where \qquad (1)$$

$$t(B, B^0) = \sum_{i,r,s} \frac{1}{B_{i,r,s}^0} * (B_{i,r,s}^0 - B_{i,r,s})^2 \qquad (2)$$

subject to the import and export constraints for the price-adjusted IEA data at the individual product level,

$$B_{IEA_{i*,s}}^{imp} = \sum_{r} B_{i,r,s} \qquad (3)$$

$$B_{IEA_{i*,r}}^{exp} = \sum_{s} B_{i,r,s} \qquad (4)$$

The 2007 dataset from EXIOBASE2 (Wood et al. 2014) was used as the benchmark year, and all trade-data was re-scaled to the 2007 benchmark in order to only capture temporal changes in data, and obtaining consistency with the EXIOBASE2 data as far as possible.

An ensuing stage included the explicit estimation of re-exports $\mathbf{B}_{i,s}^{re-exp}$ (transit trade – products that are imported into a country and not subject to further processing before being exported again) based on the proportion of re-exports in total imports in EXIOBASE2 (2007) – hence a limitation is that the changes in the proportions of re-exports over time are not considered. The so-called "domestic" trade block $B_{i,r,s}^{dom,0}$ (estimates of exports produced within an economy) is set-up so that the proportions of re-exports in total imports is subtracted from the full bilateral trade block $B_{i,r,s}$

$$B_{i,r,s}^{dom,0} = B_{i,r,s} * (1 - \frac{B_{i,k}^{re-exp}}{\sum_r B_{i,r,s}}) \tag{5}$$

Subsequently the import and export constraints for the macro-accounts data at the product group level, where the matrix **G** is a concordance matrix mapping the product groups of the national accounts with the more detailed product groups in the trade cube (N.b. as of version 3.1, data at macro accounts doesn't distinguish product groups, only import and export totals, and hence **G** aggregates over all products.

$$\mathbf{B}_{\mathbf{NA}}^{\mathbf{imp}} = \mathbf{G} * \sum_r B_{i,r,s} + \sum_r B_{i,r,s} * B_{i,r,s}^{marg} \tag{6}$$

$$\mathbf{B}_{\mathbf{NA}}^{\mathbf{exp}} = \mathbf{G} * \sum_s B_{i,r,s} \tag{7}$$

3.4 Industry/Product Output Data

Product and industry totals were estimated for each country in order to apply to technical and sales coefficients (section 3.5), thus providing a first estimate of the SUT data in flows.

Product totals detail is higher than industry detail, and most auxiliary data for agricultural and energy refers to products. A number of datasets are used in the estimation of the product output, listed in table 3.1:

Order	Dataset Name
1	Default assumption based on EXIOBASE2 (mainly for waste products)
2	Selected mining and mineral data*price
3	Product output data from available country national accounts
4	Product output data from available country SUT
5	FAO Monetary data
6	Detailed IEA energy balance data*energy prices
7	Macro database of industry output for 7 product groups

Table 3.1: Basic order of usage of auxiliary data.

The full list of final data used for each product is available on request. The gross output per broad sector is based on the macro-economic parameter dataset described at 3.2. We used the "Output, gross value added, and fixed assets by industries at current prices (ISIC Rev. 3) and (ISIC Rev. 4)" (Table 2.3 and 2.6 from National Accounts Official Country Data - http://data.un.org/Explorer.aspx) to estimate value added to industry output factors. These factors were then applied to the macro-economic parameter dataset in order to obtain gross output in current/constant Euros. A recursive routine was utilized to add detail to this gross output values (#7 listed above) so that, for example, the FAO data would be respected over the SUT or national account data, and if a more aggregate value in the SUT referred to two sub-groups of products (e.g. electricity generation and transmission/distribution) then the SUT data would be used to do a first split before national account or default data is used to split the electricity generators individually. Industry total in EXIOBASE 3.1 is done by simply aggregating the product output to industry classification.

3.5 Technical Coefficient Data

In order to construct time series of technical coefficients we have collected the time series of Supply and Use tables and/or Input-Output tables from national statistical offices (see Table 3.2 for an overview of SUTs/IOTs time-series availability). In order to create an overview of the available data we have checked the web-sites and got in contact, if necessary, with Eurostat and National statistical offices. For the cross-check we have also investigated the data sources reportedly used in construction of World Input-Output Database (WIOD: Timmer et al. 2012).

Table 3.2: Overview of availability of SUTs/IOTs time-series

Country name	Available years	Disaggregation level	Data source
Austria	1995, 1997, 1999-2010	NACE, 2-digit	Eurostat
Belgium	1995, 1997, 1999-2010	NACE, 2-digit	Eurostat
Bulgaria	2000-2006, 2008-2010	NACE, 2-digit	Eurostat
Cyprus	1995-2009	NACE, 2-digit	Eurostat
Czech Republic	1995-2011	NACE, 2-digit	Eurostat
Germany	1995, 1997-2010	NACE, 2-digit	Eurostat
Denmark	1995-2009	NACE, 2-digit	Eurostat
Estonia	1997, 2000-2010	NACE, 2-digit	Eurostat
Spain	1995-2009	NACE, 2-digit	Eurostat
Finland	1995-2011	NACE, 2-digit	Eurostat
France	1995, 1997, 1999-2010	NACE, 2-digit	Eurostat
Greece	2000-2011	NACE, 2-digit	Eurostat
Hungary	1998-2010	NACE, 2-digit	Eurostat
Ireland	1998, 2000-2010	NACE, 2-digit	Eurostat
Italy	1995-2010	NACE, 2-digit	Eurostat
Lithuania	2000-2010	NACE, 2-digit	Eurostat
Luxembourg*	1995-2012	NACE, 2-digit	Eurostat
Latvia	1996, 1998, 2004, 2007, 2008*,2009*	NACE, 2-digit	Eurostat
Malta	2000, 2001, 2004, 2008*	NACE, 2-digit	Eurostat
Netherlands	1995-2010	NACE, 2-digit	Eurostat
Poland	2000-2010	NACE, 2-digit	Eurostat
Portugal	1995-2010	NACE, 2-digit	Eurostat
Romania	2000, 2003-2010	NACE, 2-digit	Eurostat
Sweden	1995-2010	NACE, 2-digit	Eurostat
Slovenia	1996, 2000-2010	NACE, 2-digit	Eurostat
Slovakia	1995-2010	NACE, 2-digit	Eurostat
United Kingdom	1995-2011	NACE, 2-digit	Eurostat
Croatia*	2004, 2005	NACE, 2-digit	Croatian Bureau of Statistics
Australia	1999, 2002, 2005-2010	106 products/sectors	Australian Bureau of

			Statistics
Brazil	1995-2009	110 products/ 55 sectors	The University of Sao Paulo, Regional and Urban Economics Lab.
Canada*	1997-2008	473 products/ 123 sectors	Statistics Canada
Switzerland	2001, 2005, 2008	42 products/sectors	Swiss Federal Statistical Office
China	2002. 2007, 2010	40 products/sectors	National Bureau of Statistics of China
Indonesia*	2000, 2005	175 products/sectors	Badan Pusat Statistik
India	1999, 2004, 2007, 2008	130 products/sectors	Central Statistics Office and Ministry Of Statistics Of India
Japan	1995-2009	108 products/sectors	Research Institute of Economy, Trade & Industry, IAA
South Korea	1995, 1998, 2000, 2003, 2005-2011	78 products/sectors	The Bank of Korea Economic Statistics System
Mexico*	2003, 2008	79 products/sectors, 262 products/sectors	National Institute of Statistics, Geography and Informatics (INEGI)
Norway	2001-2011	NACE, 2-digit	Eurostat
Russia	1998, 2000-2006	15 products/sectors	Russian Bureau of Statistics (Federal State Statistics Service)
Turkey*	2002	97 products/sectors	Eurostat
Taiwan	1996, 1999*, 2001, 2004*, 2006-2011	160 products/sectors, 52 products/ 63 sectors	National Statistics Republic of China (Taiwan)
United States	1997-2012	65 products/sectors	Bureau of Economic Analysis
South Africa	1998-2000, 2002, 2005	95 products/secotrs	Statistics South Africa

* SUTs/IOTs of these countries/years have not been used for construction of the current EXIOBASE version 3.1 due confidentiality issues or difficulties to obtain time-series in a suitable format.

The data originally collected from Eurostat/NSIs comes in different formats and in different classifications. The following steps had to be undertaken prior to using the data for construction of EXIOBASE-level of technical coefficients:

1. Convert the data in a standardized Excel format.
2. Check the data and accompanying description for confidential values, non-numerical entries in the tables.
3. Check the data and accompanying description for changes in classifications over time.
4. Create the mapping between the EXIOBASE 3.0 classification of sectors/products and national classification, several national classifications for one country is possible.

Checking of the data in steps 2 and 3 involves manual work, even if the data are collected from Eurostat, where we expected to have completely standardized time-series. The main issues with the original data were the following:

1. Change of classifications and underlying concepts over time. It is understandable that the statistical offices improve their approaches over time, but in case the older time-series are not being revised by the statistical offices according to the new concepts, the time-series become not usable for analysing structural changes over time.
2. Confidential values in the tables.
   a. In case the confidential values are indicated in the original tables, they can be estimated. Eurostat tables can be improved in this sense by using standardized non-numerical coding in the tables over all the countries and all the years.
   b. In case on Canadian tables, the confidential tables are not being indicated in the tables, and can only be guessed by comparing the sums of intermediate values with columns/rows of totals.
3. Format of the originally provided data.
   a. Eurostat NACE Rev.2 tables for some countries included sub-totals in the intermediate part of the supply and use tables. The sub-totals were related to a newly defined product/sector of Imputed rents. The presence of sub-totals has not been indicated in any of documentation and had to be manually checked for each country.
   b. Tables in PDF format has been provided by India and Indonesia. After contacting the NSIs the Indian data has been obtained in Excel format, but the Indonesian table has remained in the unusable PDF format.
   c. Language barriers are still present when dealing with non-European NSIs data. In the project we had enough international colleagues to overcome this issue, but in a lot of case the data available in the original language and English differs so much that the local knowledge becomes essential for appropriate data usage.

As indicated in Table 3.1, the described data issues have prevented us from processing all of the original SUTs into the current version of EXIOBASE. More specifically, large number of confidential values were observed in the data for Canada, Luxembourg and NACE Rev.2 data for Latvia and Malta. In Indonesia, large-sized data was available in PDF format only. For Turkey and Croatia the data are effectively not in a form of time-series and therefore it doesn't provide information on structural change. Significant changes in classification and statistical concepts were problematic for the data in Mexico and in 1999 and 2004 years for Taiwan. For the next revision of EXIOBASE we will work further on the methodologies for estimation of confidential values and bridging classifications, as well using 'similar-country' assumptions for the countries with only 1 year of data.

Creation of coefficient time series for each country starts with technical coefficients obtained from EXIOBASE 2.0 developed within CREEA FP7 project (Wood et al. 2014). The data in CREEA project has been collected only for one year, which will be calling in the further description as the base year (2007). We have developed a procedure to estimate the full time series of EXIOBASE-level coefficients. The procedure has been developed in GAMS programming language goes over the following steps:

0. Preliminary step performed only once: convert all the input data from Excel for GAMS GDX format, this reduces the time needed to read-in the data.
1. Standardize the original supply and use tables:
   a. In case of several classification present in the original data for one country, convert the tables in the classification of the base year.
   b. Convert transactions into technical coefficients.
2. Fill-in time gaps in the original technical coefficients:
   a. In case of gaps in-between two available year, the gap is filled using linear interpolation of existing coefficients.
   b. In case the original time-series start after 1995, we extrapolate the tail backwards till 1995 using the same approach as for now-casting, as described in Annex Now casting. The only difference with now-casting approach is that the second average needs to be calculated over the <u>first</u> four years of available data.
3. Load base year data from CREEA project and clean up transactions indicated as non-reliable from LCA perspective.
4. Create full time-series of technical coefficients in EXIOBASE 3.0 classification:
   a. Create time series based on the structural change information from the original supply and use tables. If $s_{m*,n*,s,base}$ is the technical coefficient describing input of row $m*$ into consumer $n*$ of region s in the base year and $\mathbf{G}_{m,m*,s,t}$ and $\mathbf{G}_{n,n*,s,t}$ are the row/column concordance matrices from EXIOBASE classification to NSI classification $(m,n) \rightarrow (m*,n*)$ respectively, the technical coefficients for region s in year t are derived as

$$s_{m,n,t} = s_{m,n,base} * G_{m,m*,s,t} * \frac{s_{m*,n*,t}}{s_{m*,n*,base}} * G_{n*,n*,s,t}$$

   b. For energy products correct the use technical coefficients with the information for IEA energy balances.
5. Export the coefficient time-series in Excel format for further processing into transaction time-series.

The procedure is automated in all the steps and can detect by itself whether the original data needs to be converted in a single base year classification (Step 1) and which time gaps need to be filled in (Step 2). So once all the input data has been prepared in the appropriate format, the procedure can be run for any set of (additional) countries.

3.6 SUT Time Series

3.6.1 SUT Pre-processing

The initial SUT time series build upon the data compiled in the previous steps. For each country and each year of the time series, the respective data were gathered and converted into a common data representation scheme. Several quality check ensured a consistent description of the economy. The pre-processing of the SUT tables consistent of the following steps:

1) SUT technical coefficients were taken from the new estimates (see previous chapter). If these were not available, EXIOBASE 2 technical coefficients were used as fall back values (for the current version 3.1 for CA, LU, HR, ID, TR, MX).
2) Total product taxes and margins were obtained from national statistics. If these data were available for one year, the shares of next available year with data were use. EXIOBASE 2 shares were use in case of completely missing values.
3) Changes in inventories and valuables were treated as in 2).
4) Subsequently, the estimated industry output and final demand values were multiplied with the estimated coefficients to obtain the SUT flows. Import and exports were replaced by the vectors given from the bilateral trade estimates. Total amount of taxes, margins and changes in inventories/valuables per product were calculated based on their shares (see 2 and 3). At this stage, the SUT system consisted of supply values in basic prices and a use table in purchaser prices.
5) Taxes and transport/trade margins were estimated from the purchaser price use table. The total amount of each valuation per product was distributed across all industries based on EXIOBASE 2 shares. This dataset was than crosscheck against missing values and value occurring for transaction not present in a specific year.
6) The basic price table got estimated by subtracting the valuation layers estimated in 5) from the purchaser use table estimated in in 4). The resulting use table was split into domestic and import used based on the shares estimated in EXIOBASE 2. These basic price tables were than controlled and adjusted for
    a. Negative estimates
    b. Import use despite no imports (per product)
    c. Domestic use despite missing domestic production (per product)
    d. Missing value added (per industry)
7) The final SUT system was fed into the balancing routine.

3.6.2 SUT balancing

The pre-processed SUT system respects all auxiliary data. However, due to different data sources and various methods to estimate the auxiliary data the resulting initial SUTs are certainly unbalanced in respect to SUT accounting rules.

One option to reconcile this difference is to fix row and column sums, and to RAS balance any difference. This has two disadvantages, (1) it is putting a high certainty on very uncertain industry and product outputs relative to the technical coefficients; and more practically (2) it allows for variation in the import and export data.

An alternate approach is to use a flexible mathematical programming approach where information gain is minimised, subject to balancing constraints, macro-economic parameters and trade (see below). To do so a final estimate of the SUT system $\boldsymbol{Z}_{m,n,t}$ is created from minimizing differences (the objective value $o(\boldsymbol{Z},\boldsymbol{Z}^0)$) from the initial estimate of the Supply Use system $\boldsymbol{Z}^0_{m,n,k,s,t}$

$$o\left(\boldsymbol{Z}_{s,t},\boldsymbol{Z}^0_{s,t}\right) = \sum_{m,n,k,s,t} \boldsymbol{SW}_{m,n,k,s,t} * \left(\boldsymbol{Z}_{m,n,k,s,t} - \boldsymbol{Z}^0_{m,n,k,s,t}\right)^2$$

with *m, n, k, s, t* representing *m*=rows (products *i* and value added), *n*=columns (industries *j* and final demand), *k*=layers (supply table, use table basic prices domestic and import use, taxes, transport and trade margins), *s*=region and *t*=time period of the SUT system.

A QP target function was chosen to minimize $o(\boldsymbol{Z}_{s,t}, \boldsymbol{Z}^0_{s,t})$. This deals with conflicting information from a variety of data sources (Robinson, Cattaneo, and El-Said 2001) and allows flexibility in estimation of inter-regional trade accounts (Canning and Wang 2005) as well as reconciling of large databases (Müller, Perez-Dominguez, and Gay 2009; Wood 2011). Weights $\boldsymbol{SW}_{m,n,k,s,t}$ for the weighted sums of least squares (Morrison and Thumann 1980) were defined as:

$$\boldsymbol{SW}_{m,n,k,s,t} = \begin{cases} \dfrac{1}{\left|\boldsymbol{Z}^0_{m,n,k,s,t}\right|} & \text{if } \left|\boldsymbol{Z}^{\boldsymbol{0}}_{m,n,k,s,t}\right| > 1\text{E}-3 \\ 1\text{E}3 & \text{if } \left|\boldsymbol{Z}^{\boldsymbol{0}}_{m,n,k,s,t}\right| \leq 1\text{E}-3 \end{cases}$$

The QP function was constrained by:

1. Product output of the supply table equals product output of the use table (basic prices)
2. Industry output of the supply table equals industry output of the use table (basic prices)
3. The amount of import equals the import use.
4. Final demand of households (purchaser prices) equals the value given in the macro-economic database (this includes Non Profit Institutions Serving Households: NPISH).
5. Final demand of governments (purchaser prices) equals the value given in the macro-economic database.
6. Gross capital formation (purchaser prices) equals the value given in the macro-economic database
7. Imports, exports and re-exports (f.o.b) respect the values obtained beforehand (see 3.3) and the total equal the values given in the macro-economic database
8. Value added per broad ISIC sector equals the value given in the macro-economic database
9. The columns sums of trade and transport margins must be zero.
10. The column sum of the tax margins must equal the taxes and subsidies given in the basic price value added plus taxes block.
11. Intermediate and final demand (except capital formation) were restricted to be positive.

Due to the pre-balanced macro-economic dataset this set of constrains also ensured GDP consistent with the given macro-economic value.

3.7 MRSUT estimation and MRIO calculation

The individual country SUT tables need to be combined with the trade data in order to arrive at a fully integrated global multi-regional SUT. From the final estimate of the individual country SUT system $\boldsymbol{Z}_{m,n,k,s,t}$ for country *s*, re-exports of product *i* $(i \in m)$ $\mathbf{B}_{i,s}^{re-exp}$ are firstly subtracted from import use. Because individual country SUT tables are constrained by the values in $\mathbf{B}_{i,s}^{re-exp}$, the subtraction is equivalent to

$$\boldsymbol{Z}_{m,n=exports,k=import\ use} = 0$$

Import shares are then calculated from $B_{i,r,s}^{dom,0}$ and multiplied by the Import use matrix in order to give the bilateral import-use tables.

$$\boldsymbol{U}_{i,n,r,s\neq r,t} = \frac{B_{i,r,s}^{dom,0}}{\sum_r B_{i,r,s}^{dom,0}} * \boldsymbol{Z}_{i,n,k=import\ use,s,t}$$

Domestic use tables are unaffected by this procedure:

$$\boldsymbol{U}_{m,n,r,r=s,t} = \boldsymbol{Z}_{m,n,k=dom\ use,s,t}$$

As with supply tables:

$$\boldsymbol{V}_{i,j,r,s,t} = \boldsymbol{Z}_{i,j,k=supply,s,t}$$

This concludes the derivation of the MRSUT tables.

Note:

1) MRSUT (and MRIO tables) are often collapsed to a 2-dimensional table per year, where rows contain region of export (*m***r*), and columns contain region of import (*n***s*). The final database is delivered in this form.

2) import matrices were estimated in f.o.b. prices from trade data (section 3.3) and in the SUT estimation process (3.6), such that no re-pricing of trade flows is done when converting from individual country SUT to MRSUT. The estimated value of international transport margins are specified in $\mathbf{B}^{marg}$ in section 3.3.

3) because individual country SUT data and bilateral trade data are harmonised such that imports and exports are in the same pricing, and have the same quantity in both datasets, the assumption of proportionality that the same bilateral trade share is used for each industry in the import use table creates the expected export column from the individual country SUT data. i.e.

$$\boldsymbol{Z}_{i,n=exports,k=dom\ use,r,t} = \sum_{n,s} \boldsymbol{U}_{i,n,r,s\neq r,t}$$

For the creation of MRIO tables from the MRSUT, two official versions of the database were provided:

1) A product by product table based on the industry technology assumption
2) An industry by industry table based on the fixed product sales assumption.

Further details of methods are available in EUROSTAT 2008 . An open source implementation of the full range of constructs to create a MRIO table are available now in Python https://github.com/stefanpauliuk/pySUT as well as matlab and java routines on request.

4 Conclusion

This annex report describes the development of monetary Supply Use tables (MSUTs) for EXIOBASE 3. EXIOBASE 3 goes beyond the previous version by (1) providing a times series of MSUTs and (2) including Croatia within the explicit modelled countries (previously included in the Rest of the World – Europe region).
EXIOBASE 3 inherits main characteristics from its precursor, most importantly the level of sectorial detail (200 products, 163 industries – see Table 4.1 for a full overview) and the operationalization of the SEEA guidelines (European Commission et al. 2012).

	EXIOBASE 3
Time series	**1995 to 2016** *)
Products	**200**
Industries	**163**
Countries	**44** (28 EU member plus 16 major economies) -)
Rest of the world regions	**5** (Europe, Asia, Africa, America, Middle East)

Table 4.1: Characteristics of the monetary part of EXIOBASE 3. For a detailed list of all items included see the corresponding annex reports. *) Original time series, EXIOBASE 3 also provides now-casted MSUTs up to 2016 (see Annex report now-casting). -) Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Germany, Denmark, Estonia, Spain, Finland, France, Greece, Croatia, Hungary, Ireland, Italy, Lithuania, Luxembourg, Latvia, Malta, Netherlands, Poland, Portugal, Romania, Sweden, Slovenia, Slovakia, United Kingdom, United States, Japan, China, Canada, South Korea, Brazil, India, Mexico, Russia, Australia, Switzerland, Turkey, Taiwan, Norway, Indonesia, South Africa,

In difference to EXIOBASE 2, the development in EXIOBASE 3 followed a top-down approach starting with the macro-economic parameters which were respected in every data processing step. The advantage of this approach is that the final data base is fully consistent with these macro-economic parameters ("United Nations Statistics Division - National Accounts" 2013).

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6 Appendix

6.1 Report Macro-Economic database

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Version: 20150218
Current Git commit: 093ed8ab934242c026e8a970359ab4ee3c3b9192

6.1.1 Data inputs

- **UN SNA main agg**
  - Downloaded: 27.08.2013
  - Source: http://unstats.un.org/unsd/snaama/dnlList.asp
  - Latest update: December 2012
  - Available in current prices and constant 2005 USD
- **Taiwan economic data**
  - Downloaded: 26.08.2013
  - Source: http://eng.stat.gov.tw/ct.asp?xItem=25763&CtNode=5347&mp=5
  - Latest update: 23.11.2012
  - The detailed tables form the statistical office Taiwan were aggregated to the UN SNA main agg classification
  - Constant 2006 NTD were converted to constant 2005 NTD based on deflator values from the statistical office
  - NTD were converted to USD based on exchange rate given by the statistical office
- **EUROSTAT**
  - Only used for exchange rates USD - EURO
  - Downloaded: 14.10.2013
  - Source: http://epp.eurostat.ec.europa.eu/portal/page/portal/exchange_rates/data/database
    - Exchange rates (ert)
    - Bilateral exchange rates (ert_bil)
    - Euro/ECU exchange rates (ert_bil_eur)
    - Euro/ECU exchange rates - annual data (ert_bil_eur_a)
  - Last update: 07.10.13

6.1.1.1 Differences including Taiwan in the final dataset

Including Taiwan reduced differences of the global sum compared to the sum of countries:

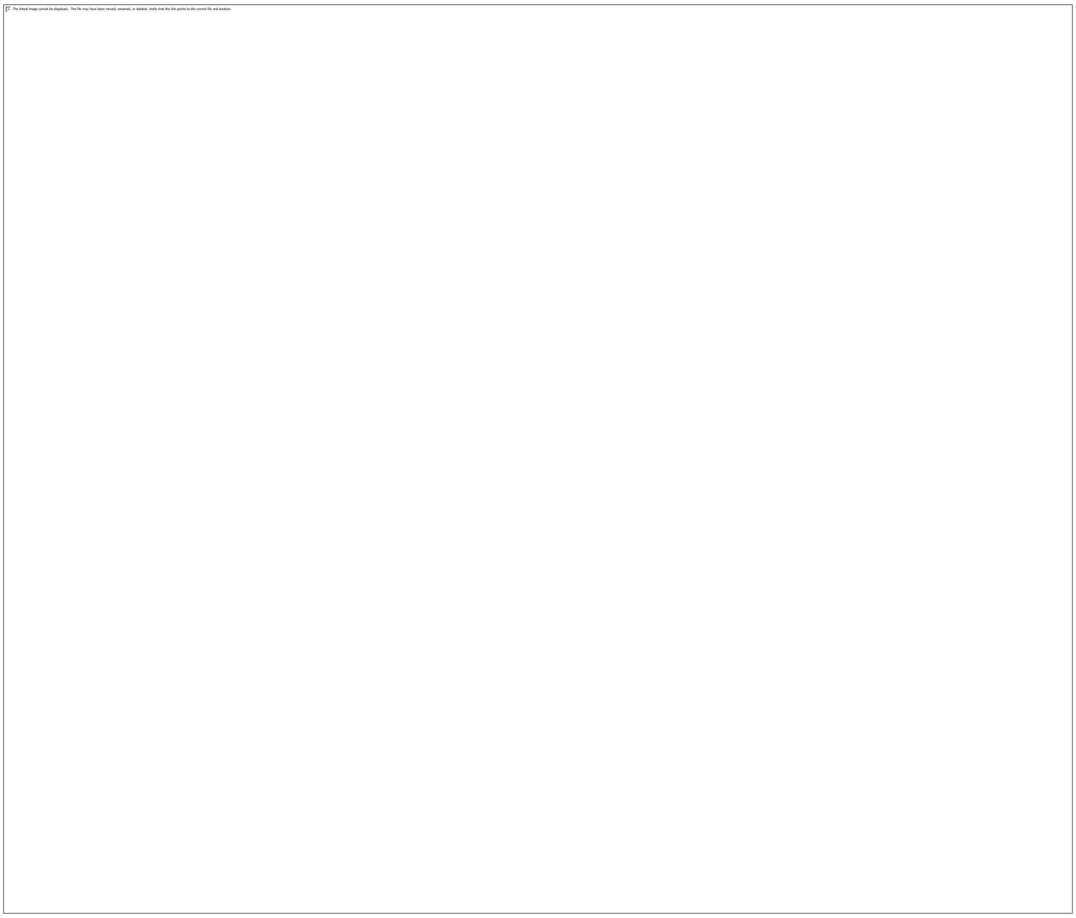

Figure 1: Percent differences global sum as given in the UN SNA main aggregates database vs. sum of all countries (all countries in the UN database with or without Taiwan data from the statistical office). Median value, errorbars: min value to max value

	Final cons.	House. cons.	Gov cons.	GCF	G fixed CF	Chang. inv	Exp	Imp	GDP	Agri...	Min. Manu., Util.	Manu.	Constr	Wholesale, Retail,...	Transp. Commun.	Other	Total Value Added
Current prices - without TW	0.77% (0.50% - 0.94%)	0.80% (0.53% - 0.97%)	0.63% (0.41% - 0.89%)	0.83% (0.43% - 1.15%)	0.86% (0.47% - 1.15%)	0.41% (0.04% - 3.40%)	1.82% (1.41% - 2.15%)	1.68% (1.23% - 2.07%)	0.83% (0.54% - 1.01%)	0.55% (0.28% - 0.76%)	1.10% (0.63% - 1.24%)	1.31% (0.94% - 1.51%)	0.38% (0.23% - 0.79%)	1.05% (0.83% - 1.30%)	0.90% (0.48% - 1.13%)	0.72% (0.54% - 0.90%)	0.84% (0.55% - 1.02%)
Current prices - with TW	0.00% (0.00% - 0.11%)	0.00% (0.00% - 0.13%)	0.00% (0.00% - 0.05%)	0.00% (0.00% - 0.10%)	0.03% (0.00% - 0.12%)	0.41% (0.04% - 3.40%)	0.00% (0.00% - 0.06%)	0.00% (0.00% - 0.07%)	0.00% (0.00% - 0.11%)	0.00% (0.00% - 1.04%)	0.00% (0.00% - 0.11%)	0.00% (0.00% - 0.06%)	0.00% (0.00% - 0.09%)	0.00% (0.00% - 0.11%)	0.00% (0.00% - 0.17%)	0.00% (0.00% - 0.05%)	0.00% (0.00% - 0.11%)
Constant prices - without TW	0.74% (0.62% - 0.76%)	0.78% (0.64% - 0.80%)	0.60% (0.52% - 0.70%)	0.79% (0.50% - 1.00%)	0.83% (0.54% - 1.00%)	0.16% (0.03% - 0.69%)	1.68% (1.45% - 1.95%)	1.64% (1.32% - 1.85%)	0.76% (0.70% - 0.88%)	0.48% (0.38% - 0.60%)	0.98% (0.84% - 1.32%)	1.31% (1.07% - 1.65%)	0.36% (0.24% - 0.49%)	1.02% (0.91% - 1.14%)	0.78% (0.61% - 0.83%)	0.69% (0.63% - 0.71%)	0.78% (0.71% - 0.89%)
Constant prices - with TW	0.00% (0.00% - 0.10%)	0.00% (0.00% - 0.12%)	0.00% (0.00% - 0.03%)	0.00% (0.00% - 0.08%)	0.03% (0.00% - 0.10%)	0.16% (0.03% - 0.69%)	0.00% (0.00% - 0.07%)	0.00% (0.00% - 0.05%)	0.00% (0.00% - 0.09%)	0.00% (0.00% - 0.95%)	0.00% (0.00% - 0.08%)	0.00% (0.00% - 0.04%)	0.00% (0.00% - 0.08%)	0.00% (0.00% - 0.09%)	0.00% (0.00% - 0.17%)	0.00% (0.00% - 0.03%)	0.00% (0.00% - 0.10%)

6.1.1.2 Final dataset

Available in current prices and constant 2005 USD and EURO Countries in the final Macro Economic Database:

Afghanistan, Albania, Algeria, Andorra, Angola, Anguilla, Antigua and Barbuda, Argentina, Armenia, Aruba, Australia, Austria, Azerbaijan, Bahamas, The, Bahrain, Bangladesh, Barbados, Belarus, Belgium, Belize, Benin, Bermuda, Bhutan, Bolivia, Bosnia and Herzegovina, Botswana, Brazil, British Virgin Islands, Brunei Darussalam, Bulgaria, Burkina Faso, Burundi, Cambodia, Cameroon, Canada, Cape Verde, Cayman Islands, Central African Republic, Chad, Chile, China, Hong Kong SAR, China, Macao SAR, China, Colombia, Comoros, Congo, Rep., Cook Islands, Costa Rica, Croatia, Cuba, Cyprus, Czech Republic, Cote d'Ivoire, Korea, democratic people's republic of, Congo, Dem. Rep., Denmark, Djibouti, Dominica, Dominican Republic, Ecuador, Egypt, Arab Rep., El Salvador, Equatorial Guinea, Eritrea, Estonia, Ethiopia, Fiji, Finland, France, French Polynesia, Gabon, Gambia, The, Georgia, Germany, Ghana, Greece, Greenland, Grenada, Guatemala, Guinea, Guinea-Bissau, Guyana, Haiti, Honduras, Hungary, Iceland, India, Indonesia, Iran, Islamic Rep., Iraq, Ireland, Israel, Italy, Jamaica, Japan, Jordan, Kazakhstan, Kenya, Kiribati, Kosovo, Kuwait, Kyrgyz Republic, Lao PDR, Latvia, Lebanon, Lesotho, Liberia, Libya, Liechtenstein, Lithuania, Luxembourg, Madagascar, Malawi, Malaysia, Maldives, Mali, Malta, Marshall Islands, Mauritania, Mauritius, Mexico, Micronesia, Fed. Sts., Monaco, Mongolia, Montenegro, Montserrat, Morocco, Mozambique, Myanmar, Namibia, Nauru, Nepal, Netherlands, Netherlands Antilles, New Caledonia, New Zealand, Nicaragua, Niger, Nigeria, Norway, Palestine, Oman, Pakistan, Palau, Panama, Papua New Guinea, Paraguay, Peru, Philippines, Poland, Portugal, Puerto Rico, Qatar, South Korea, Moldova, Romania, Russia, Rwanda, St. Kitts and Nevis, St. Lucia, Samoa, San Marino, Sao Tome and Principe, Saudi Arabia, Senegal, Serbia, Seychelles, Sierra Leone, Singapore, Slovakia, Slovenia, Solomon Islands, Somalia, South Africa, South Sudan, Spain, Sri Lanka, St. Vincent and the Grenadines, Sudan, Suriname, Swaziland, Sweden, Switzerland, Syrian Arab Republic, Tajikistan, Thailand, Macedonia, FYR, Timor-Leste, Togo, Tonga, Trinidad and Tobago, Tunisia, Turkey, Turkmenistan, Turks and Caicos Islands, Tuvalu, Uganda, Ukraine, United Arab Emirates, United Kingdom, Tanganjika, United States, Uruguay, Uzbekistan, Vanuatu, Venezuela, RB, Vietnam, Yemen, Rep., Zambia, Zanzibar, Zimbabwe, Taiwan,

6.1.1.2.1 Categories in the final Macro Economic Database

Final consumption expenditure

Household consumption expenditure (including Non-profit institutions serving households)

General government final consumption expenditure

Gross capital formation

Exports of goods and services

Imports of goods and services

Gross Domestic Product (GDP)

Agriculture, hunting, forestry, fishing (ISIC A-B)

Mining, Manufacturing, Utilities (ISIC C-E)

Manufacturing (ISIC D)

Construction (ISIC F)

Wholesale, retail trade, restaurants and hotels (ISIC G-H)

Transport, storage and communication (ISIC I)

Other Activities (ISIC J-P)

6.1.2 Data checks

6.1.2.1 Negative values were set to zero for

6.1.2.1.1 Constant prices

Nauru - Mining, Manufacturing, Utilities (ISIC C-E) - 1995
Nauru - Mining, Manufacturing, Utilities (ISIC C-E) - 1996
Nauru - Mining, Manufacturing, Utilities (ISIC C-E) - 1997
Nauru - Mining, Manufacturing, Utilities (ISIC C-E) - 2004
Nauru - Mining, Manufacturing, Utilities (ISIC C-E) - 2005
Swaziland - Gross capital formation - 2006
Nauru - Mining, Manufacturing, Utilities (ISIC C-E) - 2006
Nauru - Manufacturing (ISIC D) - 2006
Swaziland - Gross capital formation - 2007
Nauru - Transport, storage and communication (ISIC I) - 2007
Swaziland - Gross capital formation - 2008
Swaziland - Gross capital formation - 2010
Swaziland - Gross capital formation - 2011

6.1.2.1.2 Current prices

Nauru - Mining, Manufacturing, Utilities (ISIC C-E) - 1995
Nauru - Mining, Manufacturing, Utilities (ISIC C-E) - 1996
Nauru - Mining, Manufacturing, Utilities (ISIC C-E) - 1997
Nauru - Mining, Manufacturing, Utilities (ISIC C-E) - 2004
Nauru - Mining, Manufacturing, Utilities (ISIC C-E) - 2005
Nauru - Mining, Manufacturing, Utilities (ISIC C-E) - 2006
Nauru - Manufacturing (ISIC D) - 2006
Nauru - Transport, storage and communication (ISIC I) - 2007

6.1.2.2 Manufactoring bigger than Sector (Mining + Manufactoring and Utilities) - set to the max of both for

6.1.2.2.1 Constant prices

Lebanon - Mining, Manufacturing, Utilities (ISIC C-E) - 1995
Nauru - Mining, Manufacturing, Utilities (ISIC C-E) - 1995
Sudan - Mining, Manufacturing, Utilities (ISIC C-E) - 1995
Lebanon - Mining, Manufacturing, Utilities (ISIC C-E) - 1996
Nauru - Mining, Manufacturing, Utilities (ISIC C-E) - 1996
Sudan - Mining, Manufacturing, Utilities (ISIC C-E) - 1996
Lebanon - Mining, Manufacturing, Utilities (ISIC C-E) - 1997
Nauru - Mining, Manufacturing, Utilities (ISIC C-E) - 1997
Sudan - Mining, Manufacturing, Utilities (ISIC C-E) - 1997
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Sudan - Mining, Manufacturing, Utilities (ISIC C-E) - 1998
Lebanon - Mining, Manufacturing, Utilities (ISIC C-E) - 1999
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Lebanon - Mining, Manufacturing, Utilities (ISIC C-E) - 2008
Lebanon - Mining, Manufacturing, Utilities (ISIC C-E) - 2009
Lebanon - Mining, Manufacturing, Utilities (ISIC C-E) - 2010
Ireland - Mining, Manufacturing, Utilities (ISIC C-E) - 2011
Lebanon - Mining, Manufacturing, Utilities (ISIC C-E) - 2011

6.1.2.2.2 Current prices

Nauru - Mining, Manufacturing, Utilities (ISIC C-E) - 1995
Nauru - Mining, Manufacturing, Utilities (ISIC C-E) - 1996
Nauru - Mining, Manufacturing, Utilities (ISIC C-E) - 1997
Nauru - Mining, Manufacturing, Utilities (ISIC C-E) - 1998
Nauru - Mining, Manufacturing, Utilities (ISIC C-E) - 1999
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Nauru - Mining, Manufacturing, Utilities (ISIC C-E) - 2003
Nauru - Mining, Manufacturing, Utilities (ISIC C-E) - 2004
Lebanon - Mining, Manufacturing, Utilities (ISIC C-E) - 2005
Nauru - Mining, Manufacturing, Utilities (ISIC C-E) - 2005
Lebanon - Mining, Manufacturing, Utilities (ISIC C-E) - 2006
Lebanon - Mining, Manufacturing, Utilities (ISIC C-E) - 2007
Lebanon - Mining, Manufacturing, Utilities (ISIC C-E) - 2008
Lebanon - Mining, Manufacturing, Utilities (ISIC C-E) - 2009
Lebanon - Mining, Manufacturing, Utilities (ISIC C-E) - 2010
Lebanon - Mining, Manufacturing, Utilities (ISIC C-E) - 2011

6.1.3 Balance global trade

Global trade was balance for equal imports / exports for each year - differences were compensated by changing gross cap formation

6.1.3.1 Required change per year (in USD)

6.1.3.1.1 Current prices (USD)

Year	Absolute change	Global trade
1995	1.41e+11	6.48e+12
1996	1.38e+11	6.80e+12
1997	1.61e+11	7.06e+12
1998	9.99e+10	6.95e+12
1999	7.39e+10	7.23e+12
2000	3.37e+10	8.03e+12
2001	1.69e+10	7.76e+12

2002	5.79e+10	8.15e+12
2003	7.50e+10	9.45e+12
2004	1.03e+11	1.14e+13
2005	1.65e+11	1.30e+13
2006	2.84e+11	1.50e+13
2007	3.71e+11	1.74e+13
2008	3.89e+11	1.99e+13
2009	3.56e+11	1.59e+13
2010	5.32e+11	1.91e+13
2011	6.08e+11	2.25e+13

6.1.3.1.2 Constant 2005 prices (USD)

Year	Absolute change	Global trade
1995	3.46e+11	6.83e+12
1996	3.39e+11	7.32e+12
1997	4.07e+11	8.07e+12
1998	3.51e+11	8.44e+12
1999	2.99e+11	8.88e+12
2000	3.25e+11	1.00e+13
2001	2.94e+11	1.01e+13
2002	3.10e+11	1.04e+13
2003	2.35e+11	1.09e+13
2004	1.94e+11	1.21e+13
2005	1.65e+11	1.30e+13
2006	2.04e+11	1.43e+13
2007	1.62e+11	1.53e+13
2008	2.18e+11	1.57e+13
2009	3.06e+11	1.43e+13
2010	2.85e+11	1.62e+13
2011	2.88e+11	1.73e+13

Figure 2: Relative change in trade required to balance global trade

6.1.4 Missing subcategories

Sub-category data missing for

6.1.4.1.1 Current prices

Korea, democratic people's republic of

6.1.4.1.2 Constant prices

Korea, democratic people's republic of
Swaziland

Missing data was estimated based on global shares

6.1.5 Balancing the dataset

All years balanced without problems

6.1.5.1 Current prices dataset

year	modelstat	solverstat
1995	1	1
1996	1	1
1997	1	1
1998	1	1
1999	1	1
2000	1	1
2001	1	1

2002	1	1
2003	1	1
2004	1	1
2005	1	1
2006	1	1
2007	1	1
2008	1	1
2009	1	1
2010	1	1
2011	1	1

6.1.5.2 Constant prices dataset

year	modelstat	solverstat
1995	1	1
1996	1	1
1997	1	1
1998	1	1
1999	1	1
2000	1	1
2001	1	1
2002	1	1
2003	1	1
2004	1	1
2005	1	1
2006	1	1
2007	1	1
2008	1	1
2009	1	1
2010	1	1
2011	1	1

6.1.6 Overall differences per country due to balancing of the dataset

6.1.6.1 Current prices - relative differences (absolute change / UN SNA initial entry: median (min - max)) over all years ()

Country	Final cons.	House. cons.	Gov cons.	GCF	Exp	Imp	GDP	Agri...	Min. Manu., Util.	Manu.	Constr	Wholesale, Retail,...	Transp. Commun.	Other
Afghanistan	0.26% (0.06% - 0.50%)	0.27% (0.02% - 0.50%)	0.29% (0.05% - 0.76%)	31.21% (5.09% - 78.19%)	0.15% (0.01% - 1.38%)	10.68% (0.17% - 14.36%)	0.00% (0.00% - 0.02%)	4.19% (0.54% - 16.07%)	6.47% (2.67% - 19.21%)	3.73% (2.13% - 8.70%)	1.81% (0.06% - 10.88%)	3.47% (0.84% - 14.41%)	1.16% (0.05% - 10.88%)	7.44% (2.39% - 21.46%)
Albania	0.19% (0.03% - 0.43%)	0.23% (0.01% - 0.43%)	0.25% (0.01% - 0.50%)	8.24% (0.63% - 27.72%)	0.17% (0.04% - 1.46%)	10.85% (0.10% - 14.92%)	0.01% (0.00% - 0.02%)	9.02% (1.48% - 14.80%)	12.12% (2.81% - 16.53%)	4.63% (2.78% - 8.87%)	5.53% (0.41% - 9.22%)	7.91% (3.14% - 9.25%)	3.74% (0.68% - 6.87%)	14.10% (2.04% - 16.81%)
Algeria	0.18% (0.02% - 0.41%)	0.24% (0.02% - 0.41%)	0.23% (0.02% - 0.40%)	8.29% (1.81% - 12.37%)	0.20% (0.04% - 1.41%)	10.87% (0.14% - 15.04%)	0.00% (0.00% - 0.03%)	2.94% (1.21% - 4.95%)	5.70% (4.19% - 6.89%)	4.69% (2.80% - 8.90%)	2.27% (0.06% - 4.96%)	2.56% (0.44% - 7.19%)	2.45% (0.07% - 5.34%)	6.61% (3.10% - 11.08%)
Andorra	0.18% (0.03% -	0.22% (0.03% -	0.25% (0.03% -	11.60% (2.23% -	0.19% (0.05% -	10.83% (0.14% -	0.01% (0.00% -	10.99% (7.70% -	13.50% (10.85% -	4.56% (2.63% -	6.70% (2.96% -	7.54% (6.23% -	4.50% (1.68% -	14.53% (12.37% -

	0.41%)	0.42%)	0.44%)	21.28%)	1.41%)	14.94%)	0.03%)	18.47%)	22.14%)	8.60%)	18.49%)	22.43%)	17.51%)	21.48%)
Angola	0.25% (0.01% - 0.50%)	0.24% (0.01% - 0.53%)	0.31% (0.01% - 0.50%)	34.17% (9.48% - 60.24%)	0.19% (0.01% - 1.32%)	10.63% (0.23% - 14.76%)	0.00% (0.00% - 0.03%)	2.25% (0.19% - 3.64%)	2.60% (0.68% - 6.78%)	4.69% (2.80% - 8.90%)	2.14% (0.13% - 7.46%)	2.37% (0.47% - 4.00%)	4.74% (1.45% - 8.73%)	3.56% (1.15% - 8.72%)
Anguilla	0.27% (0.01% - 0.48%)	0.22% (0.02% - 0.49%)	0.30% (0.02% - 0.78%)	20.74% (2.99% - 63.28%)	0.16% (0.03% - 1.39%)	10.48% (0.09% - 14.11%)	0.01% (0.01% - 0.03%)	12.66% (8.11% - 23.09%)	15.82% (12.22% - 25.52%)	3.99% (2.04% - 8.62%)	10.79% (7.36% - 18.35%)	13.53% (8.50% - 19.78%)	9.52% (4.87% - 15.83%)	17.78% (10.64% - 25.68%)
Antigua and Barbuda	0.14% (0.02% - 0.45%)	0.20% (0.01% - 0.45%)	0.28% (0.07% - 0.50%)	17.20% (4.62% - 32.34%)	0.15% (0.03% - 1.39%)	10.74% (0.16% - 14.85%)	0.01% (0.01% - 0.03%)	12.09% (8.21% - 18.46%)	15.82% (11.67% - 20.64%)	4.53% (2.65% - 8.84%)	10.18% (8.05% - 12.59%)	11.80% (8.45% - 16.18%)	8.37% (4.97% - 11.87%)	16.46% (13.36% - 20.84%)
Argentina	0.18% (0.00% - 0.41%)	0.23% (0.02% - 0.42%)	0.23% (0.01% - 0.40%)	7.35% (0.64% - 11.68%)	0.22% (0.03% - 1.41%)	10.87% (0.14% - 15.05%)	0.00% (0.00% - 0.02%)	4.66% (2.03% - 11.41%)	8.21% (4.45% - 13.11%)	4.69% (2.80% - 8.90%)	3.62% (0.12% - 5.83%)	4.68% (1.15% - 8.50%)	2.10% (0.22% - 4.04%)	9.88% (6.65% - 12.56%)
Armenia	0.16% (0.03% - 0.39%)	0.17% (0.01% - 0.40%)	0.21% (0.06% - 0.59%)	13.28% (1.71% - 57.44%)	0.10% (0.01% - 1.21%)	10.75% (0.34% - 15.06%)	0.01% (0.00% - 0.02%)	7.95% (0.91% - 13.93%)	10.84% (5.24% - 15.71%)	4.66% (2.79% - 8.88%)	5.94% (1.98% - 7.45%)	6.97% (4.79% - 9.25%)	3.19% (1.05% - 5.70%)	12.91% (4.43% - 15.37%)
Aruba	0.20% (0.00% - 0.47%)	0.22% (0.00% - 0.49%)	0.31% (0.04% - 0.53%)	24.66% (4.53% - 41.25%)	0.09% (0.00% - 1.39%)	10.70% (0.16% - 14.73%)	0.00% (0.00% - 0.02%)	0.79% (0.10% - 7.99%)	4.06% (1.80% - 9.98%)	4.64% (2.76% - 8.83%)	1.20% (0.02% - 4.08%)	1.34% (0.12% - 4.79%)	2.26% (0.37% - 5.96%)	6.57% (3.17% - 8.18%)
Australia	0.00% (0.00% - 0.22%)	0.00% (0.00% - 0.22%)	0.00% (0.00% - 0.22%)	0.00% (0.00% - 0.22%)	0.00% (0.00% - 0.22%)	0.00% (0.00% - 0.22%)	0.00% (0.00% - 0.00%)	8.67% (7.13% - 9.65%)	8.67% (7.13% - 9.65%)	8.67% (7.13% - 9.65%)	8.67% (7.13% - 9.65%)	8.67% (7.13% - 9.65%)	8.67% (7.13% - 9.65%)	8.67% (7.13% - 9.65%)
Austria	0.15% (0.00% - 0.24%)	0.15% (0.00% - 0.24%)	0.15% (0.00% - 0.24%)	0.15% (0.00% - 0.24%)	0.15% (0.00% - 0.24%)	0.15% (0.00% - 0.24%)	0.00% (0.00% - 0.00%)	10.63% (10.34% - 11.73%)	10.63% (10.34% - 11.73%)	10.63% (10.34% - 11.73%)	10.63% (10.34% - 11.73%)	10.63% (10.34% - 11.73%)	10.63% (10.34% - 11.73%)	10.63% (10.34% - 11.73%)
Azerbaijan	0.16% (0.01% - 0.39%)	0.19% (0.01% - 0.39%)	0.21% (0.04% - 0.51%)	4.82% (0.16% - 29.31%)	0.22% (0.02% - 1.40%)	10.82% (0.15% - 15.08%)	0.00% (0.00% - 0.03%)	5.98% (1.54% - 8.11%)	8.44% (4.27% - 12.01%)	4.69% (2.80% - 8.90%)	2.40% (0.92% - 8.62%)	4.04% (0.01% - 12.21%)	1.42% (0.25% - 7.90%)	8.45% (5.50% - 13.77%)
Bahamas, The	0.20% (0.05% - 0.44%)	0.21% (0.01% - 0.45%)	0.28% (0.02% - 0.50%)	15.06% (0.73% - 30.35%)	0.15% (0.00% - 1.41%)	10.74% (0.15% - 14.86%)	0.00% (0.00% - 0.03%)	1.44% (0.16% - 5.52%)	4.03% (1.23% - 6.55%)	4.67% (2.77% - 8.85%)	2.49% (0.22% - 5.32%)	1.57% (0.01% - 6.39%)	3.66% (0.66% - 6.39%)	5.96% (1.10% - 7.88%)
Bahrain	0.17% (0.02% - 0.47%)	0.23% (0.01% - 0.50%)	0.27% (0.04% - 0.51%)	23.18% (9.02% - 41.76%)	0.15% (0.01% - 1.34%)	10.70% (0.21% - 14.85%)	0.01% (0.00% - 0.04%)	11.51% (3.62% - 13.81%)	8.33% (1.88% - 10.60%)	4.69% (2.80% - 8.90%)	13.10% (9.16% - 17.38%)	12.34% (7.90% - 14.01%)	15.19% (11.72% - 17.74%)	6.80% (4.48% - 9.62%)
Bangladesh	0.21% (0.07% - 0.45%)	0.21% (0.04% - 0.45%)	0.27% (0.05% - 0.53%)	15.51% (1.31% - 32.28%)	0.16% (0.00% - 1.46%)	10.65% (0.09% - 14.92%)	0.00% (0.00% - 0.03%)	2.41% (1.64% - 5.87%)	5.96% (4.24% - 7.59%)	4.69% (2.80% - 8.89%)	1.82% (0.00% - 2.74%)	1.33% (0.18% - 6.33%)	2.22% (0.10% - 3.74%)	6.94% (4.63% - 9.72%)
Barbados	0.20% (0.02% - 0.44%)	0.21% (0.05% - 0.46%)	0.32% (0.00% - 0.59%)	22.50% (1.95% - 49.09%)	0.07% (0.00% - 1.40%)	10.60% (0.16% - 14.60%)	0.01% (0.01% - 0.03%)	14.04% (9.85% - 21.75%)	16.69% (13.76% - 23.64%)	4.65% (2.75% - 8.82%)	11.64% (9.24% - 16.31%)	13.66% (11.75% - 15.54%)	10.64% (6.73% - 13.18%)	19.63% (12.34% - 21.82%)
Belarus	0.14% (0.01% - 0.47%)	0.22% (0.00% - 0.49%)	0.32% (0.06% - 0.50%)	23.91% (1.45% - 35.33%)	0.15% (0.00% - 1.45%)	10.72% (0.10% - 14.89%)	0.01% (0.01% - 0.02%)	12.50% (3.90% - 16.38%)	14.94% (8.20% - 18.16%)	4.69% (2.80% - 8.90%)	8.97% (4.98% - 12.80%)	11.65% (6.09% - 14.48%)	7.72% (4.08% - 9.56%)	16.74% (7.42% - 21.27%)
Belgium	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	11.87% (10.99% - 12.34%)	11.87% (10.99% - 12.34%)	11.87% (10.99% - 12.34%)	11.87% (10.99% - 12.34%)	11.87% (10.99% - 12.34%)	11.87% (10.99% - 12.34%)	11.87% (10.99% - 12.34%)
Belize	0.31% (0.06% - 0.54%)	0.29% (0.02% - 0.56%)	0.28% (0.03% - 0.63%)	14.82% (1.93% - 45.25%)	0.17% (0.00% - 1.49%)	10.64% (0.06% - 14.50%)	0.01% (0.01% - 0.02%)	11.31% (8.41% - 12.40%)	12.83% (11.56% - 15.93%)	4.59% (2.69% - 8.67%)	6.77% (3.19% - 12.69%)	7.37% (5.24% - 16.24%)	4.22% (2.32% - 12.43%)	14.33% (11.17% - 16.91%)
Benin	0.19% (0.02% - 0.43%)	0.20% (0.02% - 0.43%)	0.26% (0.05% - 0.44%)	14.33% (2.71% - 21.29%)	0.15% (0.03% - 1.41%)	10.81% (0.14% - 14.98%)	0.01% (0.00% - 0.02%)	7.74% (4.44% - 11.02%)	10.86% (7.55% - 12.83%)	4.49% (2.71% - 8.76%)	5.03% (3.22% - 6.98%)	6.73% (4.19% - 9.75%)	3.06% (1.62% - 5.50%)	11.37% (7.34% - 15.05%)
Bermuda	0.21% (0.02% - 0.89%)	0.24% (0.04% - 0.90%)	0.37% (0.02% - 0.88%)	31.73% (13.11% - 80.25%)	0.14% (0.00% - 2.20%)	10.66% (0.65% - 14.74%)	0.01% (0.00% - 0.03%)	4.15% (1.18% - 7.41%)	1.41% (0.18% - 4.25%)	4.63% (2.69% - 8.73%)	7.32% (0.66% - 12.59%)	5.91% (1.44% - 10.54%)	10.27% (1.38% - 12.59%)	1.72% (0.23% - 3.85%)
Bhutan	0.22% (0.04% - 0.53%)	0.26% (0.04% - 0.55%)	0.26% (0.02% - 0.47%)	16.05% (3.60% - 55.31%)	0.21% (0.05% - 1.25%)	10.45% (0.27% - 14.87%)	0.00% (0.00% - 0.03%)	2.51% (0.38% - 5.64%)	5.21% (3.33% - 7.15%)	4.61% (2.74% - 8.85%)	1.26% (0.15% - 3.09%)	1.63% (0.16% - 5.39%)	2.54% (0.28% - 3.81%)	6.17% (3.78% - 10.27%)
Bolivia	0.19% (0.07% - 0.46%)	0.22% (0.00% - 0.47%)	0.30% (0.06% - 0.49%)	18.82% (2.90% - 30.17%)	0.16% (0.01% - 1.40%)	10.73% (0.15% - 14.86%)	0.01% (0.00% - 0.02%)	9.19% (5.51% - 25.01%)	13.10% (8.67% - 26.79%)	4.69% (2.80% - 8.90%)	8.71% (5.05% - 18.91%)	12.10% (6.68% - 19.33%)	8.08% (2.67% - 16.79%)	15.59% (10.79% - 26.18%)
Bosnia and Herzegovina	0.17% (0.03% - 0.46%)	0.21% (0.06% - 0.47%)	0.18% (0.02% - 0.45%)	16.65% (0.90% - 41.85%)	0.30% (0.03% - 1.41%)	10.89% (0.14% - 15.36%)	0.01% (0.01% - 0.03%)	19.05% (14.93% - 22.82%)	20.61% (18.15% - 24.75%)	4.69% (2.80% - 8.90%)	14.95% (11.46% - 20.24%)	16.12% (13.30% - 23.83%)	11.97% (10.18% - 19.90%)	22.54% (18.27% - 25.86%)
Botswana	0.29% (0.00% - 0.58%)	0.30% (0.02% - 0.58%)	0.38% (0.02% - 0.58%)	41.14% (2.31% - 78.04%)	0.15% (0.00% - 1.97%)	10.17% (0.41% - 14.48%)	0.00% (0.00% - 0.03%)	1.46% (0.16% - 6.67%)	5.01% (2.59% - 8.39%)	4.69% (2.79% - 8.90%)	1.92% (0.01% - 3.73%)	0.87% (0.04% - 6.17%)	2.61% (0.39% - 5.20%)	6.52% (3.60% - 9.62%)
Brazil	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	16.08% (13.06% - 17.51%)	16.08% (13.06% - 17.51%)	16.08% (13.06% - 17.51%)	16.08% (13.06% - 17.51%)	16.08% (13.06% - 17.51%)	16.08% (13.06% - 17.51%)	16.08% (13.06% - 17.51%)
British Virgin Islands	0.26% (0.01% - 0.56%)	0.25% (0.01% - 0.58%)	0.36% (0.02% - 0.68%)	33.21% (6.23% - 48.53%)	0.15% (0.03% - 1.38%)	10.52% (0.18% - 14.36%)	0.01% (0.00% - 0.03%)	3.36% (0.12% - 4.98%)	1.05% (0.16% - 4.56%)	4.12% (2.36% - 8.34%)	4.49% (3.07% - 8.77%)	3.92% (0.12% - 5.32%)	7.06% (3.82% - 10.05%)	1.85% (0.28% - 3.46%)

Brunei Darussalam	0.25% (0.00% - 0.60%)	0.34% (0.02% - 0.64%)	0.31% (0.03% - 0.56%)	22.83% (6.02% - 70.79%)	0.29% (0.03% - 1.33%)	10.68% (0.22% - 15.43%)	0.01% (0.00% - 0.03%)	2.91% (0.06% - 3.57%)	0.69% (0.01% - 1.47%)	4.69% (2.80% - 8.90%)	5.25% (2.40% - 8.25%)	4.25% (1.07% - 7.07%)	8.03% (2.71% - 9.42%)	1.88% (0.00% - 3.87%)
Bulgaria	0.00% (0.00% - 2.87%)	0.00% (0.00% - 2.40%)	0.00% (0.00% - 2.40%)	0.00% (0.00% - 2.87%)	0.00% (0.00% - 2.87%)	0.00% (0.00% - 2.87%)	0.00% (0.00% - 0.00%)	16.13% (12.66% - 28.56%)	16.13% (12.66% - 28.56%)	16.13% (12.66% - 28.56%)	16.13% (12.66% - 28.56%)	16.13% (12.66% - 28.56%)	16.13% (12.66% - 28.56%)	16.13% (12.66% - 28.56%)
Burkina Faso	0.18% (0.01% - 0.41%)	0.29% (0.03% - 0.43%)	0.25% (0.01% - 0.40%)	6.33% (2.11% - 13.68%)	0.19% (0.04% - 1.41%)	10.84% (0.14% - 15.03%)	0.01% (0.00% - 0.03%)	7.32% (4.49% - 10.29%)	10.51% (7.74% - 12.29%)	4.63% (2.71% - 8.89%)	3.83% (1.16% - 9.10%)	5.32% (0.01% - 12.48%)	1.80% (0.20% - 8.17%)	10.89% (5.50% - 14.01%)
Burundi	0.25% (0.07% - 0.47%)	0.25% (0.00% - 0.49%)	0.31% (0.02% - 0.58%)	16.27% (0.41% - 55.59%)	0.12% (0.01% - 1.45%)	10.23% (0.05% - 14.75%)	0.01% (0.00% - 0.02%)	9.07% (3.40% - 12.90%)	12.03% (6.66% - 17.23%)	4.42% (2.42% - 8.61%)	5.91% (1.56% - 13.97%)	7.43% (1.88% - 17.52%)	3.68% (1.41% - 13.71%)	11.82% (9.75% - 16.82%)
Cambodia	0.22% (0.00% - 0.59%)	0.23% (0.01% - 0.59%)	0.39% (0.03% - 0.60%)	32.88% (5.29% - 51.82%)	0.11% (0.00% - 1.38%)	10.65% (0.17% - 14.64%)	0.00% (0.00% - 0.02%)	4.52% (2.45% - 8.48%)	7.75% (5.60% - 10.52%)	4.31% (2.68% - 8.74%)	2.51% (0.09% - 5.54%)	3.54% (1.36% - 7.36%)	0.88% (0.03% - 3.25%)	9.82% (5.69% - 11.63%)
Cameroon	0.18% (0.01% - 0.41%)	0.19% (0.01% - 0.42%)	0.25% (0.04% - 0.44%)	10.80% (2.11% - 18.14%)	0.19% (0.05% - 1.41%)	10.79% (0.14% - 14.98%)	0.00% (0.00% - 0.02%)	6.20% (3.64% - 9.77%)	8.84% (7.86% - 11.48%)	4.69% (2.80% - 8.90%)	4.05% (0.70% - 5.97%)	5.19% (3.04% - 9.00%)	1.66% (0.13% - 4.44%)	10.47% (7.08% - 13.18%)
Canada	0.04% (0.01% - 0.15%)	0.04% (0.01% - 0.15%)	0.04% (0.01% - 0.15%)	0.04% (0.01% - 0.15%)	0.04% (0.01% - 0.15%)	0.04% (0.01% - 0.15%)	0.00% (0.00% - 0.00%)	7.46% (6.24% - 8.08%)	7.46% (6.24% - 8.08%)	7.46% (6.24% - 8.08%)	7.46% (6.24% - 8.08%)	7.46% (6.24% - 8.08%)	7.46% (6.24% - 8.08%)	7.46% (6.24% - 8.08%)
Cape Verde	0.19% (0.04% - 0.43%)	0.20% (0.01% - 0.43%)	0.27% (0.07% - 0.46%)	15.36% (1.76% - 24.20%)	0.17% (0.03% - 1.40%)	10.75% (0.13% - 14.91%)	0.01% (0.00% - 0.02%)	9.08% (2.28% - 13.24%)	11.83% (5.88% - 14.99%)	4.45% (2.63% - 8.72%)	5.62% (2.18% - 7.69%)	7.41% (5.49% - 8.99%)	4.02% (1.21% - 5.18%)	13.39% (5.18% - 16.05%)
Cayman Islands	0.18% (0.02% - 0.47%)	0.22% (0.02% - 0.48%)	0.31% (0.05% - 0.53%)	23.46% (1.02% - 35.69%)	0.11% (0.00% - 1.35%)	10.70% (0.21% - 14.77%)	0.01% (0.00% - 0.04%)	11.62% (5.20% - 13.00%)	8.18% (3.59% - 10.69%)	4.67% (2.80% - 8.89%)	12.59% (10.58% - 17.63%)	12.84% (6.99% - 14.18%)	15.88% (11.20% - 18.91%)	6.65% (5.37% - 8.60%)
Central African Republic	0.16% (0.01% - 0.49%)	0.21% (0.02% - 0.50%)	0.29% (0.06% - 0.56%)	20.92% (4.00% - 38.51%)	0.12% (0.00% - 1.38%)	10.69% (0.14% - 14.82%)	0.00% (0.00% - 0.03%)	5.56% (3.45% - 9.04%)	8.89% (6.02% - 10.63%)	4.61% (2.68% - 8.68%)	2.50% (0.21% - 7.11%)	3.78% (0.64% - 9.51%)	1.19% (0.12% - 5.66%)	9.80% (5.93% - 11.93%)
Chad	0.18% (0.00% - 0.42%)	0.20% (0.02% - 0.44%)	0.25% (0.04% - 0.46%)	15.78% (1.25% - 42.18%)	0.10% (0.02% - 1.42%)	10.81% (0.13% - 15.02%)	0.00% (0.00% - 0.03%)	2.22% (0.18% - 12.55%)	5.72% (3.28% - 13.40%)	4.37% (2.01% - 8.89%)	2.61% (0.49% - 7.36%)	2.75% (0.64% - 8.14%)	2.65% (0.24% - 6.04%)	7.10% (2.54% - 13.03%)
Chile	0.19% (0.03% - 0.42%)	0.21% (0.02% - 0.43%)	0.26% (0.04% - 0.45%)	10.71% (2.28% - 21.07%)	0.20% (0.04% - 1.40%)	10.79% (0.15% - 14.96%)	0.01% (0.00% - 0.02%)	7.81% (6.28% - 10.79%)	10.47% (9.25% - 12.49%)	4.69% (2.80% - 8.90%)	5.15% (1.09% - 8.95%)	5.98% (3.78% - 12.50%)	2.18% (0.29% - 8.68%)	11.67% (9.55% - 14.29%)
China	0.03% (0.00% - 0.86%)	0.03% (0.00% - 0.86%)	0.03% (0.00% - 0.86%)	0.03% (0.00% - 0.86%)	0.03% (0.00% - 0.86%)	0.03% (0.00% - 0.86%)	0.00% (0.00% - 0.00%)	1.19% (0.01% - 4.69%)	1.19% (0.01% - 4.69%)	Inf% (0.01% - Inf%)	1.19% (0.01% - 4.69%)	1.19% (0.01% - 4.69%)	1.19% (0.01% - 4.69%)	1.19% (0.01% - 4.69%)
Hong Kong SAR, China	0.40% (0.03% - 1.16%)	0.36% (0.02% - 1.14%)	0.41% (0.18% - 1.58%)	46.31% (7.20% - 99.96%)	0.45% (0.03% - 1.86%)	10.04% (0.19% - 12.85%)	0.00% (0.00% - 0.02%)	0.76% (0.13% - 7.72%)	3.37% (2.26% - 9.52%)	4.69% (2.80% - 8.90%)	1.11% (0.15% - 5.46%)	1.61% (0.27% - 4.95%)	2.77% (0.03% - 6.96%)	5.54% (1.73% - 8.10%)
Macao SAR, China	0.24% (0.00% - 0.51%)	0.23% (0.01% - 0.52%)	0.29% (0.04% - 0.61%)	22.66% (12.66% - 57.16%)	0.06% (0.00% - 1.30%)	10.74% (0.25% - 14.61%)	0.03% (0.02% - 0.04%)	0.00% (0.00% - 0.00%)	29.32% (20.04% - 57.47%)	4.68% (2.79% - 8.88%)	22.60% (16.40% - 50.18%)	25.10% (19.41% - 50.78%)	20.09% (15.42% - 48.37%)	33.01% (19.39% - 56.54%)
Colombia	0.19% (0.00% - 0.41%)	0.29% (0.01% - 0.44%)	0.23% (0.03% - 0.40%)	5.73% (1.83% - 12.98%)	0.22% (0.04% - 1.41%)	10.86% (0.14% - 15.04%)	0.00% (0.00% - 0.02%)	5.87% (0.02% - 11.26%)	8.98% (2.13% - 12.96%)	4.69% (2.80% - 8.90%)	2.84% (0.11% - 5.68%)	4.53% (1.50% - 6.24%)	1.37% (0.03% - 3.13%)	10.76% (1.77% - 13.29%)
Comoros	0.28% (0.00% - 0.83%)	0.29% (0.05% - 0.85%)	0.33% (0.09% - 0.77%)	25.56% (4.87% - 47.12%)	0.27% (0.01% - 1.34%)	10.30% (0.03% - 14.00%)	0.01% (0.00% - 0.03%)	2.96% (1.87% - 4.88%)	0.51% (0.11% - 1.57%)	3.38% (0.66% - 7.23%)	6.53% (2.64% - 9.99%)	4.03% (0.01% - 8.63%)	9.04% (3.81% - 10.62%)	1.86% (0.17% - 3.86%)
Congo, Rep.	0.18% (0.00% - 0.44%)	0.21% (0.02% - 0.44%)	0.27% (0.05% - 0.42%)	14.72% (4.48% - 24.78%)	0.14% (0.02% - 1.39%)	10.77% (0.16% - 14.95%)	0.00% (0.00% - 0.03%)	1.12% (0.14% - 2.65%)	3.50% (2.53% - 5.54%)	4.68% (2.81% - 8.89%)	2.49% (0.14% - 5.76%)	2.22% (0.01% - 5.74%)	4.14% (1.07% - 6.76%)	4.83% (0.85% - 8.55%)
Cook Islands	0.36% (0.23% - 1.10%)	0.32% (0.05% - 1.10%)	0.45% (0.19% - 1.27%)	37.88% (7.40% - 52.03%)	0.67% (0.21% - 1.46%)	9.88% (0.01% - 12.93%)	0.01% (0.00% - 0.03%)	4.62% (0.26% - 6.77%)	1.35% (0.04% - 3.11%)	3.16% (0.46% - 6.65%)	6.92% (4.49% - 9.77%)	5.67% (2.12% - 7.43%)	8.52% (5.97% - 10.74%)	1.65% (0.18% - 3.74%)
Costa Rica	0.16% (0.02% - 0.45%)	0.21% (0.00% - 0.47%)	0.29% (0.04% - 0.50%)	21.35% (3.69% - 30.15%)	0.09% (0.01% - 1.40%)	10.74% (0.15% - 14.87%)	0.00% (0.00% - 0.02%)	4.14% (3.02% - 8.34%)	7.28% (6.00% - 10.12%)	4.68% (2.79% - 8.88%)	1.50% (0.01% - 4.70%)	2.87% (0.58% - 8.29%)	1.57% (0.01% - 3.98%)	8.92% (6.16% - 10.55%)
Croatia	0.00% (0.00% - 0.73%)	0.00% (0.00% - 0.73%)	0.00% (0.00% - 0.73%)	0.00% (0.00% - 0.73%)	0.00% (0.00% - 0.73%)	0.00% (0.00% - 0.73%)	0.00% (0.00% - 0.00%)	18.73% (16.31% - 22.22%)	18.73% (16.31% - 22.22%)	18.73% (16.31% - 22.22%)	18.73% (16.31% - 22.22%)	18.73% (16.31% - 22.22%)	18.73% (16.31% - 22.22%)	18.73% (16.31% - 22.22%)
Cuba	0.17% (0.06% - 0.41%)	0.20% (0.02% - 0.44%)	0.27% (0.05% - 0.39%)	12.88% (2.07% - 35.92%)	0.18% (0.03% - 1.40%)	10.78% (0.16% - 14.91%)	0.02% (0.01% - 0.04%)	20.39% (15.79% - 24.12%)	23.47% (18.02% - 28.41%)	4.69% (2.80% - 8.90%)	16.10% (14.57% - 25.19%)	18.20% (14.95% - 28.74%)	14.59% (11.85% - 24.92%)	24.22% (21.77% - 27.64%)
Cyprus	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	10.10% (7.09% - 13.20%)	10.10% (7.09% - 13.20%)	10.10% (7.09% - 13.20%)	10.10% (7.09% - 13.20%)	10.10% (7.09% - 13.20%)	10.10% (7.09% - 13.20%)	10.10% (7.09% - 13.20%)
Czech Republic	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	10.31% (9.52% - 10.98%)	10.31% (9.52% - 10.98%)	10.31% (9.52% - 10.98%)	10.31% (9.52% - 10.98%)	10.31% (9.52% - 10.98%)	10.31% (9.52% - 10.98%)	10.31% (9.52% - 10.98%)
Cote d'Ivoire	0.26% (0.01% -	0.26% (0.00% -	0.32% (0.05% -	28.03% (5.93% -	0.15% (0.01% -	10.58% (0.19% -	0.01% (0.00% -	9.31% (2.01% -	11.74% (5.18% -	4.68% (2.80% -	6.29% (2.12% -	7.69% (2.10% -	3.94% (0.38% -	11.34% (7.31% -

	0.55%)	0.56%)	0.67%)	62.48%)	1.36%)	14.59%)	0.02%)	13.76%)	15.53%)	8.89%)	9.36%)	12.95%)	8.64%)	18.01%)
Korea, democratic people's republic of	22.55% (20.72% - 24.33%)	Inf% (Inf% - Inf%)	Inf% (Inf% - Inf%)	Inf% (Inf% - Inf%)	0.24% (0.02% - 1.42%)	10.90% (0.13% - 15.08%)	0.01% (0.00% - 0.03%)	2.40% (0.07% - 3.01%)	0.79% (0.18% - 1.92%)	4.69% (2.80% - 8.90%)	5.25% (1.59% - 7.74%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	2.57% (0.14% - 4.22%)
Congo, Dem. Rep.	0.23% (0.06% - 0.56%)	0.23% (0.06% - 0.57%)	0.37% (0.01% - 0.64%)	31.52% (7.56% - 80.43%)	0.21% (0.02% - 1.35%)	10.50% (0.21% - 14.71%)	0.00% (0.00% - 0.03%)	2.16% (0.21% - 7.91%)	5.34% (2.17% - 9.97%)	4.69% (2.79% - 8.89%)	0.68% (0.02% - 6.58%)	1.14% (0.18% - 10.17%)	2.44% (0.05% - 5.86%)	6.26% (2.61% - 9.90%)
Denmark	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	16.77% (15.70% - 18.28%)	16.77% (15.70% - 18.28%)	16.77% (15.70% - 18.28%)	16.77% (15.70% - 18.28%)	16.77% (15.70% - 18.28%)	16.77% (15.70% - 18.28%)	16.77% (15.70% - 18.28%)
Djibouti	0.27% (0.00% - 0.58%)	0.28% (0.03% - 0.60%)	0.39% (0.01% - 0.64%)	32.60% (7.52% - 50.05%)	0.20% (0.00% - 1.38%)	10.54% (0.17% - 14.46%)	0.01% (0.01% - 0.03%)	12.98% (10.86% - 15.02%)	15.86% (13.45% - 17.70%)	4.55% (2.64% - 8.76%)	9.87% (7.10% - 14.47%)	11.33% (8.02% - 18.02%)	7.62% (5.67% - 14.21%)	16.92% (13.77% - 20.27%)
Dominica	0.23% (0.01% - 0.61%)	0.22% (0.01% - 0.63%)	0.37% (0.01% - 0.65%)	29.13% (4.45% - 61.61%)	0.16% (0.01% - 1.39%)	10.47% (0.12% - 14.41%)	0.01% (0.00% - 0.02%)	7.32% (3.87% - 22.25%)	10.90% (7.17% - 23.99%)	4.34% (2.50% - 8.82%)	6.74% (2.60% - 16.40%)	10.33% (3.90% - 15.56%)	6.03% (0.30% - 13.53%)	13.97% (7.39% - 21.08%)
Dominican Republic	0.20% (0.05% - 0.44%)	0.20% (0.03% - 0.45%)	0.29% (0.06% - 0.52%)	22.03% (3.15% - 31.25%)	0.14% (0.01% - 1.40%)	10.73% (0.15% - 14.86%)	0.00% (0.00% - 0.03%)	4.38% (1.97% - 8.72%)	7.12% (5.07% - 10.66%)	4.69% (2.80% - 8.88%)	1.64% (0.29% - 5.64%)	2.63% (0.23% - 9.18%)	1.75% (0.70% - 5.37%)	8.79% (4.79% - 10.72%)
Ecuador	0.19% (0.02% - 0.42%)	0.20% (0.03% - 0.42%)	0.26% (0.05% - 0.45%)	14.49% (2.29% - 22.32%)	0.19% (0.04% - 1.41%)	10.81% (0.14% - 14.94%)	0.00% (0.00% - 0.03%)	3.26% (0.60% - 5.22%)	6.02% (3.70% - 7.64%)	4.69% (2.80% - 8.90%)	3.07% (0.16% - 5.65%)	2.72% (0.46% - 7.36%)	3.11% (0.67% - 4.99%)	6.42% (3.61% - 11.52%)
Egypt, Arab Rep.	0.20% (0.04% - 0.42%)	0.21% (0.00% - 0.44%)	0.28% (0.04% - 0.46%)	13.53% (2.64% - 21.27%)	0.19% (0.01% - 1.41%)	10.77% (0.15% - 14.96%)	0.00% (0.00% - 0.03%)	5.08% (1.56% - 6.55%)	7.64% (5.25% - 8.90%)	4.69% (2.80% - 8.90%)	1.61% (0.16% - 6.76%)	3.31% (0.18% - 7.10%)	1.64% (0.17% - 3.35%)	9.12% (4.60% - 12.06%)
El Salvador	0.20% (0.04% - 0.50%)	0.22% (0.06% - 0.50%)	0.33% (0.02% - 0.60%)	23.31% (3.48% - 46.87%)	0.10% (0.01% - 1.40%)	10.62% (0.15% - 14.70%)	0.00% (0.00% - 0.03%)	1.63% (0.02% - 7.27%)	5.60% (2.91% - 9.02%)	4.67% (2.78% - 8.86%)	1.07% (0.01% - 3.33%)	0.79% (0.06% - 6.25%)	2.07% (0.45% - 4.62%)	6.23% (3.52% - 8.51%)
Equatorial Guinea	0.18% (0.04% - 0.41%)	0.20% (0.01% - 0.41%)	0.26% (0.02% - 0.41%)	12.21% (1.90% - 19.52%)	0.19% (0.03% - 1.42%)	10.83% (0.14% - 15.05%)	0.00% (0.00% - 0.03%)	1.09% (0.27% - 7.76%)	2.01% (1.20% - 12.03%)	4.77% (2.78% - 8.92%)	4.70% (0.48% - 8.81%)	3.28% (0.79% - 12.34%)	6.87% (0.93% - 8.84%)	5.25% (0.06% - 11.23%)
Eritrea	0.20% (0.01% - 0.49%)	0.23% (0.02% - 0.51%)	0.31% (0.01% - 0.55%)	21.12% (1.19% - 40.81%)	0.15% (0.00% - 1.38%)	10.66% (0.13% - 14.62%)	0.01% (0.00% - 0.03%)	7.11% (5.22% - 10.95%)	10.31% (6.19% - 13.92%)	4.26% (2.39% - 8.60%)	4.20% (0.04% - 9.74%)	6.58% (0.13% - 13.39%)	1.87% (0.78% - 9.48%)	12.17% (5.61% - 17.92%)
Estonia	0.00% (0.00% - 1.57%)	0.00% (0.00% - 1.57%)	0.00% (0.00% - 1.57%)	0.00% (0.00% - 1.57%)	0.00% (0.00% - 1.57%)	0.00% (0.00% - 1.57%)	0.00% (0.00% - 0.00%)	13.00% (11.26% - 15.64%)	13.00% (11.26% - 15.64%)	13.00% (11.26% - 15.64%)	13.00% (11.26% - 15.64%)	13.00% (11.26% - 15.64%)	13.00% (11.26% - 15.64%)	13.00% (11.26% - 15.64%)
Ethiopia	0.16% (0.01% - 0.54%)	0.21% (0.00% - 0.55%)	0.26% (0.01% - 0.54%)	19.40% (0.06% - 43.39%)	0.12% (0.01% - 1.42%)	10.71% (0.13% - 14.97%)	0.00% (0.00% - 0.02%)	5.82% (2.20% - 8.97%)	8.26% (6.10% - 11.02%)	4.68% (2.78% - 8.89%)	2.88% (0.78% - 5.46%)	4.95% (1.67% - 8.00%)	1.43% (0.23% - 3.26%)	9.74% (4.68% - 14.42%)
Fiji	0.21% (0.02% - 0.58%)	0.22% (0.01% - 0.60%)	0.37% (0.00% - 0.62%)	36.79% (5.27% - 53.29%)	0.16% (0.03% - 1.38%)	10.52% (0.17% - 14.60%)	0.01% (0.01% - 0.03%)	16.37% (5.86% - 19.29%)	18.49% (9.78% - 21.31%)	4.61% (2.71% - 8.79%)	11.77% (6.37% - 16.15%)	13.26% (9.22% - 16.50%)	10.57% (5.65% - 12.75%)	18.85% (8.35% - 23.61%)
Finland	0.00% (0.00% - 0.77%)	0.00% (0.00% - 0.77%)	0.00% (0.00% - 0.77%)	0.00% (0.00% - 0.77%)	0.00% (0.00% - 0.77%)	0.00% (0.00% - 0.77%)	0.00% (0.00% - 0.00%)	14.95% (14.19% - 15.89%)	14.95% (14.19% - 15.89%)	14.95% (14.19% - 15.89%)	14.95% (14.19% - 15.89%)	14.95% (14.19% - 15.89%)	14.95% (14.19% - 15.89%)	14.95% (14.19% - 15.89%)
France	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	11.60% (10.85% - 12.26%)	11.60% (10.85% - 12.26%)	11.60% (10.85% - 12.26%)	11.60% (10.85% - 12.26%)	11.60% (10.85% - 12.26%)	11.60% (10.85% - 12.26%)	11.60% (10.85% - 12.26%)
French Polynesia	0.33% (0.00% - 0.68%)	0.34% (0.02% - 0.68%)	0.46% (0.09% - 0.76%)	52.13% (20.78% - 73.13%)	0.35% (0.01% - 1.73%)	10.29% (0.18% - 14.35%)	0.00% (0.00% - 0.02%)	5.10% (0.54% - 11.16%)	8.22% (0.64% - 12.94%)	4.65% (2.75% - 8.83%)	1.97% (0.37% - 5.61%)	3.87% (0.02% - 5.25%)	2.11% (0.56% - 3.92%)	10.15% (0.01% - 11.91%)
Gabon	0.16% (0.03% - 4.35%)	0.19% (0.00% - 4.10%)	0.25% (0.02% - 4.59%)	10.21% (2.77% - 99.97%)	0.20% (0.00% - 8.08%)	8.31% (0.16% - 15.05%)	0.00% (0.00% - 0.02%)	6.54% (2.21% - 10.33%)	8.45% (5.69% - 12.79%)	4.68% (2.80% - 8.90%)	3.20% (0.14% - 10.80%)	5.70% (0.02% - 12.17%)	2.59% (0.12% - 8.27%)	8.97% (4.27% - 15.62%)
Gambia, The	0.13% (0.00% - 0.47%)	0.22% (0.01% - 0.48%)	0.25% (0.03% - 0.50%)	23.39% (2.86% - 38.44%)	0.14% (0.02% - 1.40%)	10.56% (0.14% - 14.79%)	0.01% (0.00% - 0.02%)	6.65% (2.50% - 11.59%)	1.52% (0.04% - 13.39%)	3.71% (2.25% - 8.60%)	3.96% (2.06% - 6.11%)	4.03% (1.66% - 6.19%)	5.84% (0.78% - 8.62%)	4.28% (0.26% - 13.59%)
Georgia	0.19% (0.01% - 0.56%)	0.20% (0.02% - 0.61%)	0.22% (0.02% - 0.51%)	17.83% (0.12% - 46.40%)	0.24% (0.00% - 1.25%)	10.68% (0.30% - 14.79%)	0.01% (0.00% - 0.02%)	4.96% (0.52% - 17.47%)	8.10% (4.43% - 19.19%)	4.66% (2.78% - 8.88%)	4.28% (1.03% - 11.89%)	7.74% (3.57% - 11.49%)	2.82% (0.19% - 8.91%)	11.94% (3.01% - 18.00%)
Germany	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	11.01% (10.42% - 12.14%)	11.01% (10.42% - 12.14%)	11.01% (10.42% - 12.14%)	11.01% (10.42% - 12.14%)	11.01% (10.42% - 12.14%)	11.01% (10.42% - 12.14%)	11.01% (10.42% - 12.14%)
Ghana	0.19% (0.00% - 0.49%)	0.19% (0.01% - 0.50%)	0.28% (0.04% - 0.51%)	20.22% (2.61% - 44.22%)	0.14% (0.01% - 1.46%)	10.71% (0.09% - 14.77%)	0.00% (0.00% - 0.02%)	5.73% (4.25% - 9.80%)	8.79% (5.11% - 13.70%)	4.69% (2.80% - 8.90%)	3.30% (0.48% - 10.31%)	3.45% (0.16% - 13.90%)	1.84% (0.08% - 9.59%)	10.11% (4.73% - 12.44%)
Greece	0.18% (0.00% - 0.82%)	0.18% (0.00% - 0.82%)	0.18% (0.00% - 0.82%)	0.18% (0.00% - 0.82%)	0.18% (0.00% - 0.82%)	0.18% (0.00% - 0.82%)	0.00% (0.00% - 0.00%)	12.87% (10.87% - 14.09%)	12.87% (10.87% - 14.09%)	12.87% (10.87% - 14.09%)	12.87% (10.87% - 14.09%)	12.87% (10.87% - 14.09%)	12.87% (10.87% - 14.09%)	12.87% (10.87% - 14.09%)
Greenland	0.17% (0.01% - 0.46%)	0.22% (0.04% - 0.48%)	0.27% (0.09% - 0.45%)	20.03% (3.29% - 44.77%)	0.11% (0.02% - 1.40%)	10.72% (0.15% - 14.91%)	0.00% (0.00% - 0.03%)	1.88% (0.17% - 6.63%)	4.38% (2.75% - 8.46%)	4.56% (2.68% - 8.71%)	0.97% (0.02% - 3.99%)	0.79% (0.01% - 4.56%)	2.08% (0.25% - 5.44%)	6.50% (2.59% - 8.40%)

Grenada	0.18% (0.05% - 0.43%)	0.21% (0.01% - 0.45%)	0.29% (0.05% - 0.58%)	17.64% (2.37% - 32.40%)	0.15% (0.06% - 1.40%)	10.71% (0.13% - 14.61%)	0.01% (0.00% - 0.03%)	13.27% (6.51% - 18.05%)	16.20% (9.70% - 19.93%)	4.49% (2.59% - 8.62%)	9.86% (7.50% - 13.17%)	11.43% (7.88% - 17.12%)	8.63% (4.13% - 12.21%)	17.21% (11.81% - 20.27%)
Guatemala	0.19% (0.05% - 0.45%)	0.21% (0.04% - 0.45%)	0.30% (0.04% - 0.56%)	20.72% (1.76% - 39.66%)	0.14% (0.01% - 1.40%)	10.70% (0.15% - 14.79%)	0.00% (0.00% - 0.03%)	3.90% (2.41% - 6.39%)	6.70% (5.39% - 8.33%)	4.69% (2.80% - 8.90%)	1.26% (0.26% - 3.77%)	2.58% (0.21% - 7.13%)	1.97% (0.36% - 3.21%)	8.05% (4.81% - 10.88%)
Guinea	0.18% (0.02% - 0.40%)	0.24% (0.01% - 0.41%)	0.25% (0.02% - 0.36%)	9.30% (2.14% - 19.94%)	0.22% (0.02% - 1.33%)	10.80% (0.22% - 14.99%)	0.01% (0.00% - 0.02%)	7.02% (1.79% - 11.10%)	9.95% (2.19% - 13.53%)	4.68% (2.78% - 8.88%)	3.70% (1.75% - 8.95%)	5.17% (1.86% - 10.22%)	2.42% (0.27% - 6.63%)	10.33% (2.96% - 18.07%)
Guinea-Bissau	0.28% (0.03% - 2.26%)	0.29% (0.02% - 2.25%)	0.34% (0.08% - 2.36%)	20.81% (4.40% - 83.78%)	0.23% (0.10% - 3.87%)	10.36% (0.13% - 12.24%)	0.00% (0.00% - 0.02%)	3.40% (0.29% - 14.09%)	8.08% (4.85% - 16.98%)	2.92% (0.34% - 7.53%)	2.55% (0.18% - 6.61%)	2.02% (0.01% - 9.16%)	3.10% (0.39% - 5.35%)	7.68% (3.18% - 12.71%)
Guyana	0.25% (0.06% - 0.57%)	0.23% (0.01% - 0.58%)	0.36% (0.03% - 0.64%)	37.67% (2.31% - 56.53%)	0.15% (0.01% - 1.50%)	10.55% (0.05% - 14.65%)	0.01% (0.00% - 0.02%)	7.50% (5.07% - 13.30%)	10.74% (7.98% - 15.24%)	4.66% (2.75% - 8.86%)	6.14% (1.46% - 8.01%)	6.88% (3.96% - 11.60%)	4.05% (0.17% - 7.29%)	12.50% (9.17% - 14.65%)
Haiti	0.19% (0.08% - 0.51%)	0.19% (0.06% - 0.51%)	0.32% (0.05% - 0.59%)	17.27% (0.42% - 41.76%)	0.11% (0.02% - 1.26%)	10.67% (0.29% - 14.76%)	0.00% (0.00% - 0.03%)	1.98% (0.01% - 3.59%)	5.15% (2.82% - 7.18%)	4.38% (2.35% - 7.66%)	3.21% (0.28% - 5.75%)	2.61% (0.08% - 7.44%)	3.50% (0.10% - 8.71%)	6.57% (0.59% - 8.85%)
Honduras	0.21% (0.05% - 0.47%)	0.24% (0.02% - 0.49%)	0.33% (0.01% - 0.53%)	18.27% (3.36% - 41.16%)	0.15% (0.01% - 1.40%)	10.71% (0.15% - 14.75%)	0.00% (0.00% - 0.03%)	3.79% (3.01% - 5.90%)	6.70% (4.00% - 9.58%)	4.68% (2.76% - 8.82%)	2.61% (0.12% - 6.38%)	2.54% (0.34% - 9.78%)	2.91% (0.00% - 5.47%)	8.40% (2.94% - 11.19%)
Hungary	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	16.82% (15.48% - 18.39%)	16.82% (15.48% - 18.39%)	16.82% (15.48% - 18.39%)	16.82% (15.48% - 18.39%)	16.82% (15.48% - 18.39%)	16.82% (15.48% - 18.39%)	16.82% (15.48% - 18.39%)
Iceland	0.19% (0.04% - 0.43%)	0.24% (0.03% - 0.44%)	0.29% (0.01% - 0.56%)	15.68% (3.41% - 52.71%)	0.10% (0.03% - 1.40%)	10.75% (0.15% - 14.62%)	0.02% (0.01% - 0.03%)	16.56% (13.72% - 21.53%)	18.94% (15.66% - 23.47%)	4.69% (2.80% - 8.89%)	13.92% (9.50% - 18.73%)	16.50% (10.09% - 20.40%)	13.29% (7.70% - 15.49%)	20.86% (15.28% - 25.15%)
India	0.91% (0.03% - 2.28%)	0.91% (0.03% - 2.28%)	0.91% (0.03% - 2.28%)	0.91% (0.03% - 2.28%)	0.91% (0.03% - 2.28%)	0.91% (0.03% - 2.28%)	0.00% (0.00% - 0.00%)	7.09% (4.37% - 8.08%)	7.09% (4.37% - 8.08%)	7.09% (4.37% - 8.08%)	7.09% (4.37% - 8.08%)	7.09% (4.37% - 8.08%)	7.09% (4.37% - 8.08%)	7.09% (4.37% - 8.08%)
Indonesia	2.31% (0.10% - 8.43%)	2.31% (0.10% - 8.43%)	2.31% (0.10% - 8.43%)	2.31% (0.10% - 8.43%)	2.31% (0.10% - 8.43%)	2.31% (0.10% - 8.43%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 1.53%)	0.00% (0.00% - 1.53%)	0.00% (0.00% - 1.53%)	0.00% (0.00% - 1.53%)	0.00% (0.00% - 1.53%)	0.00% (0.00% - 1.53%)	0.00% (0.00% - 1.53%)
Iran, Islamic Rep.	0.22% (0.01% - 0.47%)	0.24% (0.01% - 0.47%)	0.25% (0.02% - 0.46%)	7.96% (2.31% - 25.73%)	0.26% (0.01% - 1.51%)	10.89% (0.04% - 15.08%)	0.01% (0.00% - 0.03%)	0.86% (0.02% - 4.04%)	1.71% (0.34% - 3.93%)	4.69% (2.80% - 8.90%)	4.45% (0.26% - 9.23%)	2.85% (0.82% - 6.72%)	6.23% (1.63% - 9.23%)	1.59% (0.04% - 6.12%)
Iraq	0.27% (0.03% - 1.38%)	0.25% (0.02% - 1.20%)	0.30% (0.01% - 1.96%)	22.64% (0.40% - 98.21%)	0.14% (0.02% - 2.94%)	7.82% (0.14% - 14.79%)	0.02% (0.01% - 0.05%)	19.36% (12.49% - 47.39%)	17.12% (10.79% - 43.10%)	4.69% (2.80% - 8.90%)	23.59% (16.97% - 46.28%)	22.29% (16.63% - 42.77%)	25.77% (20.38% - 46.58%)	16.60% (11.73% - 43.87%)
Ireland	0.75% (0.06% - 2.97%)	0.75% (0.06% - 2.97%)	0.75% (0.06% - 2.97%)	0.75% (0.06% - 2.97%)	0.75% (0.06% - 2.97%)	0.75% (0.06% - 2.97%)	0.00% (0.00% - 0.00%)	12.02% (9.57% - 14.19%)	12.02% (9.57% - 14.19%)	12.02% (9.57% - 14.19%)	12.02% (9.57% - 14.19%)	12.02% (9.57% - 14.19%)	12.02% (9.57% - 14.19%)	12.02% (9.57% - 14.19%)
Israel	0.17% (0.04% - 0.45%)	0.23% (0.01% - 0.47%)	0.29% (0.04% - 0.46%)	16.64% (3.27% - 32.42%)	0.17% (0.01% - 1.40%)	10.72% (0.15% - 14.84%)	0.01% (0.00% - 0.02%)	8.26% (6.84% - 11.26%)	11.73% (9.26% - 14.49%)	4.69% (2.80% - 8.90%)	5.01% (1.72% - 10.85%)	5.96% (3.70% - 14.79%)	2.53% (1.15% - 9.87%)	12.30% (10.02% - 15.42%)
Italy	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	11.20% (10.66% - 12.11%)	11.20% (10.66% - 12.11%)	11.20% (10.66% - 12.11%)	11.20% (10.66% - 12.11%)	11.20% (10.66% - 12.11%)	11.20% (10.66% - 12.11%)	11.20% (10.66% - 12.11%)
Jamaica	0.19% (0.04% - 0.46%)	0.21% (0.04% - 0.48%)	0.30% (0.04% - 0.53%)	21.40% (2.66% - 35.49%)	0.13% (0.01% - 1.41%)	10.65% (0.14% - 14.82%)	0.01% (0.00% - 0.02%)	6.47% (3.07% - 14.12%)	9.57% (6.97% - 15.84%)	4.69% (2.80% - 8.89%)	5.24% (2.86% - 8.54%)	6.84% (5.15% - 8.90%)	2.94% (0.35% - 5.41%)	12.54% (5.56% - 14.41%)
Japan	0.00% (0.00% - 0.08%)	0.00% (0.00% - 0.08%)	0.00% (0.00% - 0.08%)	0.00% (0.00% - 0.08%)	0.00% (0.00% - 0.08%)	0.00% (0.00% - 0.08%)	0.00% (0.00% - 0.00%)	0.72% (0.07% - 1.03%)	0.72% (0.07% - 1.03%)	0.72% (0.07% - 1.03%)	0.72% (0.07% - 1.03%)	0.72% (0.07% - 1.03%)	0.72% (0.07% - 1.03%)	0.72% (0.07% - 1.03%)
Jordan	0.20% (0.00% - 0.50%)	0.22% (0.02% - 0.52%)	0.32% (0.03% - 0.51%)	26.66% (3.76% - 40.58%)	0.09% (0.01% - 1.40%)	10.65% (0.16% - 14.76%)	0.01% (0.00% - 0.03%)	9.78% (6.15% - 14.04%)	12.06% (8.46% - 17.94%)	4.69% (2.79% - 8.90%)	4.95% (0.50% - 14.62%)	7.45% (1.01% - 18.14%)	2.54% (0.42% - 13.83%)	13.93% (7.69% - 18.90%)
Kazakhstan	0.17% (0.00% - 0.54%)	0.18% (0.00% - 0.55%)	0.25% (0.02% - 0.60%)	19.15% (7.22% - 53.51%)	0.16% (0.04% - 1.51%)	10.61% (0.04% - 14.85%)	0.00% (0.00% - 0.03%)	3.49% (0.76% - 7.05%)	5.88% (3.65% - 8.75%)	4.69% (2.80% - 8.90%)	2.33% (0.21% - 4.10%)	2.71% (0.32% - 5.92%)	1.69% (0.20% - 4.18%)	7.89% (3.28% - 11.29%)
Kenya	0.16% (0.04% - 0.40%)	0.20% (0.02% - 0.42%)	0.20% (0.03% - 0.51%)	15.60% (4.73% - 39.02%)	0.15% (0.02% - 1.28%)	10.57% (0.27% - 15.01%)	0.01% (0.01% - 0.02%)	9.76% (7.77% - 14.40%)	13.00% (11.40% - 15.95%)	4.69% (2.79% - 8.88%)	8.18% (4.88% - 10.03%)	8.86% (7.50% - 12.82%)	5.73% (3.48% - 8.57%)	14.55% (11.21% - 16.74%)
Kiribati	0.22% (0.03% - 0.57%)	0.24% (0.03% - 0.59%)	0.29% (0.02% - 0.62%)	20.85% (0.82% - 29.80%)	0.38% (0.06% - 3.11%)	10.43% (0.07% - 14.37%)	0.00% (0.00% - 0.03%)	3.23% (0.15% - 7.32%)	9.10% (4.79% - 14.99%)	1.65% (0.05% - 7.46%)	3.25% (1.15% - 8.38%)	2.96% (0.18% - 9.66%)	3.39% (0.08% - 7.93%)	5.85% (2.21% - 12.36%)
Kosovo	0.14% (0.00% - 0.48%)	0.21% (0.00% - 0.49%)	0.26% (0.08% - 0.49%)	20.92% (7.56% - 32.27%)	0.11% (0.00% - 1.28%)	10.74% (0.27% - 14.89%)	0.01% (0.00% - 0.02%)	14.73% (1.04% - 21.42%)	17.81% (1.37% - 23.42%)	4.69% (2.70% - 8.79%)	11.71% (0.02% - 15.35%)	12.96% (0.32% - 17.11%)	9.43% (1.74% - 13.81%)	19.31% (0.34% - 25.01%)
Kuwait	0.14% (0.00% - 0.43%)	0.21% (0.05% - 0.44%)	0.27% (0.09% - 0.42%)	16.84% (5.77% - 48.71%)	0.10% (0.00% - 1.38%)	10.80% (0.18% - 14.95%)	0.01% (0.01% - 0.04%)	6.35% (3.37% - 7.24%)	3.34% (0.57% - 4.76%)	4.69% (2.80% - 8.90%)	9.33% (3.90% - 12.20%)	7.83% (0.36% - 10.47%)	11.76% (4.17% - 12.79%)	1.64% (0.13% - 4.61%)
Kyrgyz Republic	0.20% (0.03% -	0.21% (0.01% -	0.34% (0.02% -	26.21% (3.85% -	0.10% (0.01% -	10.62% (0.15% -	0.01% (0.00% -	8.06% (3.90% -	10.68% (8.09% -	4.63% (2.75% -	5.63% (3.14% -	7.20% (3.72% -	3.61% (1.34% -	11.89% (7.42% -

	0.52%)	0.53%)	0.60%)	49.16%)	1.40%)	14.72%)	0.02%)	13.65%)	15.61%)	8.85%)	7.58%)	9.57%)	6.04%)	16.26%)
Lao PDR	0.18% (0.00% - 0.42%)	0.19% (0.01% - 0.42%)	0.23% (0.02% - 0.50%)	10.75% (1.44% - 29.76%)	0.15% (0.05% - 1.39%)	10.85% (0.16% - 14.99%)	0.00% (0.00% - 0.03%)	4.75% (1.73% - 6.41%)	6.02% (0.47% - 8.19%)	4.60% (2.79% - 8.89%)	1.47% (0.03% - 4.52%)	2.07% (0.08% - 3.81%)	1.36% (0.06% - 4.93%)	7.61% (0.20% - 11.67%)
Latvia	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	11.89% (10.82% - 13.66%)	11.89% (10.82% - 13.66%)	11.89% (10.82% - 13.66%)	11.89% (10.82% - 13.66%)	11.89% (10.82% - 13.66%)	11.89% (10.82% - 13.66%)	11.89% (10.82% - 13.66%)
Lebanon	0.19% (0.01% - 0.43%)	0.21% (0.01% - 0.44%)	0.28% (0.06% - 0.48%)	15.64% (1.96% - 22.17%)	0.16% (0.00% - 1.42%)	10.77% (0.14% - 14.94%)	0.01% (0.00% - 0.03%)	2.58% (0.03% - 6.53%)	1.14% (0.09% - 66.08%)	3.14% (1.10% - 7.72%)	4.88% (0.95% - 7.98%)	3.64% (0.19% - 6.52%)	6.52% (2.20% - 8.65%)	2.33% (0.12% - 5.29%)
Lesotho	0.26% (0.01% - 0.65%)	0.28% (0.03% - 0.68%)	0.37% (0.02% - 0.63%)	25.89% (1.03% - 64.11%)	0.16% (0.03% - 1.42%)	10.56% (0.13% - 14.40%)	0.00% (0.00% - 0.02%)	4.38% (2.76% - 11.14%)	8.37% (5.24% - 12.68%)	4.56% (2.75% - 8.85%)	2.51% (0.08% - 5.45%)	3.27% (0.59% - 9.23%)	1.14% (0.10% - 5.18%)	8.94% (5.46% - 11.75%)
Liberia	0.25% (0.02% - 0.65%)	0.27% (0.03% - 0.66%)	0.31% (0.07% - 0.76%)	24.30% (5.75% - 54.58%)	0.22% (0.07% - 1.37%)	10.45% (0.15% - 14.24%)	0.00% (0.00% - 0.02%)	3.90% (0.55% - 9.94%)	8.09% (3.28% - 17.68%)	3.73% (0.08% - 8.56%)	3.39% (0.47% - 5.52%)	4.68% (1.79% - 6.84%)	2.19% (1.08% - 6.79%)	8.54% (4.84% - 13.26%)
Libya	0.22% (0.04% - 0.48%)	0.24% (0.01% - 0.50%)	0.29% (0.03% - 0.48%)	20.67% (2.11% - 44.48%)	0.13% (0.00% - 1.38%)	10.66% (0.17% - 14.74%)	0.01% (0.00% - 0.04%)	12.87% (8.44% - 15.61%)	9.91% (6.19% - 14.08%)	4.69% (2.80% - 8.90%)	16.48% (9.14% - 22.45%)	13.98% (6.59% - 21.94%)	18.72% (11.50% - 23.84%)	8.13% (2.36% - 15.26%)
Liechtenstein	0.20% (0.06% - 0.45%)	0.21% (0.01% - 0.46%)	0.29% (0.06% - 0.49%)	16.11% (3.29% - 30.56%)	0.16% (0.00% - 1.40%)	10.74% (0.15% - 14.84%)	0.01% (0.01% - 0.03%)	4.76% (2.32% - 7.60%)	1.49% (0.31% - 5.10%)	4.42% (2.43% - 8.01%)	7.62% (3.03% - 11.10%)	6.37% (0.65% - 10.60%)	10.56% (4.96% - 12.49%)	1.82% (0.02% - 3.91%)
Lithuania	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	11.54% (10.53% - 14.09%)	11.54% (10.53% - 14.09%)	11.54% (10.53% - 14.09%)	11.54% (10.53% - 14.09%)	11.54% (10.53% - 14.09%)	11.54% (10.53% - 14.09%)	11.54% (10.53% - 14.09%)
Luxembourg	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	11.19% (10.14% - 12.11%)	11.19% (10.14% - 12.11%)	11.19% (10.14% - 12.11%)	11.19% (10.14% - 12.11%)	11.19% (10.14% - 12.11%)	11.19% (10.14% - 12.11%)	11.19% (10.14% - 12.11%)
Madagascar	0.20% (0.02% - 0.43%)	0.20% (0.02% - 0.44%)	0.29% (0.06% - 0.57%)	17.39% (3.41% - 40.04%)	0.12% (0.01% - 1.40%)	10.80% (0.15% - 14.83%)	0.01% (0.00% - 0.02%)	7.98% (3.98% - 12.20%)	10.50% (7.22% - 14.01%)	4.62% (2.72% - 8.80%)	5.05% (2.50% - 8.34%)	6.40% (3.76% - 9.25%)	3.33% (0.72% - 4.93%)	12.14% (6.91% - 14.98%)
Malawi	0.19% (0.02% - 0.45%)	0.22% (0.01% - 0.46%)	0.28% (0.05% - 0.87%)	19.79% (1.47% - 79.80%)	0.08% (0.01% - 1.42%)	10.75% (0.13% - 14.87%)	0.00% (0.00% - 0.03%)	2.02% (0.07% - 4.54%)	4.03% (0.99% - 6.77%)	4.60% (2.70% - 8.78%)	1.76% (0.18% - 4.64%)	1.52% (0.08% - 5.31%)	3.56% (1.50% - 6.30%)	5.02% (0.58% - 9.66%)
Malaysia	0.22% (0.00% - 0.54%)	0.26% (0.01% - 0.56%)	0.34% (0.04% - 0.56%)	21.09% (3.98% - 48.64%)	0.17% (0.05% - 1.36%)	10.59% (0.20% - 14.68%)	0.00% (0.00% - 0.03%)	1.89% (0.68% - 4.69%)	2.12% (0.25% - 4.24%)	4.69% (2.80% - 8.90%)	4.07% (0.80% - 6.26%)	2.81% (1.39% - 4.54%)	6.22% (1.07% - 7.95%)	2.36% (0.44% - 5.27%)
Maldives	0.17% (0.01% - 0.44%)	0.21% (0.04% - 0.45%)	0.25% (0.09% - 0.44%)	19.50% (4.43% - 29.76%)	0.11% (0.02% - 1.39%)	10.77% (0.16% - 14.89%)	0.01% (0.00% - 0.03%)	3.84% (0.66% - 5.43%)	0.75% (0.13% - 1.62%)	4.08% (2.26% - 8.24%)	6.20% (3.16% - 10.01%)	4.34% (0.59% - 7.39%)	8.96% (4.63% - 10.05%)	1.68% (0.45% - 3.86%)
Mali	0.17% (0.03% - 0.43%)	0.20% (0.04% - 0.43%)	0.28% (0.06% - 0.43%)	12.98% (2.30% - 25.33%)	0.18% (0.03% - 1.41%)	10.82% (0.14% - 15.00%)	0.01% (0.00% - 0.02%)	8.37% (6.44% - 12.75%)	10.99% (9.36% - 14.46%)	4.67% (2.79% - 8.89%)	6.48% (2.21% - 8.84%)	7.39% (5.14% - 11.06%)	4.01% (1.58% - 7.24%)	12.66% (9.05% - 15.77%)
Malta	0.00% (0.00% - 2.33%)	0.00% (0.00% - 2.33%)	0.00% (0.00% - 2.33%)	0.00% (0.00% - 2.33%)	0.00% (0.00% - 2.33%)	0.00% (0.00% - 2.33%)	0.00% (0.00% - 0.00%)	14.54% (10.76% - 16.55%)	14.54% (10.76% - 16.55%)	14.54% (10.76% - 16.55%)	14.54% (10.76% - 16.55%)	14.54% (10.76% - 16.55%)	14.54% (10.76% - 16.55%)	14.54% (10.76% - 16.55%)
Marshall Islands	0.20% (0.00% - 0.48%)	0.22% (0.01% - 0.49%)	0.30% (0.05% - 0.55%)	21.12% (0.72% - 29.00%)	0.35% (0.01% - 1.11%)	10.57% (0.09% - 14.56%)	0.00% (0.00% - 0.03%)	2.97% (0.53% - 6.48%)	7.07% (1.39% - 10.17%)	3.06% (1.36% - 8.29%)	3.06% (0.18% - 4.67%)	0.85% (0.17% - 8.26%)	2.82% (0.21% - 6.98%)	6.52% (4.41% - 8.25%)
Mauritania	0.18% (0.02% - 0.45%)	0.21% (0.00% - 0.46%)	0.30% (0.02% - 0.58%)	18.63% (2.63% - 57.54%)	0.07% (0.01% - 1.41%)	10.72% (0.14% - 14.47%)	0.00% (0.00% - 0.02%)	4.67% (2.23% - 8.16%)	7.56% (4.66% - 9.67%)	4.67% (2.79% - 8.88%)	1.52% (0.05% - 5.51%)	2.47% (0.46% - 9.45%)	1.41% (0.09% - 4.53%)	8.48% (6.44% - 11.41%)
Mauritius	0.20% (0.02% - 0.47%)	0.21% (0.03% - 0.49%)	0.32% (0.03% - 0.54%)	25.60% (5.06% - 39.55%)	0.10% (0.00% - 1.38%)	10.70% (0.17% - 14.77%)	0.01% (0.01% - 0.03%)	12.26% (10.37% - 15.68%)	15.43% (12.63% - 17.44%)	4.66% (2.76% - 8.85%)	9.15% (6.20% - 13.28%)	10.83% (8.51% - 16.22%)	6.87% (5.82% - 11.86%)	16.45% (14.07% - 19.53%)
Mexico	0.00% (0.00% - 0.72%)	0.00% (0.00% - 0.72%)	0.00% (0.00% - 0.72%)	0.00% (0.00% - 0.72%)	0.00% (0.00% - 0.72%)	0.00% (0.00% - 0.72%)	0.00% (0.00% - 0.00%)	2.21% (0.14% - 5.90%)	2.21% (0.14% - 5.90%)	2.21% (0.14% - 5.90%)	2.21% (0.14% - 5.90%)	2.21% (0.14% - 5.90%)	2.21% (0.14% - 5.90%)	2.21% (0.14% - 5.90%)
Micronesia, Fed. Sts.	8.32% (7.99% - 8.61%)	8.29% (7.95% - 8.81%)	8.13% (7.92% - 8.43%)	5.15% (0.21% - 31.22%)	0.44% (0.09% - 0.99%)	10.88% (0.44% - 14.92%)	0.00% (0.00% - 0.02%)	3.39% (1.13% - 9.09%)	6.57% (4.34% - 15.59%)	4.41% (0.06% - 11.74%)	1.76% (0.16% - 3.61%)	3.49% (0.19% - 6.13%)	1.00% (0.01% - 4.28%)	8.07% (3.75% - 11.15%)
Monaco	0.18% (0.05% - 0.42%)	0.22% (0.02% - 0.42%)	0.26% (0.03% - 0.42%)	14.27% (2.85% - 21.66%)	0.18% (0.04% - 1.40%)	10.81% (0.15% - 14.93%)	0.00% (0.00% - 0.03%)	0.00% (0.00% - 0.00%)	3.68% (2.92% - 9.07%)	2.12% (0.17% - 5.62%)	3.04% (1.45% - 6.22%)	2.40% (0.85% - 3.02%)	5.15% (2.97% - 7.71%)	3.66% (0.04% - 5.31%)
Mongolia	0.19% (0.03% - 0.43%)	0.20% (0.00% - 0.44%)	0.25% (0.03% - 0.45%)	12.79% (0.47% - 21.93%)	0.20% (0.02% - 1.31%)	10.82% (0.24% - 14.94%)	0.01% (0.01% - 0.02%)	10.88% (2.92% - 14.46%)	13.48% (1.38% - 15.97%)	4.66% (2.79% - 8.89%)	7.44% (1.85% - 12.11%)	9.24% (1.70% - 12.53%)	5.35% (2.11% - 9.43%)	13.39% (0.60% - 19.45%)
Montenegro	0.21% (0.01% - 0.48%)	0.21% (0.02% - 0.50%)	0.33% (0.05% - 0.60%)	24.53% (3.17% - 48.59%)	0.10% (0.00% - 1.40%)	10.71% (0.15% - 14.74%)	0.02% (0.01% - 0.02%)	14.59% (7.31% - 27.48%)	17.70% (10.32% - 29.42%)	4.64% (2.77% - 8.85%)	10.27% (7.03% - 20.27%)	13.48% (7.52% - 22.47%)	8.47% (3.84% - 19.89%)	21.39% (10.53% - 28.86%)
Montserrat	0.26% (0.05% - 1.46%)	0.29% (0.10% - 1.34%)	0.31% (0.07% - 1.62%)	24.10% (2.19% - 32.80%)	0.15% (0.01% - 1.30%)	9.16% (0.11% - 12.49%)	0.01% (0.01% - 0.02%)	11.11% (5.92% - 21.36%)	14.84% (10.64% - 21.71%)	3.30% (1.38% - 20.94%)	6.31% (2.25% - 12.89%)	9.43% (4.68% - 12.77%)	4.76% (2.36% - 9.02%)	13.33% (9.44% - 18.91%)

Morocco	0.18% (0.03% - 0.42%)	0.21% (0.03% - 0.43%)	0.26% (0.05% - 0.43%)	13.39% (2.29% - 19.60%)	0.19% (0.05% - 1.41%)	10.81% (0.14% - 14.98%)	0.00% (0.00% - 0.02%)	5.08% (3.23% - 7.93%)	7.69% (7.31% - 9.63%)	4.69% (2.80% - 8.90%)	2.39% (0.06% - 5.94%)	3.22% (0.45% - 9.73%)	1.27% (0.07% - 4.87%)	9.54% (6.69% - 12.04%)
Mozambique	0.20% (0.04% - 0.47%)	0.22% (0.03% - 0.48%)	0.30% (0.04% - 0.47%)	18.88% (1.98% - 37.26%)	0.16% (0.00% - 1.41%)	10.71% (0.14% - 14.78%)	0.01% (0.00% - 0.02%)	8.14% (1.89% - 11.69%)	9.91% (2.81% - 15.00%)	4.43% (2.79% - 8.88%)	3.14% (0.23% - 12.04%)	4.90% (1.79% - 13.99%)	1.06% (0.09% - 9.68%)	11.85% (1.63% - 17.84%)
Myanmar	0.25% (0.00% - 0.38%)	0.27% (0.01% - 0.38%)	0.24% (0.00% - 0.38%)	2.27% (0.07% - 14.96%)	0.47% (0.02% - 1.27%)	10.20% (0.06% - 14.68%)	0.00% (0.00% - 0.03%)	0.71% (0.06% - 2.51%)	3.19% (2.20% - 4.27%)	4.34% (2.68% - 8.84%)	3.07% (0.06% - 5.35%)	1.17% (0.20% - 4.22%)	4.93% (0.79% - 6.22%)	4.56% (1.14% - 7.30%)
Namibia	0.20% (0.02% - 0.46%)	0.21% (0.02% - 0.47%)	0.24% (0.10% - 0.51%)	23.77% (9.17% - 53.60%)	0.15% (0.02% - 1.26%)	10.74% (0.29% - 14.93%)	0.00% (0.00% - 0.02%)	5.53% (2.48% - 8.73%)	8.91% (5.58% - 10.44%)	4.68% (2.80% - 8.90%)	2.52% (0.15% - 7.52%)	3.74% (1.32% - 10.13%)	1.25% (0.00% - 6.32%)	9.28% (7.49% - 11.80%)
Nauru	0.22% (0.01% - 0.98%)	0.23% (0.00% - 0.95%)	0.29% (0.06% - 1.06%)	17.74% (0.87% - 27.97%)	0.77% (0.05% - 8.10%)	8.92% (0.89% - 13.71%)	0.01% (0.00% - 0.03%)	5.92% (0.13% - 13.53%)	122.37% (1.71% - 1572.23%)	8.68% (3.28% - 100.00%)	7.05% (4.04% - 18.42%)	4.63% (3.24% - 15.03%)	8.13% (5.95% - 100.00%)	1.81% (0.41% - 8.26%)
Nepal	0.18% (0.00% - 0.42%)	0.20% (0.03% - 0.42%)	0.24% (0.04% - 0.49%)	12.79% (2.37% - 26.84%)	0.14% (0.06% - 1.41%)	10.84% (0.14% - 15.02%)	0.00% (0.00% - 0.02%)	3.04% (1.07% - 9.46%)	6.17% (4.07% - 11.20%)	4.64% (2.77% - 8.86%)	1.92% (0.23% - 3.88%)	2.24% (0.28% - 6.33%)	1.62% (0.07% - 3.20%)	7.60% (3.99% - 9.86%)
Netherlands	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	12.16% (10.73% - 12.78%)	12.16% (10.73% - 12.78%)	12.16% (10.73% - 12.78%)	12.16% (10.73% - 12.78%)	12.16% (10.73% - 12.78%)	12.16% (10.73% - 12.78%)	12.16% (10.73% - 12.78%)
Netherlands Antilles	0.20% (0.00% - 0.49%)	0.22% (0.03% - 0.51%)	0.32% (0.03% - 0.53%)	28.10% (3.07% - 47.32%)	0.09% (0.01% - 1.40%)	10.67% (0.15% - 14.76%)	0.00% (0.00% - 0.02%)	4.11% (1.02% - 11.19%)	7.32% (5.33% - 13.14%)	4.66% (2.75% - 8.81%)	2.92% (0.41% - 5.80%)	4.31% (2.27% - 6.93%)	1.83% (0.20% - 2.89%)	10.16% (4.00% - 11.25%)
New Caledonia	0.17% (0.03% - 0.42%)	0.20% (0.03% - 0.43%)	0.26% (0.06% - 0.41%)	13.21% (2.18% - 20.83%)	0.16% (0.04% - 1.41%)	10.83% (0.14% - 14.99%)	0.00% (0.00% - 0.02%)	5.47% (1.64% - 11.30%)	8.66% (1.88% - 13.13%)	4.65% (2.73% - 8.81%)	3.40% (0.30% - 6.33%)	4.41% (2.21% - 10.27%)	1.60% (0.30% - 5.35%)	10.39% (0.86% - 12.52%)
New Zealand	0.19% (0.05% - 0.42%)	0.21% (0.03% - 0.42%)	0.26% (0.04% - 0.44%)	14.14% (3.00% - 22.93%)	0.19% (0.06% - 1.41%)	10.80% (0.15% - 14.94%)	0.00% (0.00% - 0.02%)	5.54% (4.34% - 10.34%)	9.09% (7.00% - 12.04%)	4.69% (2.80% - 8.90%)	3.55% (0.27% - 6.17%)	4.43% (3.16% - 9.76%)	1.46% (0.14% - 5.65%)	9.89% (8.15% - 11.81%)
Nicaragua	0.20% (0.06% - 0.45%)	0.21% (0.01% - 0.46%)	0.30% (0.03% - 0.52%)	17.47% (1.92% - 39.53%)	0.17% (0.00% - 1.42%)	10.71% (0.14% - 14.76%)	0.01% (0.00% - 0.02%)	7.05% (5.14% - 10.61%)	10.18% (7.77% - 12.35%)	4.67% (2.77% - 8.86%)	3.16% (0.18% - 8.63%)	4.68% (1.73% - 11.59%)	1.58% (0.07% - 7.04%)	11.60% (7.59% - 13.45%)
Niger	0.18% (0.01% - 0.42%)	0.20% (0.04% - 0.42%)	0.25% (0.06% - 0.44%)	13.03% (2.91% - 22.31%)	0.17% (0.05% - 1.40%)	10.83% (0.14% - 14.98%)	0.00% (0.00% - 0.02%)	5.72% (0.20% - 9.80%)	8.21% (4.49% - 11.51%)	4.65% (2.75% - 8.87%)	2.14% (0.33% - 4.70%)	4.63% (1.47% - 6.05%)	1.00% (0.05% - 1.83%)	8.92% (3.72% - 12.92%)
Nigeria	0.18% (0.04% - 0.51%)	0.20% (0.02% - 0.52%)	0.30% (0.03% - 0.57%)	29.96% (4.98% - 48.71%)	0.09% (0.00% - 1.34%)	10.65% (0.22% - 14.80%)	0.00% (0.00% - 0.03%)	1.76% (0.17% - 2.81%)	4.52% (2.70% - 5.37%)	4.69% (2.80% - 8.90%)	2.76% (0.03% - 5.59%)	3.10% (0.47% - 5.69%)	4.06% (0.40% - 5.97%)	4.91% (1.57% - 9.17%)
Norway	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	13.11% (11.34% - 16.08%)	13.11% (11.34% - 16.08%)	13.11% (11.34% - 16.08%)	13.11% (11.34% - 16.08%)	13.11% (11.34% - 16.08%)	13.11% (11.34% - 16.08%)	13.11% (11.34% - 16.08%)
Palestine	0.19% (0.02% - 0.47%)	0.22% (0.03% - 0.49%)	0.31% (0.02% - 0.54%)	22.58% (1.57% - 42.92%)	0.14% (0.02% - 1.42%)	10.60% (0.13% - 14.72%)	0.01% (0.01% - 0.03%)	14.78% (3.96% - 19.58%)	17.43% (8.26% - 21.37%)	4.67% (2.77% - 8.86%)	11.09% (5.03% - 15.42%)	12.44% (6.48% - 18.62%)	9.89% (1.99% - 13.71%)	17.34% (7.48% - 21.68%)
Oman	0.15% (0.04% - 0.42%)	0.20% (0.02% - 0.43%)	0.26% (0.04% - 0.50%)	13.28% (3.54% - 49.90%)	0.16% (0.01% - 1.39%)	10.62% (0.17% - 14.97%)	0.01% (0.00% - 0.03%)	3.74% (0.84% - 4.71%)	0.68% (0.21% - 1.73%)	4.69% (2.80% - 8.90%)	6.72% (2.46% - 9.73%)	5.42% (0.07% - 8.17%)	9.07% (3.06% - 10.43%)	1.35% (0.24% - 2.83%)
Pakistan	0.18% (0.01% - 0.41%)	0.21% (0.01% - 0.41%)	0.24% (0.03% - 0.47%)	8.64% (1.30% - 21.82%)	0.18% (0.04% - 1.41%)	10.84% (0.14% - 14.98%)	0.00% (0.00% - 0.02%)	6.43% (5.03% - 8.50%)	8.69% (6.81% - 12.80%)	4.69% (2.80% - 8.90%)	2.85% (0.29% - 9.58%)	5.33% (1.12% - 13.12%)	1.05% (0.20% - 9.31%)	10.48% (5.39% - 13.25%)
Palau	0.32% (0.02% - 0.74%)	0.32% (0.03% - 0.71%)	0.35% (0.13% - 0.91%)	23.18% (4.35% - 43.96%)	0.35% (0.04% - 1.41%)	10.11% (0.08% - 13.63%)	0.00% (0.00% - 0.03%)	1.51% (0.04% - 7.22%)	3.56% (2.00% - 9.20%)	6.33% (0.72% - 24.00%)	1.08% (0.57% - 4.95%)	1.30% (0.12% - 2.74%)	3.09% (0.65% - 6.71%)	5.25% (0.91% - 7.86%)
Panama	0.20% (0.00% - 0.51%)	0.21% (0.03% - 0.52%)	0.33% (0.03% - 0.55%)	28.96% (6.15% - 44.18%)	0.13% (0.02% - 1.37%)	10.67% (0.18% - 14.74%)	0.00% (0.00% - 0.02%)	1.76% (0.10% - 8.18%)	5.50% (2.35% - 9.90%)	4.68% (2.79% - 8.89%)	1.60% (0.14% - 3.10%)	1.57% (0.04% - 6.37%)	1.55% (0.22% - 4.80%)	7.06% (4.16% - 8.44%)
Papua New Guinea	0.25% (0.01% - 0.59%)	0.26% (0.03% - 0.61%)	0.35% (0.02% - 0.71%)	23.27% (4.38% - 69.67%)	0.16% (0.02% - 1.39%)	10.56% (0.16% - 14.55%)	0.00% (0.00% - 0.03%)	1.91% (0.63% - 3.68%)	4.59% (3.73% - 5.63%)	4.69% (2.80% - 8.89%)	2.09% (0.17% - 4.56%)	1.72% (0.19% - 5.96%)	3.44% (0.69% - 5.23%)	6.02% (2.31% - 8.95%)
Paraguay	0.20% (0.02% - 0.50%)	0.22% (0.04% - 0.52%)	0.33% (0.01% - 0.60%)	27.16% (3.65% - 48.14%)	0.09% (0.06% - 1.40%)	10.63% (0.15% - 14.69%)	0.01% (0.00% - 0.02%)	7.65% (6.09% - 13.49%)	11.70% (9.24% - 15.22%)	4.68% (2.77% - 8.87%)	7.11% (3.93% - 8.48%)	7.50% (5.89% - 12.03%)	4.14% (1.40% - 8.21%)	12.96% (9.47% - 15.66%)
Peru	0.18% (0.00% - 0.41%)	0.21% (0.03% - 0.41%)	0.24% (0.03% - 0.42%)	9.68% (1.54% - 13.71%)	0.21% (0.04% - 1.41%)	10.85% (0.14% - 15.04%)	0.01% (0.00% - 0.02%)	7.93% (6.98% - 11.39%)	11.11% (9.36% - 13.09%)	4.69% (2.80% - 8.90%)	4.91% (2.67% - 8.84%)	6.30% (4.66% - 12.39%)	3.09% (1.29% - 8.58%)	12.56% (10.15% - 14.51%)
Philippines	0.20% (0.03% - 0.47%)	0.23% (0.00% - 0.48%)	0.29% (0.06% - 0.49%)	19.04% (3.62% - 28.89%)	0.13% (0.02% - 1.40%)	10.74% (0.15% - 14.90%)	0.00% (0.00% - 0.03%)	2.01% (0.87% - 2.68%)	1.54% (0.06% - 3.72%)	4.69% (2.80% - 8.90%)	4.03% (1.61% - 6.82%)	3.02% (0.68% - 4.88%)	6.46% (1.88% - 8.23%)	2.67% (0.33% - 4.85%)
Poland	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	13.43% (12.13% - 14.31%)	13.43% (12.13% - 14.31%)	13.43% (12.13% - 14.31%)	13.43% (12.13% - 14.31%)	13.43% (12.13% - 14.31%)	13.43% (12.13% - 14.31%)	13.43% (12.13% - 14.31%)
Portugal	0.00% (0.00% -	0.00% (0.00% -	0.00% (0.00% -	0.00% (0.00% -	0.00% (0.00% -	0.00% (0.00% -	0.00% (0.00% -	14.42% (13.32% -	14.42% (13.32% -	14.42% (13.32% -	14.42% (13.32% -	14.42% (13.32% -	14.42% (13.32% -	14.42% (13.32% -

	0.00%)	0.00%)	0.00%)	0.00%)	0.00%)	0.00%)	0.00%)	16.27%)	16.27%)	16.27%)	16.27%)	16.27%)	16.27%)	16.27%)
Puerto Rico	0.27% (0.00% - 0.62%)	0.25% (0.03% - 0.63%)	0.35% (0.11% - 0.74%)	34.51% (6.79% - 80.57%)	0.21% (0.01% - 1.37%)	10.42% (0.18% - 14.36%)	0.01% (0.00% - 0.03%)	2.71% (0.11% - 4.05%)	0.53% (0.04% - 3.03%)	4.67% (2.78% - 7.47%)	5.44% (1.02% - 8.84%)	4.13% (0.04% - 6.84%)	7.82% (3.16% - 9.59%)	1.75% (0.23% - 3.79%)
Qatar	0.16% (0.01% - 0.41%)	0.28% (0.01% - 0.50%)	0.23% (0.00% - 0.40%)	8.69% (2.46% - 16.87%)	0.19% (0.04% - 1.40%)	10.88% (0.15% - 15.05%)	0.01% (0.01% - 0.03%)	4.77% (1.27% - 5.76%)	1.38% (0.03% - 3.27%)	4.69% (2.80% - 8.90%)	6.84% (4.59% - 9.10%)	5.60% (1.08% - 8.02%)	9.02% (4.95% - 11.30%)	1.56% (0.10% - 2.89%)
South Korea	0.05% (0.01% - 0.23%)	0.05% (0.01% - 0.23%)	0.05% (0.01% - 0.23%)	0.05% (0.01% - 0.23%)	0.05% (0.01% - 0.23%)	0.05% (0.01% - 0.23%)	0.00% (0.00% - 0.00%)	11.52% (9.98% - 12.87%)	11.52% (9.98% - 12.87%)	11.52% (9.98% - 12.87%)	11.52% (9.98% - 12.87%)	11.52% (9.98% - 12.87%)	11.52% (9.98% - 12.87%)	11.52% (9.98% - 12.87%)
Moldova	0.21% (0.00% - 0.48%)	0.22% (0.02% - 0.49%)	0.34% (0.00% - 0.60%)	25.25% (3.77% - 49.53%)	0.08% (0.01% - 1.40%)	10.70% (0.15% - 14.67%)	0.01% (0.00% - 0.02%)	12.00% (3.34% - 20.74%)	15.19% (6.52% - 22.53%)	4.63% (2.75% - 8.86%)	9.70% (4.36% - 14.52%)	12.19% (4.70% - 14.42%)	8.38% (0.95% - 12.52%)	18.58% (8.64% - 21.10%)
Romania	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	11.71% (5.81% - 13.59%)	11.71% (5.81% - 13.59%)	11.71% (5.81% - 13.59%)	11.71% (5.81% - 13.59%)	11.71% (5.81% - 13.59%)	11.71% (5.81% - 13.59%)	11.71% (5.81% - 13.59%)
Russia	0.58% (0.06% - 2.18%)	0.58% (0.06% - 2.18%)	0.58% (0.06% - 2.18%)	0.58% (0.06% - 2.18%)	0.58% (0.06% - 2.18%)	0.58% (0.06% - 2.18%)	0.00% (0.00% - 0.00%)	13.83% (8.59% - 17.84%)	13.83% (8.59% - 17.84%)	13.83% (8.59% - 17.84%)	13.83% (8.59% - 17.84%)	13.83% (8.59% - 17.84%)	13.83% (8.59% - 17.84%)	13.83% (8.59% - 17.84%)
Rwanda	0.19% (0.02% - 0.43%)	0.20% (0.02% - 0.43%)	0.27% (0.06% - 0.46%)	15.55% (2.79% - 30.88%)	0.16% (0.03% - 1.39%)	10.80% (0.14% - 14.94%)	0.00% (0.00% - 0.02%)	6.04% (4.59% - 9.61%)	9.23% (7.04% - 13.61%)	4.53% (2.36% - 8.74%)	3.33% (0.29% - 10.12%)	4.54% (2.27% - 13.71%)	0.64% (0.10% - 9.40%)	11.08% (7.75% - 13.17%)
St. Kitts and Nevis	0.18% (0.02% - 0.39%)	0.19% (0.01% - 0.40%)	0.21% (0.04% - 0.46%)	14.61% (0.96% - 20.53%)	0.16% (0.04% - 1.41%)	10.77% (0.12% - 14.83%)	0.01% (0.01% - 0.03%)	13.54% (6.80% - 16.34%)	16.54% (10.14% - 19.10%)	4.10% (2.34% - 8.33%)	9.64% (6.37% - 15.59%)	10.35% (6.73% - 19.18%)	7.91% (3.33% - 14.87%)	17.08% (13.29% - 19.55%)
St. Lucia	0.15% (0.00% - 0.48%)	0.20% (0.00% - 0.49%)	0.28% (0.07% - 0.49%)	21.87% (3.26% - 33.86%)	0.11% (0.01% - 1.40%)	10.68% (0.14% - 14.82%)	0.01% (0.01% - 0.02%)	10.73% (5.44% - 19.24%)	13.85% (9.30% - 21.11%)	4.56% (2.64% - 8.68%)	7.75% (5.63% - 13.80%)	9.63% (8.25% - 12.70%)	6.38% (4.63% - 10.70%)	15.17% (8.63% - 18.83%)
Samoa	0.36% (0.09% - 1.04%)	0.35% (0.05% - 1.06%)	0.40% (0.14% - 1.32%)	33.83% (4.96% - 59.62%)	0.47% (0.00% - 1.39%)	9.81% (0.10% - 13.03%)	0.00% (0.00% - 0.03%)	2.37% (1.02% - 3.45%)	1.67% (0.21% - 4.22%)	4.12% (2.14% - 8.52%)	4.14% (2.09% - 6.85%)	3.33% (1.16% - 4.53%)	6.42% (2.65% - 8.48%)	2.25% (0.06% - 4.68%)
San Marino	0.40% (0.11% - 0.85%)	0.45% (0.08% - 0.82%)	0.48% (0.19% - 1.32%)	57.30% (0.49% - 98.43%)	0.41% (0.06% - 1.74%)	9.18% (0.11% - 13.49%)	0.01% (0.00% - 0.02%)	6.52% (0.68% - 14.55%)	10.42% (5.94% - 19.99%)	3.99% (1.81% - 7.24%)	3.87% (1.53% - 10.66%)	6.66% (1.29% - 13.24%)	2.26% (0.08% - 10.25%)	10.48% (5.63% - 20.30%)
Sao Tome and Principe	0.24% (0.03% - 0.76%)	0.31% (0.05% - 0.79%)	0.31% (0.04% - 0.84%)	17.75% (2.05% - 37.63%)	0.13% (0.04% - 0.88%)	10.19% (0.06% - 13.93%)	0.00% (0.00% - 0.03%)	4.60% (1.35% - 6.17%)	7.62% (2.51% - 10.91%)	3.27% (0.22% - 7.36%)	1.33% (0.37% - 4.58%)	2.08% (0.09% - 5.26%)	2.00% (0.74% - 4.76%)	5.08% (0.46% - 12.49%)
Saudi Arabia	0.17% (0.03% - 0.42%)	0.24% (0.01% - 0.46%)	0.26% (0.04% - 0.41%)	17.04% (2.77% - 25.90%)	0.18% (0.03% - 1.40%)	10.78% (0.15% - 14.91%)	0.01% (0.00% - 0.03%)	3.19% (0.08% - 3.99%)	0.78% (0.04% - 1.62%)	4.69% (2.80% - 8.90%)	5.66% (2.61% - 8.66%)	4.67% (0.63% - 6.99%)	8.17% (3.18% - 10.05%)	1.66% (0.02% - 3.07%)
Senegal	0.14% (0.03% - 0.44%)	0.20% (0.01% - 0.44%)	0.28% (0.06% - 0.51%)	18.54% (3.34% - 32.68%)	0.10% (0.02% - 1.40%)	10.78% (0.15% - 14.90%)	0.01% (0.01% - 0.02%)	12.31% (8.31% - 17.59%)	15.42% (12.27% - 19.53%)	4.67% (2.79% - 8.88%)	10.05% (8.00% - 12.39%)	11.46% (9.91% - 13.62%)	8.25% (6.19% - 9.98%)	16.67% (11.83% - 20.22%)
Serbia	0.19% (0.03% - 0.46%)	0.21% (0.00% - 0.46%)	0.30% (0.03% - 0.55%)	22.95% (2.99% - 44.46%)	0.10% (0.00% - 1.39%)	10.75% (0.17% - 14.72%)	0.01% (0.00% - 0.02%)	15.16% (1.33% - 18.44%)	18.26% (5.62% - 20.37%)	4.69% (2.80% - 8.90%)	10.18% (2.40% - 12.47%)	11.29% (4.71% - 15.13%)	8.96% (1.23% - 10.87%)	17.97% (4.84% - 21.95%)
Seychelles	0.24% (0.00% - 0.57%)	0.25% (0.04% - 0.60%)	0.30% (0.08% - 0.62%)	30.24% (5.90% - 52.33%)	0.20% (0.03% - 1.38%)	10.40% (0.17% - 14.54%)	0.02% (0.01% - 0.03%)	16.78% (13.08% - 22.10%)	20.23% (16.27% - 24.83%)	4.47% (2.59% - 8.34%)	15.19% (7.92% - 20.05%)	16.70% (10.16% - 21.36%)	12.88% (7.59% - 16.88%)	19.52% (16.55% - 29.23%)
Sierra Leone	0.23% (0.02% - 0.55%)	0.23% (0.03% - 0.59%)	0.29% (0.00% - 0.57%)	22.95% (0.04% - 49.10%)	0.20% (0.02% - 1.41%)	10.60% (0.10% - 14.91%)	0.00% (0.00% - 0.03%)	3.50% (0.14% - 5.10%)	6.11% (3.41% - 8.82%)	4.55% (2.73% - 8.79%)	2.05% (0.12% - 5.59%)	2.38% (0.10% - 9.14%)	2.40% (0.01% - 5.33%)	6.65% (2.41% - 10.58%)
Singapore	0.30% (0.00% - 0.84%)	0.26% (0.02% - 0.81%)	0.42% (0.17% - 1.18%)	46.81% (9.03% - 99.88%)	0.44% (0.01% - 1.35%)	10.28% (0.21% - 13.49%)	0.00% (0.00% - 0.02%)	4.08% (2.66% - 9.11%)	7.71% (5.13% - 10.90%)	4.69% (2.80% - 8.90%)	2.01% (0.02% - 5.07%)	2.60% (1.43% - 8.53%)	1.35% (0.02% - 4.72%)	8.44% (6.57% - 10.88%)
Slovakia	0.00% (0.00% - 0.06%)	0.00% (0.00% - 0.06%)	0.00% (0.00% - 0.06%)	0.00% (0.00% - 0.06%)	0.00% (0.00% - 0.06%)	0.00% (0.00% - 0.06%)	0.00% (0.00% - 0.00%)	10.93% (10.01% - 12.58%)	10.93% (10.01% - 12.58%)	10.93% (10.01% - 12.58%)	10.93% (10.01% - 12.58%)	10.93% (10.01% - 12.58%)	10.93% (10.01% - 12.58%)	10.93% (10.01% - 12.58%)
Slovenia	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	14.76% (13.92% - 16.82%)	14.76% (13.92% - 16.82%)	14.76% (13.92% - 16.82%)	14.76% (13.92% - 16.82%)	14.76% (13.92% - 16.82%)	14.76% (13.92% - 16.82%)	14.76% (13.92% - 16.82%)
Solomon Islands	0.21% (0.03% - 0.96%)	0.23% (0.03% - 0.77%)	0.32% (0.03% - 1.29%)	33.57% (4.89% - 76.22%)	0.31% (0.00% - 1.39%)	10.32% (0.14% - 14.88%)	0.00% (0.00% - 0.03%)	1.77% (0.02% - 3.83%)	4.21% (0.69% - 8.07%)	3.88% (1.42% - 8.09%)	4.21% (2.57% - 6.53%)	3.84% (0.44% - 8.35%)	5.44% (1.04% - 7.75%)	6.19% (1.29% - 8.99%)
Somalia	0.22% (0.01% - 0.39%)	0.25% (0.00% - 0.40%)	0.18% (0.01% - 0.37%)	1.17% (0.06% - 2.08%)	0.72% (0.27% - 12.57%)	10.65% (0.10% - 14.34%)	0.01% (0.00% - 0.02%)	12.81% (2.28% - 15.72%)	15.96% (0.14% - 18.31%)	4.10% (2.40% - 7.54%)	8.92% (3.30% - 10.36%)	9.78% (0.09% - 12.67%)	6.92% (0.11% - 8.94%)	15.53% (1.00% - 19.59%)
South Africa	0.24% (0.01% - 0.86%)	0.24% (0.01% - 0.86%)	0.24% (0.01% - 0.86%)	0.24% (0.01% - 0.86%)	0.24% (0.01% - 0.86%)	0.24% (0.01% - 0.86%)	0.00% (0.00% - 0.00%)	10.16% (9.28% - 12.51%)	10.16% (9.28% - 12.51%)	10.16% (9.28% - 12.51%)	10.16% (9.28% - 12.51%)	10.16% (9.28% - 12.51%)	10.16% (9.28% - 12.51%)	10.16% (9.28% - 12.51%)
South Sudan	0.00% (0.00% - 0.23%)	0.00% (0.00% - 0.06%)	0.00% (0.00% - 0.55%)	0.00% (0.00% - 48.13%)	0.00% (0.00% - 0.08%)	0.00% (0.00% - 14.30%)	0.00% (0.00% - 0.03%)	0.00% (0.00% - 2.84%)	0.00% (0.00% - 4.55%)	0.00% (0.00% - 8.89%)	0.00% (0.00% - 2.74%)	0.00% (0.00% - 3.89%)	0.00% (0.00% - 5.89%)	0.00% (0.00% - 1.59%)

Spain	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	10.19% (7.67% - 12.43%)	10.19% (7.67% - 12.43%)	10.19% (7.67% - 12.43%)	10.19% (7.67% - 12.43%)	10.19% (7.67% - 12.43%)	10.19% (7.67% - 12.43%)	10.19% (7.67% - 12.43%)
Sri Lanka	0.20% (0.03% - 0.44%)	0.21% (0.02% - 0.44%)	0.28% (0.05% - 0.44%)	14.53% (3.20% - 20.43%)	0.18% (0.00% - 1.40%)	10.79% (0.15% - 14.98%)	0.01% (0.00% - 0.03%)	2.42% (0.53% - 15.74%)	4.20% (1.21% - 20.03%)	4.69% (2.79% - 8.89%)	5.73% (2.66% - 16.81%)	3.81% (1.88% - 20.36%)	6.94% (4.98% - 16.54%)	5.76% (1.68% - 19.26%)
St. Vincent and the Grenadines	0.19% (0.07% - 0.48%)	0.21% (0.03% - 0.50%)	0.29% (0.02% - 0.57%)	14.60% (3.27% - 31.93%)	0.16% (0.00% - 1.40%)	10.66% (0.13% - 14.63%)	0.01% (0.01% - 0.03%)	13.53% (11.53% - 20.48%)	16.77% (14.27% - 22.30%)	4.50% (2.55% - 8.56%)	12.94% (7.59% - 14.73%)	13.65% (11.12% - 17.76%)	10.52% (6.62% - 13.32%)	19.14% (15.39% - 20.92%)
Sudan	0.19% (0.01% - 0.41%)	0.19% (0.04% - 0.41%)	0.23% (0.03% - 0.44%)	7.18% (2.05% - 13.05%)	0.20% (0.04% - 1.41%)	10.86% (0.14% - 15.05%)	0.00% (0.00% - 0.03%)	3.11% (0.47% - 5.92%)	5.48% (2.24% - 9.09%)	4.66% (2.80% - 8.90%)	3.30% (0.50% - 6.94%)	3.05% (0.19% - 9.09%)	3.69% (0.43% - 7.76%)	7.89% (0.82% - 11.22%)
Suriname	0.17% (0.00% - 0.38%)	0.23% (0.02% - 0.40%)	0.24% (0.03% - 0.41%)	11.92% (0.33% - 37.83%)	0.18% (0.02% - 1.30%)	10.82% (0.25% - 14.99%)	0.01% (0.00% - 0.02%)	7.02% (2.24% - 10.25%)	10.14% (0.07% - 12.09%)	4.64% (2.78% - 8.87%)	3.32% (0.19% - 5.61%)	4.24% (0.38% - 7.40%)	2.06% (0.44% - 5.79%)	9.66% (0.10% - 15.48%)
Swaziland	0.32% (0.02% - 0.82%)	0.28% (0.03% - 0.79%)	0.39% (0.14% - 1.23%)	49.78% (5.96% - 84.74%)	0.37% (0.02% - 1.38%)	10.21% (0.18% - 13.55%)	0.02% (0.00% - 0.03%)	17.42% (13.03% - 31.79%)	20.53% (17.02% - 33.75%)	4.64% (2.78% - 8.85%)	16.86% (13.71% - 25.66%)	18.00% (15.91% - 28.96%)	13.83% (11.30% - 25.42%)	24.21% (15.70% - 36.02%)
Sweden	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	14.19% (13.87% - 14.97%)	14.19% (13.87% - 14.97%)	14.19% (13.87% - 14.97%)	14.19% (13.87% - 14.97%)	14.19% (13.87% - 14.97%)	14.19% (13.87% - 14.97%)	14.19% (13.87% - 14.97%)
Switzerland	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	5.93% (4.55% - 6.51%)	5.93% (4.55% - 6.51%)	5.93% (4.55% - 6.51%)	5.93% (4.55% - 6.51%)	5.93% (4.55% - 6.51%)	5.93% (4.55% - 6.51%)	5.93% (4.55% - 6.51%)
Syrian Arab Republic	0.20% (0.02% - 0.42%)	0.22% (0.04% - 0.43%)	0.28% (0.05% - 0.44%)	13.00% (3.45% - 20.37%)	0.17% (0.01% - 1.40%)	10.83% (0.15% - 14.98%)	0.00% (0.00% - 0.03%)	1.48% (0.67% - 2.51%)	2.27% (1.03% - 3.98%)	4.69% (2.80% - 8.90%)	3.30% (0.56% - 6.11%)	2.02% (0.22% - 4.63%)	6.00% (1.70% - 7.15%)	3.72% (0.38% - 6.22%)
Tajikistan	1.52% (0.10% - 4.35%)	1.53% (0.01% - 4.25%)	1.43% (0.20% - 4.80%)	93.91% (11.37% - 99.97%)	2.11% (0.18% - 8.71%)	4.85% (0.11% - 14.14%)	0.01% (0.00% - 0.03%)	10.58% (2.20% - 15.99%)	13.20% (2.06% - 17.85%)	3.98% (2.09% - 8.53%)	6.80% (2.70% - 12.21%)	8.67% (6.30% - 11.71%)	5.59% (1.99% - 12.47%)	14.11% (4.68% - 17.16%)
Thailand	0.22% (0.04% - 0.49%)	0.25% (0.04% - 0.49%)	0.32% (0.03% - 0.57%)	17.67% (0.82% - 47.84%)	0.16% (0.00% - 1.44%)	10.66% (0.11% - 14.76%)	0.00% (0.00% - 0.03%)	1.93% (0.62% - 3.31%)	1.20% (0.12% - 2.92%)	4.69% (2.80% - 8.90%)	4.19% (1.46% - 6.90%)	2.99% (0.50% - 5.64%)	6.77% (2.51% - 8.16%)	2.82% (0.15% - 5.05%)
Macedonia, FYR	0.19% (0.02% - 0.49%)	0.22% (0.04% - 0.51%)	0.31% (0.05% - 0.56%)	21.72% (4.12% - 42.72%)	0.13% (0.05% - 1.39%)	10.66% (0.16% - 14.79%)	0.01% (0.01% - 0.02%)	14.48% (10.05% - 18.32%)	17.49% (12.53% - 20.70%)	4.68% (2.78% - 8.88%)	10.94% (8.98% - 16.11%)	12.92% (10.31% - 17.38%)	9.82% (7.70% - 12.89%)	18.68% (13.67% - 25.25%)
Timor-Leste	0.29% (0.01% - 1.16%)	0.28% (0.01% - 1.20%)	0.30% (0.01% - 1.13%)	18.92% (0.99% - 75.03%)	0.18% (0.04% - 1.45%)	10.06% (0.12% - 14.59%)	0.00% (0.00% - 0.03%)	2.06% (0.26% - 5.39%)	0.85% (0.11% - 1.64%)	4.82% (2.78% - 8.88%)	5.43% (1.04% - 8.46%)	3.25% (0.23% - 7.72%)	7.68% (3.64% - 9.60%)	2.74% (0.08% - 5.04%)
Togo	0.21% (0.01% - 0.57%)	0.21% (0.01% - 0.58%)	0.36% (0.02% - 0.58%)	30.79% (4.09% - 50.57%)	0.16% (0.01% - 1.39%)	10.62% (0.16% - 14.66%)	0.01% (0.00% - 0.03%)	10.55% (5.92% - 20.38%)	12.85% (9.22% - 24.67%)	4.66% (2.76% - 8.84%)	6.79% (4.16% - 21.44%)	8.03% (5.98% - 24.99%)	5.19% (2.17% - 21.18%)	14.48% (11.41% - 23.89%)
Tonga	0.22% (0.01% - 0.68%)	0.24% (0.00% - 0.70%)	0.32% (0.04% - 0.58%)	22.57% (4.90% - 34.70%)	0.14% (0.03% - 1.25%)	10.32% (0.02% - 14.68%)	0.01% (0.01% - 0.02%)	11.37% (8.15% - 18.47%)	14.81% (11.55% - 20.37%)	3.87% (1.57% - 8.28%)	8.59% (5.30% - 11.80%)	10.49% (6.87% - 15.34%)	6.13% (4.03% - 11.53%)	14.83% (12.36% - 19.00%)
Trinidad and Tobago	0.18% (0.05% - 0.61%)	0.24% (0.03% - 0.63%)	0.30% (0.04% - 0.57%)	19.19% (3.31% - 69.30%)	0.20% (0.00% - 1.40%)	10.26% (0.15% - 14.84%)	0.00% (0.00% - 0.03%)	1.73% (0.57% - 2.97%)	1.61% (0.32% - 3.66%)	4.69% (2.80% - 8.90%)	3.78% (0.08% - 6.90%)	2.98% (0.70% - 5.11%)	6.36% (1.02% - 8.41%)	3.18% (0.63% - 5.36%)
Tunisia	0.18% (0.05% - 0.46%)	0.22% (0.01% - 0.47%)	0.30% (0.07% - 0.50%)	17.99% (2.93% - 33.43%)	0.16% (0.00% - 1.41%)	10.71% (0.15% - 14.86%)	0.01% (0.00% - 0.02%)	8.14% (5.45% - 9.34%)	10.86% (9.16% - 11.90%)	4.69% (2.80% - 8.90%)	4.53% (0.44% - 9.44%)	7.03% (1.29% - 11.82%)	2.02% (0.06% - 6.91%)	11.46% (7.97% - 15.43%)
Turkey	0.00% (0.00% - 5.03%)	0.00% (0.00% - 5.03%)	0.00% (0.00% - 5.03%)	0.00% (0.00% - 5.03%)	0.00% (0.00% - 5.03%)	0.00% (0.00% - 5.03%)	0.00% (0.00% - 0.00%)	10.55% (2.30% - 13.51%)	10.55% (2.30% - 13.51%)	10.55% (2.30% - 13.51%)	10.55% (2.30% - 13.51%)	10.55% (2.30% - 13.51%)	10.55% (2.30% - 13.51%)	10.55% (2.30% - 13.51%)
Turkmenistan	0.20% (0.01% - 0.44%)	0.21% (0.04% - 0.46%)	0.23% (0.07% - 0.43%)	13.12% (3.78% - 49.93%)	0.21% (0.01% - 1.40%)	10.97% (0.16% - 15.02%)	0.01% (0.00% - 0.02%)	3.06% (0.42% - 29.09%)	5.83% (2.31% - 29.94%)	4.37% (1.91% - 8.89%)	2.55% (0.31% - 23.90%)	3.23% (0.76% - 24.67%)	5.22% (0.90% - 22.29%)	7.67% (2.47% - 29.57%)
Turks and Caicos Islands	0.15% (0.02% - 0.43%)	0.20% (0.01% - 0.45%)	0.28% (0.08% - 0.55%)	19.65% (4.24% - 48.07%)	0.09% (0.02% - 1.40%)	10.58% (0.14% - 14.83%)	0.00% (0.00% - 0.03%)	6.32% (1.25% - 9.96%)	6.77% (1.92% - 10.86%)	4.39% (2.61% - 8.84%)	2.59% (0.04% - 9.48%)	2.32% (0.08% - 6.47%)	2.32% (0.53% - 10.20%)	7.51% (2.57% - 14.37%)
Tuvalu	0.13% (0.01% - 1.20%)	1.07% (0.03% - 6.99%)	0.23% (0.02% - 1.52%)	9.29% (0.24% - 17.23%)	9.41% (0.30% - 36.42%)	8.97% (0.56% - 13.17%)	0.00% (0.00% - 0.02%)	3.72% (1.55% - 8.49%)	18.05% (9.37% - 30.35%)	7.18% (0.57% - 12.84%)	1.76% (0.40% - 9.54%)	1.77% (0.58% - 13.28%)	1.85% (0.41% - 9.42%)	7.95% (6.19% - 11.93%)
Uganda	0.15% (0.03% - 0.42%)	0.19% (0.01% - 0.42%)	0.26% (0.05% - 0.52%)	14.81% (2.11% - 36.09%)	0.18% (0.01% - 1.41%)	10.75% (0.14% - 14.93%)	0.00% (0.00% - 0.02%)	5.96% (4.45% - 9.61%)	9.12% (7.43% - 11.33%)	4.68% (2.79% - 8.89%)	3.47% (0.71% - 7.32%)	4.35% (2.89% - 11.26%)	1.12% (0.23% - 6.35%)	11.09% (6.94% - 12.58%)
Ukraine	0.20% (0.02% - 0.44%)	0.22% (0.01% - 0.45%)	0.30% (0.02% - 0.53%)	20.96% (4.18% - 42.51%)	0.11% (0.00% - 1.39%)	10.75% (0.16% - 14.74%)	0.01% (0.00% - 0.03%)	10.17% (6.24% - 16.86%)	13.04% (9.88% - 20.02%)	4.69% (2.80% - 8.90%)	6.76% (1.94% - 17.88%)	8.56% (4.37% - 18.22%)	5.02% (0.67% - 14.47%)	14.55% (9.51% - 22.16%)
United Arab Emirates	0.18% (0.00% - 0.49%)	0.23% (0.06% - 0.50%)	0.31% (0.03% - 0.55%)	25.89% (3.76% - 38.27%)	0.11% (0.01% - 1.40%)	10.63% (0.15% - 14.80%)	0.01% (0.00% - 0.03%)	4.57% (2.34% - 6.04%)	1.55% (0.64% - 3.58%)	4.69% (2.80% - 8.90%)	7.92% (4.25% - 9.83%)	5.69% (1.40% - 9.06%)	9.83% (5.21% - 11.07%)	2.19% (0.25% - 3.58%)
United Kingdom	0.00% (0.00% -	0.00% (0.00% -	0.00% (0.00% -	0.00% (0.00% -	0.00% (0.00% -	0.00% (0.00% -	0.00% (0.00% -	12.21% (10.35% -	12.21% (10.35% -	12.21% (10.35% -	12.21% (10.35% -	12.21% (10.35% -	12.21% (10.35% -	12.21% (10.35% -

	0.07%)	0.07%)	0.07%)	0.07%)	0.07%)	0.07%)	0.00%)	13.09%)	13.09%)	13.09%)	13.09%)	13.09%)	13.09%)	13.09%)
Tanganjika	0.18% (0.03% - 0.41%)	0.20% (0.04% - 0.42%)	0.26% (0.05% - 0.43%)	8.69% (2.10% - 18.80%)	0.18% (0.05% - 1.41%)	10.82% (0.14% - 14.98%)	0.01% (0.00% - 0.02%)	5.22% (1.17% - 11.32%)	8.32% (5.46% - 13.03%)	4.68% (2.79% - 8.89%)	3.67% (0.79% - 5.74%)	5.17% (3.98% - 8.22%)	1.98% (0.49% - 3.79%)	10.97% (4.69% - 13.73%)
United States	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.16% (0.00% - 1.13%)	0.16% (0.00% - 1.13%)	0.16% (0.00% - 1.13%)	0.16% (0.00% - 1.13%)	0.16% (0.00% - 1.13%)	0.16% (0.00% - 1.13%)	0.16% (0.00% - 1.13%)
Uruguay	0.19% (0.03% - 0.42%)	0.20% (0.02% - 0.43%)	0.27% (0.04% - 0.45%)	12.81% (2.41% - 21.20%)	0.19% (0.03% - 1.40%)	10.79% (0.15% - 14.95%)	0.01% (0.00% - 0.02%)	6.39% (3.97% - 14.38%)	9.76% (6.52% - 16.10%)	4.69% (2.79% - 8.89%)	5.77% (2.02% - 8.80%)	7.75% (3.29% - 10.05%)	5.13% (0.27% - 5.95%)	13.01% (8.00% - 16.53%)
Uzbekistan	0.16% (0.06% - 0.43%)	0.20% (0.01% - 0.44%)	0.29% (0.03% - 0.50%)	15.03% (0.76% - 35.29%)	0.17% (0.00% - 1.43%)	10.69% (0.13% - 14.86%)	0.01% (0.00% - 0.03%)	12.29% (8.55% - 15.57%)	14.54% (9.41% - 18.75%)	4.69% (2.80% - 8.90%)	10.50% (3.37% - 15.48%)	12.35% (4.14% - 16.79%)	8.36% (1.76% - 12.89%)	15.91% (9.04% - 22.15%)
Vanuatu	0.18% (0.01% - 0.47%)	0.21% (0.01% - 0.48%)	0.29% (0.00% - 0.48%)	20.66% (3.60% - 39.29%)	0.10% (0.01% - 1.50%)	10.72% (0.01% - 14.78%)	0.01% (0.00% - 0.02%)	7.30% (4.05% - 13.72%)	10.54% (8.48% - 15.60%)	3.92% (1.77% - 8.22%)	5.33% (1.63% - 8.99%)	6.57% (5.11% - 9.36%)	3.66% (0.10% - 5.61%)	12.41% (7.32% - 14.06%)
Venezuela, RB	0.18% (0.00% - 0.41%)	0.23% (0.02% - 0.41%)	0.23% (0.03% - 0.41%)	8.69% (1.44% - 17.75%)	0.20% (0.04% - 1.42%)	10.87% (0.13% - 15.04%)	0.00% (0.00% - 0.02%)	3.94% (0.06% - 10.05%)	7.23% (3.33% - 11.75%)	4.69% (2.80% - 8.90%)	1.28% (0.19% - 4.47%)	2.54% (0.31% - 7.78%)	1.50% (0.09% - 5.89%)	7.47% (3.46% - 10.63%)
Vietnam	0.20% (0.06% - 0.48%)	0.20% (0.06% - 0.49%)	0.28% (0.06% - 0.68%)	19.52% (3.08% - 63.17%)	0.13% (0.02% - 1.40%)	10.66% (0.15% - 14.87%)	0.00% (0.00% - 0.03%)	1.49% (0.85% - 2.68%)	1.68% (0.50% - 3.31%)	4.69% (2.80% - 8.90%)	3.97% (1.06% - 6.38%)	2.47% (0.12% - 5.12%)	6.28% (1.88% - 7.68%)	3.22% (0.27% - 5.49%)
Yemen, Rep.	0.19% (0.03% - 0.42%)	0.26% (0.02% - 0.43%)	0.30% (0.05% - 0.78%)	15.02% (2.92% - 81.48%)	0.12% (0.04% - 1.41%)	10.79% (0.15% - 14.81%)	0.00% (0.00% - 0.03%)	0.76% (0.10% - 3.38%)	3.57% (2.26% - 5.19%)	4.69% (2.80% - 8.90%)	2.20% (0.02% - 5.39%)	1.74% (0.27% - 5.49%)	4.77% (0.57% - 5.86%)	4.76% (1.49% - 7.45%)
Zambia	0.14% (0.03% - 0.42%)	0.19% (0.05% - 0.44%)	0.28% (0.05% - 0.50%)	18.16% (2.88% - 33.37%)	0.12% (0.02% - 1.41%)	10.78% (0.15% - 14.92%)	0.00% (0.00% - 0.03%)	3.48% (1.71% - 4.96%)	6.12% (2.90% - 8.60%)	4.68% (2.79% - 8.89%)	3.14% (0.71% - 5.21%)	3.61% (0.40% - 8.80%)	3.42% (0.13% - 6.25%)	7.67% (1.24% - 10.61%)
Zanzibar	0.46% (0.03% - 1.80%)	0.46% (0.01% - 1.69%)	0.36% (0.05% - 2.19%)	34.92% (1.93% - 85.72%)	0.51% (0.10% - 3.12%)	9.76% (0.58% - 13.27%)	0.01% (0.01% - 0.03%)	16.15% (13.52% - 21.07%)	18.09% (16.46% - 23.83%)	4.19% (2.26% - 8.44%)	10.58% (8.24% - 21.43%)	13.11% (9.38% - 22.89%)	9.32% (7.29% - 18.92%)	19.75% (14.78% - 26.32%)
Zimbabwe	0.24% (0.08% - 1.67%)	0.33% (0.06% - 1.67%)	0.32% (0.02% - 1.60%)	18.88% (5.39% - 91.52%)	0.36% (0.04% - 2.58%)	8.86% (0.18% - 14.74%)	0.01% (0.00% - 0.02%)	7.21% (0.77% - 16.79%)	10.92% (2.70% - 19.97%)	4.69% (2.80% - 8.89%)	6.45% (0.09% - 11.83%)	7.55% (0.11% - 15.29%)	5.55% (1.69% - 10.56%)	10.39% (2.13% - 23.37%)
Taiwan	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	3.24% (1.95% - 4.30%)	3.24% (1.95% - 4.30%)	3.24% (1.95% - 4.30%)	3.24% (1.95% - 4.30%)	3.24% (1.95% - 4.30%)	3.24% (1.95% - 4.30%)	3.24% (1.95% - 4.30%)

6.1.6.2 Constant 2005 prices - relative differences (absolute change / UN SNA initial entry: median (min - max)) over all years

Country	Final cons.	House. cons.	Gov cons.	GCF	Exp	Imp	GDP	Agri...	Min. Manu., Util.	Manu.	Constr	Wholesale, Retail,...	Transp. Commun.	Other
Afghanistan	0.35% (0.04% - 1.08%)	0.89% (0.05% - 2.47%)	1.13% (0.21% - 3.05%)	19.57% (0.22% - 82.10%)	0.64% (0.07% - 2.78%)	14.45% (5.04% - 31.68%)	0.00% (0.00% - 0.02%)	3.18% (0.17% - 7.12%)	8.35% (4.43% - 10.43%)	1.41% (0.04% - 6.90%)	2.60% (0.77% - 6.12%)	4.47% (2.01% - 7.62%)	1.34% (0.32% - 4.23%)	11.35% (8.17% - 16.38%)
Albania	0.58% (0.10% - 2.36%)	0.17% (0.02% - 1.71%)	0.27% (0.04% - 2.11%)	13.90% (0.63% - 43.28%)	0.40% (0.08% - 3.11%)	14.12% (5.93% - 32.14%)	0.01% (0.00% - 0.02%)	7.11% (0.56% - 10.43%)	11.60% (3.13% - 13.57%)	1.07% (0.05% - 6.93%)	5.33% (1.17% - 9.17%)	7.24% (0.40% - 10.28%)	4.02% (0.04% - 5.30%)	14.91% (5.03% - 18.14%)
Algeria	0.32% (0.06% - 1.70%)	0.29% (0.03% - 1.74%)	0.52% (0.08% - 2.31%)	19.54% (5.85% - 43.63%)	0.40% (0.01% - 2.54%)	14.18% (5.85% - 31.59%)	0.00% (0.00% - 0.03%)	1.09% (0.01% - 5.89%)	5.09% (0.04% - 6.94%)	1.04% (0.04% - 6.93%)	4.06% (0.43% - 9.44%)	3.38% (1.21% - 7.02%)	3.57% (0.54% - 9.27%)	7.57% (1.06% - 11.91%)
Andorra	0.35% (0.02% - 1.74%)	0.33% (0.01% - 1.60%)	0.50% (0.09% - 2.17%)	15.94% (6.76% - 44.46%)	0.35% (0.04% - 2.56%)	14.14% (5.85% - 31.55%)	0.01% (0.00% - 0.03%)	6.13% (0.35% - 13.82%)	10.93% (4.57% - 19.93%)	1.32% (0.00% - 6.88%)	3.71% (0.65% - 17.97%)	6.14% (2.72% - 17.20%)	2.74% (0.00% - 12.49%)	13.17% (10.46% - 21.83%)
Angola	0.69% (0.01% - 2.48%)	0.36% (0.03% - 2.48%)	0.46% (0.13% - 1.85%)	42.34% (11.92% - 99.95%)	0.44% (0.06% - 4.27%)	13.46% (5.76% - 31.45%)	0.01% (0.00% - 0.03%)	4.48% (0.09% - 11.40%)	8.72% (3.25% - 15.79%)	1.04% (0.04% - 6.93%)	3.04% (0.33% - 12.55%)	3.94% (0.20% - 11.92%)	4.14% (0.13% - 8.83%)	11.61% (5.61% - 23.87%)
Anguilla	0.30% (0.01% - 1.46%)	0.31% (0.02% - 1.53%)	0.36% (0.00% - 1.15%)	36.83% (10.23% - 95.60%)	0.18% (0.02% - 4.03%)	13.83% (5.76% - 25.35%)	0.01% (0.00% - 0.04%)	12.65% (7.13% - 20.22%)	16.64% (11.38% - 23.20%)	1.38% (0.03% - 6.82%)	11.22% (6.53% - 20.07%)	13.53% (8.99% - 19.92%)	8.64% (3.08% - 14.57%)	18.04% (15.14% - 28.68%)
Antigua and Barbuda	0.37% (0.04% - 1.50%)	0.30% (0.01% - 1.38%)	0.44% (0.02% - 1.78%)	37.20% (11.05% - 82.40%)	0.26% (0.00% - 1.85%)	13.92% (5.80% - 31.25%)	0.01% (0.00% - 0.03%)	8.77% (4.85% - 15.88%)	13.52% (11.34% - 19.74%)	1.19% (0.05% - 6.90%)	9.31% (7.86% - 11.46%)	10.36% (8.61% - 14.48%)	6.63% (2.71% - 11.40%)	17.57% (13.24% - 22.13%)
Argentina	0.37% (0.02% - 1.68%)	0.32% (0.00% - 1.61%)	0.56% (0.10% - 2.18%)	17.74% (0.84% - 53.73%)	0.43% (0.00% - 2.51%)	14.26% (5.81% - 31.46%)	0.00% (0.00% - 0.02%)	3.01% (0.83% - 10.04%)	9.03% (4.79% - 12.82%)	1.04% (0.04% - 6.93%)	4.70% (0.97% - 7.08%)	5.18% (3.59% - 6.53%)	1.90% (0.06% - 4.65%)	11.39% (10.10% - 18.48%)
Armenia	0.28% (0.00% - 1.56%)	0.28% (0.04% - 1.00%)	0.46% (0.11% - 1.57%)	23.54% (2.76% - 96.76%)	0.30% (0.02% - 1.78%)	13.97% (5.85% - 30.44%)	0.01% (0.00% - 0.02%)	6.62% (0.82% - 12.70%)	11.01% (4.23% - 15.85%)	1.07% (0.05% - 6.93%)	7.33% (1.78% - 8.96%)	8.11% (0.98% - 10.07%)	2.38% (0.67% - 7.76%)	14.81% (6.61% - 21.23%)
Aruba	0.33% (0.05% - 1.60%)	0.23% (0.04% - 1.45%)	0.46% (0.07% - 1.86%)	33.35% (2.47% - 81.57%)	0.21% (0.02% - 2.08%)	13.97% (5.77% - 31.42%)	0.00% (0.00% - 0.02%)	2.57% (1.39% - 4.46%)	3.51% (0.75% - 7.35%)	1.10% (0.07% - 6.92%)	1.96% (0.09% - 3.81%)	0.68% (0.02% - 1.26%)	4.15% (0.83% - 7.56%)	6.66% (5.36% - 11.00%)

Australia	0.16% (0.00% - 0.89%)	0.20% (0.00% - 1.00%)	0.20% (0.00% - 1.00%)	0.16% (0.00% - 0.89%)	0.16% (0.00% - 0.89%)	0.16% (0.00% - 0.89%)	0.00% (0.00% - 0.00%)	8.46% (7.94% - 8.90%)	8.46% (7.94% - 8.90%)	8.46% (7.94% - 8.90%)	8.46% (7.94% - 8.90%)	8.46% (7.94% - 8.90%)	8.46% (7.94% - 8.90%)	8.46% (7.94% - 8.90%)
Austria	0.29% (0.05% - 1.53%)	0.29% (0.04% - 1.53%)	0.29% (0.04% - 1.53%)	0.29% (0.05% - 1.53%)	0.29% (0.05% - 1.53%)	0.29% (0.05% - 1.53%)	0.00% (0.00% - 0.00%)	11.18% (9.83% - 11.83%)	11.18% (9.83% - 11.83%)	11.18% (9.83% - 11.83%)	11.18% (9.83% - 11.83%)	11.18% (9.83% - 11.83%)	11.18% (9.83% - 11.83%)	11.18% (9.83% - 11.83%)
Azerbaijan	0.37% (0.05% - 1.38%)	0.33% (0.03% - 1.40%)	0.44% (0.08% - 1.66%)	20.10% (0.13% - 99.93%)	0.37% (0.04% - 3.45%)	14.20% (5.84% - 31.04%)	0.01% (0.00% - 0.02%)	4.83% (0.46% - 15.78%)	7.25% (1.51% - 12.05%)	1.05% (0.04% - 6.93%)	3.19% (0.16% - 11.92%)	4.95% (0.38% - 12.75%)	1.68% (0.05% - 15.82%)	9.70% (1.22% - 19.99%)
Bahamas, The	0.35% (0.03% - 1.59%)	0.30% (0.02% - 1.35%)	0.51% (0.05% - 1.88%)	29.04% (10.32% - 81.19%)	0.36% (0.00% - 2.12%)	14.01% (5.82% - 31.30%)	0.00% (0.00% - 0.03%)	1.74% (0.11% - 7.38%)	3.48% (1.31% - 4.60%)	1.08% (0.06% - 6.93%)	2.60% (0.26% - 8.69%)	1.57% (0.19% - 6.85%)	4.81% (2.51% - 9.95%)	6.29% (3.02% - 8.23%)
Bahrain	0.38% (0.07% - 1.25%)	0.37% (0.01% - 1.35%)	0.32% (0.01% - 0.79%)	48.84% (10.11% - 99.98%)	0.31% (0.00% - 3.38%)	13.81% (5.82% - 27.52%)	0.01% (0.00% - 0.04%)	14.44% (8.56% - 17.94%)	9.82% (5.79% - 12.24%)	1.04% (0.04% - 6.93%)	13.96% (11.46% - 19.64%)	13.16% (9.81% - 16.74%)	18.23% (13.96% - 20.75%)	7.24% (3.12% - 9.41%)
Bangladesh	0.37% (0.00% - 1.67%)	0.38% (0.01% - 1.80%)	0.59% (0.10% - 2.37%)	21.02% (9.61% - 51.32%)	0.39% (0.00% - 2.69%)	14.21% (5.71% - 31.63%)	0.00% (0.00% - 0.02%)	0.60% (0.18% - 3.72%)	6.00% (3.74% - 6.66%)	1.05% (0.04% - 6.93%)	1.97% (0.26% - 4.62%)	2.93% (0.05% - 3.89%)	2.38% (0.38% - 3.86%)	8.56% (6.73% - 11.82%)
Barbados	1.97% (0.20% - 5.43%)	0.74% (0.04% - 2.35%)	0.82% (0.16% - 2.98%)	83.03% (1.30% - 99.97%)	0.39% (0.01% - 7.06%)	13.44% (6.05% - 24.20%)	0.02% (0.00% - 0.05%)	15.44% (9.49% - 18.19%)	19.76% (13.90% - 24.37%)	1.09% (0.06% - 6.93%)	14.83% (8.19% - 22.32%)	17.91% (10.03% - 21.49%)	11.24% (6.94% - 17.32%)	23.52% (19.39% - 26.13%)
Belarus	1.16% (0.17% - 3.31%)	0.53% (0.09% - 1.22%)	0.38% (0.02% - 0.70%)	22.65% (1.18% - 89.05%)	0.31% (0.04% - 2.07%)	14.08% (5.87% - 31.15%)	0.01% (0.00% - 0.03%)	8.46% (1.17% - 13.80%)	13.24% (7.43% - 17.52%)	1.05% (0.04% - 6.93%)	8.63% (3.74% - 11.16%)	10.58% (4.21% - 13.09%)	4.66% (1.13% - 9.21%)	16.56% (9.84% - 19.95%)
Belgium	0.10% (0.00% - 0.49%)	0.09% (0.00% - 0.49%)	0.09% (0.00% - 0.49%)	0.10% (0.00% - 0.49%)	0.10% (0.00% - 0.49%)	0.10% (0.00% - 0.49%)	0.00% (0.00% - 0.00%)	11.71% (10.02% - 12.24%)	11.71% (10.02% - 12.24%)	11.71% (10.02% - 12.24%)	11.71% (10.02% - 12.24%)	11.71% (10.02% - 12.24%)	11.71% (10.02% - 12.24%)	11.71% (10.02% - 12.24%)
Belize	0.40% (0.08% - 1.60%)	0.32% (0.00% - 1.52%)	0.40% (0.01% - 2.09%)	43.54% (24.89% - 71.76%)	0.24% (0.03% - 2.34%)	13.69% (5.62% - 31.20%)	0.01% (0.00% - 0.03%)	7.75% (3.06% - 9.20%)	12.18% (7.47% - 14.61%)	1.18% (0.12% - 6.92%)	6.41% (1.75% - 12.21%)	9.76% (3.58% - 11.89%)	3.51% (0.49% - 8.23%)	15.68% (10.63% - 17.50%)
Benin	0.32% (0.05% - 1.77%)	0.32% (0.03% - 1.62%)	0.50% (0.06% - 2.19%)	13.02% (1.95% - 44.96%)	0.36% (0.03% - 2.61%)	14.17% (5.89% - 31.56%)	0.01% (0.00% - 0.03%)	6.12% (4.21% - 8.59%)	11.39% (9.28% - 12.33%)	1.15% (0.09% - 6.92%)	5.21% (3.12% - 10.27%)	7.80% (4.68% - 9.20%)	2.90% (1.73% - 5.27%)	13.69% (11.56% - 17.34%)
Bermuda	0.42% (0.01% - 2.69%)	0.40% (0.02% - 2.76%)	0.57% (0.03% - 2.44%)	44.16% (16.30% - 99.68%)	0.20% (0.00% - 4.54%)	13.86% (5.76% - 30.65%)	0.01% (0.00% - 0.03%)	9.28% (2.88% - 10.89%)	3.44% (0.05% - 6.60%)	1.15% (0.09% - 6.91%)	8.24% (3.78% - 12.20%)	6.96% (4.85% - 10.37%)	11.11% (8.27% - 14.90%)	0.67% (0.00% - 1.58%)
Bhutan	0.60% (0.02% - 1.77%)	0.45% (0.02% - 1.58%)	0.87% (0.09% - 2.14%)	42.01% (4.43% - 86.49%)	0.87% (0.12% - 2.55%)	14.23% (4.92% - 31.33%)	0.00% (0.00% - 0.02%)	1.28% (0.30% - 5.31%)	5.96% (3.34% - 8.46%)	1.15% (0.09% - 6.93%)	1.38% (0.02% - 4.19%)	2.36% (0.60% - 3.68%)	1.97% (0.36% - 4.98%)	8.78% (7.06% - 14.03%)
Bolivia	0.32% (0.05% - 1.65%)	0.29% (0.04% - 1.42%)	0.50% (0.04% - 1.99%)	32.27% (13.54% - 72.72%)	0.33% (0.01% - 2.23%)	13.98% (5.78% - 31.41%)	0.01% (0.00% - 0.03%)	12.63% (9.08% - 16.49%)	18.16% (14.50% - 19.52%)	1.05% (0.04% - 6.93%)	11.53% (10.74% - 16.83%)	14.01% (12.20% - 15.76%)	10.23% (6.20% - 12.59%)	21.22% (17.34% - 25.27%)
Bosnia and Herzegovina	0.24% (0.00% - 20.39%)	0.15% (0.00% - 19.12%)	0.36% (0.03% - 18.82%)	29.63% (0.90% - 99.78%)	0.58% (0.15% - 6.32%)	14.26% (6.23% - 30.99%)	0.01% (0.00% - 0.04%)	14.22% (6.68% - 17.47%)	19.82% (12.78% - 21.76%)	1.05% (0.04% - 6.93%)	11.67% (8.13% - 19.72%)	13.45% (10.32% - 18.65%)	11.48% (3.96% - 14.72%)	22.15% (14.94% - 24.86%)
Botswana	0.49% (0.02% - 2.06%)	0.17% (0.01% - 1.48%)	0.31% (0.01% - 2.05%)	11.53% (2.31% - 47.31%)	0.40% (0.01% - 2.76%)	14.08% (5.96% - 31.59%)	0.00% (0.00% - 0.02%)	1.66% (0.03% - 3.59%)	4.77% (1.83% - 6.74%)	1.05% (0.04% - 6.93%)	2.34% (0.15% - 3.33%)	0.88% (0.03% - 2.82%)	3.15% (1.35% - 6.47%)	7.28% (5.57% - 12.51%)
Brazil	0.33% (0.00% - 2.70%)	0.36% (0.00% - 2.50%)	0.36% (0.00% - 2.50%)	0.33% (0.00% - 2.70%)	0.33% (0.00% - 2.70%)	0.33% (0.00% - 2.70%)	0.00% (0.00% - 0.00%)	17.13% (16.34% - 19.04%)	17.13% (16.34% - 19.04%)	17.13% (16.34% - 19.04%)	17.13% (16.34% - 19.04%)	17.13% (16.34% - 19.04%)	17.13% (16.34% - 19.04%)	17.13% (16.34% - 19.04%)
British Virgin Islands	0.26% (0.01% - 0.70%)	0.31% (0.04% - 0.64%)	0.44% (0.01% - 1.03%)	48.17% (20.25% - 96.58%)	0.12% (0.02% - 0.57%)	13.80% (5.66% - 29.33%)	0.01% (0.00% - 0.03%)	6.26% (0.21% - 7.39%)	1.11% (0.15% - 3.15%)	1.37% (0.05% - 6.86%)	5.41% (1.96% - 8.49%)	3.90% (3.04% - 6.06%)	8.61% (5.14% - 11.05%)	2.83% (0.73% - 5.88%)
Brunei Darussalam	0.73% (0.09% - 2.38%)	0.87% (0.09% - 2.44%)	0.65% (0.08% - 2.37%)	85.32% (42.36% - 99.95%)	1.04% (0.18% - 4.36%)	13.62% (5.22% - 31.12%)	0.01% (0.00% - 0.02%)	5.53% (0.02% - 7.42%)	1.61% (0.11% - 4.86%)	1.04% (0.04% - 6.93%)	4.56% (0.68% - 8.00%)	2.97% (0.76% - 4.97%)	8.24% (3.31% - 10.41%)	2.97% (0.96% - 11.19%)
Bulgaria	0.19% (0.00% - 3.57%)	0.19% (0.00% - 3.57%)	0.19% (0.00% - 3.57%)	0.19% (0.00% - 3.57%)	0.19% (0.00% - 3.57%)	0.19% (0.00% - 3.57%)	0.00% (0.00% - 0.00%)	16.07% (7.65% - 18.60%)	16.07% (7.65% - 18.60%)	16.07% (7.65% - 18.60%)	16.07% (7.65% - 18.60%)	16.07% (7.65% - 18.60%)	16.07% (7.65% - 18.60%)	16.07% (7.65% - 18.60%)
Burkina Faso	0.29% (0.00% - 2.02%)	0.39% (0.00% - 1.54%)	0.47% (0.06% - 2.00%)	16.40% (4.97% - 30.78%)	0.33% (0.03% - 2.67%)	14.14% (5.87% - 31.73%)	0.01% (0.00% - 0.04%)	8.93% (2.95% - 16.21%)	12.09% (0.32% - 22.92%)	1.10% (0.08% - 6.93%)	7.70% (0.01% - 20.87%)	7.58% (1.10% - 19.80%)	8.42% (0.15% - 15.87%)	14.01% (0.12% - 24.15%)
Burundi	0.32% (0.06% - 13.04%)	0.35% (0.05% - 13.10%)	0.50% (0.03% - 12.51%)	43.19% (0.16% - 99.65%)	0.38% (0.01% - 26.78%)	11.89% (0.98% - 32.36%)	0.01% (0.00% - 0.05%)	3.21% (0.25% - 14.52%)	5.81% (0.38% - 17.47%)	1.50% (0.02% - 6.24%)	3.88% (0.58% - 9.31%)	5.91% (0.78% - 12.67%)	5.16% (0.61% - 9.00%)	8.71% (0.11% - 19.68%)
Cambodia	0.30% (0.09% - 1.30%)	0.28% (0.08% - 1.27%)	0.47% (0.04% - 1.66%)	51.58% (14.74% - 94.13%)	0.19% (0.01% - 1.55%)	13.78% (5.58% - 30.95%)	0.00% (0.00% - 0.02%)	2.61% (0.04% - 7.97%)	7.94% (6.32% - 10.80%)	1.21% (0.09% - 6.92%)	3.44% (0.21% - 5.91%)	4.42% (3.00% - 5.53%)	1.72% (0.08% - 2.58%)	10.98% (8.35% - 17.22%)
Cameroon	0.37% (0.00% - 1.65%)	0.32% (0.00% - 1.57%)	0.46% (0.09% - 2.14%)	16.40% (6.39% - 54.10%)	0.34% (0.02% - 2.43%)	14.14% (5.86% - 31.46%)	0.00% (0.00% - 0.03%)	4.34% (2.52% - 9.32%)	9.64% (7.22% - 12.10%)	1.05% (0.04% - 6.93%)	4.64% (1.21% - 9.17%)	5.66% (5.00% - 8.39%)	1.97% (0.18% - 4.08%)	12.74% (11.18% - 17.72%)
Canada	0.06% (0.01% -	0.07% (0.00% -	0.07% (0.00% -	0.06% (0.01% -	0.06% (0.01% -	0.06% (0.01% -	0.00% (0.00% -	7.24% (6.37% -	7.24% (6.37% -	7.24% (6.37% -	7.24% (6.37% -	7.24% (6.37% -	7.24% (6.37% -	7.24% (6.37% -

	0.48%)	0.48%)	0.48%)	0.48%)	0.48%)	0.48%)	0.00%)	7.77%)	7.77%)	7.77%)	7.77%)	7.77%)	7.77%)	7.77%)
Cape Verde	0.36% (0.01% - 1.49%)	0.30% (0.00% - 1.70%)	0.39% (0.02% - 2.27%)	24.60% (5.19% - 53.37%)	0.33% (0.03% - 2.44%)	14.05% (5.85% - 31.44%)	0.01% (0.00% - 0.02%)	5.18% (0.08% - 9.98%)	9.14% (4.22% - 13.41%)	1.34% (0.08% - 6.91%)	4.70% (2.14% - 5.56%)	5.89% (1.43% - 8.40%)	2.43% (0.28% - 5.04%)	12.99% (6.06% - 17.84%)
Cayman Islands	0.33% (0.00% - 1.43%)	0.27% (0.00% - 1.32%)	0.49% (0.05% - 1.89%)	34.53% (11.90% - 90.81%)	0.24% (0.01% - 1.97%)	13.95% (5.80% - 30.94%)	0.01% (0.00% - 0.04%)	14.87% (9.06% - 16.50%)	9.18% (6.31% - 12.15%)	1.02% (0.04% - 6.92%)	14.24% (10.40% - 17.85%)	12.89% (11.48% - 16.03%)	17.65% (14.50% - 20.30%)	6.55% (4.08% - 7.29%)
Central African Republic	0.75% (0.10% - 2.80%)	0.22% (0.02% - 0.78%)	0.23% (0.00% - 1.20%)	37.21% (14.82% - 91.96%)	0.23% (0.00% - 2.66%)	13.86% (5.34% - 30.56%)	0.00% (0.00% - 0.03%)	4.47% (2.21% - 7.10%)	9.01% (6.73% - 11.66%)	1.16% (0.11% - 6.91%)	3.29% (0.21% - 9.39%)	4.92% (2.60% - 8.96%)	1.25% (0.03% - 4.42%)	11.60% (9.64% - 15.74%)
Chad	0.50% (0.01% - 5.48%)	0.48% (0.01% - 5.64%)	0.40% (0.01% - 5.00%)	41.78% (7.79% - 99.90%)	0.33% (0.07% - 11.12%)	11.99% (5.63% - 25.80%)	0.02% (0.00% - 0.05%)	11.41% (0.20% - 17.50%)	15.36% (2.30% - 23.06%)	1.06% (0.04% - 6.93%)	10.54% (0.98% - 20.82%)	14.26% (0.42% - 20.59%)	7.07% (0.83% - 15.46%)	21.37% (5.27% - 26.91%)
Chile	0.36% (0.01% - 1.71%)	0.26% (0.03% - 1.48%)	0.50% (0.08% - 2.05%)	23.96% (10.16% - 57.74%)	0.40% (0.03% - 2.40%)	14.06% (5.81% - 31.44%)	0.00% (0.00% - 0.02%)	3.51% (0.78% - 8.74%)	9.48% (5.79% - 11.61%)	1.04% (0.04% - 6.93%)	2.83% (1.64% - 8.23%)	5.59% (3.90% - 7.16%)	1.94% (0.22% - 3.51%)	12.19% (9.04% - 16.39%)
China	0.50% (0.02% - 1.28%)	0.50% (0.02% - 1.28%)	0.50% (0.02% - 1.28%)	0.50% (0.02% - 1.28%)	0.50% (0.02% - 1.28%)	0.50% (0.02% - 1.28%)	0.00% (0.00% - 0.00%)	2.85% (0.87% - 5.24%)	2.85% (0.87% - 5.24%)	Inf% (0.87% - Inf%)	2.85% (0.87% - 5.24%)	2.85% (0.87% - 5.24%)	2.85% (0.87% - 5.24%)	2.85% (0.87% - 5.24%)
Hong Kong SAR, China	0.75% (0.08% - 1.51%)	0.73% (0.15% - 1.55%)	0.65% (0.02% - 1.21%)	94.97% (48.37% - 100.00%)	1.01% (0.12% - 4.08%)	13.35% (5.44% - 25.32%)	0.00% (0.00% - 0.03%)	4.97% (0.19% - 6.98%)	1.06% (0.10% - 5.45%)	1.04% (0.04% - 6.93%)	3.65% (0.89% - 5.96%)	1.98% (0.51% - 3.45%)	6.52% (2.72% - 10.01%)	4.54% (0.97% - 8.90%)
Macao SAR, China	0.41% (0.03% - 1.50%)	0.40% (0.00% - 1.36%)	0.38% (0.03% - 1.93%)	62.95% (13.32% - 99.27%)	0.43% (0.01% - 2.08%)	13.67% (5.79% - 31.02%)	0.03% (0.02% - 0.05%)	0.00% (0.00% - 0.00%)	27.50% (18.62% - 55.60%)	1.06% (0.05% - 6.93%)	22.68% (16.67% - 48.73%)	26.40% (15.89% - 49.60%)	19.21% (11.18% - 47.53%)	33.10% (20.53% - 56.98%)
Colombia	0.33% (0.02% - 1.84%)	0.33% (0.00% - 1.76%)	0.49% (0.08% - 2.33%)	15.87% (6.06% - 31.89%)	0.33% (0.00% - 2.81%)	14.14% (5.86% - 31.71%)	0.01% (0.00% - 0.02%)	4.44% (1.27% - 9.54%)	9.13% (7.74% - 12.32%)	1.04% (0.04% - 6.93%)	5.10% (2.30% - 6.37%)	5.96% (5.04% - 7.29%)	1.12% (0.10% - 4.14%)	13.12% (9.23% - 17.63%)
Comoros	0.47% (0.07% - 1.61%)	0.52% (0.00% - 1.47%)	0.48% (0.01% - 2.04%)	41.34% (21.09% - 63.48%)	0.35% (0.02% - 2.32%)	13.69% (5.48% - 31.09%)	0.01% (0.00% - 0.03%)	4.72% (4.05% - 6.89%)	1.59% (0.05% - 3.26%)	1.78% (0.18% - 6.16%)	5.23% (0.24% - 10.00%)	2.53% (0.57% - 8.10%)	8.74% (5.57% - 10.60%)	3.20% (0.17% - 5.56%)
Congo, Rep.	0.70% (0.01% - 2.77%)	0.21% (0.02% - 1.86%)	0.52% (0.03% - 2.43%)	24.82% (2.79% - 53.20%)	0.47% (0.02% - 2.44%)	13.93% (5.67% - 31.54%)	0.00% (0.00% - 0.03%)	3.04% (0.03% - 12.53%)	3.81% (0.48% - 7.36%)	1.04% (0.03% - 6.93%)	2.78% (0.94% - 8.47%)	2.17% (0.05% - 8.90%)	5.87% (0.95% - 15.23%)	4.75% (1.00% - 11.90%)
Cook Islands	0.86% (0.14% - 2.59%)	0.86% (0.18% - 2.84%)	0.85% (0.07% - 2.31%)	68.24% (22.25% - 93.79%)	1.63% (0.15% - 5.42%)	12.16% (5.30% - 24.94%)	0.01% (0.00% - 0.03%)	5.59% (2.54% - 9.89%)	2.47% (0.25% - 6.99%)	2.75% (0.03% - 5.97%)	8.47% (0.94% - 11.21%)	4.86% (0.10% - 9.36%)	9.80% (2.53% - 12.45%)	1.96% (0.42% - 6.10%)
Costa Rica	0.22% (0.08% - 1.23%)	0.39% (0.07% - 1.91%)	0.67% (0.08% - 2.48%)	28.05% (15.10% - 68.83%)	0.39% (0.00% - 2.36%)	14.02% (5.76% - 31.31%)	0.00% (0.00% - 0.02%)	1.53% (0.08% - 4.42%)	7.05% (4.05% - 7.96%)	1.06% (0.05% - 6.93%)	1.23% (0.06% - 5.71%)	3.48% (0.18% - 5.32%)	1.26% (0.08% - 3.37%)	9.95% (7.27% - 12.13%)
Croatia	0.09% (0.00% - 1.84%)	0.08% (0.00% - 2.00%)	0.08% (0.00% - 2.00%)	0.09% (0.00% - 1.84%)	0.09% (0.00% - 1.84%)	0.09% (0.00% - 1.84%)	0.00% (0.00% - 0.00%)	18.00% (16.42% - 18.46%)	18.00% (16.42% - 18.46%)	18.00% (16.42% - 18.46%)	18.00% (16.42% - 18.46%)	18.00% (16.42% - 18.46%)	18.00% (16.42% - 18.46%)	18.00% (16.42% - 18.46%)
Cuba	0.47% (0.08% - 2.14%)	0.30% (0.02% - 1.16%)	0.37% (0.08% - 1.73%)	17.39% (4.16% - 50.37%)	0.45% (0.01% - 2.51%)	14.20% (5.82% - 31.49%)	0.02% (0.00% - 0.04%)	18.63% (13.99% - 21.71%)	23.36% (18.39% - 25.33%)	1.05% (0.04% - 6.93%)	16.51% (12.68% - 23.25%)	19.86% (14.52% - 22.87%)	14.84% (11.43% - 17.63%)	26.39% (22.41% - 27.49%)
Cyprus	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	11.25% (11.24% - 11.26%)	11.25% (11.24% - 11.26%)	11.25% (11.24% - 11.26%)	11.25% (11.24% - 11.26%)	11.25% (11.24% - 11.26%)	11.25% (11.24% - 11.26%)	11.25% (11.24% - 11.26%)
Czech Republic	0.16% (0.00% - 0.59%)	0.16% (0.00% - 0.59%)	0.16% (0.00% - 0.59%)	0.16% (0.00% - 0.59%)	0.16% (0.00% - 0.59%)	0.16% (0.00% - 0.59%)	0.00% (0.00% - 0.00%)	10.17% (5.19% - 10.98%)	10.17% (5.19% - 10.98%)	10.17% (5.19% - 10.98%)	10.17% (5.19% - 10.98%)	10.17% (5.19% - 10.98%)	10.17% (5.19% - 10.98%)	10.17% (5.19% - 10.98%)
Cote d'Ivoire	0.27% (0.01% - 2.24%)	0.71% (0.01% - 2.56%)	0.74% (0.04% - 2.83%)	44.56% (23.41% - 99.89%)	0.38% (0.02% - 4.29%)	13.83% (5.26% - 32.47%)	0.01% (0.00% - 0.03%)	11.37% (6.61% - 16.84%)	15.76% (11.94% - 19.62%)	1.05% (0.04% - 6.93%)	9.35% (6.81% - 16.77%)	11.89% (9.05% - 15.69%)	8.38% (3.60% - 11.77%)	19.31% (15.22% - 23.84%)
Korea, democratic people's republic of	22.87% (21.27% - 24.24%)	Inf% (Inf% - Inf%)	Inf% (Inf% - Inf%)	Inf% (Inf% - Inf%)	0.41% (0.05% - 2.83%)	14.22% (5.89% - 31.82%)	0.01% (0.00% - 0.03%)	4.84% (1.61% - 7.47%)	0.83% (0.02% - 1.20%)	1.05% (0.04% - 6.93%)	5.43% (1.24% - 7.59%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 0.00%)	2.95% (1.05% - 6.91%)
Congo, Dem. Rep.	0.25% (0.05% - 3.16%)	0.86% (0.23% - 4.08%)	1.01% (0.18% - 4.66%)	23.27% (4.19% - 99.10%)	0.67% (0.00% - 4.09%)	13.59% (5.77% - 32.09%)	0.00% (0.00% - 0.02%)	3.98% (0.33% - 6.70%)	4.80% (0.28% - 11.30%)	1.06% (0.04% - 6.93%)	1.45% (0.63% - 9.26%)	2.05% (0.50% - 8.19%)	4.26% (0.04% - 9.35%)	8.35% (1.62% - 15.08%)
Denmark	0.20% (0.00% - 0.64%)	0.20% (0.00% - 0.64%)	0.20% (0.00% - 0.64%)	0.20% (0.00% - 0.64%)	0.20% (0.00% - 0.64%)	0.20% (0.00% - 0.64%)	0.00% (0.00% - 0.00%)	16.31% (14.34% - 18.32%)	16.31% (14.34% - 18.32%)	16.31% (14.34% - 18.32%)	16.31% (14.34% - 18.32%)	16.31% (14.34% - 18.32%)	16.31% (14.34% - 18.32%)	16.31% (14.34% - 18.32%)
Djibouti	0.90% (0.22% - 2.82%)	0.45% (0.02% - 1.33%)	0.27% (0.01% - 0.95%)	47.51% (25.96% - 96.84%)	0.25% (0.00% - 1.52%)	13.81% (5.50% - 29.34%)	0.01% (0.01% - 0.03%)	9.53% (4.51% - 21.77%)	14.06% (11.29% - 24.75%)	1.17% (0.08% - 6.91%)	11.27% (7.22% - 17.42%)	11.34% (8.30% - 19.68%)	6.04% (2.66% - 16.87%)	18.09% (12.48% - 29.22%)
Dominica	0.23% (0.01% - 1.02%)	0.30% (0.05% - 0.91%)	0.41% (0.01% - 1.48%)	38.52% (16.49% - 97.65%)	0.21% (0.04% - 2.61%)	13.83% (5.63% - 29.01%)	0.01% (0.00% - 0.03%)	8.37% (4.59% - 16.89%)	14.27% (8.60% - 20.05%)	1.35% (0.08% - 6.87%)	9.24% (4.65% - 13.21%)	10.85% (7.34% - 14.02%)	6.89% (0.27% - 11.95%)	16.50% (13.46% - 23.03%)
Dominican Republic	0.21% (0.01% - 1.51%)	0.44% (0.00% - 1.54%)	0.56% (0.11% - 2.07%)	30.72% (3.60% - 74.66%)	0.32% (0.01% - 2.23%)	13.91% (5.86% - 31.28%)	0.00% (0.00% - 0.02%)	4.79% (0.86% - 10.79%)	3.61% (0.60% - 13.57%)	1.05% (0.04% - 6.93%)	1.76% (0.30% - 6.61%)	1.49% (0.07% - 7.48%)	5.39% (0.34% - 6.66%)	7.63% (2.74% - 19.37%)

Ecuador	0.28% (0.05% - 1.19%)	0.26% (0.03% - 2.09%)	0.47% (0.13% - 2.66%)	18.91% (6.30% - 51.59%)	0.32% (0.01% - 2.49%)	14.11% (5.86% - 31.48%)	0.00% (0.00% - 0.03%)	2.15% (0.23% - 6.06%)	1.88% (0.82% - 4.95%)	1.04% (0.04% - 6.93%)	2.66% (0.19% - 4.56%)	1.34% (0.15% - 2.73%)	5.82% (3.86% - 7.40%)	6.34% (1.90% - 9.22%)
Egypt, Arab Rep.	0.41% (0.00% - 1.58%)	0.29% (0.00% - 1.54%)	0.45% (0.07% - 2.11%)	24.02% (13.28% - 74.03%)	0.39% (0.00% - 2.33%)	14.06% (5.79% - 31.26%)	0.00% (0.00% - 0.02%)	2.50% (0.06% - 4.04%)	6.40% (2.58% - 7.18%)	1.04% (0.04% - 6.93%)	1.87% (0.16% - 5.07%)	1.44% (0.05% - 5.26%)	1.91% (1.46% - 3.72%)	8.83% (4.83% - 12.53%)
El Salvador	0.31% (0.10% - 1.49%)	0.33% (0.01% - 1.67%)	0.56% (0.05% - 2.24%)	39.73% (12.48% - 88.42%)	0.25% (0.02% - 2.38%)	13.91% (5.80% - 31.11%)	0.00% (0.00% - 0.02%)	1.35% (0.11% - 4.13%)	4.75% (3.02% - 6.93%)	1.06% (0.05% - 6.93%)	2.26% (0.28% - 3.50%)	1.50% (0.25% - 2.42%)	3.13% (1.26% - 5.30%)	7.71% (6.61% - 11.54%)
Equatorial Guinea	1.04% (0.06% - 19.14%)	1.45% (0.02% - 14.60%)	1.74% (0.08% - 14.08%)	45.90% (3.69% - 100.00%)	1.47% (0.03% - 34.68%)	10.13% (0.04% - 31.59%)	0.01% (0.00% - 0.09%)	7.43% (1.94% - 36.62%)	6.93% (0.41% - 42.79%)	0.85% (0.06% - 6.93%)	5.62% (0.85% - 40.35%)	5.12% (0.55% - 39.36%)	7.63% (0.70% - 35.14%)	6.19% (1.72% - 44.77%)
Eritrea	0.49% (0.04% - 1.30%)	0.34% (0.05% - 1.46%)	0.34% (0.01% - 1.84%)	37.15% (10.69% - 95.03%)	0.46% (0.03% - 2.26%)	13.93% (5.69% - 30.87%)	0.01% (0.00% - 0.03%)	5.62% (0.01% - 8.74%)	10.24% (4.50% - 13.99%)	1.40% (0.07% - 6.82%)	4.63% (0.21% - 11.90%)	7.80% (0.05% - 11.51%)	1.58% (0.45% - 7.40%)	13.55% (6.93% - 18.71%)
Estonia	0.32% (0.00% - 3.35%)	0.32% (0.00% - 3.35%)	0.32% (0.00% - 3.35%)	0.32% (0.00% - 3.35%)	0.32% (0.00% - 3.35%)	0.32% (0.00% - 3.35%)	0.00% (0.00% - 0.00%)	12.01% (7.91% - 15.20%)	12.01% (7.91% - 15.20%)	12.01% (7.91% - 15.20%)	12.01% (7.91% - 15.20%)	12.01% (7.91% - 15.20%)	12.01% (7.91% - 15.20%)	12.01% (7.91% - 15.20%)
Ethiopia	0.38% (0.01% - 1.60%)	0.38% (0.01% - 1.53%)	0.57% (0.05% - 2.10%)	28.47% (12.97% - 64.94%)	0.46% (0.00% - 2.36%)	14.09% (5.77% - 31.35%)	0.01% (0.00% - 0.02%)	4.81% (2.28% - 7.51%)	9.59% (7.70% - 11.36%)	1.07% (0.05% - 6.93%)	4.50% (0.73% - 7.85%)	6.21% (1.30% - 8.61%)	1.03% (0.21% - 2.64%)	12.08% (8.19% - 15.78%)
Fiji	0.29% (0.04% - 1.00%)	0.31% (0.05% - 1.07%)	0.40% (0.03% - 0.69%)	52.87% (23.64% - 99.87%)	0.21% (0.03% - 3.10%)	13.77% (5.67% - 26.63%)	0.01% (0.00% - 0.04%)	14.25% (2.76% - 17.42%)	18.21% (9.11% - 21.02%)	1.12% (0.09% - 6.92%)	11.20% (6.58% - 18.98%)	13.52% (5.79% - 18.21%)	9.91% (2.72% - 13.50%)	21.01% (11.42% - 24.87%)
Finland	0.48% (0.00% - 1.53%)	0.38% (0.00% - 1.79%)	0.38% (0.00% - 1.79%)	0.48% (0.00% - 1.53%)	0.48% (0.00% - 1.53%)	0.48% (0.00% - 1.53%)	0.00% (0.00% - 0.00%)	13.99% (11.56% - 15.94%)	13.99% (11.56% - 15.94%)	13.99% (11.56% - 15.94%)	13.99% (11.56% - 15.94%)	13.99% (11.56% - 15.94%)	13.99% (11.56% - 15.94%)	13.99% (11.56% - 15.94%)
France	0.02% (0.00% - 0.24%)	0.02% (0.00% - 0.24%)	0.02% (0.00% - 0.24%)	0.02% (0.00% - 0.24%)	0.02% (0.00% - 0.24%)	0.02% (0.00% - 0.24%)	0.00% (0.00% - 0.00%)	11.12% (10.15% - 11.57%)	11.12% (10.15% - 11.57%)	11.12% (10.15% - 11.57%)	11.12% (10.15% - 11.57%)	11.12% (10.15% - 11.57%)	11.12% (10.15% - 11.57%)	11.12% (10.15% - 11.57%)
French Polynesia	0.43% (0.03% - 1.59%)	0.43% (0.06% - 1.53%)	0.58% (0.07% - 2.10%)	61.70% (53.86% - 97.63%)	0.44% (0.07% - 2.34%)	13.52% (5.36% - 31.14%)	0.00% (0.00% - 0.02%)	5.48% (0.09% - 7.81%)	6.16% (0.21% - 10.61%)	1.09% (0.06% - 6.93%)	1.23% (0.20% - 3.40%)	3.46% (0.66% - 5.35%)	2.16% (0.54% - 6.98%)	11.20% (2.04% - 13.58%)
Gabon	0.40% (0.02% - 1.81%)	0.36% (0.00% - 1.93%)	0.45% (0.08% - 2.50%)	14.13% (8.27% - 26.29%)	0.43% (0.03% - 2.88%)	14.16% (5.82% - 31.86%)	0.00% (0.00% - 0.02%)	4.83% (0.65% - 13.58%)	6.64% (0.04% - 11.80%)	1.05% (0.04% - 6.93%)	2.44% (0.08% - 9.73%)	4.31% (1.28% - 10.55%)	2.24% (0.24% - 13.62%)	10.50% (0.23% - 16.22%)
Gambia, The	0.38% (0.04% - 1.65%)	0.39% (0.05% - 1.78%)	0.39% (0.00% - 1.40%)	33.36% (12.08% - 99.21%)	0.41% (0.00% - 4.46%)	14.14% (5.63% - 24.94%)	0.01% (0.00% - 0.02%)	5.75% (3.69% - 8.70%)	4.19% (0.31% - 12.85%)	3.49% (0.11% - 6.88%)	2.43% (1.02% - 4.74%)	2.72% (1.02% - 8.15%)	5.79% (1.21% - 8.27%)	5.99% (2.07% - 16.24%)
Georgia	0.40% (0.01% - 1.69%)	0.32% (0.01% - 1.64%)	0.55% (0.11% - 2.22%)	21.25% (3.42% - 65.31%)	0.48% (0.03% - 2.56%)	14.05% (5.75% - 31.34%)	0.01% (0.00% - 0.04%)	12.12% (4.25% - 24.21%)	16.34% (8.65% - 30.48%)	1.06% (0.05% - 6.93%)	10.71% (2.95% - 28.00%)	14.43% (4.78% - 27.24%)	7.82% (1.69% - 24.17%)	20.42% (14.70% - 32.82%)
Germany	0.09% (0.00% - 0.45%)	0.09% (0.00% - 0.45%)	0.09% (0.00% - 0.45%)	0.09% (0.00% - 0.45%)	0.09% (0.00% - 0.45%)	0.09% (0.00% - 0.45%)	0.00% (0.00% - 0.00%)	11.28% (9.96% - 12.48%)	11.28% (9.96% - 12.48%)	11.28% (9.96% - 12.48%)	11.28% (9.96% - 12.48%)	11.28% (9.96% - 12.48%)	11.28% (9.96% - 12.48%)	11.28% (9.96% - 12.48%)
Ghana	0.28% (0.01% - 1.66%)	0.22% (0.00% - 1.54%)	0.41% (0.07% - 2.11%)	19.52% (1.87% - 81.47%)	0.29% (0.08% - 2.41%)	14.11% (5.84% - 31.31%)	0.00% (0.00% - 0.03%)	2.56% (0.21% - 4.29%)	7.15% (4.60% - 10.79%)	1.05% (0.04% - 6.93%)	2.64% (0.30% - 8.75%)	4.55% (0.48% - 7.68%)	1.57% (0.48% - 4.08%)	10.45% (6.11% - 12.78%)
Greece	0.23% (0.00% - 0.98%)	0.23% (0.00% - 0.98%)	0.23% (0.00% - 0.98%)	0.23% (0.00% - 0.98%)	0.23% (0.00% - 0.98%)	0.23% (0.00% - 0.98%)	0.00% (0.00% - 0.00%)	12.21% (7.74% - 13.96%)	12.21% (7.74% - 13.96%)	12.21% (7.74% - 13.96%)	12.21% (7.74% - 13.96%)	12.21% (7.74% - 13.96%)	12.21% (7.74% - 13.96%)	12.21% (7.74% - 13.96%)
Greenland	0.30% (0.05% - 0.77%)	0.29% (0.02% - 0.63%)	0.38% (0.03% - 0.92%)	44.45% (12.54% - 98.43%)	0.21% (0.02% - 1.35%)	13.85% (5.79% - 29.15%)	0.00% (0.00% - 0.03%)	2.27% (0.39% - 3.50%)	4.32% (2.15% - 6.32%)	1.19% (0.11% - 6.91%)	2.31% (0.81% - 3.58%)	0.92% (0.10% - 2.83%)	3.47% (1.89% - 6.00%)	7.56% (4.90% - 10.20%)
Grenada	0.40% (0.01% - 1.62%)	0.29% (0.02% - 1.54%)	0.56% (0.09% - 2.10%)	22.45% (9.23% - 58.04%)	0.34% (0.05% - 2.37%)	14.07% (5.79% - 31.39%)	0.02% (0.00% - 0.05%)	18.30% (6.45% - 26.60%)	22.29% (10.88% - 32.63%)	1.25% (0.01% - 6.88%)	18.25% (5.15% - 30.67%)	21.09% (6.98% - 29.90%)	14.01% (3.90% - 25.19%)	26.64% (15.92% - 34.54%)
Guatemala	0.38% (0.02% - 1.65%)	0.32% (0.01% - 1.59%)	0.53% (0.06% - 2.16%)	29.73% (11.79% - 58.50%)	0.32% (0.01% - 2.45%)	14.00% (5.81% - 31.41%)	0.00% (0.00% - 0.02%)	1.37% (0.22% - 3.95%)	6.11% (3.19% - 7.07%)	1.05% (0.04% - 6.93%)	1.84% (0.50% - 4.31%)	2.81% (0.09% - 4.22%)	1.80% (0.26% - 3.77%)	9.01% (6.65% - 11.27%)
Guinea	0.38% (0.02% - 1.02%)	0.46% (0.08% - 2.09%)	0.75% (0.06% - 2.66%)	15.96% (6.03% - 64.46%)	0.35% (0.05% - 2.32%)	14.14% (5.86% - 31.39%)	0.01% (0.00% - 0.02%)	5.33% (0.27% - 9.00%)	9.34% (5.91% - 11.94%)	1.06% (0.05% - 6.93%)	3.80% (1.55% - 6.68%)	5.91% (2.68% - 8.26%)	1.18% (0.05% - 3.32%)	12.44% (8.22% - 17.23%)
Guinea-Bissau	0.68% (0.03% - 3.23%)	0.62% (0.05% - 3.32%)	0.81% (0.10% - 2.69%)	28.55% (6.11% - 81.06%)	0.61% (0.02% - 6.15%)	12.94% (5.63% - 32.09%)	0.00% (0.00% - 0.02%)	6.85% (0.71% - 16.05%)	5.63% (0.12% - 11.26%)	2.78% (0.37% - 6.05%)	2.95% (1.17% - 11.89%)	3.97% (0.59% - 12.74%)	5.05% (0.97% - 16.19%)	8.11% (0.35% - 17.56%)
Guyana	0.38% (0.01% - 1.31%)	0.44% (0.03% - 1.23%)	0.42% (0.08% - 1.80%)	57.02% (2.31% - 96.48%)	0.19% (0.00% - 1.75%)	13.62% (5.72% - 30.19%)	0.01% (0.00% - 0.02%)	4.23% (1.73% - 9.64%)	9.55% (6.32% - 12.58%)	1.08% (0.06% - 6.92%)	4.44% (3.08% - 7.57%)	5.95% (4.38% - 8.71%)	2.59% (0.11% - 3.96%)	12.35% (10.28% - 17.63%)
Haiti	0.59% (0.06% - 5.89%)	0.34% (0.04% - 6.45%)	0.44% (0.03% - 6.15%)	59.20% (6.43% - 99.97%)	0.29% (0.01% - 13.25%)	12.89% (5.85% - 21.60%)	0.00% (0.00% - 0.04%)	1.89% (0.08% - 7.73%)	5.15% (0.85% - 14.05%)	1.40% (0.06% - 6.25%)	3.68% (0.18% - 11.57%)	2.78% (0.19% - 10.77%)	3.98% (0.02% - 8.39%)	9.36% (2.20% - 16.39%)
Honduras	0.38% (0.03% -	0.26% (0.01% -	0.46% (0.02% -	38.73% (12.32% -	0.29% (0.00% -	13.91% (5.80% -	0.00% (0.00% -	2.43% (0.32% -	6.57% (0.69% -	1.07% (0.06% -	5.29% (0.30% -	4.68% (0.12% -	3.22% (0.29% -	10.69% (2.68% -

	1.67%)	1.44%)	2.02%)	64.10%)	2.33%)	31.43%)	0.03%)	5.34%)	11.38%)	6.92%)	9.42%)	8.64%)	7.68%)	13.34%)
Hungary	0.22% (0.00% - 0.95%)	0.22% (0.00% - 0.95%)	0.22% (0.00% - 0.95%)	0.22% (0.00% - 0.95%)	0.22% (0.00% - 0.95%)	0.22% (0.00% - 0.95%)	0.00% (0.00% - 0.00%)	16.21% (13.23% - 17.70%)	16.21% (13.23% - 17.70%)	16.21% (13.23% - 17.70%)	16.21% (13.23% - 17.70%)	16.21% (13.23% - 17.70%)	16.21% (13.23% - 17.70%)	16.21% (13.23% - 17.70%)
Iceland	0.52% (0.01% - 1.43%)	0.28% (0.01% - 1.68%)	0.42% (0.10% - 2.25%)	38.52% (10.66% - 67.62%)	0.41% (0.00% - 2.32%)	14.01% (5.82% - 31.32%)	0.02% (0.00% - 0.05%)	18.98% (12.98% - 26.63%)	21.95% (17.38% - 33.51%)	1.05% (0.04% - 6.93%)	15.00% (9.95% - 31.47%)	17.49% (12.37% - 30.40%)	13.59% (10.12% - 26.48%)	24.71% (20.53% - 34.59%)
India	1.80% (0.19% - 4.28%)	1.80% (0.18% - 4.28%)	1.80% (0.18% - 4.28%)	1.80% (0.19% - 4.28%)	1.80% (0.19% - 4.28%)	1.80% (0.19% - 4.28%)	0.00% (0.00% - 0.00%)	6.92% (4.61% - 7.83%)	6.92% (4.61% - 7.83%)	6.92% (4.61% - 7.83%)	6.92% (4.61% - 7.83%)	6.92% (4.61% - 7.83%)	6.92% (4.61% - 7.83%)	6.92% (4.61% - 7.83%)
Indonesia	1.92% (0.00% - 5.33%)	1.97% (0.01% - 5.33%)	1.97% (0.01% - 5.33%)	1.92% (0.00% - 5.33%)	1.92% (0.00% - 5.33%)	1.92% (0.00% - 5.33%)	0.00% (0.00% - 0.00%)	0.09% (0.00% - 0.57%)	0.09% (0.00% - 0.57%)	0.09% (0.00% - 0.57%)	0.09% (0.00% - 0.57%)	0.09% (0.00% - 0.57%)	0.09% (0.00% - 0.57%)	0.09% (0.00% - 0.57%)
Iran, Islamic Rep.	0.16% (0.00% - 2.10%)	0.70% (0.06% - 3.32%)	0.90% (0.13% - 3.89%)	15.04% (2.27% - 19.99%)	0.35% (0.01% - 2.81%)	14.17% (5.76% - 31.80%)	0.01% (0.00% - 0.03%)	3.73% (0.00% - 6.21%)	0.86% (0.05% - 3.42%)	1.04% (0.04% - 6.93%)	4.15% (0.24% - 9.13%)	2.33% (0.43% - 5.77%)	6.93% (5.39% - 9.61%)	3.90% (1.24% - 8.15%)
Iraq	0.31% (0.01% - 3.46%)	0.25% (0.04% - 3.53%)	0.45% (0.01% - 3.23%)	38.09% (13.18% - 99.99%)	0.44% (0.00% - 7.90%)	13.36% (5.74% - 27.63%)	0.03% (0.00% - 0.05%)	33.37% (21.60% - 40.72%)	29.42% (18.45% - 35.22%)	1.04% (0.04% - 6.93%)	34.23% (25.34% - 37.97%)	33.08% (24.47% - 38.28%)	36.60% (26.54% - 43.73%)	25.34% (15.84% - 32.11%)
Ireland	0.96% (0.02% - 1.91%)	0.91% (0.00% - 1.70%)	0.91% (0.00% - 1.70%)	0.96% (0.02% - 1.91%)	0.96% (0.02% - 1.91%)	0.96% (0.02% - 1.91%)	0.00% (0.00% - 0.00%)	9.05% (0.56% - 16.95%)	9.05% (0.56% - 18.64%)	9.05% (0.56% - 16.95%)	9.05% (0.56% - 16.95%)	9.05% (0.56% - 16.95%)	9.05% (0.56% - 16.95%)	9.05% (0.56% - 16.95%)
Israel	0.40% (0.04% - 1.71%)	0.25% (0.01% - 1.51%)	0.47% (0.03% - 2.08%)	32.93% (13.11% - 57.52%)	0.35% (0.00% - 2.43%)	13.97% (5.79% - 31.42%)	0.00% (0.00% - 0.03%)	5.47% (2.44% - 9.16%)	10.19% (1.96% - 13.14%)	1.05% (0.04% - 6.93%)	4.49% (1.88% - 11.19%)	5.90% (1.91% - 10.42%)	2.07% (0.04% - 5.97%)	12.74% (10.04% - 15.05%)
Italy	0.03% (0.00% - 0.10%)	0.03% (0.00% - 0.10%)	0.03% (0.00% - 0.10%)	0.03% (0.00% - 0.10%)	0.03% (0.00% - 0.10%)	0.03% (0.00% - 0.10%)	0.00% (0.00% - 0.00%)	11.17% (10.53% - 11.65%)	11.17% (10.53% - 11.65%)	11.17% (10.53% - 11.65%)	11.17% (10.53% - 11.65%)	11.17% (10.53% - 11.65%)	11.17% (10.53% - 11.65%)	11.17% (10.53% - 11.65%)
Jamaica	0.35% (0.02% - 1.55%)	0.29% (0.00% - 1.48%)	0.53% (0.07% - 2.05%)	28.56% (13.98% - 73.11%)	0.37% (0.01% - 2.24%)	14.02% (5.78% - 31.34%)	0.01% (0.00% - 0.02%)	4.62% (1.93% - 9.29%)	10.13% (8.07% - 12.07%)	1.05% (0.04% - 6.93%)	4.87% (2.99% - 8.21%)	6.86% (5.14% - 7.83%)	2.05% (0.23% - 3.94%)	13.40% (9.89% - 17.09%)
Japan	0.12% (0.00% - 1.30%)	0.12% (0.00% - 0.75%)	0.12% (0.00% - 0.75%)	0.12% (0.00% - 1.30%)	0.12% (0.00% - 1.30%)	0.12% (0.00% - 1.30%)	0.00% (0.00% - 0.00%)	1.33% (0.30% - 2.07%)	1.33% (0.30% - 2.07%)	1.33% (0.30% - 2.07%)	1.33% (0.30% - 2.07%)	1.33% (0.30% - 2.07%)	1.33% (0.30% - 2.07%)	1.33% (0.30% - 2.07%)
Jordan	0.33% (0.02% - 1.68%)	0.33% (0.04% - 1.31%)	0.50% (0.01% - 1.88%)	43.04% (12.53% - 92.96%)	0.27% (0.01% - 2.20%)	13.95% (5.78% - 31.06%)	0.01% (0.00% - 0.03%)	6.45% (3.33% - 11.29%)	10.19% (7.40% - 14.08%)	1.05% (0.04% - 6.93%)	5.13% (1.05% - 11.68%)	6.78% (3.86% - 10.60%)	1.88% (0.40% - 6.68%)	14.30% (11.22% - 15.81%)
Kazakhstan	0.36% (0.01% - 2.40%)	0.22% (0.00% - 2.04%)	0.22% (0.03% - 1.75%)	32.63% (1.59% - 100.00%)	0.25% (0.06% - 4.87%)	13.98% (5.94% - 29.99%)	0.00% (0.00% - 0.03%)	1.86% (0.11% - 3.02%)	5.46% (2.53% - 8.68%)	1.04% (0.04% - 6.93%)	3.43% (0.41% - 6.73%)	3.14% (0.54% - 5.96%)	2.89% (0.07% - 4.77%)	9.48% (5.37% - 11.53%)
Kenya	0.36% (0.01% - 1.29%)	0.45% (0.02% - 1.82%)	0.57% (0.00% - 2.39%)	28.57% (0.30% - 81.27%)	0.39% (0.02% - 2.33%)	14.30% (5.74% - 31.18%)	0.01% (0.00% - 0.03%)	5.92% (5.25% - 13.23%)	11.88% (9.66% - 16.01%)	1.05% (0.04% - 6.93%)	8.50% (4.86% - 10.33%)	9.14% (8.29% - 10.33%)	4.48% (1.36% - 7.83%)	15.30% (13.44% - 22.28%)
Kiribati	0.35% (0.01% - 1.31%)	0.27% (0.02% - 1.21%)	0.49% (0.02% - 1.58%)	27.28% (12.96% - 61.45%)	0.90% (0.06% - 2.09%)	13.95% (5.61% - 30.81%)	0.00% (0.00% - 0.03%)	1.65% (0.17% - 4.05%)	13.16% (4.90% - 15.11%)	5.23% (0.33% - 10.47%)	4.33% (1.31% - 7.53%)	2.86% (1.14% - 6.51%)	3.34% (0.43% - 7.88%)	8.14% (2.96% - 13.09%)
Kosovo	0.33% (0.01% - 1.47%)	0.36% (0.01% - 1.33%)	0.45% (0.04% - 1.90%)	40.37% (11.87% - 93.47%)	0.26% (0.00% - 2.02%)	13.90% (5.80% - 31.00%)	0.01% (0.00% - 0.02%)	13.85% (2.55% - 18.28%)	17.01% (3.10% - 22.09%)	1.12% (0.09% - 6.92%)	10.68% (0.67% - 15.28%)	12.96% (0.13% - 18.70%)	9.13% (1.34% - 13.67%)	20.63% (4.27% - 25.40%)
Kuwait	0.42% (0.02% - 1.74%)	0.21% (0.01% - 2.46%)	0.29% (0.02% - 3.04%)	9.38% (0.56% - 49.70%)	0.42% (0.01% - 3.13%)	14.24% (5.93% - 32.08%)	0.01% (0.00% - 0.03%)	8.66% (3.58% - 13.96%)	4.26% (0.43% - 7.08%)	1.04% (0.04% - 6.93%)	9.02% (6.65% - 12.41%)	8.08% (5.30% - 10.20%)	12.49% (8.52% - 15.05%)	1.45% (0.45% - 6.01%)
Kyrgyz Republic	0.67% (0.04% - 2.12%)	0.26% (0.01% - 0.86%)	0.30% (0.01% - 1.24%)	41.01% (20.55% - 96.44%)	0.41% (0.02% - 1.95%)	13.78% (5.71% - 31.35%)	0.01% (0.01% - 0.04%)	8.60% (6.13% - 18.49%)	12.10% (10.47% - 25.38%)	1.09% (0.07% - 6.93%)	5.65% (3.34% - 23.32%)	8.95% (5.36% - 22.25%)	3.78% (2.18% - 18.33%)	16.06% (12.24% - 26.44%)
Lao PDR	0.16% (0.01% - 1.50%)	0.55% (0.06% - 1.86%)	0.70% (0.06% - 2.43%)	9.49% (0.29% - 54.07%)	0.46% (0.10% - 2.58%)	14.27% (6.02% - 31.55%)	0.01% (0.00% - 0.03%)	4.96% (0.26% - 6.57%)	8.19% (4.13% - 12.99%)	1.09% (0.06% - 6.93%)	2.53% (0.04% - 10.94%)	6.18% (0.14% - 9.87%)	2.21% (0.07% - 5.94%)	12.94% (7.03% - 15.79%)
Latvia	0.61% (0.00% - 1.55%)	1.06% (0.00% - 2.46%)	1.06% (0.00% - 2.46%)	0.61% (0.00% - 1.55%)	0.61% (0.00% - 1.55%)	0.61% (0.00% - 1.55%)	0.00% (0.00% - 0.00%)	12.98% (9.24% - 14.49%)	12.98% (9.24% - 14.49%)	12.98% (9.24% - 14.49%)	12.98% (9.24% - 14.49%)	12.98% (9.24% - 14.49%)	12.98% (9.24% - 14.49%)	12.98% (9.24% - 14.49%)
Lebanon	0.39% (0.03% - 1.71%)	0.27% (0.02% - 1.83%)	0.45% (0.08% - 2.40%)	28.62% (7.44% - 53.01%)	0.38% (0.00% - 2.54%)	14.02% (5.78% - 31.47%)	0.01% (0.00% - 0.03%)	4.73% (0.17% - 8.23%)	8.35% (4.88% - 17.26%)	1.30% (0.25% - 4.86%)	5.38% (2.34% - 7.40%)	3.65% (2.73% - 5.14%)	8.23% (0.38% - 10.46%)	3.66% (0.29% - 9.86%)
Lesotho	0.40% (0.03% - 1.54%)	0.41% (0.06% - 1.33%)	0.48% (0.01% - 1.88%)	55.33% (23.09% - 85.64%)	0.38% (0.07% - 2.06%)	13.74% (5.67% - 31.25%)	0.01% (0.00% - 0.03%)	5.12% (1.24% - 7.35%)	8.92% (5.23% - 13.08%)	1.14% (0.10% - 6.93%)	2.93% (0.03% - 11.02%)	4.12% (2.29% - 9.94%)	1.96% (0.04% - 6.21%)	11.37% (10.33% - 14.92%)
Liberia	0.40% (0.06% - 1.41%)	0.37% (0.01% - 1.34%)	0.55% (0.07% - 1.68%)	50.91% (22.41% - 76.79%)	0.62% (0.04% - 2.21%)	13.36% (5.61% - 31.08%)	0.01% (0.00% - 0.02%)	4.65% (0.47% - 10.46%)	8.09% (2.28% - 14.39%)	3.25% (0.13% - 8.38%)	1.67% (0.00% - 5.64%)	2.37% (0.16% - 8.87%)	4.28% (0.16% - 6.89%)	9.06% (2.16% - 18.81%)
Libya	0.43% (0.02% - 2.61%)	0.30% (0.09% - 2.19%)	0.38% (0.02% - 2.76%)	25.25% (3.46% - 99.87%)	0.55% (0.01% - 2.94%)	14.16% (5.83% - 32.03%)	0.01% (0.00% - 0.04%)	15.00% (5.86% - 21.24%)	10.06% (1.47% - 14.36%)	1.04% (0.03% - 6.93%)	15.28% (7.17% - 18.85%)	13.63% (5.34% - 17.47%)	18.57% (8.43% - 21.66%)	6.95% (3.91% - 13.28%)

Liechtenstein	0.39% (0.02% - 1.70%)	0.31% (0.00% - 1.60%)	0.54% (0.07% - 2.18%)	25.51% (12.49% - 53.54%)	0.40% (0.00% - 2.52%)	14.05% (5.79% - 31.46%)	0.01% (0.01% - 0.03%)	7.90% (4.30% - 11.31%)	2.18% (0.45% - 5.93%)	1.22% (0.11% - 6.43%)	8.71% (2.60% - 13.25%)	6.21% (3.00% - 10.86%)	11.03% (8.18% - 14.32%)	0.89% (0.01% - 3.53%)
Lithuania	0.46% (0.00% - 1.75%)	0.46% (0.00% - 1.75%)	0.46% (0.00% - 1.75%)	0.46% (0.00% - 1.75%)	0.46% (0.00% - 1.75%)	0.46% (0.00% - 1.75%)	0.00% (0.00% - 0.00%)	10.32% (8.57% - 10.69%)	10.32% (8.57% - 10.69%)	10.32% (8.57% - 10.69%)	10.32% (8.57% - 10.69%)	10.32% (8.57% - 10.69%)	10.32% (8.57% - 10.69%)	10.32% (8.57% - 10.69%)
Luxembourg	0.14% (0.00% - 0.59%)	0.14% (0.00% - 0.59%)	0.14% (0.00% - 0.59%)	0.14% (0.00% - 0.59%)	0.14% (0.00% - 0.59%)	0.14% (0.00% - 0.59%)	0.00% (0.00% - 0.00%)	11.15% (9.43% - 12.12%)	11.15% (9.43% - 12.12%)	11.15% (9.43% - 12.12%)	11.15% (9.43% - 12.12%)	11.15% (9.43% - 12.12%)	11.15% (9.43% - 12.12%)	11.15% (9.43% - 12.12%)
Madagascar	0.41% (0.05% - 1.67%)	0.40% (0.05% - 1.61%)	0.47% (0.01% - 2.19%)	27.73% (5.54% - 54.64%)	0.47% (0.01% - 2.50%)	13.78% (5.87% - 31.45%)	0.01% (0.01% - 0.03%)	6.84% (4.45% - 9.94%)	11.48% (9.20% - 13.09%)	1.10% (0.10% - 6.92%)	6.04% (3.34% - 9.43%)	7.93% (6.05% - 9.69%)	3.33% (0.84% - 5.98%)	14.15% (12.54% - 21.02%)
Malawi	0.50% (0.03% - 1.58%)	0.27% (0.04% - 1.96%)	0.43% (0.07% - 2.53%)	22.04% (5.15% - 88.96%)	0.37% (0.02% - 2.76%)	14.46% (5.87% - 30.97%)	0.00% (0.00% - 0.02%)	2.42% (0.10% - 6.43%)	6.10% (0.01% - 9.37%)	1.17% (0.11% - 6.93%)	1.92% (0.02% - 7.26%)	2.26% (0.07% - 6.19%)	2.47% (0.13% - 8.33%)	8.65% (5.56% - 12.57%)
Malaysia	0.39% (0.02% - 1.58%)	0.33% (0.05% - 1.47%)	0.47% (0.01% - 2.04%)	47.74% (22.98% - 85.78%)	0.27% (0.01% - 2.27%)	13.82% (5.69% - 31.30%)	0.00% (0.00% - 0.03%)	3.57% (0.28% - 6.18%)	2.19% (0.02% - 3.22%)	1.04% (0.04% - 6.93%)	3.97% (0.21% - 6.17%)	2.08% (0.01% - 3.44%)	6.42% (3.66% - 8.54%)	4.41% (2.39% - 8.76%)
Maldives	0.58% (0.08% - 1.53%)	0.73% (0.03% - 3.26%)	0.63% (0.07% - 2.70%)	62.42% (12.53% - 99.53%)	0.49% (0.02% - 3.83%)	13.87% (5.63% - 26.79%)	0.01% (0.00% - 0.03%)	9.18% (2.53% - 13.57%)	2.65% (0.11% - 5.41%)	2.22% (0.06% - 6.89%)	8.16% (6.09% - 10.05%)	6.51% (4.05% - 10.54%)	12.53% (7.12% - 14.22%)	1.87% (0.07% - 5.43%)
Mali	0.21% (0.07% - 1.53%)	0.36% (0.00% - 1.63%)	0.51% (0.11% - 2.21%)	22.53% (4.13% - 66.65%)	0.33% (0.03% - 2.38%)	14.08% (5.88% - 31.42%)	0.00% (0.00% - 0.03%)	4.64% (2.14% - 7.32%)	9.63% (7.50% - 12.56%)	1.06% (0.04% - 6.93%)	3.78% (0.54% - 10.09%)	5.96% (3.39% - 9.30%)	1.58% (0.05% - 6.22%)	12.06% (10.27% - 16.97%)
Malta	0.24% (0.00% - 1.07%)	0.25% (0.00% - 1.10%)	0.25% (0.00% - 1.10%)	0.24% (0.00% - 1.07%)	0.24% (0.00% - 1.07%)	0.24% (0.00% - 1.07%)	0.00% (0.00% - 0.00%)	14.54% (10.76% - 16.55%)	14.54% (10.76% - 16.55%)	14.54% (10.76% - 16.55%)	14.54% (10.76% - 16.55%)	14.54% (10.76% - 16.55%)	14.54% (10.76% - 16.55%)	14.54% (10.76% - 16.55%)
Marshall Islands	0.35% (0.02% - 1.48%)	0.27% (0.00% - 1.32%)	0.48% (0.03% - 1.82%)	28.93% (11.73% - 67.01%)	0.90% (0.05% - 2.27%)	13.98% (5.69% - 31.13%)	0.00% (0.00% - 0.02%)	1.71% (0.09% - 5.91%)	11.32% (5.10% - 18.27%)	4.22% (0.92% - 9.83%)	2.59% (0.05% - 6.40%)	1.73% (0.01% - 6.15%)	2.59% (0.19% - 7.44%)	8.27% (6.04% - 11.39%)
Mauritania	0.27% (0.00% - 1.83%)	0.27% (0.02% - 1.44%)	0.57% (0.01% - 2.01%)	11.12% (0.27% - 44.86%)	0.38% (0.04% - 2.48%)	14.14% (5.94% - 31.61%)	0.00% (0.00% - 0.02%)	2.75% (0.20% - 9.19%)	7.09% (2.92% - 9.26%)	1.07% (0.05% - 6.93%)	1.77% (0.09% - 7.05%)	3.72% (0.62% - 6.61%)	0.94% (0.05% - 9.20%)	10.26% (0.53% - 14.36%)
Mauritius	0.36% (0.01% - 1.49%)	0.26% (0.04% - 1.39%)	0.41% (0.06% - 1.96%)	27.04% (10.79% - 84.48%)	0.26% (0.02% - 2.09%)	14.03% (5.82% - 31.23%)	0.01% (0.00% - 0.03%)	11.73% (7.82% - 13.87%)	15.46% (12.22% - 20.13%)	1.07% (0.06% - 6.93%)	9.38% (6.50% - 18.00%)	12.80% (8.34% - 17.17%)	7.10% (5.25% - 13.81%)	19.80% (16.25% - 22.52%)
Mexico	0.16% (0.00% - 2.50%)	0.15% (0.00% - 2.46%)	0.15% (0.00% - 2.46%)	0.16% (0.00% - 2.50%)	0.16% (0.00% - 2.50%)	0.16% (0.00% - 2.50%)	0.00% (0.00% - 0.00%)	2.47% (1.09% - 3.44%)	2.47% (1.09% - 3.44%)	2.47% (1.09% - 3.44%)	2.47% (1.09% - 3.44%)	2.47% (1.09% - 3.44%)	2.47% (1.09% - 3.44%)	2.47% (1.09% - 3.44%)
Micronesia, Fed. Sts.	8.04% (6.41% - 8.59%)	8.34% (7.96% - 9.57%)	8.51% (7.91% - 10.11%)	15.01% (1.64% - 53.09%)	0.67% (0.15% - 2.46%)	14.25% (6.03% - 31.39%)	0.00% (0.00% - 0.02%)	1.88% (0.12% - 6.36%)	8.25% (4.44% - 13.63%)	1.63% (0.13% - 9.40%)	1.77% (0.14% - 5.54%)	3.23% (1.16% - 5.38%)	0.89% (0.08% - 4.76%)	9.96% (8.38% - 13.11%)
Monaco	0.36% (0.01% - 1.72%)	0.29% (0.02% - 1.55%)	0.50% (0.09% - 2.12%)	20.79% (8.13% - 53.75%)	0.36% (0.01% - 2.49%)	14.09% (5.84% - 31.46%)	0.00% (0.00% - 0.03%)	0.00% (0.00% - 0.00%)	2.66% (0.86% - 6.59%)	1.64% (0.31% - 4.14%)	3.82% (0.51% - 6.47%)	2.15% (1.48% - 4.64%)	6.60% (4.42% - 9.18%)	4.42% (2.60% - 7.31%)
Mongolia	0.38% (0.03% - 1.63%)	0.33% (0.02% - 1.58%)	0.55% (0.07% - 2.13%)	24.26% (4.69% - 56.41%)	0.41% (0.02% - 2.39%)	14.06% (5.83% - 31.59%)	0.01% (0.00% - 0.02%)	8.51% (0.32% - 15.32%)	12.46% (3.53% - 18.47%)	1.06% (0.05% - 6.93%)	6.86% (1.50% - 11.57%)	9.74% (0.42% - 12.44%)	4.17% (0.28% - 10.37%)	17.12% (4.60% - 22.65%)
Montenegro	0.96% (0.01% - 1.65%)	1.02% (0.16% - 2.32%)	1.00% (0.22% - 2.89%)	11.42% (0.98% - 75.11%)	0.30% (0.01% - 2.84%)	13.51% (6.01% - 31.88%)	0.02% (0.00% - 0.02%)	9.04% (0.32% - 20.62%)	12.99% (3.32% - 23.98%)	1.10% (0.07% - 6.93%)	8.17% (0.53% - 15.82%)	11.89% (0.23% - 18.24%)	5.22% (0.49% - 15.99%)	18.59% (6.40% - 27.36%)
Montserrat	0.45% (0.10% - 1.27%)	0.44% (0.13% - 1.09%)	0.44% (0.03% - 1.41%)	28.29% (13.56% - 73.91%)	0.25% (0.03% - 1.28%)	13.88% (5.05% - 30.60%)	0.01% (0.00% - 0.03%)	11.16% (1.95% - 20.92%)	15.93% (0.99% - 27.78%)	1.89% (0.06% - 6.07%)	7.58% (2.31% - 17.92%)	9.02% (1.66% - 17.02%)	5.40% (1.19% - 11.19%)	16.58% (0.16% - 22.25%)
Morocco	0.33% (0.03% - 1.63%)	0.33% (0.02% - 1.55%)	0.57% (0.09% - 2.12%)	15.79% (8.23% - 58.05%)	0.37% (0.00% - 2.40%)	14.15% (5.84% - 31.48%)	0.00% (0.00% - 0.02%)	2.04% (0.44% - 4.87%)	7.52% (4.68% - 8.01%)	1.05% (0.04% - 6.93%)	1.12% (0.03% - 5.71%)	3.99% (0.74% - 5.32%)	1.08% (0.08% - 2.41%)	9.97% (7.08% - 12.92%)
Mozambique	0.42% (0.01% - 1.65%)	0.27% (0.01% - 1.38%)	0.49% (0.05% - 1.95%)	29.74% (12.38% - 70.08%)	0.44% (0.00% - 2.25%)	13.95% (5.80% - 31.32%)	0.01% (0.00% - 0.03%)	5.55% (2.00% - 7.34%)	9.82% (4.41% - 11.76%)	1.07% (0.05% - 6.93%)	2.97% (0.63% - 9.69%)	7.07% (1.03% - 9.23%)	1.67% (0.42% - 4.69%)	12.80% (6.66% - 16.06%)
Myanmar	0.28% (0.09% - 10.56%)	0.27% (0.07% - 10.48%)	0.40% (0.08% - 11.05%)	9.51% (0.11% - 89.97%)	1.16% (0.04% - 16.72%)	14.11% (5.46% - 46.38%)	0.00% (0.00% - 0.03%)	0.71% (0.01% - 1.20%)	4.24% (3.57% - 7.53%)	1.16% (0.11% - 6.79%)	3.86% (0.26% - 5.22%)	2.54% (0.33% - 4.80%)	4.10% (0.54% - 5.16%)	8.07% (4.14% - 11.62%)
Namibia	0.43% (0.08% - 1.39%)	0.29% (0.03% - 1.55%)	0.44% (0.07% - 2.12%)	45.63% (9.46% - 98.06%)	0.52% (0.02% - 2.15%)	13.95% (5.58% - 30.55%)	0.00% (0.00% - 0.02%)	1.86% (0.42% - 7.46%)	6.90% (4.61% - 10.24%)	1.05% (0.04% - 6.93%)	2.42% (0.19% - 5.33%)	3.78% (1.49% - 5.69%)	1.21% (0.02% - 3.68%)	10.67% (7.12% - 14.33%)
Nauru	0.40% (0.00% - 1.02%)	0.38% (0.01% - 0.93%)	0.31% (0.05% - 1.40%)	24.54% (11.33% - 58.88%)	0.93% (0.08% - 3.67%)	13.42% (5.02% - 30.11%)	0.01% (0.00% - 0.03%)	7.48% (1.55% - 15.77%)	127.57% (0.13% - 1567.58%)	14.25% (1.64% - 100.00%)	5.73% (2.44% - 21.32%)	5.06% (3.27% - 14.53%)	10.91% (5.95% - 100.00%)	2.13% (0.13% - 8.26%)
Nepal	0.25% (0.00% - 1.65%)	0.22% (0.02% - 1.61%)	0.47% (0.09% - 2.18%)	22.27% (4.43% - 73.24%)	0.29% (0.04% - 2.48%)	14.08% (5.85% - 31.43%)	0.00% (0.00% - 0.02%)	1.52% (0.04% - 4.59%)	6.27% (5.12% - 7.64%)	1.08% (0.06% - 6.93%)	2.24% (0.12% - 5.04%)	3.53% (0.53% - 4.63%)	2.15% (0.04% - 3.20%)	8.84% (7.60% - 13.90%)
Netherlands	0.05% (0.00% -	0.05% (0.00% -	0.05% (0.00% -	0.05% (0.00% -	0.05% (0.00% -	0.05% (0.00% -	0.00% (0.00% -	12.38% (10.83% -	12.38% (10.83% -	12.38% (10.83% -	12.38% (10.83% -	12.38% (10.83% -	12.38% (10.83% -	12.38% (10.83% -

	0.38%)	0.38%)	0.38%)	0.38%)	0.38%)	0.38%)	0.00%)	12.82%)	12.82%)	12.82%)	12.82%)	12.82%)	12.82%)	12.82%)
Netherlands Antilles	0.31% (0.01% - 1.19%)	0.27% (0.02% - 1.06%)	0.48% (0.01% - 1.44%)	35.87% (16.56% - 99.65%)	0.30% (0.02% - 1.29%)	13.94% (5.75% - 30.63%)	0.00% (0.00% - 0.02%)	1.65% (0.01% - 7.76%)	6.43% (4.78% - 10.62%)	1.09% (0.07% - 6.92%)	2.33% (0.07% - 5.11%)	3.94% (1.53% - 4.66%)	1.69% (0.15% - 2.73%)	10.81% (6.04% - 13.85%)
New Caledonia	0.35% (0.01% - 1.66%)	0.25% (0.02% - 1.49%)	0.49% (0.09% - 2.06%)	20.86% (7.32% - 60.93%)	0.34% (0.01% - 2.37%)	14.09% (5.85% - 31.39%)	0.00% (0.00% - 0.02%)	3.93% (1.63% - 8.45%)	8.44% (1.42% - 11.27%)	1.10% (0.08% - 6.92%)	2.09% (0.00% - 7.14%)	4.45% (1.08% - 6.37%)	1.39% (0.02% - 5.00%)	11.28% (3.11% - 14.53%)
New Zealand	0.42% (0.01% - 1.67%)	0.26% (0.01% - 1.60%)	0.45% (0.08% - 2.18%)	19.77% (6.20% - 50.72%)	0.34% (0.00% - 2.49%)	14.10% (5.86% - 31.49%)	0.00% (0.00% - 0.02%)	3.14% (1.43% - 8.62%)	8.35% (5.82% - 11.40%)	1.04% (0.04% - 6.93%)	3.00% (0.01% - 7.25%)	5.13% (1.95% - 6.86%)	1.14% (0.12% - 3.23%)	11.42% (9.42% - 13.90%)
Nicaragua	0.38% (0.02% - 1.58%)	0.37% (0.06% - 1.95%)	0.55% (0.01% - 2.52%)	34.60% (14.40% - 47.04%)	0.41% (0.00% - 2.53%)	14.02% (5.77% - 31.53%)	0.01% (0.00% - 0.03%)	6.16% (4.02% - 7.59%)	9.75% (8.41% - 13.69%)	1.07% (0.06% - 6.93%)	3.85% (1.08% - 11.48%)	7.57% (3.31% - 11.03%)	1.51% (0.25% - 6.22%)	14.27% (10.20% - 16.49%)
Niger	0.35% (0.00% - 1.51%)	0.34% (0.02% - 1.69%)	0.48% (0.05% - 2.26%)	24.42% (8.02% - 53.59%)	0.34% (0.01% - 2.42%)	14.06% (5.83% - 31.49%)	0.00% (0.00% - 0.02%)	4.28% (0.09% - 7.49%)	8.24% (5.64% - 10.38%)	1.11% (0.07% - 6.93%)	3.51% (0.97% - 5.79%)	5.08% (2.39% - 7.62%)	0.93% (0.04% - 2.33%)	11.49% (8.01% - 17.37%)
Nigeria	2.17% (0.25% - 6.81%)	5.85% (0.25% - 10.40%)	6.11% (0.20% - 11.02%)	85.73% (1.41% - 89.99%)	2.66% (0.08% - 12.04%)	15.06% (7.66% - 32.88%)	0.01% (0.00% - 0.02%)	3.65% (0.17% - 6.98%)	2.20% (0.07% - 7.80%)	1.04% (0.03% - 6.93%)	2.25% (0.17% - 5.27%)	1.27% (0.03% - 3.87%)	6.39% (0.38% - 10.32%)	6.33% (0.98% - 14.53%)
Norway	0.44% (0.00% - 0.63%)	0.44% (0.00% - 0.63%)	0.44% (0.00% - 0.63%)	0.44% (0.00% - 0.63%)	0.44% (0.00% - 0.63%)	0.44% (0.00% - 0.63%)	0.00% (0.00% - 0.00%)	11.04% (7.67% - 13.19%)	11.04% (7.67% - 13.19%)	11.04% (7.67% - 13.19%)	11.04% (7.67% - 13.19%)	11.04% (7.67% - 13.19%)	11.04% (7.67% - 13.19%)	11.04% (7.67% - 13.19%)
Palestine	0.40% (0.02% - 1.54%)	0.35% (0.02% - 1.45%)	0.48% (0.02% - 2.02%)	39.18% (15.30% - 74.15%)	0.22% (0.01% - 2.22%)	13.91% (5.77% - 31.25%)	0.01% (0.00% - 0.03%)	12.15% (2.35% - 19.04%)	16.96% (8.66% - 21.98%)	1.08% (0.06% - 6.93%)	10.95% (6.18% - 17.87%)	13.33% (5.38% - 17.41%)	9.70% (1.91% - 13.35%)	20.07% (11.01% - 24.20%)
Oman	0.46% (0.00% - 1.56%)	0.30% (0.00% - 1.47%)	0.45% (0.12% - 1.90%)	22.32% (11.16% - 86.13%)	0.48% (0.00% - 2.11%)	14.11% (5.80% - 31.41%)	0.01% (0.00% - 0.03%)	6.71% (0.55% - 10.33%)	2.84% (1.16% - 4.47%)	1.04% (0.03% - 6.93%)	5.51% (3.78% - 9.73%)	4.23% (1.66% - 7.43%)	10.16% (3.91% - 12.89%)	2.39% (0.00% - 9.33%)
Pakistan	0.23% (0.01% - 1.82%)	0.38% (0.01% - 1.64%)	0.59% (0.11% - 2.21%)	11.76% (2.83% - 31.78%)	0.36% (0.01% - 2.67%)	14.18% (5.89% - 31.68%)	0.00% (0.00% - 0.03%)	4.62% (1.86% - 6.82%)	8.57% (5.59% - 13.08%)	1.04% (0.04% - 6.93%)	3.75% (0.29% - 10.65%)	6.59% (0.12% - 9.85%)	0.57% (0.03% - 6.78%)	12.71% (8.04% - 15.48%)
Palau	0.42% (0.02% - 1.49%)	0.52% (0.00% - 1.46%)	0.33% (0.03% - 1.75%)	50.28% (16.20% - 80.81%)	0.52% (0.01% - 2.03%)	13.27% (5.49% - 31.21%)	0.00% (0.00% - 0.03%)	3.21% (0.60% - 4.40%)	4.78% (0.65% - 13.87%)	5.23% (0.78% - 26.87%)	1.66% (0.05% - 4.73%)	0.86% (0.11% - 1.73%)	5.01% (1.02% - 8.06%)	5.87% (3.54% - 10.19%)
Panama	0.47% (0.00% - 1.02%)	0.27% (0.01% - 1.66%)	0.37% (0.05% - 2.23%)	50.47% (12.81% - 99.19%)	0.19% (0.02% - 1.82%)	13.80% (5.79% - 30.79%)	0.00% (0.00% - 0.02%)	2.87% (0.18% - 5.20%)	3.86% (1.35% - 8.03%)	1.06% (0.04% - 6.93%)	1.53% (0.14% - 2.34%)	1.09% (0.41% - 2.00%)	3.18% (0.07% - 6.95%)	8.08% (4.93% - 13.64%)
Papua New Guinea	0.76% (0.01% - 2.76%)	0.82% (0.11% - 2.73%)	1.04% (0.07% - 3.04%)	44.09% (1.08% - 98.89%)	0.17% (0.03% - 1.74%)	13.86% (5.91% - 31.15%)	0.00% (0.00% - 0.02%)	3.15% (0.28% - 6.33%)	4.30% (0.69% - 9.74%)	1.05% (0.04% - 6.93%)	1.38% (0.10% - 4.04%)	1.77% (0.19% - 5.87%)	4.15% (0.33% - 7.41%)	8.19% (2.42% - 17.82%)
Paraguay	0.34% (0.02% - 1.38%)	0.31% (0.02% - 1.55%)	0.42% (0.05% - 2.12%)	29.61% (16.68% - 88.22%)	0.38% (0.03% - 2.07%)	14.01% (5.76% - 31.23%)	0.01% (0.01% - 0.03%)	6.34% (5.21% - 9.79%)	11.71% (10.20% - 12.94%)	1.07% (0.06% - 6.93%)	6.05% (3.93% - 10.06%)	8.70% (5.78% - 9.50%)	3.49% (1.88% - 6.03%)	14.34% (12.66% - 18.81%)
Peru	0.32% (0.02% - 1.79%)	0.32% (0.01% - 1.58%)	0.50% (0.07% - 2.16%)	18.68% (7.70% - 38.96%)	0.34% (0.02% - 2.59%)	14.11% (5.85% - 31.61%)	0.01% (0.00% - 0.02%)	5.25% (4.32% - 9.16%)	10.94% (8.92% - 11.94%)	1.04% (0.04% - 6.93%)	4.74% (2.72% - 9.17%)	7.54% (5.05% - 8.31%)	2.55% (0.69% - 4.61%)	13.56% (12.16% - 17.00%)
Philippines	0.37% (0.00% - 1.74%)	0.30% (0.05% - 1.43%)	0.51% (0.04% - 2.00%)	30.81% (17.59% - 64.60%)	0.31% (0.03% - 2.38%)	13.99% (5.72% - 31.42%)	0.00% (0.00% - 0.03%)	4.22% (0.40% - 5.38%)	1.50% (0.03% - 2.38%)	1.05% (0.04% - 6.93%)	4.82% (0.22% - 6.77%)	1.88% (0.86% - 4.65%)	7.22% (4.26% - 8.61%)	3.94% (2.60% - 7.30%)
Poland	0.09% (0.00% - 0.63%)	0.09% (0.00% - 0.63%)	0.09% (0.00% - 0.63%)	0.09% (0.00% - 0.63%)	0.09% (0.00% - 0.63%)	0.09% (0.00% - 0.63%)	0.00% (0.00% - 0.00%)	12.88% (8.13% - 13.94%)	12.88% (8.13% - 13.94%)	12.88% (8.13% - 13.94%)	12.88% (8.13% - 13.94%)	12.88% (8.13% - 13.94%)	12.88% (8.13% - 13.94%)	12.88% (8.13% - 13.94%)
Portugal	0.11% (0.00% - 0.38%)	0.10% (0.00% - 0.39%)	0.10% (0.00% - 0.39%)	0.11% (0.00% - 0.38%)	0.11% (0.00% - 0.38%)	0.11% (0.00% - 0.38%)	0.00% (0.00% - 0.00%)	15.36% (13.23% - 16.65%)	15.36% (13.23% - 16.65%)	15.36% (13.23% - 16.65%)	15.36% (13.23% - 16.65%)	15.36% (13.23% - 16.65%)	15.36% (13.23% - 16.65%)	15.36% (13.23% - 16.65%)
Puerto Rico	0.34% (0.02% - 2.00%)	0.39% (0.00% - 2.08%)	0.55% (0.05% - 1.69%)	71.95% (13.68% - 100.00%)	0.23% (0.06% - 5.10%)	13.75% (5.79% - 24.30%)	0.01% (0.00% - 0.03%)	6.75% (1.89% - 7.71%)	1.17% (0.14% - 3.03%)	1.05% (0.04% - 6.53%)	6.32% (2.17% - 9.02%)	4.33% (3.25% - 6.23%)	8.86% (7.17% - 11.33%)	1.93% (0.73% - 5.72%)
Qatar	0.41% (0.04% - 1.93%)	0.23% (0.08% - 1.34%)	0.31% (0.02% - 1.92%)	16.77% (0.30% - 53.35%)	0.37% (0.02% - 2.49%)	14.13% (5.93% - 31.47%)	0.01% (0.00% - 0.03%)	7.05% (1.01% - 8.38%)	1.46% (0.28% - 3.51%)	1.04% (0.04% - 6.93%)	5.99% (2.81% - 8.53%)	4.69% (3.78% - 5.34%)	9.16% (6.40% - 11.81%)	2.11% (0.07% - 7.46%)
South Korea	0.44% (0.00% - 4.37%)	0.44% (0.00% - 4.37%)	0.44% (0.00% - 4.37%)	0.44% (0.00% - 4.37%)	0.44% (0.00% - 4.37%)	0.44% (0.00% - 4.37%)	0.00% (0.00% - 0.00%)	11.00% (8.10% - 11.71%)	11.00% (8.10% - 11.71%)	11.00% (8.10% - 11.71%)	11.00% (8.10% - 11.71%)	11.00% (8.10% - 11.71%)	11.00% (8.10% - 11.71%)	11.00% (8.10% - 11.71%)
Moldova	0.57% (0.07% - 5.95%)	0.48% (0.02% - 2.72%)	0.36% (0.04% - 2.15%)	32.93% (16.08% - 55.16%)	0.28% (0.02% - 2.45%)	13.90% (5.76% - 31.44%)	0.01% (0.00% - 0.03%)	10.65% (0.14% - 19.95%)	15.73% (6.04% - 22.74%)	1.11% (0.08% - 6.93%)	10.26% (3.87% - 15.52%)	13.51% (3.49% - 16.67%)	6.99% (2.07% - 14.55%)	19.72% (8.11% - 28.62%)
Romania	2.37% (0.00% - 9.78%)	0.64% (0.00% - 5.56%)	0.64% (0.00% - 5.56%)	2.37% (0.00% - 9.78%)	2.37% (0.00% - 9.78%)	2.37% (0.00% - 9.78%)	0.00% (0.00% - 0.00%)	13.20% (9.72% - 16.86%)	13.20% (9.72% - 16.86%)	13.20% (9.72% - 16.86%)	13.20% (9.72% - 16.86%)	13.20% (9.72% - 16.86%)	13.20% (9.72% - 16.86%)	13.20% (9.72% - 16.86%)
Russia	0.69% (0.09% - 4.42%)	1.45% (0.12% - 3.82%)	1.45% (0.12% - 3.82%)	0.69% (0.09% - 4.42%)	0.69% (0.09% - 4.42%)	0.69% (0.09% - 4.42%)	0.00% (0.00% - 0.00%)	15.35% (9.79% - 17.59%)	15.35% (9.79% - 17.59%)	15.35% (9.79% - 17.59%)	15.35% (9.79% - 17.59%)	15.35% (9.79% - 17.59%)	15.35% (9.79% - 17.59%)	15.35% (9.79% - 17.59%)

Rwanda	0.26% (0.01% - 1.10%)	0.22% (0.03% - 1.04%)	0.41% (0.08% - 1.28%)	20.46% (11.23% - 99.61%)	0.29% (0.03% - 3.16%)	14.09% (5.79% - 27.26%)	0.00% (0.00% - 0.03%)	4.35% (1.94% - 7.12%)	9.31% (7.54% - 12.65%)	1.28% (0.05% - 6.73%)	2.97% (0.87% - 10.54%)	5.97% (3.24% - 9.47%)	0.89% (0.10% - 5.54%)	12.22% (10.13% - 15.52%)
St. Kitts and Nevis	0.36% (0.00% - 1.83%)	0.36% (0.00% - 1.77%)	0.51% (0.09% - 2.36%)	12.33% (2.52% - 25.49%)	0.36% (0.03% - 2.82%)	14.12% (5.81% - 31.79%)	0.01% (0.00% - 0.03%)	7.63% (4.65% - 13.99%)	13.82% (9.58% - 16.98%)	1.35% (0.04% - 6.80%)	7.68% (5.26% - 12.21%)	9.93% (6.95% - 12.17%)	5.57% (0.77% - 8.33%)	16.17% (13.13% - 19.18%)
St. Lucia	0.67% (0.00% - 2.38%)	0.69% (0.03% - 1.84%)	0.97% (0.03% - 2.22%)	41.21% (1.61% - 70.54%)	0.27% (0.02% - 2.24%)	13.86% (5.83% - 31.26%)	0.00% (0.00% - 0.02%)	2.20% (0.00% - 12.36%)	5.19% (0.89% - 15.52%)	1.24% (0.05% - 6.91%)	1.87% (0.37% - 7.26%)	2.13% (0.32% - 11.02%)	3.10% (0.72% - 7.49%)	8.73% (5.73% - 17.44%)
Samoa	0.71% (0.07% - 1.92%)	0.71% (0.14% - 2.00%)	0.55% (0.02% - 1.62%)	59.23% (26.97% - 97.13%)	0.86% (0.13% - 4.94%)	13.39% (5.35% - 28.09%)	0.00% (0.00% - 0.03%)	4.52% (0.21% - 5.33%)	1.56% (0.05% - 2.71%)	1.38% (0.05% - 6.86%)	4.61% (0.29% - 6.70%)	2.09% (1.38% - 4.09%)	7.08% (4.55% - 8.91%)	3.96% (2.78% - 7.95%)
San Marino	0.62% (0.05% - 4.58%)	0.68% (0.06% - 4.68%)	0.60% (0.03% - 4.10%)	71.17% (30.13% - 99.96%)	0.62% (0.05% - 10.04%)	13.60% (5.61% - 22.79%)	0.01% (0.00% - 0.03%)	2.50% (0.12% - 14.37%)	7.48% (4.49% - 18.27%)	1.45% (0.07% - 6.28%)	4.11% (1.25% - 9.94%)	3.70% (1.05% - 13.30%)	2.84% (0.27% - 9.67%)	11.03% (7.66% - 20.45%)
Sao Tome and Principe	0.45% (0.03% - 1.80%)	0.49% (0.05% - 1.76%)	0.56% (0.02% - 2.39%)	23.53% (7.79% - 40.81%)	0.45% (0.04% - 3.36%)	13.81% (5.53% - 31.56%)	0.01% (0.00% - 0.02%)	3.38% (0.33% - 13.91%)	10.43% (4.95% - 17.43%)	2.39% (0.13% - 6.55%)	5.55% (0.44% - 9.42%)	6.61% (2.58% - 10.05%)	3.68% (1.05% - 8.53%)	11.20% (8.96% - 21.22%)
Saudi Arabia	0.38% (0.02% - 1.92%)	0.43% (0.01% - 1.21%)	0.57% (0.01% - 1.67%)	42.84% (11.48% - 74.10%)	0.27% (0.00% - 2.24%)	13.92% (5.81% - 31.27%)	0.01% (0.00% - 0.03%)	4.78% (0.43% - 7.86%)	0.63% (0.04% - 3.58%)	1.04% (0.04% - 6.93%)	3.73% (1.52% - 8.28%)	3.25% (0.72% - 4.56%)	8.01% (4.52% - 9.19%)	3.54% (0.10% - 9.70%)
Senegal	0.37% (0.03% - 1.42%)	0.29% (0.02% - 1.44%)	0.51% (0.07% - 1.82%)	29.19% (10.32% - 96.86%)	0.39% (0.02% - 1.83%)	14.01% (5.82% - 31.24%)	0.01% (0.00% - 0.03%)	11.77% (8.84% - 14.87%)	16.05% (14.75% - 18.14%)	1.06% (0.05% - 6.93%)	10.91% (9.04% - 14.08%)	12.88% (10.22% - 14.84%)	8.00% (6.62% - 9.82%)	19.29% (17.11% - 22.82%)
Serbia	0.36% (0.02% - 1.52%)	0.31% (0.01% - 1.38%)	0.42% (0.04% - 1.95%)	42.77% (11.66% - 99.28%)	0.18% (0.00% - 2.11%)	13.87% (5.81% - 31.24%)	0.01% (0.00% - 0.03%)	11.43% (4.08% - 17.42%)	15.38% (10.18% - 20.20%)	1.05% (0.04% - 6.93%)	10.57% (7.64% - 13.00%)	12.82% (7.34% - 15.13%)	7.09% (1.36% - 12.03%)	20.42% (12.34% - 24.77%)
Seychelles	2.18% (0.23% - 5.18%)	1.76% (0.22% - 4.92%)	1.61% (0.20% - 4.84%)	37.56% (0.48% - 59.92%)	0.57% (0.01% - 2.44%)	14.21% (6.23% - 31.58%)	0.01% (0.00% - 0.04%)	16.51% (11.67% - 19.07%)	20.68% (16.14% - 25.53%)	1.34% (0.02% - 6.88%)	13.92% (10.39% - 23.09%)	17.00% (12.22% - 22.73%)	12.09% (9.13% - 17.75%)	24.17% (20.00% - 27.74%)
Sierra Leone	0.47% (0.02% - 5.51%)	0.49% (0.03% - 5.57%)	0.44% (0.01% - 5.19%)	51.51% (13.09% - 99.76%)	0.22% (0.04% - 12.09%)	11.97% (5.74% - 21.40%)	0.00% (0.00% - 0.03%)	2.39% (0.14% - 4.98%)	5.32% (1.05% - 6.43%)	1.17% (0.10% - 6.92%)	1.16% (0.19% - 3.68%)	1.11% (0.05% - 3.91%)	3.19% (0.18% - 6.39%)	7.66% (2.95% - 13.39%)
Singapore	0.71% (0.11% - 1.95%)	0.74% (0.14% - 2.04%)	0.64% (0.00% - 1.73%)	99.95% (40.84% - 100.00%)	1.69% (0.04% - 4.76%)	11.63% (5.51% - 25.12%)	0.00% (0.00% - 0.03%)	1.09% (0.01% - 4.19%)	6.25% (2.91% - 6.98%)	1.05% (0.04% - 6.93%)	2.19% (0.07% - 4.72%)	3.02% (0.16% - 4.18%)	2.18% (0.05% - 4.05%)	8.80% (7.21% - 10.99%)
Slovakia	0.07% (0.00% - 0.73%)	0.07% (0.00% - 0.73%)	0.07% (0.00% - 0.73%)	0.07% (0.00% - 0.73%)	0.07% (0.00% - 0.73%)	0.07% (0.00% - 0.73%)	0.00% (0.00% - 0.00%)	8.87% (1.39% - 12.58%)	8.87% (1.39% - 12.58%)	8.87% (1.39% - 12.58%)	8.87% (1.39% - 12.58%)	8.87% (1.39% - 12.58%)	8.87% (1.39% - 12.58%)	8.87% (1.39% - 12.58%)
Slovenia	0.12% (0.00% - 1.66%)	0.12% (0.00% - 1.64%)	0.12% (0.00% - 1.64%)	0.12% (0.00% - 1.66%)	0.12% (0.00% - 1.66%)	0.12% (0.00% - 1.66%)	0.00% (0.00% - 0.00%)	14.08% (13.43% - 15.37%)	14.08% (13.43% - 15.37%)	14.08% (13.43% - 15.37%)	14.08% (13.43% - 15.37%)	14.08% (13.43% - 15.37%)	14.08% (13.43% - 15.37%)	14.08% (13.43% - 15.37%)
Solomon Islands	0.32% (0.03% - 5.99%)	0.44% (0.21% - 6.07%)	0.37% (0.12% - 5.80%)	53.29% (0.80% - 99.69%)	0.46% (0.02% - 12.49%)	13.34% (5.23% - 21.76%)	0.00% (0.00% - 0.03%)	2.11% (0.02% - 7.48%)	3.25% (0.48% - 6.51%)	0.94% (0.12% - 6.28%)	2.63% (0.20% - 5.58%)	1.60% (0.31% - 3.72%)	5.59% (2.85% - 8.17%)	5.15% (0.47% - 10.35%)
Somalia	0.31% (0.03% - 1.71%)	0.30% (0.05% - 1.97%)	0.44% (0.02% - 2.54%)	2.25% (0.02% - 9.41%)	1.93% (0.03% - 3.19%)	14.22% (5.77% - 31.81%)	0.01% (0.00% - 0.03%)	12.32% (10.83% - 14.03%)	17.20% (15.84% - 18.08%)	1.46% (0.09% - 6.87%)	11.66% (8.12% - 15.67%)	13.94% (10.11% - 15.38%)	8.82% (7.43% - 10.85%)	19.59% (16.99% - 24.46%)
South Africa	0.42% (0.01% - 2.71%)	0.42% (0.01% - 2.71%)	0.42% (0.01% - 2.71%)	0.42% (0.01% - 2.71%)	0.42% (0.01% - 2.71%)	0.42% (0.01% - 2.71%)	0.00% (0.00% - 0.00%)	12.17% (11.81% - 12.96%)	12.17% (11.81% - 12.96%)	12.17% (11.81% - 12.96%)	12.17% (11.81% - 12.96%)	12.17% (11.81% - 12.96%)	12.17% (11.81% - 12.96%)	12.17% (11.81% - 12.96%)
South Sudan	0.00% (0.00% - 4.30%)	0.00% (0.00% - 4.30%)	0.00% (0.00% - 4.57%)	0.00% (0.00% - 40.60%)	0.00% (0.00% - 0.50%)	0.00% (0.00% - 10.05%)	0.00% (0.00% - 0.00%)	0.00% (0.00% - 8.54%)	0.00% (0.00% - 4.14%)	0.00% (0.00% - 4.00%)	0.00% (0.00% - 9.84%)	0.00% (0.00% - 8.01%)	0.00% (0.00% - 11.10%)	0.00% (0.00% - 3.94%)
Spain	0.18% (0.00% - 1.17%)	0.15% (0.00% - 1.18%)	0.15% (0.00% - 1.18%)	0.18% (0.00% - 1.17%)	0.18% (0.00% - 1.17%)	0.18% (0.00% - 1.17%)	0.00% (0.00% - 0.00%)	11.27% (10.35% - 11.92%)	11.27% (10.35% - 11.92%)	11.27% (10.35% - 11.92%)	11.27% (10.35% - 11.92%)	11.27% (10.35% - 11.92%)	11.27% (10.35% - 11.92%)	11.27% (10.35% - 11.92%)
Sri Lanka	0.29% (0.05% - 1.60%)	0.29% (0.00% - 1.56%)	0.53% (0.11% - 2.13%)	28.88% (11.24% - 61.75%)	0.36% (0.00% - 2.38%)	14.01% (5.81% - 31.38%)	0.00% (0.00% - 0.03%)	3.42% (0.23% - 4.78%)	1.98% (0.46% - 3.25%)	1.06% (0.04% - 6.93%)	3.95% (0.01% - 5.76%)	1.33% (0.32% - 3.41%)	6.08% (3.86% - 7.85%)	4.82% (3.32% - 8.96%)
St. Vincent and the Grenadines	0.42% (0.02% - 1.58%)	0.31% (0.01% - 1.47%)	0.53% (0.06% - 1.99%)	26.68% (12.65% - 56.50%)	0.39% (0.00% - 2.22%)	14.02% (5.74% - 31.39%)	0.02% (0.01% - 0.04%)	16.81% (8.70% - 20.52%)	21.30% (12.67% - 24.47%)	1.31% (0.04% - 6.89%)	14.59% (7.59% - 22.39%)	16.67% (11.35% - 21.57%)	12.74% (4.37% - 17.77%)	24.30% (17.77% - 26.59%)
Sudan	0.47% (0.13% - 3.81%)	0.44% (0.07% - 1.68%)	0.45% (0.04% - 1.98%)	33.48% (7.18% - 99.97%)	0.53% (0.01% - 6.27%)	13.93% (6.18% - 30.72%)	0.00% (0.00% - 0.04%)	1.15% (0.07% - 7.44%)	4.68% (1.51% - 23.29%)	1.05% (0.04% - 6.93%)	3.35% (0.13% - 11.27%)	2.87% (0.49% - 10.47%)	4.14% (0.64% - 10.21%)	8.71% (0.21% - 16.10%)
Suriname	0.36% (0.02% - 1.64%)	0.35% (0.04% - 1.52%)	0.45% (0.10% - 1.90%)	10.43% (1.18% - 74.93%)	0.46% (0.06% - 2.18%)	14.27% (5.86% - 31.50%)	0.01% (0.00% - 0.03%)	4.79% (0.85% - 10.71%)	8.82% (5.25% - 16.83%)	1.08% (0.06% - 6.93%)	3.93% (0.05% - 14.71%)	7.04% (0.49% - 14.35%)	1.71% (0.44% - 7.98%)	13.32% (7.37% - 18.96%)
Swaziland	0.55% (0.17% - 27.26%)	2.38% (0.27% - 33.79%)	2.66% (0.30% - 19.34%)	37.89% (3.53% - 1569.22%)	0.76% (0.03% - 4.37%)	14.27% (5.45% - 31.83%)	0.02% (0.01% - 0.04%)	19.01% (18.45% - 22.65%)	24.77% (22.84% - 25.46%)	1.08% (0.06% - 6.93%)	18.35% (16.21% - 23.37%)	21.41% (18.77% - 22.65%)	16.27% (14.51% - 18.40%)	27.21% (25.66% - 31.08%)
Sweden	0.09% (0.00% -	0.09% (0.00% -	0.09% (0.00% -	0.09% (0.00% -	0.09% (0.00% -	0.09% (0.00% -	0.00% (0.00% -	14.10% (13.17% -	14.10% (13.17% -	14.10% (13.17% -	14.10% (13.17% -	14.10% (13.17% -	14.10% (13.17% -	14.10% (13.17% -

	1.69%)	1.69%)	1.69%)	1.69%)	1.69%)	1.69%)	0.00%)	14.65%)	14.65%)	14.65%)	14.65%)	14.65%)	14.65%)	14.65%)
Switzerland	0.06% (0.00% - 0.35%)	0.06% (0.00% - 0.35%)	0.06% (0.00% - 0.35%)	0.06% (0.00% - 0.35%)	0.06% (0.00% - 0.35%)	0.06% (0.00% - 0.35%)	0.00% (0.00% - 0.00%)	5.83% (0.17% - 6.13%)	5.83% (0.17% - 6.13%)	5.83% (0.17% - 6.13%)	5.83% (0.17% - 6.13%)	5.83% (0.17% - 6.13%)	5.83% (0.17% - 6.13%)	5.83% (0.17% - 6.13%)
Syrian Arab Republic	0.52% (0.00% - 1.59%)	0.29% (0.03% - 1.39%)	0.38% (0.00% - 1.96%)	20.15% (2.34% - 77.56%)	0.43% (0.01% - 2.20%)	14.03% (5.95% - 31.35%)	0.00% (0.00% - 0.03%)	3.05% (0.05% - 5.03%)	1.76% (0.31% - 2.83%)	1.04% (0.04% - 6.93%)	3.09% (0.01% - 6.21%)	1.32% (0.22% - 4.02%)	6.45% (4.30% - 7.54%)	4.53% (2.90% - 8.39%)
Tajikistan	2.05% (0.18% - 5.40%)	2.07% (0.04% - 5.37%)	1.89% (0.14% - 5.32%)	98.80% (11.24% - 99.95%)	4.17% (0.30% - 10.03%)	12.46% (1.00% - 31.88%)	0.02% (0.01% - 0.04%)	9.35% (5.89% - 12.25%)	14.50% (12.30% - 16.18%)	1.26% (0.04% - 6.75%)	8.73% (6.22% - 13.40%)	9.97% (8.11% - 12.63%)	5.85% (4.30% - 7.96%)	16.83% (14.54% - 21.51%)
Thailand	0.46% (0.00% - 1.84%)	0.31% (0.01% - 1.65%)	0.48% (0.01% - 2.22%)	29.72% (16.31% - 56.21%)	0.25% (0.00% - 2.70%)	13.94% (5.76% - 31.68%)	0.00% (0.00% - 0.03%)	4.14% (0.40% - 6.46%)	1.03% (0.04% - 2.38%)	1.04% (0.04% - 6.93%)	4.82% (0.94% - 6.93%)	2.69% (1.31% - 5.02%)	7.38% (5.79% - 8.51%)	3.63% (1.50% - 6.93%)
Macedonia, FYR	0.33% (0.01% - 1.46%)	0.28% (0.01% - 1.32%)	0.47% (0.00% - 1.89%)	38.10% (16.03% - 95.98%)	0.20% (0.02% - 2.00%)	13.92% (5.76% - 30.92%)	0.01% (0.00% - 0.03%)	13.01% (8.54% - 16.27%)	17.48% (12.94% - 20.63%)	1.06% (0.05% - 6.93%)	11.56% (7.23% - 18.19%)	14.45% (9.06% - 17.39%)	9.03% (5.97% - 14.32%)	21.30% (18.11% - 23.03%)
Timor-Leste	0.65% (0.03% - 2.20%)	1.07% (0.06% - 1.54%)	0.98% (0.12% - 1.87%)	22.95% (3.24% - 74.13%)	0.65% (0.15% - 2.74%)	14.42% (5.16% - 31.75%)	0.01% (0.00% - 0.03%)	5.17% (1.25% - 9.76%)	1.33% (0.09% - 4.72%)	1.52% (0.03% - 6.93%)	6.41% (1.34% - 9.54%)	4.65% (2.14% - 6.20%)	7.84% (5.19% - 13.01%)	2.49% (0.16% - 8.16%)
Togo	0.37% (0.03% - 1.28%)	0.33% (0.00% - 0.90%)	0.52% (0.01% - 1.38%)	57.68% (24.32% - 99.73%)	0.19% (0.01% - 2.81%)	13.71% (5.63% - 29.23%)	0.01% (0.00% - 0.03%)	6.93% (0.71% - 13.19%)	10.31% (6.83% - 19.46%)	1.11% (0.07% - 6.92%)	4.70% (0.49% - 16.98%)	5.00% (3.42% - 16.21%)	2.01% (0.01% - 13.13%)	12.69% (8.96% - 21.84%)
Tonga	0.26% (0.01% - 2.84%)	0.39% (0.01% - 2.80%)	0.27% (0.05% - 2.52%)	39.73% (4.24% - 94.30%)	0.37% (0.05% - 6.01%)	13.83% (5.65% - 28.51%)	0.01% (0.00% - 0.03%)	8.72% (7.66% - 13.39%)	14.69% (12.40% - 16.44%)	1.21% (0.01% - 6.79%)	8.88% (5.80% - 13.29%)	10.49% (8.57% - 12.20%)	5.97% (3.67% - 8.63%)	16.78% (15.62% - 21.42%)
Trinidad and Tobago	1.11% (0.18% - 2.78%)	0.78% (0.16% - 2.21%)	0.91% (0.13% - 2.78%)	51.24% (6.31% - 99.82%)	0.85% (0.04% - 3.35%)	15.54% (5.70% - 31.55%)	0.00% (0.00% - 0.03%)	3.80% (0.57% - 4.75%)	1.51% (0.13% - 2.58%)	1.04% (0.04% - 6.93%)	4.31% (0.07% - 6.97%)	2.06% (0.52% - 5.01%)	6.83% (4.49% - 8.57%)	3.94% (1.87% - 8.21%)
Tunisia	0.62% (0.02% - 1.93%)	0.53% (0.02% - 1.79%)	0.64% (0.04% - 2.36%)	8.83% (1.92% - 66.33%)	0.77% (0.01% - 2.93%)	14.23% (5.58% - 31.95%)	0.00% (0.00% - 0.02%)	4.63% (1.18% - 8.06%)	8.87% (7.27% - 10.84%)	1.05% (0.04% - 6.93%)	3.96% (1.50% - 6.49%)	5.36% (3.43% - 7.68%)	1.44% (0.16% - 2.67%)	12.40% (9.43% - 15.38%)
Turkey	0.21% (0.00% - 1.41%)	0.26% (0.00% - 1.23%)	0.26% (0.00% - 1.23%)	0.21% (0.00% - 1.41%)	0.21% (0.00% - 1.41%)	0.21% (0.00% - 1.41%)	0.00% (0.00% - 0.00%)	12.99% (9.77% - 14.40%)	12.99% (9.77% - 14.40%)	12.99% (9.77% - 14.40%)	12.99% (9.77% - 14.40%)	12.99% (9.77% - 14.40%)	12.99% (9.77% - 14.40%)	12.99% (9.77% - 14.40%)
Turkmenistan	0.24% (0.02% - 1.54%)	0.23% (0.01% - 1.48%)	0.33% (0.04% - 1.86%)	32.12% (2.02% - 99.96%)	0.30% (0.01% - 2.25%)	13.98% (5.82% - 31.40%)	0.01% (0.00% - 0.03%)	2.36% (0.03% - 27.46%)	5.95% (1.60% - 30.24%)	1.13% (0.06% - 6.93%)	3.51% (0.03% - 23.04%)	3.85% (0.59% - 23.57%)	6.16% (0.36% - 22.06%)	9.34% (4.03% - 32.61%)
Turks and Caicos Islands	0.29% (0.03% - 1.26%)	0.24% (0.01% - 1.12%)	0.43% (0.07% - 1.68%)	26.90% (10.56% - 84.98%)	0.15% (0.01% - 1.57%)	14.01% (5.79% - 30.12%)	0.00% (0.00% - 0.03%)	4.34% (0.08% - 12.17%)	4.57% (0.12% - 10.86%)	1.43% (0.03% - 6.89%)	3.59% (0.00% - 7.46%)	4.22% (0.37% - 8.55%)	4.45% (0.11% - 12.90%)	6.86% (0.51% - 14.00%)
Tuvalu	0.33% (0.05% - 15.12%)	1.34% (0.01% - 14.52%)	0.41% (0.06% - 13.79%)	20.88% (4.80% - 45.88%)	8.55% (2.20% - 52.78%)	13.12% (4.16% - 29.93%)	0.01% (0.00% - 0.03%)	3.27% (0.54% - 5.19%)	15.38% (8.59% - 36.21%)	5.75% (0.87% - 12.74%)	1.63% (0.13% - 8.34%)	2.21% (0.08% - 7.96%)	1.20% (0.01% - 5.43%)	9.29% (3.07% - 13.18%)
Uganda	0.44% (0.02% - 1.67%)	0.24% (0.02% - 1.59%)	0.40% (0.06% - 2.16%)	17.73% (7.57% - 51.49%)	0.38% (0.01% - 2.48%)	14.12% (5.84% - 31.56%)	0.00% (0.00% - 0.02%)	1.57% (0.45% - 10.55%)	7.31% (4.66% - 13.33%)	1.06% (0.05% - 6.93%)	4.28% (0.28% - 6.13%)	4.66% (3.28% - 7.14%)	1.96% (0.28% - 5.15%)	11.09% (8.42% - 18.46%)
Ukraine	1.00% (0.21% - 2.74%)	0.37% (0.01% - 1.06%)	0.18% (0.02% - 0.94%)	30.48% (8.57% - 93.24%)	0.33% (0.00% - 2.32%)	14.00% (5.80% - 31.06%)	0.01% (0.00% - 0.04%)	9.11% (5.23% - 17.96%)	12.64% (9.62% - 24.05%)	1.04% (0.04% - 6.93%)	5.20% (2.94% - 21.98%)	8.91% (3.68% - 21.59%)	4.43% (1.08% - 15.24%)	17.56% (10.57% - 26.21%)
United Arab Emirates	0.39% (0.04% - 1.60%)	0.37% (0.00% - 1.52%)	0.55% (0.04% - 2.09%)	30.67% (19.81% - 63.71%)	0.48% (0.02% - 2.34%)	14.06% (5.72% - 31.36%)	0.01% (0.00% - 0.03%)	6.53% (4.52% - 15.79%)	2.51% (1.03% - 9.53%)	1.04% (0.04% - 6.93%)	9.72% (3.80% - 11.95%)	7.75% (3.43% - 12.75%)	11.19% (9.54% - 15.82%)	2.44% (0.08% - 7.12%)
United Kingdom	0.05% (0.00% - 0.25%)	0.05% (0.00% - 0.25%)	0.05% (0.00% - 0.25%)	0.05% (0.00% - 0.25%)	0.05% (0.00% - 0.25%)	0.05% (0.00% - 0.25%)	0.00% (0.00% - 0.00%)	13.06% (8.36% - 13.51%)	13.06% (8.36% - 13.51%)	13.06% (8.36% - 13.51%)	13.06% (8.36% - 13.51%)	13.06% (8.36% - 13.51%)	13.06% (8.36% - 13.51%)	13.06% (8.36% - 13.51%)
Tanganjika	0.43% (0.01% - 1.81%)	0.23% (0.02% - 1.71%)	0.32% (0.01% - 2.28%)	19.01% (4.45% - 61.78%)	0.32% (0.03% - 2.49%)	14.11% (5.88% - 31.38%)	0.01% (0.00% - 0.03%)	5.85% (4.65% - 8.63%)	10.87% (9.04% - 13.42%)	1.05% (0.04% - 6.93%)	4.60% (2.43% - 11.38%)	7.71% (4.74% - 10.30%)	2.25% (0.99% - 6.38%)	13.79% (11.63% - 17.12%)
United States	0.05% (0.00% - 0.40%)	0.05% (0.00% - 0.40%)	0.05% (0.00% - 0.40%)	0.05% (0.00% - 0.40%)	0.05% (0.00% - 0.40%)	0.05% (0.00% - 0.40%)	0.00% (0.00% - 0.00%)	0.88% (0.06% - 3.78%)	0.88% (0.06% - 3.78%)	0.88% (0.06% - 3.78%)	0.88% (0.06% - 3.78%)	0.88% (0.06% - 3.78%)	0.88% (0.06% - 3.78%)	0.88% (0.06% - 3.78%)
Uruguay	0.37% (0.02% - 1.67%)	0.29% (0.02% - 1.60%)	0.54% (0.08% - 2.17%)	22.09% (10.07% - 53.67%)	0.36% (0.03% - 2.49%)	14.08% (5.82% - 31.46%)	0.01% (0.00% - 0.03%)	6.06% (4.31% - 13.77%)	12.09% (8.27% - 16.75%)	1.05% (0.04% - 6.93%)	8.08% (4.58% - 10.36%)	9.09% (7.07% - 10.72%)	4.65% (0.03% - 8.65%)	15.48% (13.08% - 22.13%)
Uzbekistan	0.37% (0.01% - 1.74%)	0.32% (0.01% - 1.57%)	0.54% (0.09% - 2.14%)	24.06% (8.08% - 59.55%)	0.44% (0.00% - 2.53%)	14.07% (5.82% - 31.40%)	0.01% (0.00% - 0.05%)	9.18% (4.91% - 26.41%)	13.65% (10.94% - 32.67%)	1.05% (0.04% - 6.93%)	7.75% (5.53% - 30.24%)	9.85% (7.75% - 29.44%)	5.37% (3.50% - 26.36%)	16.42% (12.85% - 35.07%)
Vanuatu	0.36% (0.03% - 2.44%)	0.39% (0.07% - 0.94%)	0.31% (0.01% - 0.53%)	26.85% (10.59% - 90.73%)	0.18% (0.00% - 1.13%)	13.98% (5.73% - 29.36%)	0.01% (0.00% - 0.03%)	5.94% (2.30% - 10.84%)	10.54% (8.33% - 15.20%)	1.15% (0.05% - 6.79%)	5.27% (2.14% - 10.05%)	6.98% (5.32% - 9.97%)	2.26% (0.09% - 6.17%)	13.73% (10.79% - 17.45%)
Venezuela, RB	0.48% (0.01% - 1.82%)	0.35% (0.00% - 1.66%)	0.55% (0.07% - 2.20%)	13.66% (6.49% - 37.40%)	0.60% (0.04% - 2.66%)	14.17% (5.78% - 31.80%)	0.00% (0.00% - 0.02%)	2.23% (0.41% - 11.49%)	6.51% (4.75% - 15.89%)	1.04% (0.04% - 6.93%)	2.97% (0.19% - 10.18%)	4.20% (1.53% - 12.02%)	2.31% (0.37% - 8.93%)	11.11% (6.08% - 23.97%)

Vietnam	0.35% (0.00% - 1.62%)	0.29% (0.01% - 1.53%)	0.50% (0.05% - 2.10%)	36.48% (12.59% - 65.35%)	0.35% (0.02% - 2.36%)	13.94% (5.75% - 31.34%)	0.00% (0.00% - 0.03%)	3.29% (0.03% - 4.19%)	2.05% (0.59% - 2.97%)	1.04% (0.04% - 6.93%)	4.11% (0.04% - 6.22%)	1.25% (0.14% - 3.86%)	6.42% (3.80% - 7.71%)	4.58% (3.03% - 9.19%)
Yemen, Rep.	0.61% (0.00% - 7.00%)	0.65% (0.06% - 6.99%)	0.75% (0.08% - 7.27%)	28.82% (1.02% - 99.99%)	1.04% (0.06% - 13.50%)	14.47% (3.94% - 34.30%)	0.01% (0.00% - 0.02%)	6.03% (0.40% - 15.33%)	2.38% (0.03% - 9.75%)	1.04% (0.04% - 6.93%)	3.51% (0.32% - 11.50%)	2.76% (0.16% - 12.30%)	6.68% (0.09% - 15.37%)	5.74% (0.72% - 15.13%)
Zambia	1.71% (0.18% - 3.84%)	0.88% (0.03% - 3.10%)	0.84% (0.01% - 2.48%)	44.74% (5.49% - 99.88%)	0.63% (0.05% - 4.19%)	14.10% (6.50% - 31.16%)	0.00% (0.00% - 0.03%)	2.28% (0.55% - 3.92%)	6.53% (4.70% - 9.66%)	1.06% (0.05% - 6.93%)	2.74% (0.05% - 7.70%)	3.59% (0.04% - 6.93%)	2.15% (0.01% - 3.69%)	9.76% (6.93% - 13.12%)
Zanzibar	0.45% (0.05% - 1.68%)	0.50% (0.02% - 1.60%)	0.56% (0.02% - 2.11%)	50.26% (19.35% - 82.83%)	0.76% (0.01% - 2.50%)	13.61% (5.40% - 31.57%)	0.01% (0.00% - 0.03%)	10.47% (9.70% - 15.82%)	16.97% (14.21% - 18.69%)	1.29% (0.03% - 6.84%)	11.27% (8.66% - 14.82%)	12.82% (11.92% - 13.74%)	8.49% (5.70% - 10.47%)	19.34% (17.91% - 24.99%)
Zimbabwe	2.58% (0.08% - 9.39%)	4.85% (0.00% - 11.19%)	4.89% (0.02% - 10.61%)	89.95% (32.79% - 99.96%)	9.34% (0.13% - 16.34%)	13.95% (5.45% - 19.78%)	0.01% (0.00% - 0.04%)	6.45% (4.14% - 11.25%)	11.53% (8.11% - 14.14%)	1.05% (0.04% - 6.93%)	5.71% (3.25% - 10.58%)	7.56% (5.50% - 10.02%)	3.43% (0.19% - 6.16%)	14.25% (12.75% - 17.49%)
Taiwan	0.21% (0.00% - 0.48%)	0.21% (0.00% - 0.48%)	0.21% (0.00% - 0.48%)	0.21% (0.00% - 0.48%)	0.21% (0.00% - 0.48%)	0.21% (0.00% - 0.48%)	0.00% (0.00% - 0.00%)	2.66% (2.11% - 3.54%)	2.66% (2.11% - 3.54%)	2.66% (2.11% - 3.54%)	2.66% (2.11% - 3.54%)	2.66% (2.11% - 3.54%)	2.66% (2.11% - 3.54%)	2.66% (2.11% - 3.54%)

6.1.7 Maximum differences occurring in DESIRE countries

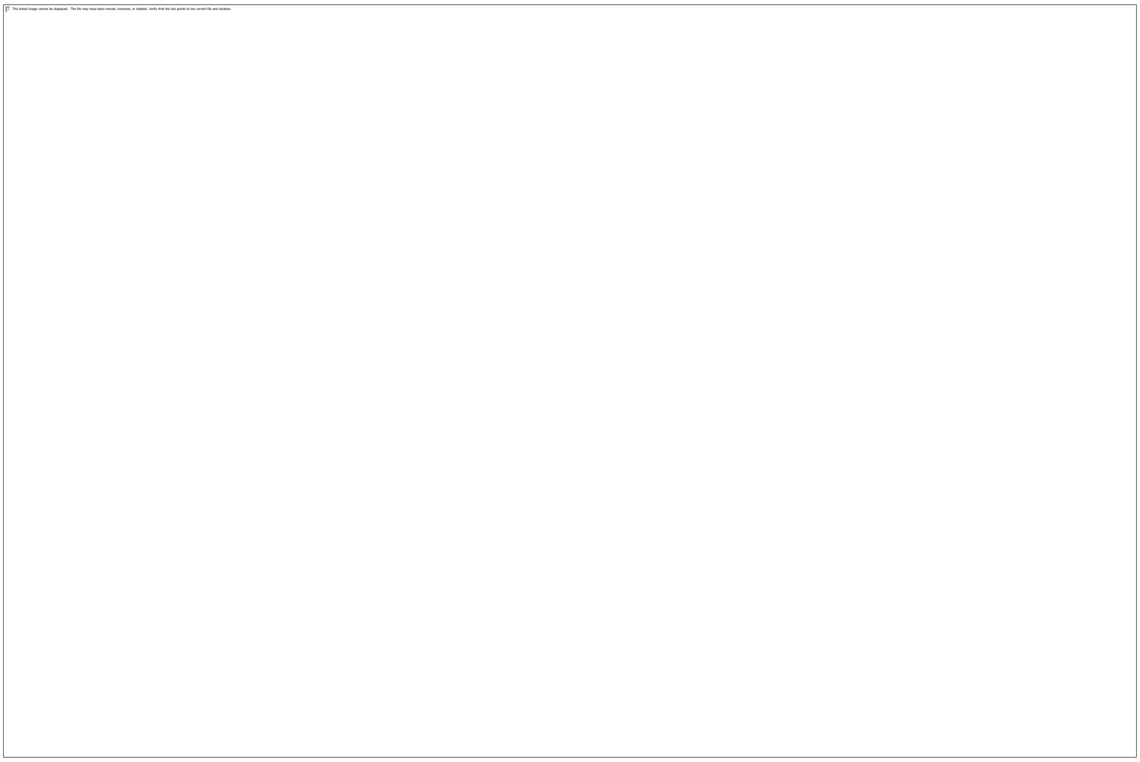

Figure 3: Overall differences in DESIRE countries (absolute change / UN SNA initial entry). Median value, errorbars: min value to max value

6.1.8 DESIRE countries with largest changes - current prices

Bulgaria

China

Indonesia

Malta

6.1.9 DESIRE countries with largest changes - constant 2005 prices

Bulgaria

China

Indonesia
Malta

6.2 Classification

6.2.1 Products

Number	Name	CodeNr	CodeTxt
1	Paddy rice	p01.a	C_PARI
2	Wheat	p01.b	C_WHEA
3	Cereal grains nec	p01.c	C_OCER
4	Vegetables, fruit, nuts	p01.d	C_FVEG
5	Oil seeds	p01.e	C_OILS
6	Sugar cane, sugar beet	p01.f	C_SUGB
7	Plant-based fibers	p01.g	C_FIBR
8	Crops nec	p01.h	C_OTCR
9	Cattle	p01.i	C_CATL
10	Pigs	p01.j	C_PIGS
11	Poultry	p01.k	C_PLTR
12	Meat animals nec	p01.l	C_OMEA
13	Animal products nec	p01.m	C_OANP
14	Raw milk	p01.n	C_MILK
15	Wool, silk-worm cocoons	p01.o	C_WOOL
16	Manure (conventional treatment)	p01.w.1	C_MANC
17	Manure (biogas treatment)	p01.w.2	C_MANB
18	Products of forestry, logging and related services (02)	p02	C_FORE
19	Fish and other fishing products; services incidental of fishing (05)	p05	C_FISH
20	Anthracite	p10.a	C_ANTH
21	Coking Coal	p10.b	C_COKC
22	Other Bituminous Coal	p10.c	C_OTBC
23	Sub-Bituminous Coal	p10.d	C_SUBC
24	Patent Fuel	p10.e	C_PATF
25	Lignite/Brown Coal	p10.f	C_LIBC
26	BKB/Peat Briquettes	p10.g	C_BKBP
27	Peat	p10.h	C_PEAT
28	Crude petroleum and services related to crude oil extraction, excluding surveying	p11.a	C_COIL
29	Natural gas and services related to natural gas extraction, excluding surveying	p11.b	C_GASE
30	Natural Gas Liquids	p11.b.1	C_GASL
31	Other Hydrocarbons	p11.c	C_OGPL
32	Uranium and thorium ores (12)	p12	C_ORAN
33	Iron ores	p13.1	C_IRON
34	Copper ores and concentrates	p13.20.11	C_COPO
35	Nickel ores and concentrates	p13.20.12	C_NIKO

36	Aluminium ores and concentrates	p13.20.13	C_ALUO
37	Precious metal ores and concentrates	p13.20.14	C_PREO
38	Lead, zinc and tin ores and concentrates	p13.20.15	C_LZTO
39	Other non-ferrous metal ores and concentrates	p13.20.16	C_ONFO
40	Stone	p14.1	C_STON
41	Sand and clay	p14.2	C_SDCL
42	Chemical and fertilizer minerals, salt and other mining and quarrying products n.e.c.	p14.3	C_CHMF
43	Products of meat cattle	p15.a	C_PCAT
44	Products of meat pigs	p15.b	C_PPIG
45	Products of meat poultry	p15.c	C_PPLT
46	Meat products nec	p15.d	C_POME
47	products of Vegetable oils and fats	p15.e	C_VOIL
48	Dairy products	p15.f	C_DAIR
49	Processed rice	p15.g	C_RICE
50	Sugar	p15.h	C_SUGR
51	Food products nec	p15.i	C_OFOD
52	Beverages	p15.j	C_BEVR
53	Fish products	p15.k	C_FSHP
54	Tobacco products (16)	p16	C_TOBC
55	Textiles (17)	p17	C_TEXT
56	Wearing apparel; furs (18)	p18	C_GARM
57	Leather and leather products (19)	p19	C_LETH
58	Wood and products of wood and cork (except furniture); articles of straw and plaiting materials (20)	p20	C_WOOD
59	Wood material for treatment, Re-processing of secondary wood material into new wood material	p20.w	C_WOOW
60	Pulp	p21.1	C_PULP
61	Secondary paper for treatment, Re-processing of secondary paper into new pulp	p21.w.1	C_PAPR
62	Paper and paper products	p21.2	C_PAPE
63	Printed matter and recorded media (22)	p22	C_MDIA
64	Coke Oven Coke	p23.1.a	C_COKE
65	Gas Coke	p23.1.b	C_GCOK
66	Coal Tar	p23.1.c	C_COTA
67	Motor Gasoline	p23.20.a	C_MGSL
68	Aviation Gasoline	p23.20.b	C_AGSL
69	Gasoline Type Jet Fuel	p23.20.c	C_GJET
70	Kerosene Type Jet Fuel	p23.20.d	C_KJET
71	Kerosene	p23.20.e	C_KERO
72	Gas/Diesel Oil	p23.20.f	C_DOIL
73	Heavy Fuel Oil	p23.20.g	C_FOIL
74	Refinery Gas	p23.20.h	C_RGAS
75	Liquefied Petroleum Gases (LPG)	p23.20.i	C_LPGA
76	Refinery Feedstocks	p23.20.j	C_REFF
77	Ethane	p23.20.k	C_ETHA
78	Naphtha	p23.20.l	C_NAPT

79	White Spirit & SBP	p23.20.m	C_WHSP
80	Lubricants	p23.20.n	C_LUBR
81	Bitumen	p23.20.o	C_BITU
82	Paraffin Waxes	p23.20.p	C_PARW
83	Petroleum Coke	p23.20.q	C_PETC
84	Non-specified Petroleum Products	p23.20.r	C_NSPP
85	Nuclear fuel	p23.3	C_NUCF
86	Plastics, basic	p24.a	C_PLAS
87	Secondary plastic for treatment, Re-processing of secondary plastic into new plastic	p24.a.w	C_PLAW
88	N-fertiliser	p24.b	C_NFER
89	P- and other fertiliser	p24.c	C_PFER
90	Chemicals nec	p24.d	C_CHEM
91	Charcoal	p24.e	C_CHAR
92	Additives/Blending Components	p24.f	C_ADDC
93	Biogasoline	p24.g	C_BIOG
94	Biodiesels	p24.h	C_BIOD
95	Other Liquid Biofuels	p24.i	C_OBIO
96	Rubber and plastic products (25)	p25	C_RUBP
97	Glass and glass products	p26.a	C_GLAS
98	Secondary glass for treatment, Re-processing of secondary glass into new glass	p26.a.w	C_GLAW
99	Ceramic goods	p26.b	C_CRMC
100	Bricks, tiles and construction products, in baked clay	p26.c	C_BRIK
101	Cement, lime and plaster	p26.d	C_CMNT
102	Ash for treatment, Re-processing of ash into clinker	p26.d.w	C_ASHW
103	Other non-metallic mineral products	p26.e	C_ONMM
104	Basic iron and steel and of ferro-alloys and first products thereof	p27.a	C_STEL
105	Secondary steel for treatment, Re-processing of secondary steel into new steel	p27.a.w	C_STEW
106	Precious metals	p27.41	C_PREM
107	Secondary preciuos metals for treatment, Re-processing of secondary preciuos metals into new preciuos metals	p27.41.w	C_PREW
108	Aluminium and aluminium products	p27.42	C_ALUM
109	Secondary aluminium for treatment, Re-processing of secondary aluminium into new aluminium	p27.42.w	C_ALUW
110	Lead, zinc and tin and products thereof	p27.43	C_LZTP
111	Secondary lead for treatment, Re-processing of secondary lead into new lead	p27.43.w	C_LZTW
112	Copper products	p27.44	C_COPP
113	Secondary copper for treatment, Re-processing of secondary copper into new copper	p27.44.w	C_COPW
114	Other non-ferrous metal products	p27.45	C_ONFM
115	Secondary other non-ferrous metals for treatment, Re-processing of secondary other non-ferrous metals into new other non-ferrous metals	p27.45.w	C_ONFW
116	Foundry work services	p27.5	C_METC

117	Fabricated metal products, except machinery and equipment (28)	p28	C_FABM
118	Machinery and equipment n.e.c. (29)	p29	C_MACH
119	Office machinery and computers (30)	p30	C_OFMA
120	Electrical machinery and apparatus n.e.c. (31)	p31	C_ELMA
121	Radio, television and communication equipment and apparatus (32)	p32	C_RATV
122	Medical, precision and optical instruments, watches and clocks (33)	p33	C_MEIN
123	Motor vehicles, trailers and semi-trailers (34)	p34	C_MOTO
124	Other transport equipment (35)	p35	C_OTRE
125	Furniture; other manufactured goods n.e.c. (36)	p36	C_FURN
126	Secondary raw materials	p37	C_RYMS
127	Bottles for treatment, Recycling of bottles by direct reuse	p37.w.1	C_BOTW
128	Electricity by coal	p40.11.a	C_POWC
129	Electricity by gas	p40.11.b	C_POWG
130	Electricity by nuclear	p40.11.c	C_POWN
131	Electricity by hydro	p40.11.d	C_POWH
132	Electricity by wind	p40.11.e	C_POWW
133	Electricity by petroleum and other oil derivatives	p40.11.f	C_POWP
134	Electricity by biomass and waste	p40.11.g	C_POWB
135	Electricity by solar photovoltaic	p40.11.h	C_POWS
136	Electricity by solar thermal	p40.11.i	C_POWE
137	Electricity by tide, wave, ocean	p40.11.j	C_POWO
138	Electricity by Geothermal	p40.11.k	C_POWM
139	Electricity nec	p40.11.l	C_POWZ
140	Transmission services of electricity	p40.12	C_POWT
141	Distribution and trade services of electricity	p40.13	C_POWD
142	Coke oven gas	p40.2.a	C_COOG
143	Blast Furnace Gas	p40.2.b	C_MBFG
144	Oxygen Steel Furnace Gas	p40.2.c	C_MOSG
145	Gas Works Gas	p40.2.d	C_MGWG
146	Biogas	p40.2.e	C_MBIO
147	Distribution services of gaseous fuels through mains	p40.2.1	C_GASD
148	Steam and hot water supply services	p40.3	C_HWAT
149	Collected and purified water, distribution services of water (41)	p41	C_WATR
150	Construction work (45)	p45	C_CONS
151	Secondary construction material for treatment, Re-processing of secondary construction material into aggregates	p45.w	C_CONW
152	Sale, maintenance, repair of motor vehicles, motor vehicles parts, motorcycles, motor cycles parts and accessoiries	p50.a	C_TDMO
153	Retail trade services of motor fuel	p50.b	C_TDFU
154	Wholesale trade and commission trade services, except of motor vehicles and motorcycles (51)	p51	C_TDWH
155	Retail trade services, except of motor vehicles and motorcycles; repair services of personal and household goods (52)	p52	C_TDRT
156	Hotel and restaurant services (55)	p55	C_HORE
157	Railway transportation services	p60.1	C_TRAI

158	Other land transportation services	p60.2	C_TLND
159	Transportation services via pipelines	p60.3	C_TPIP
160	Sea and coastal water transportation services	p61.1	C_TWAS
161	Inland water transportation services	p61.2	C_TWAI
162	Air transport services (62)	p62	C_TAIR
163	Supporting and auxiliary transport services; travel agency services (63)	p63	C_TAUX
164	Post and telecommunication services (64)	p64	C_PTEL
165	Financial intermediation services, except insurance and pension funding services (65)	p65	C_FINT
166	Insurance and pension funding services, except compulsory social security services (66)	p66	C_FINS
167	Services auxiliary to financial intermediation (67)	p67	C_FAUX
168	Real estate services (70)	p70	C_REAL
169	Renting services of machinery and equipment without operator and of personal and household goods (71)	p71	C_MARE
170	Computer and related services (72)	p72	C_COMP
171	Research and development services (73)	p73	C_RESD
172	Other business services (74)	p74	C_OBUS
173	Public administration and defence services; compulsory social security services (75)	p75	C_PADF
174	Education services (80)	p80	C_EDUC
175	Health and social work services (85)	p85	C_HEAL
176	Food waste for treatment: incineration	p90.1.a	C_INCF
177	Paper waste for treatment: incineration	p90.1.b	C_INCP
178	Plastic waste for treatment: incineration	p90.1.c	C_INCL
179	Intert/metal waste for treatment: incineration	p90.1.d	C_INCM
180	Textiles waste for treatment: incineration	p90.1.e	C_INCT
181	Wood waste for treatment: incineration	p90.1.f	C_INCW
182	Oil/hazardous waste for treatment: incineration	p90.1.g	C_INCO
183	Food waste for treatment: biogasification and land application	p90.2.a	C_BIOF
184	Paper waste for treatment: biogasification and land application	p90.2.b	C_BIOP
185	Sewage sludge for treatment: biogasification and land application	p90.2.c	C_BIOS
186	Food waste for treatment: composting and land application	p90.3.a	C_COMF
187	Paper and wood waste for treatment: composting and land application	p90.3.b	C_COMW
188	Food waste for treatment: waste water treatment	p90.4.a	C_WASF
189	Other waste for treatment: waste water treatment	p90.4.b	C_WASO
190	Food waste for treatment: landfill	p90.5.a	C_LANF
191	Paper for treatment: landfill	p90.5.b	C_LANP
192	Plastic waste for treatment: landfill	p90.5.c	C_LANL
193	Inert/metal/hazardous waste for treatment: landfill	p90.5.d	C_LANI
194	Textiles waste for treatment: landfill	p90.5.e	C_LANT
195	Wood waste for treatment: landfill	p90.5.f	C_LANW
196	Membership organisation services n.e.c. (91)	p91	C_ORGA
197	Recreational, cultural and sporting services (92)	p92	C_RECR
198	Other services (93)	p93	C_OSER

199	Private households with employed persons (95)	p95	C_PRHH
200	Extra-territorial organizations and bodies	p99	C_EXTO

6.2.2 Industries

Number	Name	CodeNr	CodeTxt
1	Cultivation of paddy rice	i01.a	A_PARI
2	Cultivation of wheat	i01.b	A_WHEA
3	Cultivation of cereal grains nec	i01.c	A_OCER
4	Cultivation of vegetables, fruit, nuts	i01.d	A_FVEG
5	Cultivation of oil seeds	i01.e	A_OILS
6	Cultivation of sugar cane, sugar beet	i01.f	A_SUGB
7	Cultivation of plant-based fibers	i01.g	A_FIBR
8	Cultivation of crops nec	i01.h	A_OTCR
9	Cattle farming	i01.i	A_CATL
10	Pigs farming	i01.j	A_PIGS
11	Poultry farming	i01.k	A_PLTR
12	Meat animals nec	i01.l	A_OMEA
13	Animal products nec	i01.m	A_OANP
14	Raw milk	i01.n	A_MILK
15	Wool, silk-worm cocoons	i01.o	A_WOOL
16	Manure treatment (conventional), storage and land application	i01.w.1	A_MANC
17	Manure treatment (biogas), storage and land application	i01.w.2	A_MANB
18	Forestry, logging and related service activities (02)	i02	A_FORE
19	Fishing, operating of fish hatcheries and fish farms; service activities incidental to fishing (05)	i05	A_FISH
20	Mining of coal and lignite; extraction of peat (10)	i10	A_COAL
21	Extraction of crude petroleum and services related to crude oil extraction, excluding surveying	i11.a	A_COIL
22	Extraction of natural gas and services related to natural gas extraction, excluding surveying	i11.b	A_GASE
23	Extraction, liquefaction, and regasification of other petroleum and gaseous materials	i11.c	A_OGPL
24	Mining of uranium and thorium ores (12)	i12	A_ORAN
25	Mining of iron ores	i13.1	A_IRON
26	Mining of copper ores and concentrates	i13.20.11	A_COPO
27	Mining of nickel ores and concentrates	i13.20.12	A_NIKO
28	Mining of aluminium ores and concentrates	i13.20.13	A_ALUO
29	Mining of precious metal ores and concentrates	i13.20.14	A_PREO
30	Mining of lead, zinc and tin ores and concentrates	i13.20.15	A_LZTO
31	Mining of other non-ferrous metal ores and concentrates	i13.20.16	A_ONFO
32	Quarrying of stone	i14.1	A_STON
33	Quarrying of sand and clay	i14.2	A_SDCL
34	Mining of chemical and fertilizer minerals, production of salt, other mining and quarrying n.e.c.	i14.3	A_CHMF

Number	Name	CodeNr	CodeTxt
35	Processing of meat cattle	i15.a	A_PCAT
36	Processing of meat pigs	i15.b	A_PPIG
37	Processing of meat poultry	i15.c	A_PPLT
38	Production of meat products nec	i15.d	A_POME
39	Processing vegetable oils and fats	i15.e	A_VOIL
40	Processing of dairy products	i15.f	A_DAIR
41	Processed rice	i15.g	A_RICE
42	Sugar refining	i15.h	A_SUGR
43	Processing of Food products nec	i15.i	A_OFOD
44	Manufacture of beverages	i15.j	A_BEVR
45	Manufacture of fish products	i15.k	A_FSHP
46	Manufacture of tobacco products (16)	i16	A_TOBC
47	Manufacture of textiles (17)	i17	A_TEXT
48	Manufacture of wearing apparel; dressing and dyeing of fur (18)	i18	A_GARM
49	Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear (19)	i19	A_LETH
50	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials (20)	i20	A_WOOD
51	Re-processing of secondary wood material into new wood material	i20.w	A_WOOW
52	Pulp	i21.1	A_PULP
53	Re-processing of secondary paper into new pulp	i21.w.1	A_PAPR
54	Paper	i21.2	A_PAPE
55	Publishing, printing and reproduction of recorded media (22)	i22	A_MDIA
56	Manufacture of coke oven products	i23.1	A_COKE
57	Petroleum Refinery	i23.2	A_REFN
58	Processing of nuclear fuel	i23.3	A_NUCF
59	Plastics, basic	i24.a	A_PLAS
60	Re-processing of secondary plastic into new plastic	i24.a.w	A_PLAW
61	N-fertiliser	i24.b	A_NFER
62	P- and other fertiliser	i24.c	A_PFER
63	Chemicals nec	i24.d	A_CHEM
64	Manufacture of rubber and plastic products (25)	i25	A_RUBP
65	Manufacture of glass and glass products	i26.a	A_GLAS
66	Re-processing of secondary glass into new glass	i26.a.w	A_GLAW
67	Manufacture of ceramic goods	i26.b	A_CRMC
68	Manufacture of bricks, tiles and construction products, in baked clay	i26.c	A_BRIK
69	Manufacture of cement, lime and plaster	i26.d	A_CMNT
70	Re-processing of ash into clinker	i26.d.w	A_ASHW
71	Manufacture of other non-metallic mineral products n.e.c.	i26.e	A_ONMM
72	Manufacture of basic iron and steel and of ferro-alloys and first products thereof	i27.a	A_STEL
73	Re-processing of secondary steel into new steel	i27.a.w	A_STEW
74	Precious metals production	i27.41	A_PREM

Number	Name	CodeNr	CodeTxt
75	Re-processing of secondary preciuos metals into new preciuos metals	i27.41.w	A_PREW
76	Aluminium production	i27.42	A_ALUM
77	Re-processing of secondary aluminium into new aluminium	i27.42.w	A_ALUW
78	Lead, zinc and tin production	i27.43	A_LZTP
79	Re-processing of secondary lead into new lead, zinc and tin	i27.43.w	A_LZTW
80	Copper production	i27.44	A_COPP
81	Re-processing of secondary copper into new copper	i27.44.w	A_COPW
82	Other non-ferrous metal production	i27.45	A_ONFM
83	Re-processing of secondary other non-ferrous metals into new other non-ferrous metals	i27.45.w	A_ONFW
84	Casting of metals	i27.5	A_METC
85	Manufacture of fabricated metal products, except machinery and equipment (28)	i28	A_FABM
86	Manufacture of machinery and equipment n.e.c. (29)	i29	A_MACH
87	Manufacture of office machinery and computers (30)	i30	A_OFMA
88	Manufacture of electrical machinery and apparatus n.e.c. (31)	i31	A_ELMA
89	Manufacture of radio, television and communication equipment and apparatus (32)	i32	A_RATV
90	Manufacture of medical, precision and optical instruments, watches and clocks (33)	i33	A_MEIN
91	Manufacture of motor vehicles, trailers and semi-trailers (34)	i34	A_MOTO
92	Manufacture of other transport equipment (35)	i35	A_OTRE
93	Manufacture of furniture; manufacturing n.e.c. (36)	i36	A_FURN
94	Recycling of waste and scrap	i37	A_RYMS
95	Recycling of bottles by direct reuse	i37.w.1	A_BOTW
96	Production of electricity by coal	i40.11.a	A_POWC
97	Production of electricity by gas	i40.11.b	A_POWG
98	Production of electricity by nuclear	i40.11.c	A_POWN
99	Production of electricity by hydro	i40.11.d	A_POWH
100	Production of electricity by wind	i40.11.e	A_POWW
101	Production of electricity by petroleum and other oil derivatives	i40.11.f	A_POWP
102	Production of electricity by biomass and waste	i40.11.g	A_POWB
103	Production of electricity by solar photovoltaic	i40.11.h	A_POWS
104	Production of electricity by solar thermal	i40.11.i	A_POWE
105	Production of electricity by tide, wave, ocean	i40.11.j	A_POWO
106	Production of electricity by Geothermal	i40.11.k	A_POWM
107	Production of electricity nec	i40.11.l	A_POWZ
108	Transmission of electricity	i40.12	A_POWT
109	Distribution and trade of electricity	i40.13	A_POWD
110	Manufacture of gas; distribution of gaseous fuels through mains	i40.2	A_GASD
111	Steam and hot water supply	i40.3	A_HWAT
112	Collection, purification and distribution of water (41)	i41	A_WATR
113	Construction (45)	i45	A_CONS
114	Re-processing of secondary construction material into aggregates	i45.w	A_CONW

Number	Name	CodeNr	CodeTxt
115	Sale, maintenance, repair of motor vehicles, motor vehicles parts, motorcycles, motor cycles parts and accessoiries	i50.a	A_TDMO
116	Retail sale of automotive fuel	i50.b	A_TDFU
117	Wholesale trade and commission trade, except of motor vehicles and motorcycles (51)	i51	A_TDWH
118	Retail trade, except of motor vehicles and motorcycles; repair of personal and household goods (52)	i52	A_TDRT
119	Hotels and restaurants (55)	i55	A_HORE
120	Transport via railways	i60.1	A_TRAI
121	Other land transport	i60.2	A_TLND
122	Transport via pipelines	i60.3	A_TPIP
123	Sea and coastal water transport	i61.1	A_TWAS
124	Inland water transport	i61.2	A_TWAI
125	Air transport (62)	i62	A_TAIR
126	Supporting and auxiliary transport activities; activities of travel agencies (63)	i63	A_TAUX
127	Post and telecommunications (64)	i64	A_PTEL
128	Financial intermediation, except insurance and pension funding (65)	i65	A_FINT
129	Insurance and pension funding, except compulsory social security (66)	i66	A_FINS
130	Activities auxiliary to financial intermediation (67)	i67	A_FAUX
131	Real estate activities (70)	i70	A_REAL
132	Renting of machinery and equipment without operator and of personal and household goods (71)	i71	A_MARE
133	Computer and related activities (72)	i72	A_COMP
134	Research and development (73)	i73	A_RESD
135	Other business activities (74)	i74	A_OBUS
136	Public administration and defence; compulsory social security (75)	i75	A_PADF
137	Education (80)	i80	A_EDUC
138	Health and social work (85)	i85	A_HEAL
139	Incineration of waste: Food	i90.1.a	A_INCF
140	Incineration of waste: Paper	i90.1.b	A_INCP
141	Incineration of waste: Plastic	i90.1.c	A_INCL
142	Incineration of waste: Metals and Inert materials	i90.1.d	A_INCM
143	Incineration of waste: Textiles	i90.1.e	A_INCT
144	Incineration of waste: Wood	i90.1.f	A_INCW
145	Incineration of waste: Oil/Hazardous waste	i90.1.g	A_INCO
146	Biogasification of food waste, incl. land application	i90.2.a	A_BIOF
147	Biogasification of paper, incl. land application	i90.2.b	A_BIOP
148	Biogasification of sewage slugde, incl. land application	i90.2.c	A_BIOS
149	Composting of food waste, incl. land application	i90.3.a	A_COMF
150	Composting of paper and wood, incl. land application	i90.3.b	A_COMW
151	Waste water treatment, food	i90.4.a	A_WASF
152	Waste water treatment, other	i90.4.b	A_WASO
153	Landfill of waste: Food	i90.5.a	A_LANF

Number	Name	CodeNr	CodeTxt
154	Landfill of waste: Paper	i90.5.b	A_LANP
155	Landfill of waste: Plastic	i90.5.c	A_LANL
156	Landfill of waste: Inert/metal/hazardous	i90.5.d	A_LANI
157	Landfill of waste: Textiles	i90.5.e	A_LANT
158	Landfill of waste: Wood	i90.5.f	A_LANW
159	Activities of membership organisation n.e.c. (91)	i91	A_ORGA
160	Recreational, cultural and sporting activities (92)	i92	A_RECR
161	Other service activities (93)	i93	A_OSER
162	Private households with employed persons (95)	i95	A_PRHH
163	Extra-territorial organizations and bodies	i99	A_EXTO

6.2.3 Countries – Regions

Nr	DESIRE code	Name	Continent	UN Region	DESIRE Region	DESIRE Region Name
1	AT	Austria	Europe	Western Europe	WE	Europe
2	BE	Belgium	Europe	Western Europe	WE	Europe
3	BG	Bulgaria	Europe	Eastern Europe	WE	Europe
4	CY	Cyprus	Asia	Western Asia	WM	Middle East
5	CZ	Czech Republic	Europe	Eastern Europe	WE	Europe
6	DE	Germany	Europe	Western Europe	WE	Europe
7	DK	Denmark	Europe	Northern Europe	WE	Europe
8	EE	Estonia	Europe	Northern Europe	WE	Europe
9	ES	Spain	Europe	Southern Europe	WE	Europe
10	FI	Finland	Europe	Northern Europe	WE	Europe
11	FR	France	Europe	Western Europe	WE	Europe
12	GR	Greece	Europe	Southern Europe	WE	Europe
13	HR	Croatia	Europe	Southern Europe	WE	Europe
14	HU	Hungary	Europe	Eastern Europe	WE	Europe
15	IE	Ireland	Europe	Northern Europe	WE	Europe
16	IT	Italy	Europe	Southern Europe	WE	Europe
17	LT	Lithuania	Europe	Northern Europe	WE	Europe
18	LU	Luxembourg	Europe	Western Europe	WE	Europe
19	LV	Latvia	Europe	Northern Europe	WE	Europe
20	MT	Malta	Europe	Southern Europe	WE	Europe
21	NL	Netherlands	Europe	Western Europe	WE	Europe
22	PL	Poland	Europe	Eastern Europe	WE	Europe
23	PT	Portugal	Europe	Southern Europe	WE	Europe
24	RO	Romania	Europe	Eastern Europe	WE	Europe
25	SE	Sweden	Europe	Northern Europe	WE	Europe
26	SI	Slovenia	Europe	Southern Europe	WE	Europe
27	SK	Slovakia	Europe	Eastern Europe	WE	Europe
28	GB	United Kingdom	Europe	Northern Europe	WE	Europe
29	US	United States	America	Northern America	WL	America
30	JP	Japan	Asia	Eastern Asia	WA	Asia and Pacific

31	CN	China	Asia	Eastern Asia	WA	Asia and Pacific
32	CA	Canada	America	Northern America	WL	America
33	KR	South Korea	Asia	Eastern Asia	WA	Asia and Pacific
34	BR	Brazil	America	South America	WL	America
35	IN	India	Asia	Southern Asia	WA	Asia and Pacific
36	MX	Mexico	America	Central America	WL	America
37	RU	Russia	Europe	Eastern Europe	WE	Europe
38	AU	Australia	Oceania	Australia and New Zealand	WA	Asia and Pacific
39	CH	Switzerland	Europe	Western Europe	WE	Europe
40	TR	Turkey	Asia	Western Asia	WM	Middle East
41	TW	Taiwan	Asia	Eastern Asia	WA	Asia and Pacific
42	NO	Norway	Europe	Northern Europe	WE	Europe
43	ID	Indonesia	Asia	South-Eastern Asia	WA	Asia and Pacific
44	ZA	South Africa	Africa	Southern Africa	WF	Africa
45	WA	RoW Asia and Pacific	Asia, Oceania, Antarctica		WA	RoW Asia and Pacific
46	WL	RoW America	America		WL	RoW America
47	WE	RoW Europe	Europe		WE	RoW Europe
48	WF	RoW Africa	Africa		WF	RoW Africa
49	WM	RoW Middle East	Asia, Africa		WM	RoW Middle East

Development of a System of Indicators for a Resource efficient Europe

DESIRE

Development of a System of Indicators for a Resource Efficient Europe

D5.3 Integrated report on EE IO related macro resource indicator time series

Annex - Energy

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About DESIRE

DESIRE is a FP7 project that will develop and apply an optimal set of indicators to monitor European progress towards resource-efficiency. The project runs from September 2012 to February 2016. We propose a combination of time series of environmentally extended input output data (EE IO) and the DPSIR framework to construct the indicator set. Only this approach will use a single data set that allows for consistent construction of resource efficiency indicators capturing the EU, country, sector and product group level, and the production and consumption perspective including impacts outside the EU. The project will:

- Improve data availability, particularly by creating EE IO time series and now-casted data
- Improve calculation methods for indicators that currently still lack scientific robustness, most notably in the field of biodiversity/ecosystem services and critical materials. We further will develop novel reference indicators for economic success.
- Explicitly address the problem of indicator proliferation and limits in available data that have a 'statistical stamp'. Via scientific analysis we will select the smallest set of indicators giving mutually independent information, and show which shortcuts in (statistical) data inventory can be made without significant loss of quality.

The project comprises further Interactive policy analysis, indicator concept development via 'brokerage' activities, Management, and Conclusions and implementation including a hand over of data and indicators to the EU's Group of Four of EEA, Eurostat, DG ENV and DG JRC.

Partners are:

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2. Wuppertal Institute (WI), Wuppertal, Germany
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Summary

Physical energy flows play an important role as environmental extension in EXIOBASE. In the database this group of extensions depicts the supply and use of around 60 primary and secondary energy products. Likewise, the database includes the emission relevant energy use, which provides the basis to calculate the air emissions of 27 substances arising from combustion processes. This type of emissions represents one of the main flows covered in air emission accounts.

The overall approach used to calculate the energy supply and use tables (ESUTs) is very similar to the one applied in previous versions of the database (Tukker et al., 2013; Wood et al., 2015). Thus, energy balances are first aligned with the system boundaries followed in the System of Economic-Environmental Accounting (SEEA) and then physical flows of energy supply and uses are allocated to the EXIOBASE industries, final consumption categories and products. In doing so, the accounting rules provided by recognised international institutions are followed (Eurostat, 2014; UNDESA, 2013). In the last step, natural inputs and energy residuals are added to the energy flows taking place within the economic system, thereby generating complete energy accounts.

The International Energy Agency's extended energy balances (IEA, 2013a, 2013b) are the starting point to generate energy accounts. Energy balances and energy statistics follow the territory principle, i.e. they account for the supply and use of energy within the borders of a territory. In contrast, the SEEA, and by extension the physical energy flow depicted in ESUTs, follow the resident principle, i.e. covers the activities carried out by the resident units of a country, independent from where these activities take place. Thus, the gap between the territory and residence principles has to be bridged in order to comply with the system boundaries of the SEEA. International transport activities are the main elements affected by this boundary issue and therefore have to be adapted to the SEEA rules. To do so, several transport models have been built to properly allocate the use of fuels from international marine, fishing and air transport activities. Additionally, data from Eurostat and other assumptions have been used to estimate the amount of fuel imported through tank tourism both from households as well as from road freight and passenger transport.

Once energy supply and use tables are aligned with the residence principle and consolidated following the energy flow and energy product classification of the International Energy Agency, these flows and energy products are allocated to EXIOBASE industries, final consumption categories and products by means of a variety of auxiliary datasets. These are described in detail in the report below. The resulting physical energy flow accounts contain separate matrices depicting the supply and use of natural inputs, products and energy residuals in accordance with the overall scheme described in the SEEA.

1 Introduction

Work package 5 (WP5) aims to compile an Environmentally-Extended Multi-Regional Input–Output database (EEMRIO) time series and calculate 'macro resource indicators' based on this database. EXIOBASE 3 will incorporate the same level of detail as the previous version. In order to do so, the following tasks have to be accomplished:

1. Specify EE IO related 'macro resource' indicators including tentative natural targets/constraints
2. Systematically use and expand Multi-regional Environmentally Extended Input-Output data to time series as a basis for indicator calculation.
3. Create now-casted EEIO data
4. Calculate EEIO-based 'macro resource' Indicators

EXIOBASE includes various macro resource accounts ("environmental extensions"), many of which refer to energy natural inputs primary and secondary energy products. This annex report describes the detailed methodology followed in task 2 to generate the physical energy supply and use tables for the period 1995-2011. Concretely, this report covers gross energy supply, gross energy use and emission relevant energy use. The last item is used to derive emission accounts from combustion uses, which are reported in the Annex report emissions. This subtask builds on D5.2 (interim report) (Stadler et al., 2014) and previous efforts on energy accounting in the EXIOPOL and DESIRE projects.

As mentioned in the DoW, both the monetary and physical data in EXIOBASE will be nowcasted to reduce the time gap of footprint calculations. This aspect is not covered in this annex and is reported in the Annex report now-casting.

2 Method

2.1 Basic concepts

2.1.1 From energy balances to energy accounts

As explained before, the main objective of this subtask is to produce complete ESUTs for the period 1995-2011. In this process, the IEA extended energy balances are taken as starting point.

In order to better understand the methodology explained in section 2.3, we should first introduce the main differences between energy balances and ESUTs, since both frameworks differ in some of their basic characteristics as shown in Table 1.

Table 1: Main characteristics of energy balances and energy accounts

Energy Balances	**Energy Accounts**
Territory principle	Resident principle
Physical	Physical and monetary
Based on energy statistics	Based on energy statistics and balances
Supply and use balances	Supply and use balances
Various formats (IEA, Eurostat, UN)	Uses national accounts SUT format
Sectors and industries (ISIC)	Industries classified by ISIC
Rearrangement of industries' energy use according to purpose (transport, auto-producers and heat for sale)	No re-arrangement of industries' energy use
Detailed description of energy sector including technologies	Energy "sector" described by ISIC. No description of technologies
All transport in one separate sector	Own account transportation included in industries' activities
Statistical differences	No statistical differences

Source: Slightly adapted from (UNDESA, 2013)

Quantitatively speaking, the most important difference between energy balances and accounts refers to the accounting rules followed in their compilation, i.e. whether they follow the territory or the residence principle. This issue deserves specific attention and is thus dealt with in more detail in section 2.1.2. Another divergence refers to the units in which they are represented. While energy balances use physical units (TJ or ktoe), energy accounts are more flexible, since they are displayed in physical, monetary or both (as hybrid accounts) units. In the case of EXIOBASE, we have compiled physical energy flow accounts in TJ.

As for the format in which they are presented, the IEA energy balances are structured in form matrices representing 63 energy products and 85 energy flows that show the supply and use of energy of different activities. Each country contains its own matrix.

The 85 flows for users and suppliers are divided into four sectors:

a) "Supply",

b) "Transformation",

c) "Energy" and

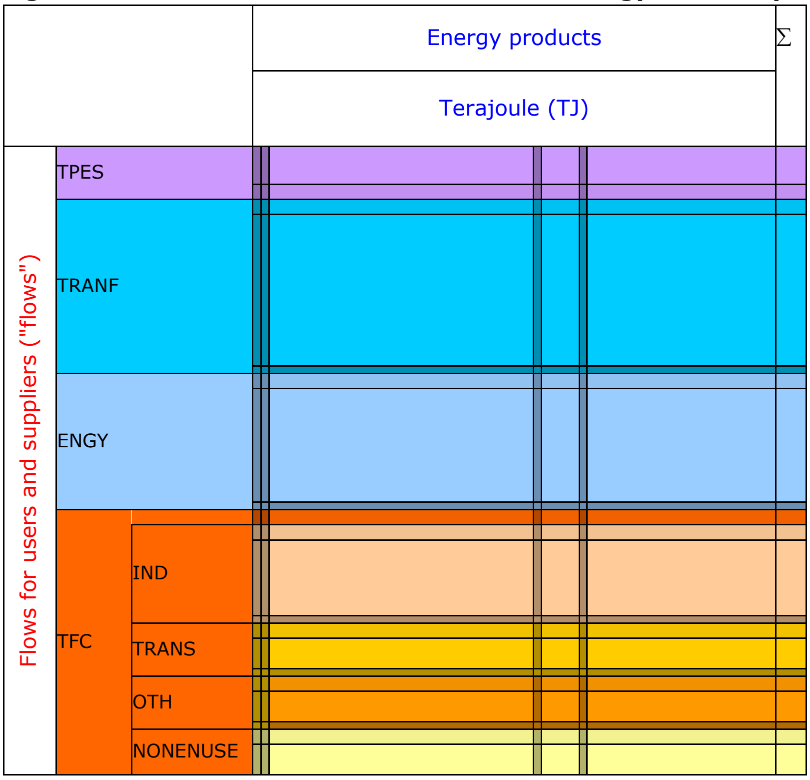
d) "Final consumption".

In addition, the sector "Final consumption" is divided into four sub-sectors: d.1) "Industry sector", d.2) "Transport sector", d.3) "Other sectors", and d.4) "Non-Energy Use". Each of these sectors and sub-sectors show a subtotal within the list of flows. In order to start with balanced tables, these subtotals are set to zero at the beginning of the procedure.

The 63 products contain four "umbrella products" that are intended to gather remainders, where the energy could not be attributed to the respective products. These four umbrella products ("hard coal (if no details)", "brown coal (if no details)", "crude/LNG/feedstock (if no details)", "non-specified primary biomass and wastes") are empty columns.

An overview of the energy balances is given in Figure 1.

Figure 1: Schematic overview of IEA extended energy balances (own illustration)



The sector "Supply" of the IEA extended energy balances contains among others the following six flows:

- Two flows referring to the supplied quantities, i.e. "Production" and "Imports"
- Three flows referring to the foreign use of domestically produced energy products, i.e. "Exports", "International Marine Bunkers" and "International Aviation Bunkers"
- One flow referring to the "Stock Changes" (positive or negative).

The sub-total "Total primary energy supply" (TPES) is made up of the sum of these six flows.

The sector "Transformation" represents the conversion of primary and secondary energy products into secondary energy products (e.g. coking of coal, transforming crude oil to petroleum products, or heavy fuel oil to electricity). It is composed of 21 flows. In this sector, the use and supply of energy products is identified by different signs.

The sector "Energy" represents the sources used by the energy producing industries (e.g. for heating, lighting and operation of all equipment used in the extraction process, for traction and for distribution). This use of the energy producing industries is represented by 18 flows.

The sector "Final Consumption" represents the consumption of energy products in the industry categories and final use categories. It is presented by 29 flows[1] in total that are distributed as follows among the sub-sectors:

- "Industry" (13 flows),
- "Transport" (7 flows),
- "Others" (5 flows),
- "Non-energy use" (4 flows).

The final consumption of private households (flow residential) covers mostly what is delivered to the final consumers. A definition of each energy product and flow is given in the documentation of the energy balances (IEA, 2011).

In contrast, in energy accounts the physical flows are organised into three broad groups (energy from natural inputs, energy products and energy residuals) according to whether they represent a supply of energy or a use of energy. An example is given in Table 2 and Table 3.

[1] In the IEA extended energy balances (2010), the sector "Final consumption" contains 30 flows, because the flow "international aviation" is included in the sub-sector "Transport".

Table 2: Example of Supply table according to SEEA.

	Intermediate consumption				Accumulation	Flows from RoW	Flows from the environment	Total Supply
	I_1	…	I_n	HH		Imports		
Energy from natural inputs								
Natural resource inputs								
Mineral and energy resources								
NI_1								
…								
NI_n								
Timber resources								
Inputs of energy from renewable resources								
NI_{n+1}								
…								
NI_x								
Other natural inputs								
Energy inputs to cultivated biomass								
Total energy from natural inputs								
Energy products								
Prod. Energy products (exc. Own use)								
EP_1								
…								
EP_n								
Own use								
EP_1								
…								
EP_n								
Energy residuals								
ER_1								
…								
ER_n								
Other residual flows								
Residuals from end use for non-energy purposes								
Energy from solid waste								
Total Supply								

The dark areas are filled with zeros.

Table 3: Example of Use table according to SEEA.

	Intermediate consumption			Final consumption	Accumulation	Flows to RoW	Flows to the environment	Total Use
	I_1	…	I_n	HH		Exports		
Energy from natural inputs								
Natural resource inputs								
Mineral and energy resources								
NI_1								
…								
NI_n								
Timber resources								
Inputs of energy from renewable resources								
NI_{n+1}								
…								
NI_x								
Other natural inputs								
Energy inputs to cultivated biomass								
Total energy from natural inputs								
Energy products								
Transformation								
EP_1								
…								
EP_n								
End use								
EP_1								
…								
EP_n								
Own end use								
EP_1								
…								
EP_n								
End use for non-energy purposes								
Energy residuals								
ER_1								
…								
ER_n								
Other residual flows								
Residuals from end use for non-energy purposes								
Energy from solid waste								
Total Use								

The dark areas are filled with zeros.

For detailed information about the remaining differences we refer back to the original source.

2.1.2 The territory vs. the residence principle

As described in the previous section, energy balances and accounts differ with regard to their accounting rules, for energy balances follow the so-called territory principle, while energy accounts follow the residence principle.

The territory principle is also followed in the generation of emission inventories. As pointed out by Eggleston and colleagues (2006, p. 8.4), the territory principle covers the activities "taking place within national territory and offshore areas over which the country has jurisdiction". In contrast, the SEEA definition used in energy accounts refers to the functional border of the country's economy: As the system border is here defined by the "residence" of the agent, this conceptual approach is called "residence principle".

Two systematic differences result when comparing both accounting principles. The first one relates to the coverage of international marine and aviation bunkers. While in the territory principle, the use of fuel related to international marine and air transport is omitted due to the lack of national jurisdiction over international sea and air space. In contrast, the SEEA includes both flows in the use table. As for the supply to bunkers, in both cases the energy products delivered to the bunkers are recorded as exports. Although quantitatively speaking lees relevant, fuel use for international fishing also needs to be aligned with the system boundaries of the SEEA.

The second difference refers to the treatment of the activities that are associated with residents with a location outside the country of residence, and non-residents within the country (e.g. tourists). In this case, a country has jurisdiction over the territory at hand. Road transport is of foremost importance in this respect, especially in European countries where countries are relatively close to each other and there is freedom of movement. The opposite case refers to islands or other countries with limited road access in comparison to their size. Thus, energy accounts have to subtract the energy use related to foreign households (tourists) and foreign freight truck operators to the road transport activity occurring within the geographical borders of a country. The same way, they have to add the activities related to resident tourists abroad and resident road freight transport operators.

In short, this means that energy use and supply from international transport by ships, airplanes, fishing vessels and trucks are allocated to their country of origin, even if the activity occurs outside the external borders of the country of residence of the operator.

Such terms can lead to net increases or decreases of the energy supply and use in the energy accounts compared to the energy balances. These differences can be significant not only on the country or regional level, but also at global level, since country totals in energy balances do not include the energy use related to international marine and aviation bunkers, while energy accounts do. Consequently, since the estimation of energy accounts is based on energy balances, a bridging procedure between both frameworks is needed in order to ensure the compatibility of the final product with the accounting rules of the SEEA.

2.1.3 General approach

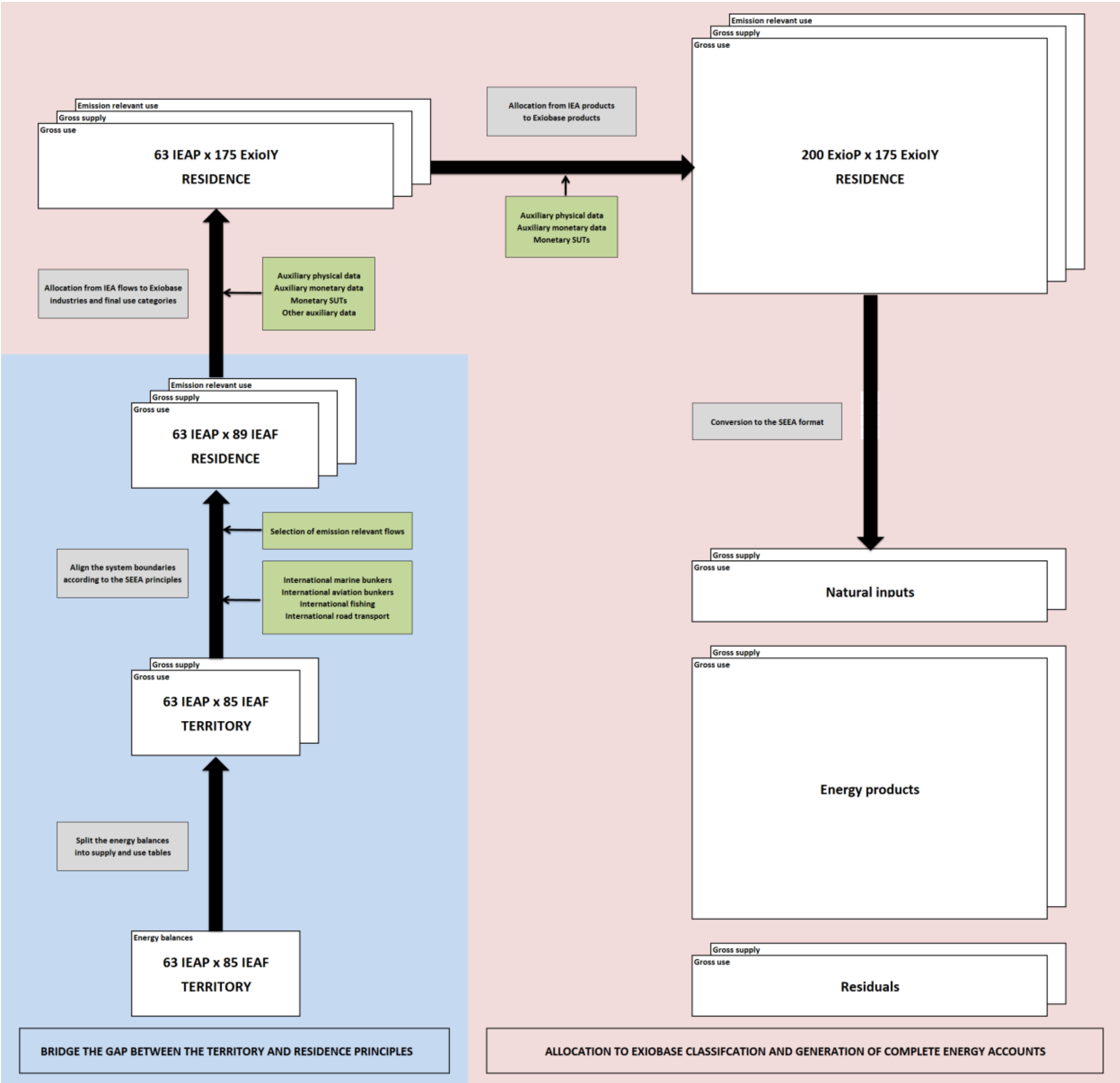
This section describes the process of generating ESUTs that cover the supply and use of natural energy inputs, energy products, and energy residuals for 44 countries and five Rest of World regions. The energy use tables are further processed to generate use tables of emission-relevant use of energy flows.

The overall approach used to calculate the ESUTs is very similar to the one applied in previous versions of the database (Tukker et al., 2013; Wood et al., 2015). Thus, energy balances are first aligned with the system boundaries followed in the SEEA and then physical flows of energy supply and uses are allocated to the EXIOBASE industries, final consumption categories and products (Figure 2). In doing so, the accounting rules provided by recognised international institutions are followed (Eurostat, 2014; UNDESA, 2013).

The International Energy Agency's extended energy balances (IEA, 2013a, 2013b) are the starting point to bridge the gap between the territory and the resident principles (step 1). To do so, several transport models have been built to properly allocate the use of fuels from international marine, fishing and air transport activities. Additionally, data from Eurostat and other assumptions have been used to estimate the amount of fuel imported through tank tourism both from households as well as from road freight and passenger transport.

Once energy supply and use tables are aligned with the residence principle and consolidated following the energy flow and energy product classification of the International Energy Agency, these flows and energy products are allocated to EXIOBASE industries, final consumption categories and products by means of a variety of auxiliary datasets (step 2). The resulting physical energy flow accounts contain separate matrices depicting the supply and use of natural inputs, products and energy residuals in accordance with the overall scheme described in the SEEA.

Figure 2: Overall scheme followed for the generation of energy accounts



Note: IEAP: IEA products, IEAF: IEA flows, ExioIY: EXIOBASE industries and final use categories, ExioP: EXIOBASE products

The following sections describe the data sources used in this process and the detailed methodology.

2.2 Data sources

The main data sources for the generation of the ESUTs and the environmental extension “Energy” are country-specific sets of physical and monetary data. We group the data according to the step in which it has been used:

a) step 1: bridge the gap between the territory and the residence principle

b) step 2: allocation to EXIOBASE classification and generation of complete energy accounts.

Step 1: bridge the gap between the territory and the residence principle

The data sources used in the first step are shown in Table 4. The primary data source on the supply and use of energy are the IEA extended energy balances for OECD and non-OECD countries for the period 1995-2011 (IEA, 2013a, 2013b). They provide year-specific data on the use and supply of 63 energy products by 85 flows for a country or world region. Annex 1 contains a list of the energy products and flows covered. All the countries covered in EXIOBASE v3 have their own energy balance. The balances for the RoW regions have been built by adding the balances of the countries included in each RoW region, and removing the intra-trade using data from the BACI database.

The remaining datasets are used to produce the necessary information to bridge the gap between the territory and the residence principles.

Table 4: Overview of the different data sources used in Step 1

Data	Database	Time	Source
Energy supply and use	Extended Energy Balances of OECD and Non-OECD countries	1995 - 2011	International Energy Agency (IEA)
Traded quantities and prices of energy products	BACI	1998-2009[2]	CEPII
Marine fleet per nationality of the owner	Lloyd's World Fleet Statistics	2000, 2002, 2004, 2007, 2008, 2010[3]	Lloyd's Register Fairplay
Average fuel consumption per ship type	Second IMO GHG Study 2009	2007	International Maritime Organisation (IMO)
Aircraft fleet, air traffic, etc.	World Air Transport Statistics 2008 Edition	1995, 1998, 2000, 2006, 2007, 2009[4]	International Air Transport Association (IATA)
Fuel consumption per aircraft type	Emission Inventory Guidebook 2009	-	EMEP/EEA
Land transport operated by national residents abroad and by non-residents on the territory	Eurostat's bridge tables	1995-2011	Eurostat

As shown in the third column, all the datasets except the ones related to fuel consumption efficiency are year specific. Nevertheless, in a few cases we did not have access to data for the whole 1995-2011 period, so intrapolations and different assumptions were made to fill the gaps.

Step 2: allocate to the EXIOBASE classification and produce complete energy accounts

[2] The 1998 share of intratrade is assumed for 1995-1997. For 2010-2011, the 2009 shares are taken.

[3] This data is used to estimate the use shares of international marine bunkers per country. Thus, for the missing years in the period 2000-2010, these shares are intrapolated. 2011 uses the 2010 share, while 1995-1999 use the 2000 share.

[4] This data is used to estimate the use shares of international aviation bunkers per country. Thus, for the missing years in the period 1995-2009, these shares are intrapolated. 2010 and 2011 use the 2009 share.

The second step requires combining the energy supply and use tables (in IEA format) resulting from step 1 with a wide range of physical and monetary activity data to allocate on the one hand, IEA flows to EXIOBASE industry and final use categories, and on the other, IEA products to EXIOBASE products. These sources are depicted in Table 5.

Table 5: Overview of the different data sources used in Step 2

Data	Database	Time	Source
Life cycle inventory data	Ecoinvent v.2.2	-	Swiss Centre for Life Cycle Inventories
	PROBAS" (Prozessorientierte Basisdaten für Umweltmanagement-Instrumente)	-	Federal Environment Agency (UBA) and Öko-Institut
Physical output of agriculture, fish, and forestry products	FAOSTAT	2007	Food and Agriculture Organization of the United Nations (FAO)
Physical and monetary outputs of various sectors	Data gathered by several CREEA partners	2007	Various – See (Merciai et al., 2013)
Monetary supply and use tables	EXIOBASE v2	2007	CREEA project
Employment of various sectors	LABORSTA	2007	International Labour Organization (ILO)

In contrast to the datasets used in the previous step, the data used in the allocation procedure refers to 2007. The impact this has on the quality of the energy accounts generated is discussed in detail in section 3.

2.3 Detailed methodology

2.3.1 Bridging the gap between the territory and the residence principles

The IEA energy balances show the supply and the use of products by energy flows (in form of industries and final use categories) according to the territory principle. The figures, which represent a product use are signed by the algebraic sign "-" (minus), and those, which represent a "product" supply, with "+" (plus). The sum of all used and supplied quantities for a certain "product" (sum per column), is the "net supply" for the respective energy product.

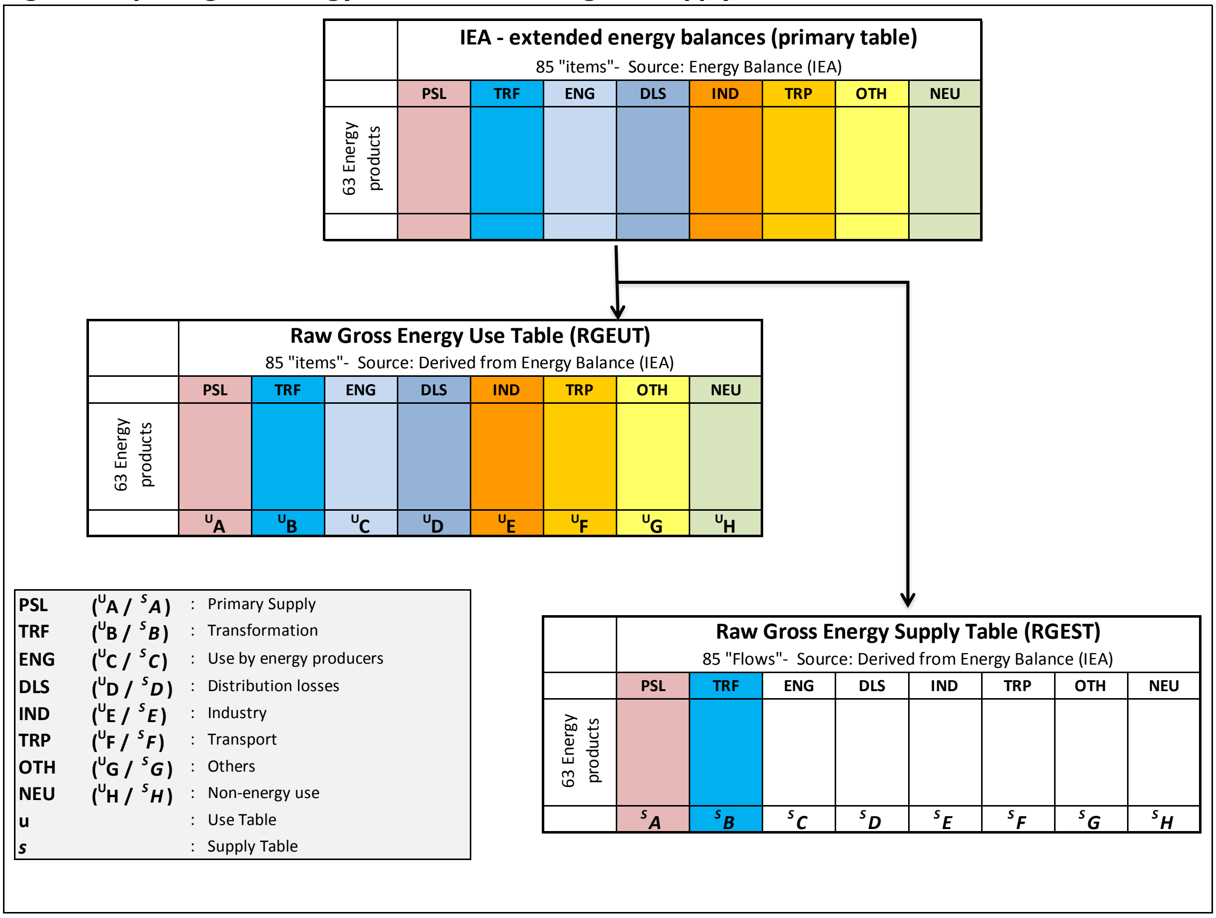
Since this structure is not suited for the purposes in EXIOBASE, a direct linkage between the data on energy use and supply, and the monetary SUTs is not possible. The SUT approach applied here requires a split of the data in use and in supply, i.e. two separate raw tables for the 'use' and the 'supply' before making the bridge to the residence principle. This is done as follows.

From Original Energy Balances to Raw Gross Energy Tables

The sectors 'Supply' and 'Transformation' show both positive and negative figures, while the sector 'Energy' shows only negative figures. The positive figures were accounted in the supply table, whereas the negative ones were accounted in the use table with a changed algebraic sign. The sector ´Final Consumption´ shows positive figures only that were accounted in the use table.

The results of this process are two separate 63 product by 85 flow tables that show the gross supply and gross use of energy products respectively.

Figure 3: Splitting the energy balances into raw gross supply and use tables



Within the raw gross energy supply and use tables ($RGEST_T$ / $RGEUT_T$ or $RGESUT_T$ – the subindex T indicates that the tables follow the territory principle), the flows are grouped in accounting areas: "Supply", "Transformation", "Use by energy producers", "Industry", "Transport", "Others", and "Non-energy use". These accounting areas correspond directly with the sectors and sub-sectors, respectively, of the IEA balances. The used and supplied quantities of energy products in these tables are given in terajoules [TJ].

It should be noted that the values for the supply and use must be identical for the totals and for each single energy product. Discrepancies were interpreted as incompleteness. Therefore, correction terms have been added where necessary.

Bridging from the 'territory principle' to the 'residence principle'

As explained in previous sections, energy balances require a bridging procedure to adjust the system boundaries according to the accounting rules of the SEEA. The main changes necessary for this bridging are located in the accounting area "Transport" due to the internationality of this activity. In many cases, this causes that the "means of transport" (road vehicles, ships, aircrafts, etc.) fill up fuel in countries different to those where the operator resides. The main energy products involved within these transport activities are various secondary energy products produced from crude oil, as well as liquefied petroleum gas and natural gas. Specifically, the following transport types are affected:

- International air transport, which is directly associated with the deliveries from international aviation bunkers;
- International maritime transport, which is directly associated with the deliveries from international marine bunkers;
- Fishing; and
- International road transport[5].

A different approach has been used depending on the transport mode. For marine and aviation bunkers, and fishing bottom-up transport models have been built. The aim of these models is not to calculate precisely the energy use of each of these flows for each country, but to provide country and year-specific **use shares** (i.e. they add up to one) that are multiplied by the total energy uses given by the IEA energy balances for each of the flows concerned, thereby ensuring consistency with the original IEA world totals. Concretely, the use shares applied to the IEA flows correspond to the following:

- International air transport: Total fuels use of aircrafts engaged in international transport
- International maritime transport: Total fuel use of vessels bigger than 1.000 GT
- Fishing: Total fuel use of shipping vessels bigger than 1.000 GT

As a resulted, 'adjusted' energy uses of international transport modes are obtained, which are consistent at the global level with the IEA totals. The description of each of the models is given in Annex 2.

In contrast, in order to bridge the flow road transport, Eurostat data on the carbon emissions (then converted to energy use) of land transport operated by national residents abroad and by non-residents on the territory has been used. All the data used both in the transport models and for the flow road transport is shown in Table 4.

[5] The term "international road transport" applies to fuelling in a country other than the vehicle's country of registration.

The last step requires overwriting the domestic use / import / export data of these flows according to the calculated bridging items ('adjusted' energy uses) as follows:

- International Air Transport

The deliveries from countries to international aviation bunkers leave the national territories and thus were interpreted as fuel exports. Likewise, the consumption of fuel by the country aircraft fleet was interpreted as fuel imported from the international aviation bunkers. This procedure was performed for each energy product separately.

- International Maritime Transport

The deliveries from countries to international marine bunkers leave the national territories and thus were interpreted as fuel exports. Likewise, the consumption of fuel by the country ship fleet was interpreted as fuel imported from the international marine bunkers. This procedure was performed for each energy product separately.

- Fishing

In general, the adjusted country energy use differed from the original country energy use by "fishing" within the raw gross energy use table. These differences are interpreted as the net foreign trade. Thus, the net imports or net exports, respectively, of fuels are calculated for each country separately. This means, that the additional energy use is interpreted as imports, while surplus of country deliveries to "fishing" is interpreted as exports. The domestic use has to be adjusted accordingly.

- Road Transport

In general, the adjusted country energy use differed from the original country energy use by "road transport" within the raw gross energy use table. These differences are interpreted as the net foreign trade. Thus, the net imports or net exports, respectively, of fuels are calculated for each country separately. This means, that the additional energy use is interpreted as imports, while surplus of country deliveries to "road transport" is interpreted as exports. The domestic use has to be adjusted accordingly.

2.3.2 Allocation to EXIOBASE classification and generation of complete energy accounts

The result of the previous step is – for each DESIRE country – a set of raw gross supply and use tables according to the residence principle, already checked for consistency. We refer to them as $RGESUT_R$, where the R subindex indicates that these tables follow the residence principle. In order to allocate or break down the flows represented in these tables according to the requirements of DESIRE, it is necessary to determine the correspondences between the *flows* and *the industries and final use categories*, henceforth named "IFU categories", of the SUTs within EXIOBASE 3.0. Likewise, the IEA energy products have to be allocated or broken down into EXIOBASE products.

Some of these correspondences can be performed by a one-to-one allocation from one specific flow to one specific IFU category. Other correspondences entail a deviation thereof for the allocation. Here, two cases are distinguished:

- Breakdown of one IEA flow (or product) into several EXIOBASE IFU (or product) categories;

- Assignment of several IEA flows (or products) to one EXIOBASE IFU (or product) category.

These correspondences are summarised in Correspondence Tables, one for the supply, one for the use, and one for products showing which correspondence type is applied for which flow or product. For illustration purposes, an excerpt of the Correspondence Table for the use is shown in Table 6.

Table 6: Correspondence table specifying the correspondences between flows (IEA classification) and IFU categories (EXIOBASE 3.0 classification). Excerpt from the applied Correspondence Table.

IEA Classification			EXIOBASE 3.0 Classification	
Area	**IEA Flow code**	**Flow label**	**Code**	**Label**
I	**PAPERPRO**	Paper, Pulp and Print	i21.1 i21.w.1 i21.2 i22	Pulp Re-processing of secondary paper into new pulp Paper Publishing, printing and reproduction of recorded media (22)
I	**WOODPRO**	Wood and Wood Products	i20 i20.w	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials (20) Re-processing of secondary wood material into new wood material
I	**CONSTRUC**	Construction	i45 i45.w	Construction (45) Re-processing of secondary construction material into aggregates
I	**TEXTILES**	Textile and Leather	i17 i18 i19	Manufacture of textiles (17) Manufacture of wearing apparel; dressing and dyeing of fur (18) Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear (19)

Allocation from IEA flows to EXIOBASE industries and final use categories

In this section, we describe the procedure of the breakdown and allocation of the 89 flows of the $RGESUT_R$ into the corresponding DESIRE IFU categories. Since the IEA extended energy balances, and also the derived $RGESUT_R$ show an identical structure for all countries, this procedure was used for the data sets of all countries.

As shown in the simplified scheme represented in

Figure 4, two allocation matrices have been used to obtain the final energy SUTs. Nonetheless, the reality is much more complex, since this is not done in one single step neither for the supply, nor for the use.

Allocation matrices for supply and use flows

The general allocation approach is based on the following formula:

$$S \times AMS = TMS$$

$$U \times AMU = TMU$$

where:

S: Extended supply table with dimension 63 x 5607 as represented in

Figure 4. This matrix is obtained by diagonalizing the 63x1 vector corresponding to each flow.

U: Extended use table with dimension 63 x 5607 as represented in

Figure 4. This matrix is obtained by diagonalizing the 63 x 1 vector corresponding to each flow.

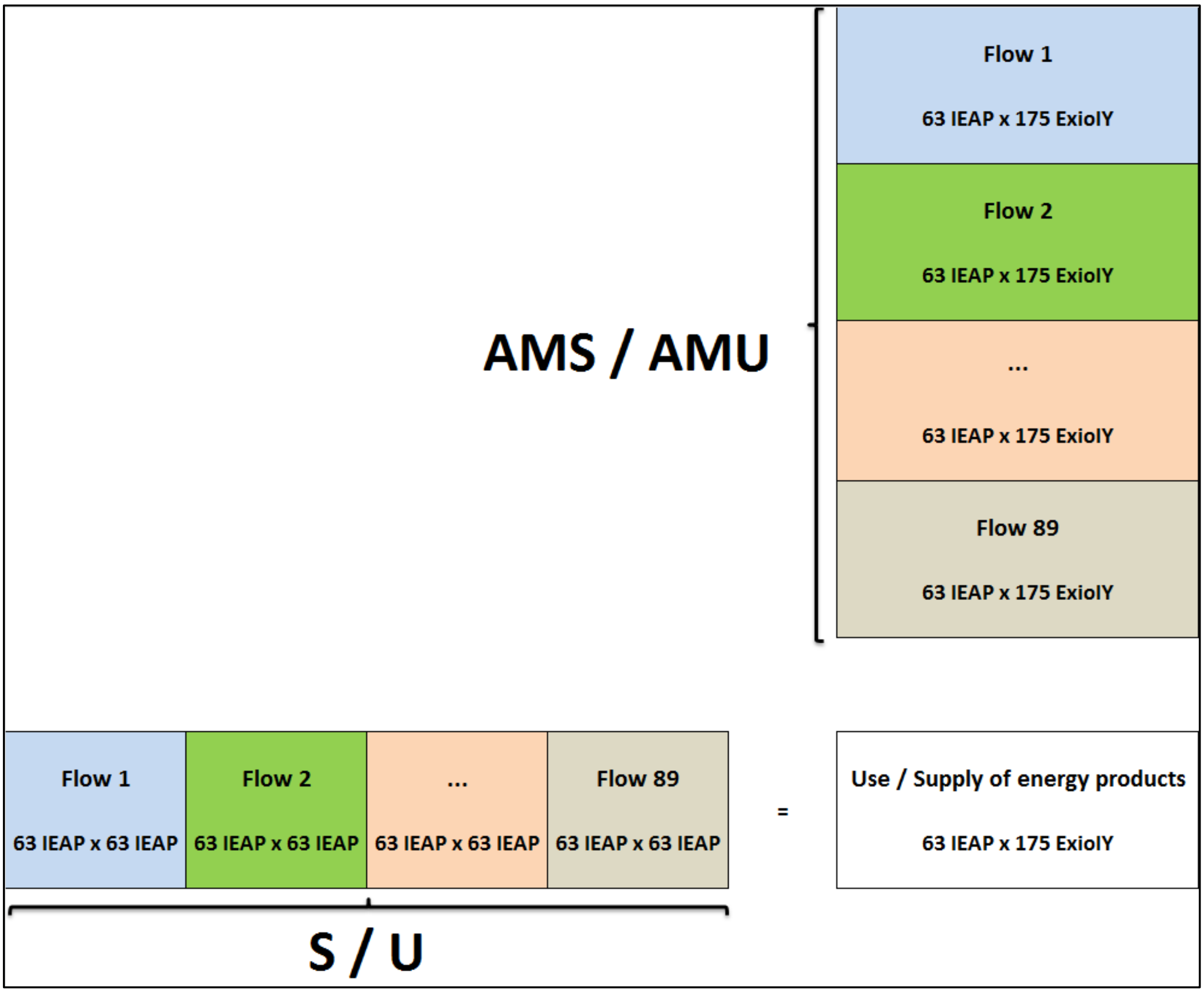
AMS: Allocation matrix for supply flows with dimensions 5607 x 175 as represented in

Figure 4. This matrix is obtained based on the correspondence tables generated in Task 3 and auxiliary data.

AMU: Allocation matrix for use flows with dimensions 5607 x 175 as represented

Figure 4. This matrix is obtained based on the correspondence tables generated in Task 3 and auxiliary data.

Figure 4: Representation of the allocation of IEA flows and products to DESIRE IFU and product categories



The result is a single 63 x 175 matrix that represents either the use or the supply of energy products.

Each of the submatrices represented in the element AMS and AMU are single allocation matrices that have been generated based on the correspondence tables generated in previously. However, their application is subject to the adequately use of the general allocation approach and the data sets to be used for the calculation of the weighting factors (allocation coefficients).

The exact allocation sequence and the approach that is used for the calculation of the allocation weighting factors are relevant for an accurate breakdown of the aggregated flows.

The application of a certain approach to generate an allocation submatrix depends directly on the availability of data on auxiliary parameters that are required for the breakdown of the aggregated flows. The approaches used for the allocation of the energy uses and supplies can be grouped in six main classes:

<u>Allocation approaches</u>

a) one-to-one allocation;

b) based on direct energy used from LCI databases;

c) based on monetary data;

d) based on allocation matrices for road transport related flows;

e) related to the use / supply by electricity and CHP plants;

f) based on data on specified supply of energy products

The following subsections describe the particular characteristics of the identified approaches used for the allocation submatrix required to break down the energy use and energy supply by a certain aggregated flow (e_{flow}) of the modified $RGESUT_R$ into the energy use and energy supply by the corresponding IFU categories (E_{IFU}). The type of allocation used for each flow (that is not one-to-one) is shown in

Table 7.

Table 7: Flows of the $RGESUT_R$ n which a determined allocation approach was applied in order to derive the energy use and energy supply of the DESIRE industries and Final use consumption categories

Nr.	Accounting area by RGEUT and RGEST	RGEUT and RGEST classification		Applied allocation approach	
		IEA Flow code	Flow label	Short label	Long label
1	Transformation	MAINELEC	Main Activity Producer Electricity Plants	Approach "e"	Allocation related to the use and supply by electricity and CHP plants
2	Transformation	AUTOELEC	Autoproducer Electricity Plants	Approach "e"	Allocation related to the use and supply by electricity and CHP plants
3	Transformation	MAINCHP	Main Activity Producer CHP Plants	Approach "e"	Allocation related to the use and supply by electricity and CHP plants
4	Transformation	AUTOCHP	Autoproducer CHP Plants	Approach "e"	Allocation related to the use and supply by electricity and CHP plants
5	Transformation	TNONSPEC	Non-specified (Transformation)	Approach "c"	Allocation based on monetary data
6	Use of energy producers[6]	EOILGASEX	Oil and Gas Extraction	Approach "b"	Allocation based on direct energy used from LCI databases
7	Use of energy producers	EPOWERPLT	Own use in electricity, CHP and heat plants	Approach "c"	Allocation based on monetary data
8	Use of energy producers	ENONSPEC	Non-specified (Energy)	Approach "c"	Allocation based on monetary data
9	Use of energy producers	DISTLOSS	Distribution Losses	Approach "f"	Allocation based on data on specified supply of energy products
10	Industry	IRONSTL	Iron and Steel	Approach "c"	Allocation based on monetary data
11	Industry	CHEMICAL	Chemical and Petrochemical	Approach "b"	Allocation based on direct energy used from LCI databases
12	Industry	NONFERR	Non-Ferrous Metals	Approach "b"	Allocation based on direct energy used from LCI databases
13	Industry	NONMET	Non-Metallic Minerals	Approach "b"	Allocation based on direct energy used from LCI databases
14	Industry	TRANSEQ	Transport Equipment	Approach "c"	Allocation based on monetary data
15	Industry	MACHINE	Machinery	Approach "b"	Allocation based on direct energy used from LCI databases
16	Industry	MINING	Mining and Quarrying	Approach "b"	Allocation based on direct energy used from LCI databases
17	Industry	FOODPRO	Food and Tobacco	Approach "b"	Allocation based on direct energy used from LCI databases
18	Industry	PAPERPRO	Paper, Pulp and Print	Approach "b"	Allocation based on direct energy used from LCI databases
19	Industry	WOODPRO	Wood and Wood Products	Approach "b"	Allocation based on direct energy used from LCI databases
20	Industry	CONSTRUC	Construction	Approach "c"	Allocation based on monetary data
21	Industry	TEXTILES	Textile and Leather	Approach "b"	Allocation based on direct energy used from LCI databases
22	Industry	INONSPEC	Non-specified (Industry)	Approach "c"	Allocation based on monetary data
23	Transport	ROAD	Road	Approach "d"	Allocation based on allocation matrices for flows related to road transport
24	Transport	DOMESNAV	Domestic Navigation	Approach "c"	Allocation based on monetary data
25	Transport	TRNONSPE	Non-specified (Transport)	Approach "c"	Allocation based on monetary data
26	Others	COMMPUB	Commercial and Public Services	Approach "c"	Allocation based on monetary data
27	Others	AGRICULT	Agriculture/Forestry	Approach "b"	Allocation based on direct energy used from LCI databases
28	Others	ONONSPEC	Non-specified (Other)	Approach "c"	Allocation based on monetary data
29	Non-Energy Use	NEINTREN	Non-Energy Use Industry/Transformation/Energy	Approach "c"	Allocation based on monetary data
30	Non-Energy Use	NETRANS	Non-Energy Use in Transport	Approach "d"	Allocation based on allocation matrices for flows related to road transport
31	Non-Energy Use	NEOTHER	Non-Energy Use in Other Sectors	Approach "c"	Allocation based on monetary data

[6] Accounting area "Own use of energy producers" corresponds with the sector "Energy" of the IEA extended energy balances.

a) One-to-one allocation[7]

In this case, the flow to be allocated has a one-to-one correspondence with one IFU category.

b) Allocation based on direct energy used from LCI databases and on data on physical output volumes

In order to derive the allocation submatrix by means of this approach two types of auxiliary data are required:

- data on direct energy use (by energy product) per unit of physical output of a certain product ($c_{IFU.i.q.z}$);
- data on physical output (year 2007), i.e. quantities of the production or of the extraction of resources ($_{p}x_{IFU.i.q.z}$), respectively, that are supplied by the corresponding DESIRE industries.

Auxiliary data on the energy use (by energy product) per physical output ($c_{IFU.i.q.z}$) was taken from appropriate life cycle inventory databases. In some cases, such information covers the use of heat, electricity and various fuels. When these measures showed differing physical units, they were converted into TJ (as common unit), and subsequently normalised on one unit of physical output of the corresponding product type. If such specific coefficients were not available for a certain product type, the direct energy use coefficient of the most similar product type was assumed.

Two different allocation types have been used in this approach, one at CPA 6-digit level and other at DESIRE industry level.

In the case of the flows "Agriculture / forestry", "Food and tobacco" and "Wood and wood products", data on the physical output ($_{p}x_{IFU.i.q.z}$) (year 2007) has mainly been obtained from the FAO database, which is at a high disaggregation level compared to the corresponding DESIRE products. Thus, a FAO to CPA 6-digit correspondence table has been built to link the products with the direct energy use coefficients.

In the second case, direct energy use coefficients at DESIRE industry level have been used to allocate the energy uses of other flows related to manufacturing.

However, as the allocation refers to DESIRE industries and this level is defined by product groups, the coefficients ($c_{IFU.i.q.z}$) referring to a specific product or product type are not adequate. Therefore, an additional abstraction step was generally required, whereat the energy used for the production of these product groups is estimated. This means that the total energy use of a DESIRE industry ($e_{IFU.j}$) is estimated based on the single components of the energy use ($e_{IFU.i.q}$) for the production of the specific products of which it is composed.

[7] The direct use of solar thermal and geothermal energy by households to generate heat is allocated to the flow AUTOHEAT and then, one to one to i40.3 following the recommendations of the SEEA Energy (UN 2013, p. 29). To be consistent with this approach, the same is done in the case of the remaining non-energy producing industries.

The procedure is based on the application of the following equations:

$$e_{i.q.z} = c_{IFU.i.q.z} \cdot {}_{p}x_{IFU.i.q.z}$$

$$e_{i.q} = e_{i.q.1} + . . . + e_{i.q.z} + . . .+ e_{i.q.l}$$

$$e_{IFU.j} = e_{i.1} + . . .+ e_{i.q} + . . . + e_{i.m}$$

$$e_{IFU} = e_{IFU.1} + . . . + e_{IFU.j} + . . . + e_{IFU.n}$$

$$w_{IFU.j} = e_{IFU.j} / e_{IFU}$$

$$1 = w_{IFU.1} + . . . + w_{IFU.j} + . . . + w_{IFU.n}$$

The estimated total apparent energy use by a certain aggregated flow (e_{IFU}) is given by the sum of the physical measures corresponding to the DESIRE industries, into which the aggregated flow is split. Hence, the weighting factors ($w_{IFU.j}$) are the shares of the estimated energy use by the corresponding DESIRE industries ($e_{IFU.j}$) in the total estimated energy use (e_{IFU}). Accordingly, the sum of the weighting factors ($w_{IFU.j}$) makes up the total and equals 1.

While this is true for the cases in which the energy products to be distributed in each flow match with those given in the direct energy use coefficients, it is not uncommon to have cases in which a quantity of a certain energy product has to be distributed for which the coefficients do not contain a value, e.g. it might happen that the flow "Agriculture / forestry" (according to the IEA energy balance) has a use of 5 TJ of anthracite, but the available LCI coefficients do not include any use of this energy products. In these cases, a second allocation is carried out based on monetary allocation matrices (see c).

c) Allocation based on monetary data

This allocation is solely based on the monetary use tables in basic prices (year 2007)[8]. Thus, the allocation coefficients used in this approach are in line with the monetary structure of the country. Mathematically this could be expressed as follows:

$${}_{m}x_{IFU} = {}_{m}x_{IFU.1} +. . .+ {}_{m}x_{IFU.j} +. . .+ {}_{m}x_{IFU.n}$$

$$w_{IFU.j} = {}_{m}x_{IFU.j} / {}_{m}x_{IFU}$$

$$1 = w_{IFU.1} + ...+ w_{IFU.j} +...+ w_{IFU.n}$$

d) Allocation based on allocation matrices for flows related to road transport

This approach was applied to derive the allocation submatrix needed to break down the energy used by vehicle fleets (e_{IFU}) into the share of households (e_H) and the share of DESIRE industries (e_I).

[8] The MSUTs might need to be further process to deal with the inconsistencies between original MSUTs and the IEA balances. For instance, there are cases in which the MSUTs do not contain any values for a given energy product, while the IEA balances have. In these cases, the distribution of a similar product within the country has been taken.

For this purpose, this approach makes use of the following types of auxiliary data:

- estimates of the fuel consumption per vehicle type from IEA balances (in TJ);
- shares of the fuel consumption per vehicle type for the year 2007;
- data on the energy use for transportation purposes by industries for the year 2007; as for most countries such data is not available, the energy use for transportation purposes by industries was generally deduced by data on the energy use from "proxy countries";
- employment data by industry (year 2007). Estimates for the DESIRE industries are calculated based on auxiliary physical and monetary output data.
- supply of products and services by DESIRE industries (output) (year 2007).

The procedure is based on the application of the following equations:

$$e_{IFU} = e_H + e_I$$

$$e_I = e_1 + \ldots + e_j + \ldots + e_{163}$$

$$e_j = ({}^{pr}e_j / {}_m{}^{pr}x_j) \cdot {}_m x_j$$

$$w_j = e_j / e_I$$

$$w_H = e_H / e_{IFU}$$

$$1 = w_H + w_1 + \ldots + w_j + \ldots + w_{163}$$

The apparent direct fuel consumption for transportation purposes by households (e_H) is estimated by use of data on vehicles of the categories "passenger cars" and "motorcycles", while the fuel consumption for transportation purposes of industries (e_I) is estimated by use of data on light trucks and heavy-duty vehicles, such as tractors, buses and lorries. This data is based on the road transport model built in the CREEA project for the year 2007. Thus, the weighting factor for households (w_H) is estimated as the share of fuel consumption by "passenger cars" and "motorcycles" in the fuel consumption of the whole vehicle fleet.

Only data for one country (DE) has been found that refers to the fuel consumption of road transport by industries. This has been used as a proxy to estimate the data for the remaining countries.

Since the energy use of road transport by industry for the proxy country does not exactly match the DESIRE classification, a few flows have been disaggregated based on monetary and physical output data. Intensities are needed (e.g. in the form of MJ/kg output or MJ/€ output) to make extrapolations to the remaining countries. Nonetheless, the physical output of the service industries is negligible, while the monetary output is a misleading parameter when it comes to link the output with the energy use related to transport. Thus, employment has been used as a common indicator for all the sectors. This allows calculating energy use intensities in the form of TJ/.000 employees.

For countries with lack of country-specific adequate data, the fuel consumption for transportation purposes by a certain DESIRE industry (e_j) is estimated by assuming the same energy use per thousand employees as the so-called "proxy country" $({}^{pr}e_j / {}_m{}^{pr}x_j)$.

e) Allocation related to the use and supply by electricity and CHP plants

This approach was applied to derive the allocation submatrix needed to break down and assign, respectively:

- the energy supplied by electricity plants (${}^{S}e_{flow}$), i.e. electricity, into the corresponding electricity producing DESIRE industries (${}^{S}E_{IFU}$);
- the energy used by electricity plants (${}^{U}e_{flow}$), i.e. several energy products, into the corresponding electricity producing DESIRE industries (${}^{U}E_{IFU}$);
- the energy supplied by CHP plants (${}^{S}e_{CHP}$), i.e. electricity and heat, into the corresponding electricity and heat producing DESIRE industries (${}^{S}E_{IFU}$);
- the energy used by CHP plants (${}^{U}e_{CHP}$), i.e. several energy products, into the corresponding electricity producing DESIRE industries (${}^{U}E_{IFU}$).

The auxiliary data (${}^{S}E_{j.z}$) used for deriving the allocation vector according to this approach are:

a) *additional data* on the supply of electricity and heat by type of energy product. This data is provided by the IEA by an additional matrix next to the extended energy balance for each country;

b) data on average conversion efficiency in water turbine plants for generating steam.

The 63 energy products, from which electricity and heat are produced, were grouped in 12 product groups. Each product group could be directly assigned to one electricity producing DESIRE industry.

- Supply by electricity plants

The allocation submatrix is derived basically by means of a "manual" allocation of the produced electricity according to the energy product used for their production. The electricity produced by each group matches one-to-one with an electricity producing DESIRE industry.

- Supply by CHP plants

The allocation of the output of the CHP plants (electricity and heat) to the corresponding DESIRE industries consists basically in the allocation of the produced electricity and heat according to the energy products used for their production. The total produced heat was allocated to the heat producing DESIRE industry, while the total produced electricity resulting for each group into which the 63 energy products were previously divided was assumed as the quantity of electricity supplied by the corresponding electricity producing

DESIRE industry. This is in accordance with the recommendations from Eurostat (Eurostat 2011, p. 52).

- Use by electricity plants

The allocation submatrix for the use was determined the same way as the assignment of the supply by electricity plants.

Each energy product used by a certain producer of electricity (main-producers or auto-producers) is assigned to one of the 12 groups, into which the 63 energy products were previously divided. Since each group of energy products corresponds directly with an electricity producing DESIRE industry (i40.1a to i40.1l), the used quantities of energy products within a given group are assumed as quantity used by the corresponding DESIRE electricity producing industry.

- Use by CHP plants

First, the use of energy products for the production of electricity and heat by CHP plants was broken down into the use for electricity and use for heat by energy product. The estimation of the energy use for the production of heat (in form of steam) by a CHP plant is based on the assumption that the calorific value of the heat output of the CHP plants corresponds with the calorific value of the energy product used for its generation. The efficiency factor, i.e. the ratio between the calorific value of the input and the calorific value of the output (i.e. heat in form of steam), is assumed to be 1.25 (80% efficiency).

The energy use for the production of electricity in CHP plants was estimated as the difference between the total quantity used in CHP plants and the quantity used for heat production. This exercise was carried out for each energy product separately.

Second, the estimated use of each energy product for the production of electricity was assigned to one of the 12 groups, into which the 63 energy products were previously divided (see above). Then, the used quantities of energy products within a given group are assumed as quantity used by the corresponding DESIRE electricity producing industries (i40.1a to i40.1l).

Third, the assignment of the estimated use of energy products for the production of heat is interpreted similarly to the allocation of the energy products used for the production of electricity. This procedure was applied in order to ensure the highest level of compatibility with the monetary SUTs referring to this allocation.

However, there is not a total compatibility between both, since they use a different principle to allocate the products used under the flows AUTOELEC and AUTOCHP. The MIOTs allocate the products used for the generation of electricity by a facility in which electricity production is not the main activity to the industrial category to which the facility belongs. Nonetheless, this monetary value will be mixed with the one belonging to its main activity, so there is no chance of estimating the share of both activities. In the energy SUTs built from the IEA extended energy balances the flows AUTOELEC and AUTOCHP have been allocated to the electricity generation industries, since no auxiliary data has been found that would allow a proper assignation to the industry category to which the facility belongs.

f) Allocation based on data on specified supply of energy products

This allocation type has been used for the losses occurring during the distribution, and transmission of energy products. Thus, these losses have been allocated to the supplier industries.

Three main matrices result from this allocation process, the gross energy supply table, gross energy use table and the gross emission relevant energy use table (all 63 x 175 matrices). Thus, the 63 energy products as given by the IEA have to be adapted to the EXIOBASE 3.0 classification (200 products) with the aid of the correspondence tables in two steps.

Allocation from IEA products to EXIOBASE products

First, the energy products "Industrial waste", "Municipal waste (renewable)", "Municipal waste (non-renewable)" and "Primary solid biomass" represented in the two main matrices resulting the previous task have to be disaggregated into their corresponding DESIRE products, which results in three 82 x 175 matrices. For this, monetary coefficients are used from the 2007 MSUTs. Since the rest of the IEA products are mapped one to one to DESIRE products, a mere one-to-one correspondence table is enough to obtain the 200 x 175 supply and use tables.

Conversion to the SEEA format

The objective of this task was the alignment of the calculated flows of energy products with the SEEA framework. This is done in a several-step process on the basis of the accounting rules described in chapter 3 of revised SEEA and the recommendation of the manual for energy accounts from Eurostat (Eurostat, 2014; UNDESA, 2013). By means of these additional steps, each energy flow should be represented in the "appropriate" place in the Physical Supply Table and/ or Physical Use Table in a way that the resulting Energy Supply Tables and the Energy Use Tables match the analytical requirements of DESIRE and SEEA.

For the derivation of the amounts of energy from natural inputs following procedure were applied:

A flow of energy from natural inputs occurs when energy is removed or captured from the environment by resident economic units. Such flows include energy from natural resource inputs (e.g. oil, natural gas, uranium, coal and peat, timber resources), inputs from renewable energy sources (e.g. solar, wind, hydro, geothermal), and other natural inputs (energy inputs to cultivated biomass).

The amounts of the energy associated to these flows were derived directly from the datasets previously calculated in previous steps and represented as use of the economic unit (i.e. mostly industries) responsible for the extraction or capture of energy from the environment. In some cases additional estimations based on conventions or data on input-output efficiency were used (e.g. in energy statistics it is assumed by convention an input-output efficiency of approx. a third for nuclear power plants). This implies that 33% of the energy input – heat from nuclear fission – comes out in form of electricity.

The amount of the energy from the natural resource input is estimated therefore with a factor of three of total produced nuclear power).

The non-fuel sources of energy provided by the environment: solar, hydro, wind, wave and tidal, geothermal energy etc. were accounted as natural inputs used in the production of electricity or heat/steam to ensure the balance of flows of energy between the environment and the economy.

Energy from cultivated biomass, including from cultivated timber resources[9], is treated as being produced within the economy and hence is first recorded as the flow of an energy product. However, to ensure a complete balance of energy flows in the PSUT, a balancing entry equal to the energy products from cultivated biomass is recorded as a component of energy from natural inputs in both the supply and the use tables. In the energy from natural inputs part of the use table the corresponding value for energy inputs to cultivated biomass is generally split among a number of industries depending on end use (UN 2013).

Solid waste incinerated for energy purposes is also treated as being produced with the economy. The energy embodied in solid waste is shown as entering the energy system as a residual flow (waste without monetary value) before becoming an energy product. By convention, the energy from solid waste is shown as supplied from within the economy in the accumulation column.

Residuals comprise two groups: energy residuals and other residuals, the energy flows to be accounted refer (as defined in the SEEA) to the physical energy flows that are discharged, or emitted by industries and households through process of production or consumption, or accumulation.

Amounts of energy residuals in terms of distribution losses were derived by means of the allocation of the available data on the original IEA balances. For the estimation of the "other energy residuals" (primarily heat generated when end users use energy products for energy purposes, i.e. dissipative losses) the calculation of the non energy uses by the industries and households was required.

After those derivation procedures, the submatrices represented in Table 2 and Table 3 were generated.

[9] Although natural timber resources represent an energy input from the environment, they were accounted as cultivated biomass due to the characteristics of the use data, which do not make this distinction.

3 Conclusion

This report describes the methodology followed in the generation of complete ESUTs for the 44 countries and 5 RoW regions represented in EXIOBASE for the period 1995-2011. It should also be noted that the data on emission relevant energy use generated provides the basis for the calculation of emissions from combustion uses. The data sources used and assumptions made in this process have been documented in sections 2.2 and 2.3. These are closely related to the quality of the final data. Following the structure of the detailed methodology, in the following lines we elaborate on the quality and potential use of the final product.

The first issue to be addressed are the IEA energy balances, which are the starting point in the generation of energy accounts. The IEA (2013a, 2013b) itself reports on known problems related to different definitions or accounting rules followed. In these cases, the IEA tries to adjust the data to the extent possible according to their accounting standards. Given the massive amount of data to be handled, only minor adjustments have been made to the original IEA balances before processing and converting them to the residence principle. These mainly refer to electricity and heat production outputs, when reported efficiencies were higher than 100%. Hence, other errors reported by the IEA in their country notes (and not corrected) are also part of the ESUTs produced here. In any case, the IEA data is acknowledged as the most reliable source for energy balances.

The second source of uncertainty would refer to the conversion of the raw energy supply and use tables from the territory to the residence principle. Given that the bridge is carried out for all the world countries and the resources available to build the transport models were limited, the aim is not to calculate exactly the difference between the energy use of residents abroad and non-residents in the territory, but to capture its magnitude. Given that to our knowledge this is the most ambitious exercise to bridge this gap both in terms of geographical and time scope, the lack of reference values prevents us from making an elaborated judgement of the uncertainty of the values we provide. In principle, we consider the estimates to be reasonable, for they are based on the most comprehensive databases on vessel and aircraft fleets, while the road transport data is retrieved directly from Eurostat.

Last, we refer to the procedure used to allocate the IEA products and flows to EXIOBASE products, industries and final use categories. While methodologically speaking we would argue that the allocation process from flows to industries and final use categories is solid – after all we use physical, monetary and other allocation methods that are tailored to each flow depending on its characteristics –, most of the auxiliary data used in this process refers to the year 2007 due to the lack of resources to process all the necessary data for the remaining years. In practice, this means that the energy supply and use by individual industries in the years other than 2007 should be interpreted carefully. For instance, we would argue that the energy use of i01 (Agriculture, hunting and related service activities) + i02 (Forestry, logging and related service activities) as a whole in Germany for the year 2001 is reliable, but the energy use at a lower resolution (e.g. cultivation of wheat; cultivation of vegetables, fruit and nuts; cultivation of plant-based fibres; cattle farming, etc.) is not. The reason why the values for the aggregated i01/i02 industry are considered solid is that it is very similar to the values of the IEA flow agriculture/forestry. On the other hand, the allocation to the disaggregated industries uses the physical outputs of those industries in the year 2007, which might differ considerably (or not) from the values of 2001. In this part we should also refer to the allocation from IEA products to EXIOBASE products. While most of the products have a one-to-one equivalence, primary solid biomass and waste products have to be disaggregated into several EXIOBASE products. This is done with 2007 activity data as well, which limits the reliability of the values provided for individual disaggregated products.

The previous paragraphs describe the strengths and weaknesses of the time series of ESUTs generated for EXIOBASE 3.0. In order to make better judgements about the limits of the data generated, reference ESUT data could be of use. So far only a few countries compiled ESUTs (e.g. DK, DE). Nevertheless, the accounts generated by individual countries were not comparable between them, since some of the accounting rules followed differed.[10] With the publication of the SEEA energy manual (UNDESA, 2013) and Eurostat's manual on physical flow accounts (Eurostat, 2014), the same compilation rules can be adopted by countries. In this context, the generation of physical energy flow accounts became mandatory for EU Member States with the adoption of the Regulation 538/2014, which amended the Regulation 691/2011 on European environmental economic accounts. First official estimates are expected by 2017, which could be used for comparison in case EXIOBASE v4 is developed and the energy accounts documented here updated.

All in all, we would argue that the energy accounts described here – and by extension the air emission accounts from combustion uses –, provide a good basis to calculate macro-level indicators related to energy (incl. footprints). We are more sceptics about its potential for indicators that refer to individual product groups, due to the limitations mentioned in relation with the auxiliary data used in the allocation process. Thus, in the latter case, the results should be interpreted carefully.

[10] Stephan Moll (Eurostat), personal communication on 05.12.2014.

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Annex 1: List of energy flows and products in the International Energy Agency's extended balances

Table 8: IEA flows

IEA Flow No	Label Energy Flows in IEA Energy Balances
Flow - 1	Production
Flow - 2	Imports
Flow - 3	Exports
Flow - 4	International marine bunkers
Flow - 5	International aviation bunkers
Flow - 6	Stock changes
Flow - 7	Total primary energy supply
Flow - 8	Transfers
Flow - 9	Statistical differences
Flow - 10	Transformation processes
Flow - 11	Main activity producer electricity plants
Flow - 12	Autoproducer electricity plants
Flow - 13	Main activity producer CHP plants
Flow - 14	Autoproducer CHP plants
Flow - 15	Main activity producer heat plants
Flow - 16	Autoproducer heat plants
Flow - 17	Heat pumps
Flow - 18	Electric boilers
Flow - 19	Chemical heat for electricity production
Flow - 20	Blast furnaces
Flow - 21	Gas works
Flow - 22	Coke ovens
Flow - 23	Patent fuel plants
Flow - 24	BKB plants
Flow - 25	Oil refineries
Flow - 26	Petrochemical plants
Flow - 27	Coal liquefaction plants
Flow - 28	Gas-to-liquids (GTL) plants
Flow - 29	For blended natural gas
Flow - 30	Charcoal production plants
Flow - 31	Non-specified (transformation)
Flow - 32	Energy industry own use
Flow - 33	Coal mines
Flow - 34	Oil and gas extraction
Flow - 35	Blast furnaces
Flow - 36	Gas works

Flow - 37	Gasification plants for biogas
Flow - 38	Coke ovens
Flow - 39	Patent fuel plants
Flow - 40	BKB plants
Flow - 41	Oil refineries
Flow - 42	Coal liquefaction plants
Flow - 43	Liquefaction (LNG)/regasification plants
Flow - 44	Gas-to-liquids (GTL) plants
Flow - 45	Own use in electricity, CHP and heat plants
Flow - 46	Used for pumped storage
Flow - 47	Nuclear industry
Flow - 48	Charcoal production plants
Flow - 49	Non-specified (energy)
Flow - 50	Losses
Flow - 51	Total final consumption
Flow - 52	Industry
Flow - 53	Iron and steel
Flow - 54	Chemical and petrochemical
Flow - 55	Non-ferrous metals
Flow - 56	Non-metallic minerals
Flow - 57	Transport equipment
Flow - 58	Machinery
Flow - 59	Mining and quarrying
Flow - 60	Food and tobacco
Flow - 61	Paper, pulp and print
Flow - 62	Wood and wood products
Flow - 63	Construction
Flow - 64	Textile and leather
Flow - 65	Non-specified (industry)
Flow - 66	Transport
Flow - 67	World aviation bunkers
Flow - 68	Domestic aviation
Flow - 69	Road
Flow - 70	Rail
Flow - 71	Pipeline transport
Flow - 72	World marine bunkers
Flow - 73	Domestic navigation
Flow - 74	Non-specified (transport)
Flow - 75	Other
Flow - 76	Residential
Flow - 77	Commercial and public services
Flow - 78	Agriculture/forestry
Flow - 79	Fishing
Flow - 80	Non-specified (other)

Flow - 81	Non-energy use
Flow - 82	Non-energy use industry/transformation/energy
Flow - 83	Memo: feedstock use in petrochemical industry
Flow - 84	Non-energy use in transport
Flow - 85	Non-energy use in other

Table 9: IEA products

IEA Prod No	Label Energy Product in IEA Energy Balances
1	Hard coal (if no detail)
2	Brown coal (if no detail)
3	Anthracite
4	Coking coal
5	Other bituminous coal
6	Sub-bituminous coal
7	Lignite/brown coal
8	Peat
9	Patent fuel
10	Coke oven coke
11	Gas coke
12	Coal tar
13	BKB/peat briquettes
14	Gas works gas
15	Coke oven gas
16	Blast furnace gas
17	Oxygen steel furnace gas
18	Elec/heat output from non-specified manufactured gases
19	Industrial waste
20	Municipal waste (renewable)
21	Municipal waste (non-renewable)
22	Primary solid biomass
23	Biogas
24	Biogasoline
25	Biodiesels
26	Other liquid biofuels
27	Non-specified primary biomass and wastes
28	Charcoal
29	Natural gas
30	Crude/NGL/feedstocks (if no detail)
31	Crude oil
32	Natural gas liquids
33	Refinery feedstocks
34	Additives/blending components
35	Other hydrocarbons

36	Refinery gas
37	Ethane
38	Liquefied petroleum gases (LPG)
39	Motor gasoline
40	Aviation gasoline
41	Gasoline type jet fuel
42	Kerosene type jet fuel
43	Kerosene
44	Gas/diesel oil
45	Fuel oil
46	Naphtha
47	White spirit & SBP
48	Lubricants
49	Bitumen
50	Paraffin waxes
51	Petroleum coke
52	Non-specified oil products
53	Heat output from non-specified combustible fuels
54	Nuclear
55	Hydro
56	Geothermal
57	Solar photovoltaics
58	Solar thermal
59	Tide, wave and ocean
60	Wind
61	Other sources
62	Electricity
63	Heat

Annex 2: Transport models used to bridge the gap between the territory and the residence principle

International Maritime Transport[11]

Lloyds provides data on the number and type of ships (>1.000 GT) by the nationality of the owner and by the country of registration. In the case of maritime transport the country of registration of the ship is a misleading parameter, since a significant share of the vessels operates under a foreign flag (UNCTAD, 2013). For this reason, it has been assumed that the nationality of the owner coincides with the one of the operator. Thus, the former has been chosen, as it is the one that fits better into the residence principle. The effect of this assumption is unknown, for no reference values are available for comparison.

The fuel consumed by the ship fleet of a certain country used for international marine transport was estimated by combining the data available on the composition of its marine merchant fleet, i.e. cargo carrying ships (16 types) and ships of miscellanea activities (8 types) that exceed a gross registered tonnage of 1.000 tonnes[12].

These data were combined with data on the annual fuel consumption per ship type as given by IMO (Buhaug et al., 2009), which are based on real ship movement data for the year 2007. The IMO study provides average fuel consumption for ships of different types and sizes. Since the Lloyd's Register's database does not disaggregate the fleet data the same way for most ship types, average values were taken for each ship type. In order to match the classifications of both sources, a basic bridge table was created. For the ship types whose fuel consumption can be disaggregated, same procedure as in the fleet estimation is followed.

Hence, in order to determine the energy use arising from international marine transport (mb) for a country (i), we combine country data on fleets (s) with average fuel consumption data (fu) by type of vessel (j) as shown in the following equation.

$$mb_i = \frac{\sum_{j=1}^{n} s_{i,j} * \overline{fu}_j}{\sum_{i=1}^{m} \sum_{j=1}^{n} s_{i,j} * \overline{fu}_j} * mb$$

Due to lack of access to all the necessary data in the period 1995-2011, the model only covers the years 2000, 2002, 2004, 2007, 2008 and 2010. The remaining years are either intra- or extrapolated. Although these assumptions are likely to have an additional

[11] The flow "international marine bunkers" (IEA code: "MARBUNK") "covers those quantities delivered to ships of all flags that are engaged in international navigation. The international navigation may take place at sea, on inland lakes and waterways, and in coastal waters. Consumption by ships engaged in domestic navigation is excluded. The domestic/international split is determined on the basis of port of departure and port of arrival, and not by the flag or nationality of the ship. Consumption by fishing vessels and by military forces is also excluded. See domestic navigation, fishing and non-specified other sectors´" (IEA 2011).

[12] The country distribution of the fuel consumption obtained for the fleet of merchant ships above 1.000 gross tonnage (GT) was assumed as representative for the international maritime transport.

impact on the results, we expect them to be limited, since no critical changes in ship ownerships are expected in such short periods of time. Given the assumptions made in the process, we aim at showing the **magnitude** of the fuel use from marine bunkers per country, rather than precise values.

International Air Transport[13]

The fuel consumed by the aircraft fleet of a certain country used for international air transport was estimated with the aid of data on fleet, annual distance flown and trips carried out (by airline), and average time flown (by airline and aircraft type). This information has been obtained from IATA. The existing gaps in the airline fleets have been filled with the average values of the same airline in the years available.

The data on km and time flown provided by the IATA is given at airline level, while the fuel consumption factors provided by the EMEP/EEA guidebook (EEA, 2013) are given at aircraft level for different flight distances. Since the IATA statistics also provide data for the aircraft types and their daily flight time, the model built estimates an average flight in terms of distance flown for each aircraft in order to link both datasets.

A correspondence table has been generated based on EMEP/EEA (2013) to match the aircraft types included in the IATA statistics and the ones for which fuel consumption data are available. Further assumptions had to be made to match a few more categories.

Thus, fuel consumed from the aviation bunkers (ab) by the aircraft fleet of a certain country (i) used for international air transport was estimated by combining data on annual flights (f) per aircraft type (j) and average distance flown in each trip (d) as follows:

$$\mathrm{ab_i} = \frac{\sum_{j=1}^{n} f_{i,j} * (fu_j^{LTO} + \bar{d}_{i,j} * fu_j^{CRU}(d))}{\sum_{i=1}^{m}\sum_{j=1}^{n} f_{i,j} * (fu_j^{LTO} + \bar{d}_{i,j} * fu_j^{CRU}(d))} * \mathrm{ab}$$

Distant-dependent fuel consumption factors (fu) are taken for landing and take-off (LTO) and cruise mode (CRU). The resulting values have been added up to the ones referring to the other aircraft models in a country's airline and thus, the total fuel consumption per country has been calculated for the selected years. The split between domestic and international fuel consumption has been made on the basis of the domestic and international trips by each airline. The value for each country is then divided by the world value to calculate the use shares as in the case of marine bunkers, and multiplied by the total deliveries to aviation bunkers from the IEA data.

Due to lack of access to all the necessary data in the period 1995-2011, the model only covers the years 1996, 2000, 2001, 2003, 2007 and 2009. The remaining years are either intra- or extrapolated. Given the assumptions made in the process, we aim at showing the **magnitude** of the fuel use from marine bunkers per country, rather than precise values.

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[13] The flow "international aviation bunkers" (IEA code: AVBUNK) "includes deliveries of aviation fuels to aircraft for international aviation. Fuels used by airlines for their road vehicles are excluded. The domestic/international split should be determined on the basis of departure and landing locations and not by the nationality of the airline. For many countries this incorrectly excludes fuel used by domestically owned carriers for their international departures" (IEA 2011).

Fishing[14]

The procedure applied for fishing is the same as for international marine bunkers. In this case, the distribution calculated for fishing vessels bigger than 1.000 GT has been used for the flow "Fishing" as a whole (both domestic and international), since the number of fishing ships per nationality of the owner is not available for ships below that size.

Road Transport[15]

For road transport, two different approaches have been used. For European countries, Eurostat's bridge tables have been used. First, the carbon emissions from foreign operators in the domestic territory and residents in foreign territory have been converted to energy equivalents. Then, the former has been subtracted from the IEA flow 'road transport' and the latter added up, which equals the energy use by resident units. This is then subtracted from the EU totals (thus considering EU as a closed system in terms of gasoline and diesel exchange by road) and the remaining fuel consumption is allocated to the rest of the EU countries based on the size of their road transport sector (from the IEA).

Further, non-European countries were either islands or countries with limited road access in relation to their size (e.g. China, India), so it has been assumed that the fuel sold in the country (as given in the IEA) is the same as the fuel used by the road vehicle fleet registered in the reporting country.

[14] The flow "fishing" (IEA code: "FISHING") "includes fuels used for inland, coastal and deep-sea fishing. Fishing covers fuels delivered to ships of all flags that have refuelled in the country (including international fishing) as well as energy used in the fishing industry [ISIC Rev. 4 Division 03].´" (IEA 2011).

[15] The flow "road transport" in the RGEST/RGEUT (IEA code: "ROAD") "includes fuels used in road vehicles as well as agricultural and industrial highway use. Excludes military consumption as well as motor gasoline used in stationary engines and diesel oil for use in tractors that are not for highway use" (IEA 2011).

Development of a System of Indicators for a Resource efficient Europe	

D5.3 Integrated report on EE IO related macro resource indicator time series

Annex - Emissions

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About DESIRE

DESIRE is a FP7 project that will develop and apply an optimal set of indicators to monitor European progress towards resource-efficiency. The project runs from September 2012 to February 2016. We propose a combination of time series of environmentally extended input output data (EE IO) and the DPSIR framework to construct the indicator set. Only this approach will use a single data set that allows for consistent construction of resource efficiency indicators capturing the EU, country, sector and product group level, and the production and consumption perspective including impacts outside the EU. The project will:

- Improve data availability, particularly by creating EE IO time series and now-casted data
- Improve calculation methods for indicators that currently still lack scientific robustness, most notably in the field of biodiversity/ecosystem services and critical materials. We further will develop novel reference indicators for economic success.
- Explicitly address the problem of indicator proliferation and limits in available data that have a 'statistical stamp'. Via scientific analysis we will select the smallest set of indicators giving mutually independent information, and show which shortcuts in (statistical) data inventory can be made without significant loss of quality.

The project comprises further Interactive policy analysis, indicator concept development via 'brokerage' activities, Management, and Conclusions and implementation including a hand over of data and indicators to the EU's Group of Four of EEA, Eurostat, DG ENV and DG JRC.

Partners are:

1. The Netherlands Organisation for Applied Scientific Research (TNO), Delft, Netherlands
2. Wuppertal Institute (WI), Wuppertal, Germany
3. Alpen Adria University - Institute of Social Ecology (UNI-KLU), Vienna, Austria
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Summary

Emissions to air are one of the main extensions in the framework of EXIOBASE. For EXIOBASE 3, emissions to air have been calculated at the global level in a consistent way for all countries and sectors to the extent possible, covering each country individually and the full time series for 1995-2011 (annual totals). The approach is similar to the earlier approaches applied in the projects EXIOPOL (Tukker et al., 2013) and CREEA (Wood et al., 2015) in the frameworks of EXIOBASE 1 and EXIOBASE 2, respectively.
Several datasets exist which have complete or partial sets of global emissions to air on a territorial basis (e.g. IIASA GAINS, JRC EDGAR, as well as official reported air emissions by individual countries to International Conventions), and also the environmental accounts reported to Eurostat. Many of these datasets may not always be as detailed, complete, transparent and methodologically consistent as we would like to have for providing a comprehensive picture of the air emissions connected to economic input-output databases.

The calculation of air emissions has been conducted by combining activity data with consolidated emission factors retrieved from the TEAM model (Pulles et al. 2007). This model has been filled with emission factors from various sources, including from the Guidelines for national Greenhouse Gas and Air Pollutant Inventories (IPCC 2006; EEA 2009) and from the GAINS model (Amann, 2009; IIASA, 2013). The model chooses for each activity the most appropriate technology or set of technologies. The main advantage of using this model is that it allows for the introduction of new (mostly cleaner) technologies over time, thus changing the emission factors associated with certain activities.

For emissions arising from combustion processes energy use data is combined with emission factors obtained from the TEAM model. In order to do so, the energy balances from the International Energy Agency (IEA, 2013a/b) have to be aligned with the system boundaries described in the System of Environmental-Economic Accounting (SEEA), which follows the so-called residence principle. Thus, the balances have to be bridged between the territory principle (on which the energy balances are based) and the residence principle. As a result, the international transport activity data has to be reallocated in the system following internationally agreed guidelines (UNDESA 2013, Eurostat 2014). This consolidated activity data is combined with emission factors that have been previously checked as explained in the main report. The resulting emissions are then allocated to the EXIOBASE industries, final consumption categories and product groups based on auxiliary datasets (ref to energy annex).

For emissions resulting from non-combustion activities, activity data are collected from various sources (e.g. UN Statistics, USGS, BGS, FAOstat, etc.) and combined with one or more chosen technologies, similar to the combustion emissions. The non-combustion emissions are then each associated to one or more DESIRE products, either in the supply or the use of these products.

1 Introduction

This Annex report describes how the emission coefficients were determined for emissions to air. Also, for combustion related emissions these The final outcome of the work described here are emission coefficients (mass of emission released per unit activity) rather than emissions to ensure a balance between the physical flows (energy, physical SUTs) and the emissions to air resulting from those flows, when these are combined.

For most emission sources, the TNO Emission Assessment Model (TEAM) (Pulles et al. 2007) has been used as the main tool to quantify emissions to air based on a detailed set of activity rates and emission factors. For the purpose of this project, the model has been expanded with a final step where emission coefficients are generated, by dividing the emissions with the activity value, at the sectorial level of detail equivalent to the detail at which the ESUT and PSUT data are available.
These emission coefficients are then combined with the energy accounts (for combustion related emissions) and physical SUTs (for non-combustion related emissions) to ensure that the activity amount and the amount of emissions are well balanced. One of the main reasons for the difference in activity data is because TEAM uses activity data following the territory principle (as also applied in most international emission reporting instruments), while DESIRE uses the residence principle which is common in the environmental accounting world.

This Annex report further describes how the emission coefficients were applied to the various EXIOBASE industries, final consumption categories and/or product groups. Therefore, they have been converted using auxiliary datasets, and afterwards the emission coefficients have been applied to the energy accounts to calculate total air emissions from combustion.
For non-combustion, a link is established between the source categories for which emissions are calculated and the supply/use of specific products. The combination of emission coefficients with PSUTs will be described in the documentation of the PSUT development.

Furthermore, this report provides a short description of the methodology used to estimate emissions from the agriculture and waste sectors, as these have been estimated using different methods compared to other sectors.

2 Method

This chapter describes the methodologies used for estimating emissions to air in the DESIRE project.
As explained in the introduction, there are several steps in the calculation of the final emission coefficients for DESIRE. In Figure 1 this is shown schematically. First, TEAM is used to calculate total emissions in a bottom-up way (by combining activity data and emission factors), similar to the methodologies applied in national emission inventory systems. Using the model output, emission coefficients are calculated at the level of detail which is also available from the ESUT and PSUT. Then, the emissions are calculated by combining the ESUT and PSUT physical data with the emission coefficients. For the PSUT this is rather straightforward (one-to-one linking of emission source to the supply/use of a product). For the energy SUT however, the connection between the emission coefficients and the energy data is more complex.

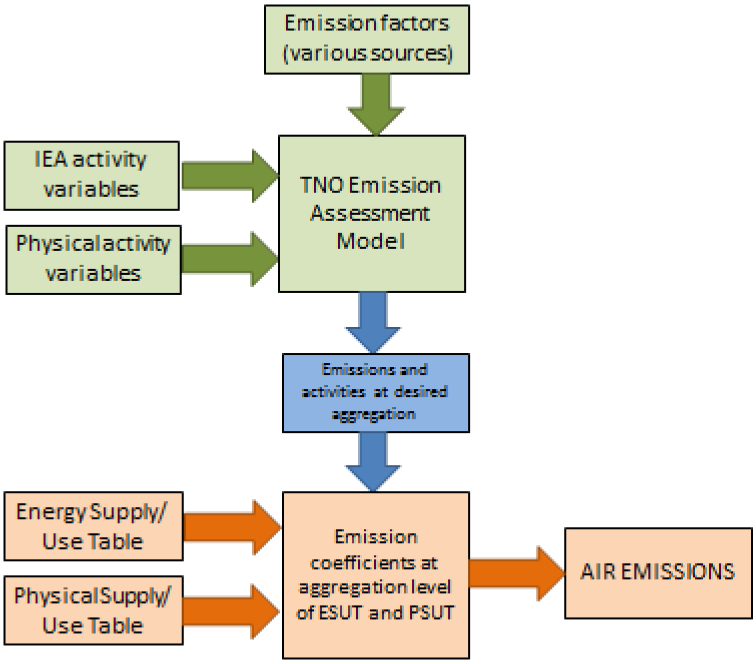

Figure 1 Emission calculation procedure applied in DESIRE

The chapter is split up in different sections:

- Section 2.1 describes the emission model TEAM which was used to calculate emissions from combustion and non-combustion sources, excluding those from the sectors agriculture and waste (indicated by the green blocks in Figure 1). These emissions are subsequently converted to emission coefficients, which is illustrated by the blue block.
- Section **Error! Reference source not found.** describes how the emission coefficients for combustion calculated by TEAM are combined with the energy accounts to calculate emissions for the various DESIRE industries, final use categories and product groups as defined in the classifications for EXIOBASE v3 (see Annex report monetary Supply-Use tables), and how the respective emissions were calculated (indicated by the red blocks in Figure 1)

- Section 2.3 and Section 2.4 describes how the emission coefficients from the agriculture and waste sector, respectively, were estimated.

2.1 Calculation of emission coefficients

2.1.1 TEAM model description

The TNO Emission Assessment Model (hereafter referred to as "TEAM") is an emission estimation model that explicitly models the use of certain technologies (Pulles et al., 2007). This is mainly important when longer time series are studied, allowing for the introduction of new, mostly cleaner technologies over time. The model has been applied earlier in the projects EXIOPOL (Tukker et al., 2013) and CREEA (Wood et al., 2015).

In the DESIRE project, the model is used to calculate emissions using the emission factors and relevant activity statistics. These can be checked and verified against other estimates for verification purposes. As a last step, emission coefficients are calculated at the desired level of detail (in industries, final use categories and/or product groups) by dividing the emission per substance with the relevant activity statistics, which allows them to be combined with processed activity data that is fully consistent with the accounting rules of the SEEA and with the physical supply and use tables that are developed elsewhere in the project.

The model is applied for all air emissions resulting from anthropogenic activities, such as the combustion of fuels. Only emissions from the sectors agriculture and waste treatment (including manure and crop management, land use (change), forestry, landfills and waste incineration) are excluded from the model at this moment, these are separately described in section 2.3.

TEAM models the emission of a substance by applying the following equation for all countries and substances:

$$E_{substance} = \sum_{activities} \left(AR_{activity} \times \sum_{technologies} \left(EF_{technology,substance} \times P_{technology} \right) \right)$$

while at the same time ensuring that for all *activities* and all *t*:

$$\sum_{technologies} P_{activity,technology}(t) = 1 \,,$$

where:

- $E_{substance}$ (t) — The emission of a certain *substance* at time *t*
- $AR_{activity}$ (t) — The activity rate for a certain *activity* at time *t*
- $P_{activity,technology}$ (t) — The penetration: fraction of the *activity* performed using the specific *technology*, at time *t*
- $EF_{technology,substance}$ — The emission factor, an attribute of the selected technology, which determines the linear relation between the activity rate and the resulting emission of a certain *substance*, using a specific *technology*

The various parameters in the equation have a different nature:

- The changes in the structure and production of the economy are specifically considered in the activity variable. The activity data contain information on production rates, but also separate sources of emissions like households and various types of transport.

- Technologies determine the emission factors: each technology has a set of emission factors, one for each relevant substance, which describe the relation between the intensity of the activity and the resulting emission from the activity.
- The penetration determines the selection of technologies for a certain activity. The penetration is defined as the fraction of a technology used for estimating the emissions from an activity.

The activity rate is a variable changing over time. In most inventories, the activity rate is dependent on location and time (in this case: country and year). The spatial and temporal resolution of the resulting emission dataset is in principal determined by the spatial and temporal resolution of the activity data.

This approach allows for the emission factors to be independent of time and location, therefore being only a property of the technology (see Figure 2). The TEAM model has been applied in such a way in the preceding projects EXIOPOL and CREEA.

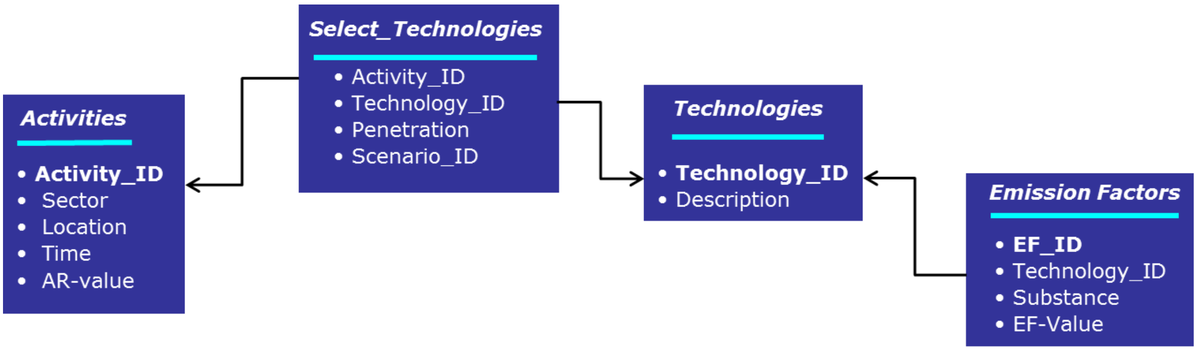

Figure 2 Overview of the core structure in the TEAM model

Setting up the model using this approach requires that for each country and for each year, the contribution of each technology in each of the activities is known. For an emission inventory of 17 years for all world countries this information is simply not available. Instead of making many assumptions on the technology level, we have chosen a different approach.

From the IIASA GAINS model, we have downloaded for most European and Asian countries the activity rates and emissions, from which implied emission factors per country, year, sector, fuel and substance were calculated. These implied emission factors per country and year implicitly hold information on the range of technologies in that country and year. To calculate the emissions, for each activity the corresponding emission factor (for the same country and year) is selected from the technologies table, as shown in Figure 3.

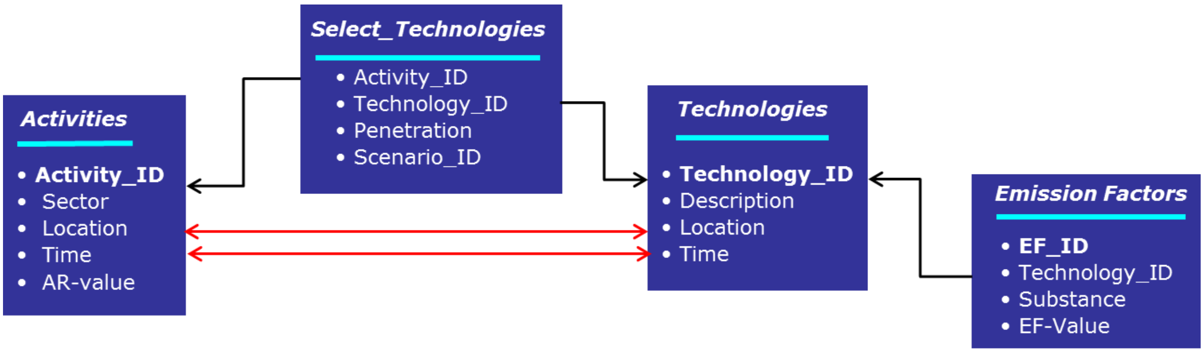

Figure 3 Overview of the core structure in the TEAM model, after adapting for the DESIRE project

The emission inventory in TEAM is compiled in a 3-step procedure:

- The "Activities" table is filled with activity rates dependent on the sector and with spatial and temporal component. This table represents the economic aspect, similar to the classical inventory approach. The activities table may be preceded by a "Sources" table, in which the sector is further specified (source description, fuel type (if applicable)).
- The technological aspect is represented by the "Technologies" table, which is filled with relevant technologies that can be used to perform the activity, independent of the spatial and temporal variables. In the "Emission Factors" table, each technology has a set of emission factors, one for each relevant substance. As explained, for DESIRE also location and time are variables included in the technologies table.
- The "Select_Technologies" table represents the behavioural aspect and chooses one or more technologies for each activity, each weighted with its penetration rate. As explained, the selection of technologies is now done by selecting for each activity the respective technology representing the same location and time.
  As soon as one or more technologies have been chosen for each activity (i.e. the "Select_Technologies" table has been filled), the emissions may be calculated by applying the equation given in the beginning of this section. Depending on the level of detail required for the resulting emissions of each substance, a summation over technologies and/or activities is made.

The TEAM model uses the "sector classifications" as used in the official air emission reporting requirements under the UN Framework Convention on Climate Change (UNFCCC) and the UNECE Convention on Long-Range Transboundary Air Pollution (CLRTAP), both of which follow the territory principle for reporting emissions by individual countries.

2.1.2 Emission factors

In contrast to earlier projects where the model has been applied (e.g. EXIOPOL, CREEA), a time series of 17 years is studies instead of a single year. Since one of the main goals of DESIRE is to see the changes in the EEMRIO over time, it is important to capture the main changes in emissions, not only due to changes in activity rates (e.g. higher energy consumption) but also changes due to technological improvements (e.g. cleaner engines or additional filters).

Unfortunately this information is not available for all countries and years considered in this study, and a lot of assumptions would be necessary to fill all the gaps. To overcome this issue, a few options have been considered:

- Use the approach used in EXIOPOL (year 2000) and CREEA (year 2007) and inter/extrapolate for all other years.
- Make the inventory only for the countries for which the information is (at least partly) available (e.g. EU27) and extrapolate to other countries.
- Introduce emission factors dependent on country and year from other sources, replacing existing emission factors but keeping a consistent approach in both space and time.

Because DESIRE wants to show the changes in time, the consistency in both space and time is a key issue. Therefore, we have chosen to use the last option mentioned and implement emission factors per country and year in the TEAM model. These emission factors are calculated per pollutant, sector, country and year based on the output of the GAINS model (IIASA, 2013; Amann, 2009). This model is a bottom-up emission model estimating emissions and impacts of policy measures on emissions and impacts (for both climate change and air pollution), which is widely used for assessment of air pollution and climate change on regional level, especially in Europe and Asia. The model is not a global model, but covers most countries included in DESIRE. Mexico, Brazil and South Africa are the only DESIRE countries not covered by GAINS. For these countries, but also for the RoW (rest of the world) country assumptions have been made regarding their technology level, by selecting similar countries or taking weighted averages of all available countries.
In terms of temporal coverage, GAINS covers 1990-2030 in 5-yearly intervals, where future years are available using different scenarios. In some cases data prior to 2000 are not available, in this case emission factors are assumed to remain constant in the period before 2000. Within the 5-yearly intervals, interpolations were used to estimate emission factors for the years in between.

The GAINS sectors and fuel categories have been grouped in aggregated sectors and fuels, for which implied emission factors for each sector and year were calculated. The aggregation of sectors and fuels is shown in the Tables 1 and 2 in the Appendix. The Appendix also shows the bridge tables which define for each IEA flow and product which aggregated GAINS sector and fuels have been chosen for the respective activity (Tables 3 and 4 in the Appendix).

The GAINS model does not contain all the harmful substances released to the air. For instance, heavy metals and persistent organic pollutants are not in the model. To account for these substances, we have used emission factors from the EMEP/EEA Guidebook (2009 version). However, these emission factors may represent different technology mixes or assumptions, and may therefore be inconsistent with the emission factors from the GAINS model. Therefore, we have used the emission factors from the EMEP/EEA Guidebook to calculate ratios between the emission factors of heavy metals and POPs and PM10. These ratios have been applied to the GAINS emission factors for PM10 to calculate emission factors for heavy metals and POPs for the TEAM model, for each relevant source.

2.1.3 Activities

2.1.3.1 Fuel combustion

For the calculation of emissions, emission factors need to be combined with the relevant activity variables, as shown in Figure 3. These activity variables are needed for each sector, country and year for which an emission is to be estimated. One of the main activity variables used is the data on energy consumption, i.e. fuel combustion.
For the TEAM model, data on combustion of (fossil) fuels have been taken from the 2013 version for the IEA energy balances, which includes all data up till 2011 plus some preliminary data for 2012. Smaller countries have been grouped in the IEA energy statistics dataset. For modelling purposes, these have been disaggregated to individual countries by using population statistics. This does not affect the final results since in the end the countries are grouped again in Rest of the World regions.

2.1.3.2 Other sources

For the non-combustion activities, we follow the emission reporting requirements set out by international conventions for reporting of national air pollutants (UNFCCC, CLRTAP). These define a number of sectors (CRF/NFR) for which emissions are to be reported, which are also used as the basis for emission calculations in the GAINS model. Because the latter is a little bit more detailed, we follow here the structure of sectors as defined in the GAINS model. For each of these sectors, guidance is available on what activity data should be used to estimate the emissions. Unlike the combustion sector, there is not a single dataset supplying all activity data. Therefore, a series of other statistical datasets have been collected. The sources may include mostly international statistical databases such as USGS, BGS, UN statistical datasets, FAOstat, and also the activity statistics from the IIASA GAINS model have been used in a large number of cases. A detailed overview of all sources taken into account is given in in Table 5 in the Appendix. A number of (relatively minor) emission sources included in GAINS are not taken into account in the emission calculation (as indicated in the Appendix - Table 5). The reason for that is two-fold:

- The emission source is too diffuse: it is an “other” category which may contain a lot of small sources which are very difficult to connect to individual industries and products.
- The emission factor uses an activity parameter which is not a typical activity parameter usable for DESIRE (i.e. some emissions are expressed per millions of people).

The data have been collected for all 44 individual DESIRE countries and for the rest of the world as a whole, however in many cases data are not available for all required countries. Especially for non-European or developing countries, data are often lacking or considered of insufficient quality. It has been chosen to use a single source representing the activity for a certain source to ensure consistency and transparency between countries.

In order to complete our database with activity rates, activity data for countries where no data are available are estimated using the countries’ GDP as a proxy. This seems the most reasonable proxy parameter, since countries with higher industrial production shares often have also higher total GDP values. Of course there is an uncertainty associated with this methodology, but in this case it is the best available. The GDP values for each individual country and year have been obtained from the World Bank website (World Bank, 2014). In cases where a world total was available for the activity rate (e.g. total production of a certain commodity), this has been taken into account as a constraint in the gapfilling procedure. This means that two different methodologies for estimating missing activity data can be identified:

- *World total activity rate is available*
  When the total activity rate in the world is known, this is used in the estimation of activity rates for specific countries. In this case, activity rates for countries in which it is not known are estimated by distributing the remaining activity rate (difference between the world total and the sum over all available activity rates) over all countries using their relative GDP as weighting factor. This ensures that the total activity rate for the world is always consistent with $AR_{world,source}(t)$. In formula:

$$\frac{AR_{country,source}(t)}{GDP_{country}(t)} = \frac{AR_{world,source}(t) - \sum_{ref.countries} AR_{country,source}(t)}{GDP_{world}(t) - \sum_{ref.countries} GDP_{country}(t)}.$$

  In this case, to the right of the equal sign is the ratio of "remaining" activity rates to be distributed over the "unknown" countries and the GDP of these countries, which represents an averaged activity rate per GDP. This averaged activity rate per GDP is then multiplied by a countries' GDP in order to estimate the activity rate.

- *World total activity rate is NOT available*
  The unknown activity rate $AR_{country,source}(t)$ is estimated for each year *t* by applying linear regression with constant offset parameter ($y=a+b*x$ with $a=0$):

$$\frac{AR_{country,source}(t)}{GDP_{country}(t)} = \frac{\sum_{ref.countries} AR_{country,source}(t)}{\sum_{ref.countries} GDP_{country}(t)}.$$

  The right side of the equation consists of the ratio of the sum of all activity rates for all reference countries (defined as the countries for which relevant activity data are available) and the sum of the GDP for these reference countries. This ratio represents an averaged activity rate per GDP. This averaged value is applied to all countries for which the activity rate is unknown. In mathematical terms this method is identical to a linear regression through the origin. This is far from being an ideal method, for the R^2 values (indicating the linearity of the data) vary a lot between sources, and in some cases estimates for the whole world are based on a limited number of real values. However, since data are usually for the major sources and for major countries, the estimated emissions using GDP only make up a small part of the total emissions.

2.1.4 Road transport sector

One of the most important sources of air pollution is road transportation. Since for road transport a lot of information is available on technologies and emissions, here we have applied a more detailed model and emission factors are calculated separately for each country, fuel and pollutant based on the detailed data available.

Similar to other combustion sources (non-road), the IEA values have been used as the baseline (IEA flow ROAD). For each country and each fuel, the energy use in road transportation has been disaggregated to a detailed level by using data from TML (Transport and Mobility Leuven) and their TREMOVE model (TML, 2011) for Europe.

In short, the approach followed for road transportation:

- For the activity data, TREMOVE data were used to disaggregate IEA energy use by fuel and country to the most detailed level (including vehicle category, vehicle type, vehicle technology and road type). For countries not included in TREMOVE, energy consumption from IEA is disaggregated to the same level as TREMOVE by assuming for each country a representative distribution based on the available distributions from the countries included in TREMOVE. For instance, for the US an average distribution of the EU15 (western Europe) has been assumed, while for China, as well as most developing countries, the average distribution of the non-EU countries in TREMOVE has been assumed.
- Emission factors at the same level of detail are available from the FP7 project TRANSPHORM (focusing on the impact of transport of human health) and are developed by the University of Thessaloniki (AUTH, 2012). These emission factors are the state-of-the-art in Europe. The emission factors cover all relevant pollutants from road transport, including the non-exhaust emissions from gasoline evaporation and from wear. These emission factors are country specific as well and only available for EU Member States. For non-European countries, no country specific emission factors are available. Weighted average emission factors are calculated for each technology by taking into account all available data (relatively minor issue, since the emission factors are already technology dependent). All emission factors are originally given in g/km and have been converted to kg/TJ by taking the ratio of the CO2 emission factor from the emission factors (in g/km) and the CO2 emission factor from the IPCC Guidelines (in kg/TJ), and apply this ratio to each emission factor.
- After preparing both the activity data (for all countries in the world), and the emission factors (also for all countries in the world), the two have been combined and the emissions have been calculated, whereafter the data have been aggregated over vehicle categories, types and technologies to receive the total activity (in TJ) and emission (in kg) per pollutant for road transport by fuel and country. By dividing these two, the implied emission factor for the specific country is obtained. This resulting implied emission factors is applied to the energy consumption from the IEA energy statistics for road transportation (flow: ROAD).

2.1.5 Resulting emissions and verification

The resulting dataset contains air emissions for all relevant substances (a total of 25 different substances are included).

Verification

Calculated emissions have been verified against other estimates to check for possible missing sources or errors. This section presents a few typical results, highlighting good agreement for some pollutants, but worse for others. Below are some illustrative results.

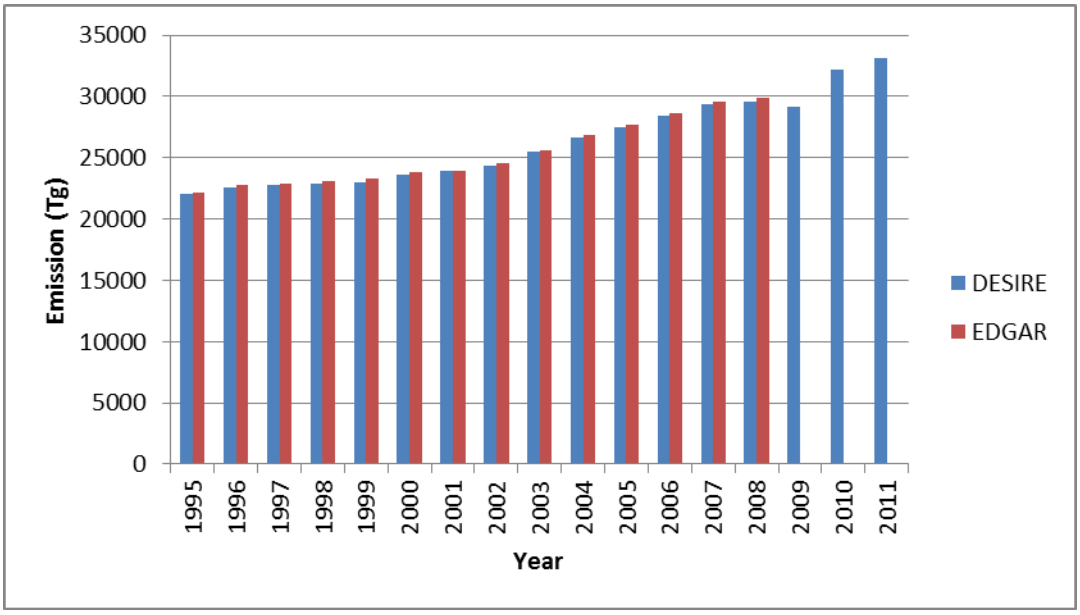

Figure 4 Comparison between total CO2 emissions in DESIRE and EDGAR per year (all countries, including RoW)

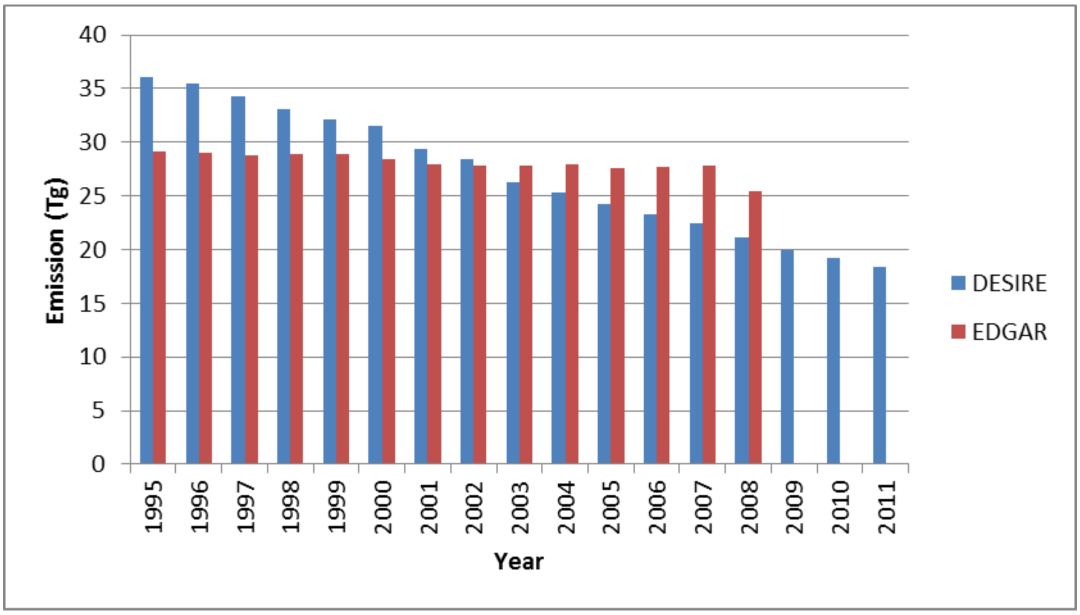

Figure 5 Comparison between total NOx emissions from the road transport sector in DESIRE and EDGAR per year (all countries, including RoW)

Figure 4 and Figure 5 show the comparison to EDGAR for CO2 and NOx, respectively. For total CO2 emissions, good agreement is found on a global scale. For the NOx comparison, only the emissions from road transport are considered. It can be seen that absolute values are in the same range, but the trend in DESIRE data is stronger than the trend in EDGAR data. This suggests that different technology assumptions have been made in both datasets.

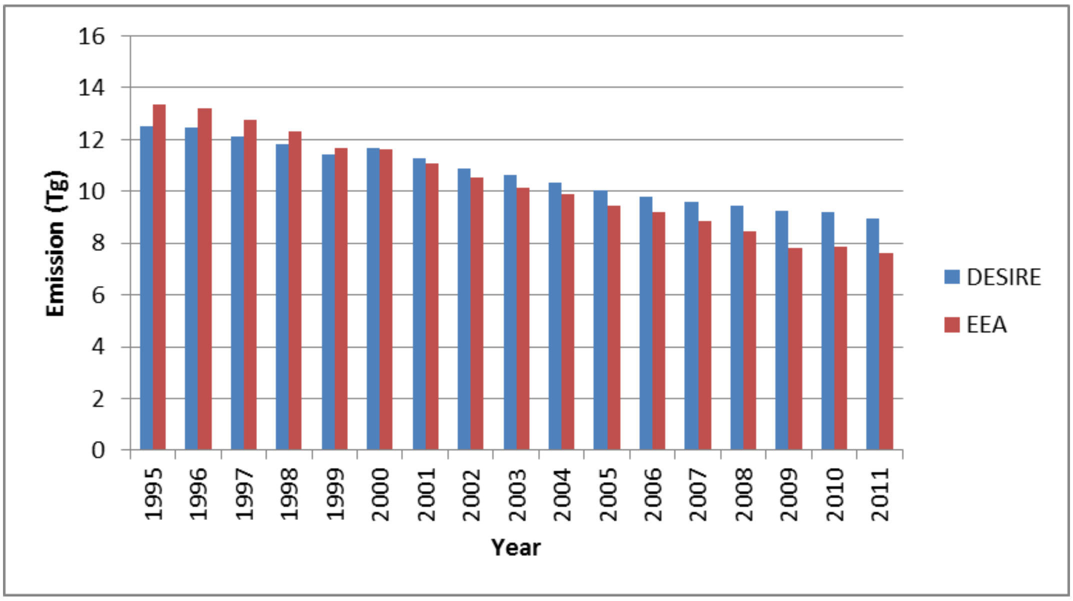

Figure 6 Comparison between NMVOC emissions in DESIRE and official reported emissions by country (for EU28 + Switzerland, Norway, Iceland and Turkey)

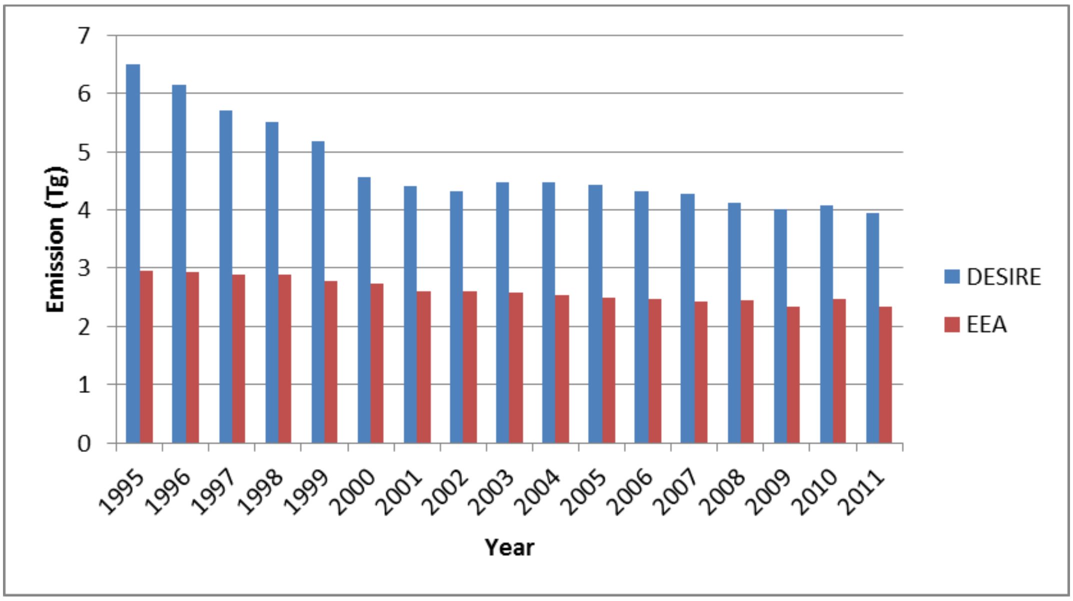

Figure 7 Comparison between PM10 emissions in DESIRE and official reported emissions by country (for EU28 + Switzerland, Norway, Iceland and Turkey)

Figure 6 and Figure 7 show the comparison of DESIRE emissions to official country emissions, as reported under the Convention on Long-Range Transboundary Air Pollution (for selected European countries only). For NMVOC the agreement is very good, although the decreasing trend in emissions in official reported emissions is somewhat stronger. For PM10 however, DESIRE seems to overestimate total emissions. For years prior to 1990, a strong decreasing trend is shown which is not observed in reported data for Europe.

Trends

Most emissions are declining in time in developed countries, while in developing countries emissions are largely increasing. Two illustrative examples show the resulting emission trends are shown in the figures below. Figure 8 shows total CO2 emissions by country. It is shown that for most countries only small changes occur, but CO2 emissions from China tripled between 1999 and 2011. **Error! Reference source not found.** shows NOx emissions for the same countries, but now on a relative scale (with 2005=1). It is shown that for most developed countries emissions have decreased in time, however for China and India emissions have significantly increased (a factor 2 or more compared to 1995).

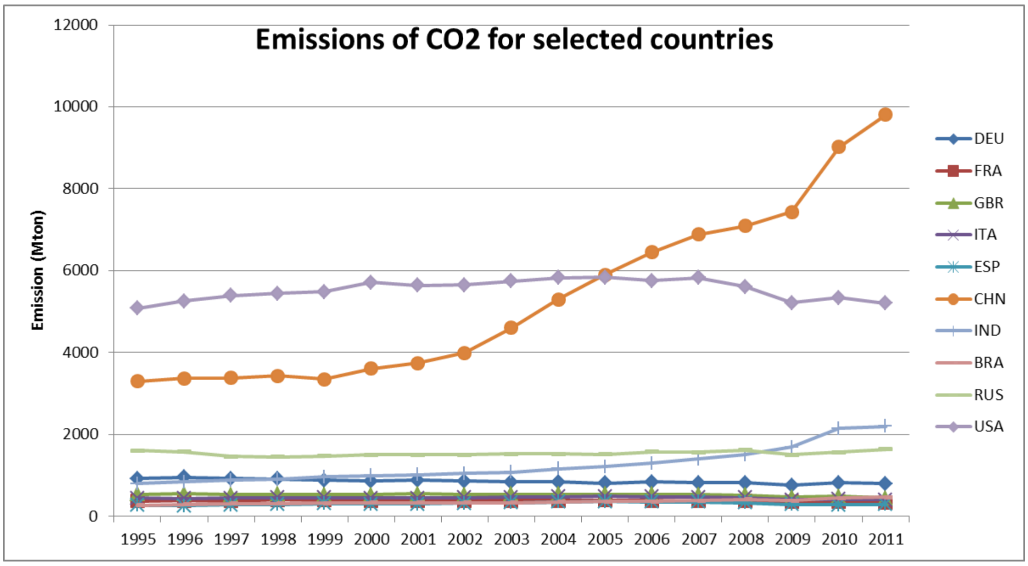

Figure 8 Trend in CO2 emissions for selected countries (represented by their ISO3 country code).

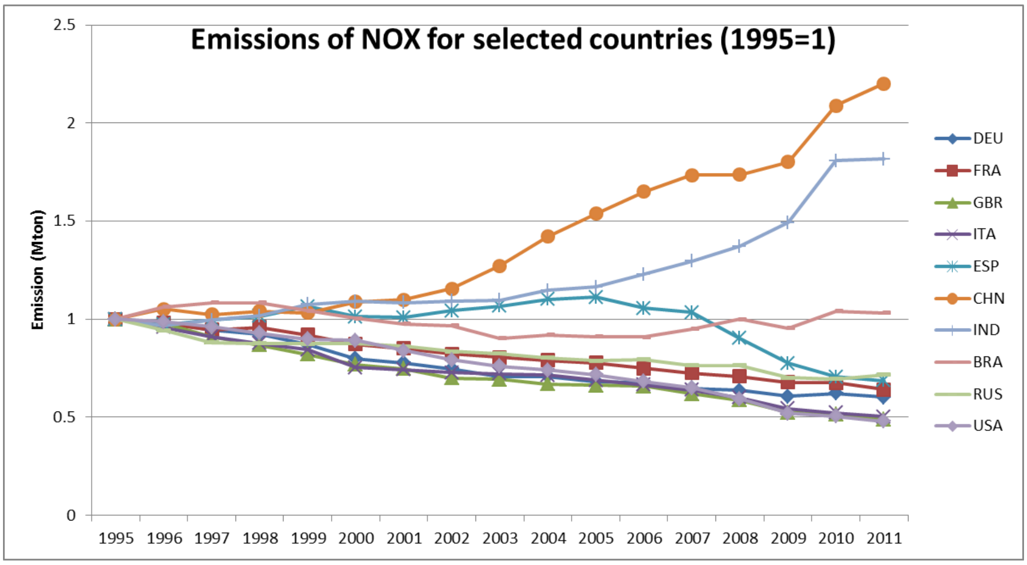

Figure 9 Trend in NOX emissions for selected countries (represented by their ISO3 country code),emissions are relative to their 1995 emission.

2.1.6 Calculation of emission coefficients

As a last step, emissions calculated using the TEAM model are translated into emission coefficients. As explained before, this is done to ensure that while physical activity variables such as the energy accounts are balanced, the emissions calculated using the supplied emission coefficients will be balanced with those physical data.

- For combustion related emissions, both the energy consumption values and the emissions are aggregated over IEA flows and products, countries, years and (for emissions only) substances. For countries, 44 countries are included individually while the remaining countries are grouped in 5 Rest-of-the-World (RoW) regions. Subsequently, a complete set of implied emission factors are calculated by taking the ratio of emissions and energy consumption. The calculation of emissions from combustion using these coefficients is described in Section 2.2.
- For non-combustion emissions (all other sources), first a link is established between the source sector and either the supply or the use of a product in the DESIRE product classification. The idea behind this is that the emissions are released when one or more of the DESIRE products are either being supplied or used in the economy. The bridge table which forms the basis for this link is given in Table 5 in the Annex to this report. The emission coefficients expressed by DESIRE product are combined with the physical information from the PSUT to calculate the non-combustion emissions (see also the upcoming report on the PSUT compilation).

2.1.7 Emissions of PFC, HFC and SF6

For PFCs, HFCs and SF6 a different procedure was followed. These emissions are not included in the TEAM model since the methodologies for these greenhouse gases are rather difficult to apply in terms of variables needed. In order to have a complete dataset, these emissions have been taken directly from the EDGAR emission inventory developed by JRC. This inventory follows the territorial principle also applied in UNFCCC and follow the same source categorization (CRF: Common Reporting Format). Emissions by CRF category have been converted to DESIRE industries following the bridge table developed in the CREEA project (where industry codes were adjusted to DESIRE industry codes as needed). The resulting dataset provides emissions per DESIRE industry and is one of the datasets that feeds into EXIOBASE.

2.2 Calculation of emissions from combustion

Emissions from combustion processes are calculated by combining the emission coefficients described in the previous section with energy use data that is consistent with the system boundaries of the SEEA. The latter point requires further elaboration in order to introduce a key concept in air emission accounting: the residence principle. Thus, this section elaborate on the differences between the territory principle, which is followed in emission inventories (such as UNFCCC), and the residence principle, which is followed in emission accounts. Then, the overall methodology to produce air emission accounts from combustion in the DESIRE project is described.

2.2.1 Territory vs. residence principle

Emission inventories and emission accounts differ with regard to their accounting rules, for the former follow the so-called territory principle, while emission accounts follow the residence principle.

As pointed out by Eggleston and colleagues (2006, p. 8.4), the territory principle covers the activities "taking place within national territory and offshore areas over which the country has jurisdiction". In contrast, the SEEA definition used in emission accounts refers to the functional border of the country's economy: As the system border is here defined by the "residence" of the agent, this conceptual approach is called "residence principle".

Two systematic differences result when comparing both accounting principles. The first one relates to the coverage of international marine and aviation bunkers. In the territory principle, the emissions arising as a result of using fuels related to international marine and air transport is omitted due to the lack of national jurisdiction over international sea and air space. In contrast, the SEEA includes both flows in the energy use table, and by extension in the air emission accounts. Although quantitatively speaking lees relevant, air emissions associated with international fishing also needs to be aligned with the system boundaries of the SEEA.

The second difference refers to the treatment of the activities that are associated with residents with a location outside the country of residence, and non-residents within the country (e.g. tourists). In this case, a country has jurisdiction over the territory at hand. Road transport is of foremost importance in this respect, especially in European countries where countries are relatively close to each other and there is freedom of movement. The opposite case refers to islands or other countries with limited road access in comparison to their size. Thus, air emission accounts have to subtract the emissions related to foreign households (tourists) and foreign freight truck operators to the road transport activity occurring within the geographical borders of a country. The same way, they have to add the activities related to resident tourists abroad and resident road freight transport operators.

In short, this means that the emissions from international transport by ships, airplanes, fishing vessels and trucks are allocated to their country of origin, even if the activity occurs outside the external borders of the country of residence of the operator.

Such terms can lead to net increases or decreases of emissions in the air emission accounts compared to the emission inventories. These differences can be significant not only on the country or regional level, but also at global level, since country totals in emission inventories do not include the energy use related to international marine and aviation bunkers, while emission accounts do.[1] Consequently, since the estimation of emission accounts from combustion in EXIOBASE is based on energy balances, a bridging procedure between both frameworks is needed in order to ensure the compatibility of the final product with the accounting rules of the SEEA.

[1] It should be noted that the UNFCCC inventories report the emission of international bunkers as memo items, where the activity data used corresponds to the fuel deliveries (not use).

2.2.2 General approach

Emissions from combustion have been estimated in a two-step process similar to the one applied in the energy supply and use data. All the details of the approach followed to generate the time series of energy accounts are document in Annex report energy. The overall approach used for air emissions from combustion is represented in Figure 10.

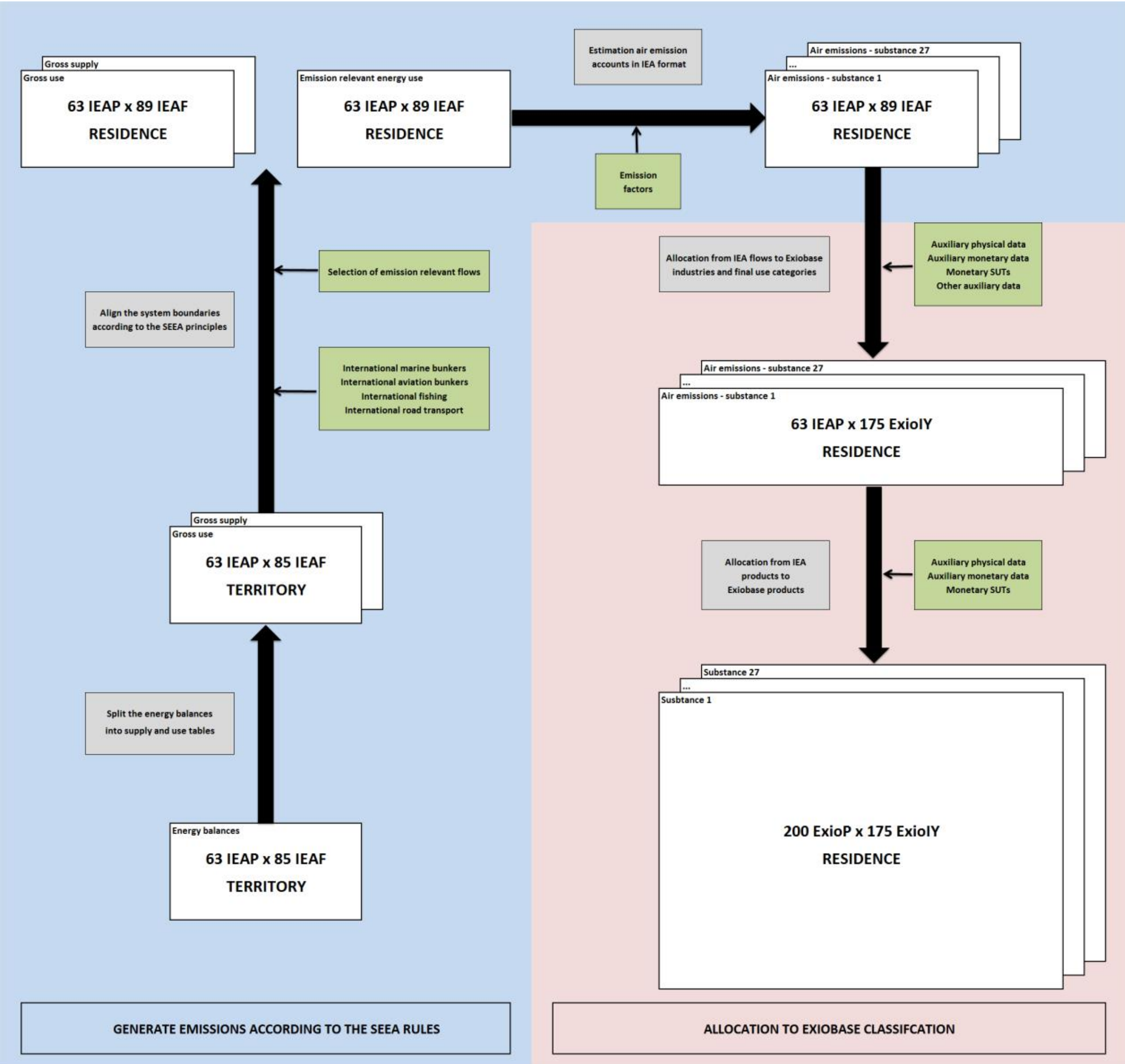

Figure 10: Overall approach used to generate emission acconuts from combustion uses

First the IEA energy balances have been bridged from the territory to the residence principle in order to align the energy data with the accounting rules of the SEEA. Thus, after splitting the energy data of the IEA energy balances into raw energy supply and use tables (63 energy products x 85 energy flows), these have been converted to the residence principle. The bridging procedure has been carried out with the aid of several international transport models built for this purpose (for international aviation bunkers, international marine bunkers and fishing), as well as with Eurostat data on the energy use of non-residents in the domestic territory and residents in the foreign territory for road transport. The models and data sources are described in Annex report energy. The emission relevant energy use has then been isolated from the gross energy use data. The tables are given in a 63 x 89 format, where the additional flows are used to accommodate the information used to bridge the tables.

After that, the emission coefficients from the previous task have been multiplied by the emission relevant energy use data, which results in conceptually sound air emissions accounts that are represented in the IEA classification of energy products and flows. As in the previous case, these emissions are represented in 63 x 89 matrices.

Last, this data needs to be allocated to the EXIOBASE classification of products, industries and final use categories. The allocation procedure is the same one applied for the emission relevant energy use and is reported in Annex report energy. It uses a wide variety of auxiliary datasets, some of which refer to auxiliary activity data. Due to the lack of resources to process all the necessary data, the auxiliary activity data used for the allocation refers to 2007. We elaborate on how this affects the final emission accounts in section 3.

2.3 Emissions from agriculture

The activities are an important source of emissions to the soil, to water and to air.
Agricultural activities are grouped into two sets in the following text; crops and livestock activities.
Emissions from crops described here derive from the use of nitrogen and phosphorus as fertilizers. For any of the two nutrients a mass balance is performed so that the emissions are consistent with the incoming quantities and the crop output.
Emissions from livestock refer to the emission produced by the animals, for example methane when burping or CO2 during respiration, and by the manure excreted.
Yet, here the methodology applied is only briefly described. Further and more exhaustive information will be included in the report on the physical SUTs that will be published in June 2015.

2.3.1 Crops

The procedure for the calculation of the emissions related to the input of nitrogen is taken from IPCC (2006). The generic and crop specific parameters are obtained from the same source. The N-balances take into account inputs of mineral and organic fertiliser and atmospheric N-deposition, and outputs of crops and emissions of N2O-N (direct), NOx-N, NH3-N, NO3-N and N2. The input of organic fertiliser is based on the amount of manure and other organic materials produced within the economy and spread on land. The allocation of the emissions to the individual crops represented in EXIOBASE is based on the production and land use data from FAOSTAT (2014) and from data on the use of fertilisers by crop (FAO et al., 2002; FAO, 2006; Heffer, 2009; Heffer, 2013). Nitrogen in the harvested crop is determined based on protein content of the crops. The protein in different crops is estimated from Moeller et al. (2005). The protein is converted to nitrogen using a protein to nitrogen ratio at 6.25 kg protein/kg N (European Commission, 2005). The N2 is calculated as N-inputs minus all other outputs; hence N2 is the balancing item of the N-balance. In some cases, the calculated N2 turned out to be negative. In these cases the protein content of the crop has been adjusted to ensure a consistent N-balance.

The emissions related to the input of phosphorus are calculated determining the input of mineral and organic fertiliser in a similar way as for the nitrogen balance. Then the P incorporated in crops and residues is determined considering the characteristics of the crops and it is subtracted from the total input. The quantity in excess is considered as emission.

2.3.2 Livestock activities

The emissions produced from cattle due to the enteric fermentation are determined following IPCC guidelines (IPCC, 2006). Animal parameters[2], which are used in the IPCC's procedure, are also taken from that source because no better one has been found.

In order to allocate the emission to dairy and to meat activities, the total cattle herd (FAOSTAT, 2014) is split according to a procedure based on data from Dalgaard and Schmidt (2012).

The procedure adopted for cattle is also used for buffalos with some obvious variations due to different animal properties and data input (FAOSTAT, 2014).

With regard to sheep, a similar procedure to the cattle herd is applied. Data on the herd and on the production are taken from FAOSTAT (2014). The herd is split in milk and meat systems by mean of a procedure developed that makes use of parameters from IPCC (2006) and from Claeys and Rogers (2003).

Data on the herd composition and the emission factors that are obtained from sheep procedure are also applied for determining emissions from goats. Of course, this is done considering the different animal qualities.

Emissions from pigs and poultry use a procedure developed by the Forwast project (Schmidt, 2010a; Schmidt, 2010b; Schmidt, 2010c; Dalgaard and Schmidt, 2010).

The emission produced by manure excreted on pasture and during the housing in the stall are also allocated to the livestock activities. The procedure applied follows IPCC (2006) and Dalgaard and Schmidt (2012).

2.4 Waste sectors

In this section we describe briefly how the emissions from waste treatment activities are calculated. More information will be included in a specific report on PSUTs and waste accounts that will be published in June 2015. Data sources on waste activities are listed in D5.3 Annex: waste accounts.

In DESIRE, so as in CREEA (Schmidt et al.2 2013; Merciai et al., 2013), waste treatment activity have a great detail and can be modelled properly. A waste treatment activity is any activity that deals with a 'material for treatment'. A 'material for treatment' (Schmidt et al. 2012) includes all the materials that need further re-processing in order to be turned into new products, emissions or stock addition in landfills. This treatment may be re-processing of scrap into new materials that can substitute virgin materials, it may be waste incineration, landfill, waste water treatment, composting, or just storage of uncontrolled discharged waste in the environment involving emissions from degradation.

[2] Animal parameters are feed digestibility, energy density of the feed, body weight of animals, etc.

With regard to the treatment of manure in a conventional way that implies the storage of manure and the application to land, the IPPC (2006) procedure is used with some further sources (Poulsen et al., 1997; Hansen et al., 2008; Dalgaard and Schmidt, 2010).
For all the other activities the FORWAST emission factors have been used (Schmidt, 2010a; Schmidt, 2010b).
FORWAST emission coefficients shows the amount of emissions discharged by waste activities per unit of processed waste. These coefficients are thus connected directly with the use of waste by productive activities.

3 Conclusion

This Annex report describes the compilation of the air emissions dataset in the DESIRE product, and how it is connected to the EXIOBASE 3 industry and product classifications, as they are defined in DESIRE.

The resulting dataset described in this Annex report provides emissions to air which have been calculated for each relevant substance released to the air. Emissions are available for each year (1995-2011), country and

- For combustion emissions per DESIRE industry and per DESIRE product;
- For non-combustion emissions for the supply or use of a specific DESIRE product.

When using these emissions, it is important to note the limitations of the data. Compared to the previous work done in CREEA, now data for a time series of 17 years instead of a single year have been produced, while the available time to produce the dataset was comparable. This implies that simplifications have been made. In TEAM, we have used implied emission factors from the IIASA GAINS model to a large extent, since these data contain the trend in technology over time. Although these data are good, they contain implicit assumptions on technologies and technology penetrations which cannot always be justified. For macro-level use of the emissions, and comparisons at global scale this is not a major issue, but when zooming in to specific products, industries and countries care should be taken in the interpretation of the results. This is clearly illustrated by the comparison of total emissions calculated using TEAM with other datasets, which highlights some of the discrepancies between the datasets. Note that this does not necessarily mean that the DESIRE emissions are wrong. Due to time and budget limitations, it was not possible to look at each of these issues in detail. The choice of using the IIASA GAINS model emission factors leads in some cases to different emission values and different trends compared to other datasets, as shown in this report. We have tried to explain these different trends and values to the extent possible, but due to limited available time not all of these could be examined in detail.

The limitations of the energy data used to calculate the air emissions from combustion uses are described in Annex report energy In the process shown in Figure 10, the main source of uncertainty are the auxiliary activity variables used in the allocation from IEA products and flows, to EXIOBASE 3 products, industries and final use categories. While methodologically speaking we would argue that the allocation process from flows to industries and final use categories is solid – after all we use physical, monetary and other allocation methods that are tailored to each flow depending on its characteristics –, most of the auxiliary data used in this process refers to the year 2007 due to the lack of resources to process all the necessary data for the remaining years. In practice, this means that the emissions by individual industries in the years other than 2007 should be interpreted carefully. For instance, we would argue that the emissions of a given substance of i01 (Agriculture, hunting and related service activities) + i02 (Forestry, logging and related service activities) as a whole in Germany for the year 2001 is reliable, but the same emissions at a lower resolution (e.g. cultivation of wheat; cultivation of vegetables, fruit and nuts; cultivation of plant-based fibres; cattle farming, etc.) is not. The reason why the values for the aggregated i01/i02 industry are considered solid is that the underlying energy data it is very similar to the values of the

IEA flow agriculture/forestry. On the other hand, the allocation to the disaggregated industries uses the physical outputs of those industries in the year 2007, which might differ considerably (or not) from the values of 2001. In this part we should also refer to the allocation from IEA products to EXIOBASE 3 products. While most of the products have a one-to-one equivalence, primary solid biomass and waste products have to be disaggregated into several EXIOBASE 3 products. This is done with 2007 activity data as well, which limits the reliability of the values provided for individual disaggregated products.

All in all, we would argue that the emission accounts from combustion described here provide a good basis to calculate macro-level indicators related to emissions (incl. footprints). The data limitations come into play when looking at the potential for indicators that refer to individual product groups, due to the limitations mentioned in relation with the auxiliary data used in the allocation process. Thus, in the latter case, the results should be interpreted carefully.

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5 Appendix: Linking and aggregation tables

Table 1: Listing and aggregation of sectors for fuel combustion for GAINS

Sector	Description	Aggregated sector
CON_COMB	Oth. En. Sect.: combustion	CON_COMB
CON_COMB1	Fuel production : Combustion, grate firing	
CON_COMB2	Fuel production : Combustion, fluidized bed	
CON_COMB3	Fuel production : Combustion, pulverized	
DOM	Residential, commercial, services, agriculture, etc.	DOM
DOM_FPLACE	Residential-Commercial: Fireplaces	
DOM_MB_A	Residential-Commercial: Medium boilers (<50MW) - automatic	
DOM_MB_M	Residential-Commercial: Medium boilers (<1MW) - manual	
DOM_SHB_A	Residential-Commercial: Single house boilers (<50 kW) - automatic	
DOM_SHB_M	Residential-Commercial: Single house boilers (<50 kW) - manual	
DOM_STOVE_H	Residential-Commercial: Heating stoves	
TRA_OT_LB	Other transport: other off-road; sources with 4-stroke engines (military, households, etc., for GAS also pipeline compressors)	
TRA_OT_LD2	Other transport: off-road; sources with 2-stroke engines	
IN_BO_CHEM	Industry: chemical industry (combustion in boilers)	IN_BO_CHEM
IN_BO_CON	Industry, transformation sector, combustion in boilers	IN_BO_CON
IN_BO_PAP	Industry: paper and pulp production (combustion in boilers)	IN_BO_PAP
IN_BO_OTH	Industry: other sectors; combustion of fossil fuels other than brown coal/lignite and hard coal	IN_BO_OTH
IN_BO_OTH_L	Industry: other sectors; combustion of brown coal/lignite and hard coal in large boilers (> 50 MWth)	
IN_BO_OTH_S	Industry: other sectors; combustion of brown coal/lignite and hard coal in small boilers (< 50 MWth)	
IN_OC	Industry: Other combustion (used in emission tables)	
IN_OC3	Industry: Other combustion, pulverized	
PP_EX_L	Power & district heat plants, existing; coal/lignite fired, large units (> 50 MW th)	PP
PP_EX_OTH	Power & district heat plants existing, non-coal; for GAS - boilers	
PP_EX_S	Power & district heat plants, existing; coal/lignite fired, small units (< 50 MW th)	
PP_IGCC	Power & district heat plants: Integrated Gasification Combined Cycle	
PP_NEW	Power & district heat plants new, non-coal; for GAS - turbines	
PP_NEW_L	Power & district heat plants, new; coal/lignite fired, large units (> 50 MW th)	
TRA_OT	Other transport, non-road	TRA_OT_RAI
TRA_OT_RAI	Other transport: rail	
TRA_OT_AGR	Other transport: agriculture and forestry	TRA_OT_AGR
TRA_OT_AIR	Other transport: air traffic - civil aviation	TRA_OT_AIR
TRA_OT_AIR_DOM	Other transport: domestic air traffic - civil aviation	

TRA_OT_CNS	Other transport: mobile sources in construction and industry	TRA_OT_CNS
TRA_OT_INW	Other transport: inland waterways	TRA_OT_NAV
TRA_OTS_L	Other transport: maritime, large vessels, >1000 GRT	
TRA_OTS_M	Other transport: maritime, medium vessels <1000GRT	
TRA_OT_EV	Evaporative emissions from gasoline vehicles	TRA_RD
TRA_RD_HDB	Heavy duty vehicles - buses	
TRA_RD_HDT	Heavy duty vehicles - trucks	
TRA_RD_LD2	Motorcycles, mopeds and cars with 2-stroke engines	
TRA_RD_LD4C	Light duty vehicles: cars and small buses with 4-stroke engines	
TRA_RD_LD4C_EV	Evaporative emissions from 4-stroke cars	
TRA_RD_LD4T	Light duty vehicles: light commercial trucks with 4-stroke engines	
TRA_RD_LD4T_EV	Evaporative emissions from 4-stroke trucks	
TRA_RD_M4	Motorcycles with 4-stroke engines	

Table 2: Listing and aggregation of fuels in GAINS and their grouping

Fuel	Description	Aggregated fuel
BC1	Brown coal/lignite, grade 1	BROWNCOAL
BC2	Brown coal/lignite, grade 2 (also peat)	
BIOG	Biogas	GAS
CHCOA	Charcoal	CHARCOAL
CRU	Crude oil	CRUDEOIL
DC	Derived coal (coke, briquettes)	COKE
FWD	Fuelwood direct	WOOD
GAS	Gas	GAS
GSL	Gasoline and other light fractions of oil (includes kerosene)	GASOLINE
H2	Hydrogen	HYDROGEN
HC1	Hard coal, grade 1	HARDCOAL
HC2	Hard coal, grade 2	
HC3	Hard coal, grade 3	
HF	Heavy fuel oil	HEAVYFUELOIL
LPG	Liquefied petroleum gas	LPG
MD	Medium distillates (diesel, light fuel oil)	DIESEL
NOF	No fuel use	NOFUEL
OS1	Biomass fuels	WOOD
OS2	Other biomass and waste fuels	WASTE

Table 3: Bridge table between IEA flows and aggregated GAINS sectors

IEA Flow	Aggregated sector
AGRICULT	TRA_OT_AGR
AUTOCHP	PP
AUTOELEC	PP
AUTOHEAT	PP

CHEMICAL	IN_BO_CHEM
COMMPUB	DOM
CONSTRUC	IN_BO_OTH
DOMESAIR	TRA_OT_AIR
DOMESNAV	TRA_OT_NAV
EBIOGAS	CON_COMB
EBKB	CON_COMB
EBLASTFUR	CON_COMB
ECHARCOAL	CON_COMB
ECOALLIQ	CON_COMB
ECOKEOVS	CON_COMB
EGASWKS	CON_COMB
EGTL	CON_COMB
ELNG	CON_COMB
EMINES	CON_COMB
ENONSPEC	CON_COMB
EOILGASEX	CON_COMB
EPATFUEL	CON_COMB
EPOWERPLT	PP
EPUMPST	CON_COMB
EREFINER	CON_COMB
FISHING	TRA_OT_NAV
FOODPRO	IN_BO_OTH
INONSPEC	IN_BO_OTH
IRONSTL	IN_BO_OTH
MACHINE	IN_BO_OTH
MAINCHP	PP
MAINELEC	PP
MAINHEAT	PP
MINING	IN_BO_OTH
NONFERR	IN_BO_OTH
NONMET	IN_BO_OTH
ONONSPEC	IN_BO_OTH
PAPERPRO	IN_BO_PAP
PIPELINE	CON_COMB
RAIL	TRA_OT_RAI
RESIDENT	DOM
ROAD	TRA_RD
TEXTILES	IN_BO_OTH
TRANSEQ	IN_BO_OTH
TRNONSPE	TRA_OT_RAI
WOODPRO	IN_BO_OTH
WORLDAV	TRA_OT_AIR
WORLDMAR	TRA_OT_NAV
AVBUNK	TRA_OT_AIR

MARBUNK	TRA_OT_NAV

Table 4: Bridge table between IEA products and aggregated GAINS fuels

Product	Fuel_agg
ADDITIVE	DIESEL
ANTCOAL	HARDCOAL
AVGAS	GASOLINE
BIODIESEL	DIESEL
BIOGASOL	GASOLINE
BITCOAL	HARDCOAL
BITUMEN	HEAVYFUELOIL
BKB	COKE
BLFURGS	GAS
BROWN	BROWNCOAL
CHARCOAL	CHARCOAL
COALTAR	COKE
COKCOAL	HARDCOAL
COKEOVGS	GAS
CRNGFEED	HEAVYFUELOIL
CRUDEOIL	HEAVYFUELOIL
ELECTR	
ETHANE	GASOLINE
GASCOKE	COKE
GASDIES	DIESEL
GASWKSGS	GAS
GBIOMASS	GAS
GEOTHERM	
HARDCOAL	HARDCOAL
HEAT	
INDWASTE	WASTE
JETGAS	GASOLINE
JETKERO	GASOLINE
LIGNITE	BROWNCOAL
LPG	LPG
LUBRIC	HEAVYFUELOIL
MOTORGAS	GASOLINE
MUNWASTEN	WASTE
MUNWASTER	WASTE
NAPHTHA	GASOLINE
NATGAS	GAS
NGL	GAS
NONCRUDE	DIESEL
OBIOLIQ	DIESEL
ONONSPEC	DIESEL

OTHKERO	GASOLINE
OVENCOKE	COKE
OXYSTGS	GAS
PARWAX	HEAVYFUELOIL
PATFUEL	COKE
PEAT	BROWNCOAL
PETCOKE	COKE
REFFEEDS	HEAVYFUELOIL
REFINGAS	GAS
RENEWNS	
RESFUEL	HEAVYFUELOIL
SBIOMASS	WOOD
SOLARTH	
SUBCOAL	HARDCOAL
WHITESP	GASOLINE

Table 5: Non-combustion emission sectors included in GAINS, and the source of the corresponding activity variable which was used in TEAM

Sector	Description	Aggregated sector	Activity statistics source (in TEAM)	DESIRE product and supply/use
AUTO_P	Manufacture of automobiles	AUTO_P	GAINS	p34, supply
AUTO_P_NEW	Manufacture of automobiles (new installations)	AUTO_P	GAINS	p34, supply
COIL	Coil coating (coating of aluminum and steel)	COIL	GAINS	p28, supply
CONSTRUCT	Construction activities	CONSTRUCT	GAINS	N/A
D_GASST	Gasoline distribution - service stations	D_GASST_GSL	GAINS	p23.20.a, supply
D_REFDEP	Gasoline distribution - transport and depots (used in mobile sources), gasoline	D_REFDEP_GSL	GAINS	p23.20.a, supply
D_REFDEP	Gasoline distribution - transport and depots (used in mobile sources), diesel	D_REFDEP_MD	GAINS	p23.20.a, supply
D_REFDEP_S	Gasoline distribution - transport and depots (used in stationary sources), gasoline	D_REFDEP_S_GSL	GAINS	p23.20.a, supply
D_REFDEP_S	Gasoline distribution - transport and depots (used in stationary sources), diesel	D_REFDEP_S_MD	GAINS	p23.20.a, supply
DECO_P	Decorative paints	DECO_P	GAINS	p24.d, use
DEGR	Degreasing	DEGR	GAINS	p24.d, use
DEGR_NEW	Degreasing (new installations)	DEGR	GAINS	p24.d, use
DOM_OS	Domestic use of solvents (other than paint)	DOM_OS	*Not taken into account (no good activity unit)*	N/A
DRY	Dry cleaning	DRY	GAINS	p24.d, use
DRY_NEW	Dry cleaning (new installations)	DRY	GAINS	p24.d, use
EXD_GAS	Extraction, proc. and distribution of gaseous fuels	EXD_GAS	GAINS	p11.b, supply
EXD_GAS_NEW	Distribution of gaseous fuels - new mains	EXD_GAS	GAINS	p11.b, supply
EXD_LQ	Extraction, proc. and distribution of	EXD_LQ	GAINS	p11.a, supply

	liquid fuels			
EXD_LQ_NEW	Extraction,proc.,distr.of lq.fuels (incl. new (Un)Load	EXD_LQ	GAINS	p11.a, supply
FATOIL	Fat, edible and non-edible oil extraction	FATOIL	GAINS	p15.e, supply
FERTPRO	N - fertilizer production	FERTPRO	GAINS	p24.b, supply
FOOD	Food and drink industry	FOOD		p15.a, supply
GLUE_INH	Industrial application of adhesives (use of high performance solvent based adhesives)	GLUE_INH	GAINS	p24.d, use
GLUE_INT	Industrial application of adhesives (use of traditional solvent based adhesives)	GLUE_INT	GAINS	p24.d, use
IND_OS	Other industrial use of solvents	IND_OS	GAINS	p24.d, use
IND_OTH	Other industrial sources	IND_OTH	*Not taken into account (too diffuse)*	N/A
IND_P_CNT	Industrial paint applications - General industry (continuous processes)	IND_P_CNT	GAINS	p24.d, use
IND_P_OT	Industrial paint applications - General industry	IND_P_OT	GAINS	p24.d, use
IND_P_PL	Industrial paint applications - General industry (plastic parts)	IND_P_PL	GAINS	p24.d, use
INORG	Inorganic chemical industry, fertilizers and other	INORG	GAINS	p24.d, supply
LEATHER	Leather coating	LEATHER	GAINS	p19, supply
MINE_BC	Mining: Brown coal	MINE_BC	IEA flow INDPROD, product LIGNITE	p10.f, supply
MINE_BC_POST	Mining: Brown coal -post-mining emissions			p10.f, supply
MINE_BC_PRE	Mining: Brown coal -pre-mining emissions			p10.f, supply
MINE_BC_VAM	Mining: Brown coal -emissions released during mining			p10.f, supply
MINE_HC	Mining: Hard coal	MINE_HC	IEA flow INDPROD, products ANTCOAL, BITCOAL, COKCOAL, SUBCOAL	p10.a, supply
MINE_HC_POST	Mining: Hard coal -post-mining emissions			p10.a, supply
MINE_HC_PRE	Mining: Hard coal -pre-mining emissions			p10.a, supply
MINE_HC_VAM	Mining: Hard coal -emissions released during mining (ventilation air methane)			p10.a, supply
MINE_OTH	Mining: Bauxite, copper, iron ore, zinc ore, manganese ore, other	MINE_OTH	UN statistics for ores and concentrates of iron, copper, nickel, aluminium (bauxite), gold, silver, platinum, tin, lead, zinc chromium, molybdenum	p13.20.13, supply
ORG_STORE	Organic chemical industry, storage	ORG_STORE	GAINS	p24.d, supply
OTH_ORG_PR	Organic chemical industry - downstream units	OTH_ORG_PR	GAINS	p24.d, supply
PHARMA	Pharmaceutical industry	PHARMA	GAINS	p24.d, use
PIS	Products incorporating solvents	PIS	GAINS	p24.d, use
PLSTYR_PR	Polystyrene processing	PLSTYR_PR	GAINS	p24.a, supply
PR_ADIP	adipic acid production	PR_ADIP	GAINS	p24.d, supply

PR_ALPRIM	Ind. Process: Aluminum production - primary	PR_ALPRIM	GAINS	p27.42, supply
PR_ALSEC	Ind. Process: Aluminum production - secondary	PR_ALSEC	GAINS	p27.42w, supply
PR_BAOX	Ind. Process: Basic oxygen furnace	PR_BAOX	GAINS	p27.a, supply
PR_BRICK	Ind. Process: Bricks production	PR_BRICK	GAINS	p14.1, supply
PR_BRIQ	Ind. Process: Briquettes production	PR_BRIQ	GAINS	p10.g, supply
PR_CAST	Ind. Process: Cast iron (grey iron foundries)	PR_CAST	GAINS	p27.a, supply
PR_CAST_F	Ind. Process: Cast iron (grey iron foundries) (fugitive)	PR_CAST	GAINS	p27.a, supply
PR_CBLACK	Ind. Process: Carbon black production	PR_CBLACK	GAINS	p24.d, supply
PR_CEM	Ind. Process: Cement production	PR_CEM	GAINS	p26.d, supply
PR_COKE	Ind. Process: Coke oven	PR_COKE	IEA flow INDPROD, products GASCOKE, OVENCOKE	p23.1.b, supply
PR_EARC	Ind. Process: Electric arc furnace	PR_EARC	GAINS	p27.a, supply
PR_FERT	Ind. Process: Fertilizer production	PR_FERT	UN statistics: nitrogenous fertilizers	p24.b, supply
PR_GLASS	Ind. Process: Glass production (flat, blown, container glass)	PR_GLASS	UN statistics: drawn glass and blown glass	p26.a, supply
PR_HEARTH	Ind. Process: Open hearth furnace	PR_HEARTH	GAINS	p27.a, supply
PR_LIME	Ind. Process: Lime production	PR_LIME	GAINS	p26.d, supply
PR_NIAC	Ind. Process: Nitric acid	PR_NIAC	GAINS	p24.d, supply
PR_OT_NFME	Ind. Process: Other non-ferrous metals prod. - primary and secondary	PR_OT_NFME	UN statistics: unrefined copper, refined copper, nickel, refined lead, zinc	p27.44, supply
PR_OTHER	Ind. Process: Production of glass fiber, gypsum, PVC, other	PR_OTHER	*Not taken into account (too diffuse)*	N/A
PR_PELL	Ind. Process: Agglomeration plant - pellets	PR_PELL	GAINS	p27.a, supply
PR_PIGI	Ind. Process: Pig iron, blast furnace	PR_PIGI	GAINS	p27.a, supply
PR_PIGI_F	Ind. Process: Pig iron, blast furnace (fugitive)	PR_PIGI	GAINS	p27.a, supply
PR_PULP	Ind. Process: Paper pulp mills	PR_PULP	UN statistics: chemical wood pulp, semi-chemical wood pulp	p21.1, supply
PR_REF	Ind. Process: Crude oil & other products - input to Petroleum refineries	PR_REF	IEA	p11.a, use
PR_SINT	Ind. Process: Agglomeration plant - sinter	PR_SINT	GAINS	p27.a, supply
PR_SINT_F	Ind. Process: Agglomeration plant - sinter (fugitive)	PR_SINT	GAINS	p27.a, supply
PR_SMIND_F	Ind. Process: Small industrial and business facilities - fugitive	PR_SMIND	*Not taken into account (too diffuse)*	N/A
PR_SUAC	Ind. Process: Sulfuric acid	PR_SUAC	GAINS	p24.d, supply
PROD	Production of oil or gas (depending on activity abbreviation)	PROD_CRU	IEA flow INDPROD, product CRUDEOIL or NATGAS	p11.a, supply

PROD	Production of oil or gas (depending on activity abbreviation)	PROD_GAS	IEA flow INDPROD, product CRUDEOIL or NATGAS	p11.a, supply
PROD_AGAS	Production of oil or gas: emissions from venting of associated gas	PROD_VENT	IEA flow INDPROD, product CRUDEOIL or NATGAS	#N/A
PROD_LEAK	Production of oil or gas: emissions from unintended leakage during extraction	PROD_LEAK	IEA flow INDPROD, product CRUDEOIL or NATGAS	#N/A
PRT_OFFS	Printing, offset	PRT_OFFS	GAINS	p24.d, use
PRT_OFFS_NEW	Printing, offset, new installations	PRT_OFFS	GAINS	p24.d, use
PRT_PACK	Flexography and rotogravure in packaging	PRT_PACK	GAINS	p24.d, use
PRT_PACK_NEW	Flexography and rotogravure in packaging, new installat	PRT_PACK	GAINS	p24.d, use
PRT_PUB	Rotogravure in publication	PRT_PUB	GAINS	p24.d, use
PRT_PUB_NEW	Rotogravure in publication, new installations	PRT_PUB	GAINS	p24.d, use
PRT_SCR	Screen printing	PRT_SCR	GAINS	p24.d, use
PRT_SCR_NEW	Screen printing, new installations	PRT_SCR	GAINS	p24.d, use
PVC_PR	Polyvinylchloride produceduction by suspension process	PVC_PR	UN statistics, polyvinyl chloride	p24.a, supply
RES_BBQ	Residential: Meat frying, food preparation, BBQ	RES_BBQ	*Not taken into account (no good activity unit)*	N/A
RES_CIGAR	Residential: Cigarette smoking	RES_CIGAR	*Not taken into account (no good activity unit)*	N/A
RES_FIREW	Residential: Fireworks	RES_FIREW	*Not taken into account (no good activity unit)*	N/A
SHOE	Manufacturing of shoes	SHOE	GAINS	#N/A
STCRACK_PR	Steam cracking (ethylene and propylene production)	STCRACK_PR	UN statistics, Polypropylene	p24.d, supply
STH_AGR	Storage and handling: Agricultural products (crops)	STH_AGR	*Not taken into account (no good activity unit)*	N/A
STH_COAL	Storage and handling: Coal	STH_COAL	*Not taken into account (no good activity unit)*	N/A
STH_FEORE	Storage and handling: Iron ore	STH_FEORE	*Not taken into account (no good activity unit)*	N/A
STH_NPK	Storage and handling: N,P,K fertilizers	STH_NPK	*Not taken into account (no good activity unit)*	N/A
STH_OTH_IN	Storage and handling: Other industrial products (cement, bauxite, coke)	STH_OTH_IN	*Not taken into account (no good activity unit)*	N/A
SYNTH_RUB	Synthetic rubber production	SYNTH_RUB	GAINS	p25, supply
TRANS	Transportation of GAS	TRANS_GAS	*Not taken into account (too diffuse)*	N/A
TYRES	Tyre production	TYRES	GAINS	p25, use
VEHR_P	Vehicle refinishing	VEHR_P	GAINS	p24.d, use
VEHR_P_NEW	Vehicle refinishing (new installations)	VEHR_P	GAINS	p24.d, use
VEHTR	Treatment of vehicles	VEHTR	*Not taken into*	N/A

			account (no good activity unit)	
WASTE_FLR	Waste: Flaring in gas and oil industry	WASTE_FLR	*Not taken into account (no good activity unit)*	N/A
WIRE	Winding wire coating	WIRE	GAINS	p24.d, use
WOOD	Wood preservation (not creosote)	WOOD	*Not taken into account (no good activity unit)*	N/A
WOOD_CR	Wood preservation (creosote)	WOOD_CR	*Not taken into account (no good activity unit)*	N/A
WOOD_P	Wood coating	WOOD_P	*Not taken into account (no good activity unit)*	N/A

Development of a System of Indicators for a Resource efficient Europe

DESIRE
Development of a System of Indicators for a Resource Efficient Europe

D5.3 Integrated report on EE IO related macro resource indicator time series

Annex - Water

Authors:
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About DESIRE

DESIRE is a FP7 project that will develop and apply an optimal set of indicators to monitor European progress towards resource-efficiency. The project runs from September 2012 to February 2016. We propose a combination of time series of environmentally extended input output data (EE IO) and the DPSIR framework to construct the indicator set. Only this approach will use a single data set that allows for consistent construction of resource efficiency indicators capturing the EU, country, sector and product group level, and the production and consumption perspective including impacts outside the EU. The project will:

- Improve data availability, particularly by creating EE IO time series and now-casted data
- Improve calculation methods for indicators that currently still lack scientific robustness, most notably in the field of biodiversity/ecosystem services and critical materials. We further will develop novel reference indicators for economic success.
- Explicitly address the problem of indicator proliferation and limits in available data that have a 'statistical stamp'. Via scientific analysis we will select the smallest set of indicators giving mutually independent information, and show which shortcuts in (statistical) data inventory can be made without significant loss of quality.

The project comprises further Interactive policy analysis, indicator concept development via 'brokerage' activities, Management, and Conclusions and implementation including a hand over of data and indicators to the EU's Group of Four of EEA, Eurostat, DG ENV and DG JRC.

Partners are:

1. The Netherlands Organisation for Applied Scientific Research (TNO), Delft, Netherlands
2. Wuppertal Institute (WI), Wuppertal, Germany
3. Alpen Adria University - Institute of Social Ecology (UNI-KLU), Vienna, Austria
4. Institute of Environmental Sciences, University of Leiden (UL-CML), Leiden, Netherlands
5. Sustainable Europe Research Institute (SERI), Vienna, Austria
6. Norwegian University of Technology (NTNU), Trondheim, Norway
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Contents

Summary

For the compilation of the environmental extensions in the areas of water use and water consumption for the EXIOBASE v3.0 the two basic data sources used were the Water Footprint dataset (Mekonnen and Hoekstra 2011) for agricultural water consumption based on FAO data and the WaterGAP model (Flörke et al. 2013) for industrial water use and water consumption. These databases are currently among the most comprehensive global databases with the agricultural water consumption datasets encompassing a vast amount of agricultural categories and the WaterGAP data set covering a large number of livestock categories as well as electricity producing and manufacturing sectors; the latter being an area where special requirements of an MRIO system meet the general poor data coverage situation. The extensions on water use and water consumption in the EXIOBASE encompass 13 categories for water consumption in agricultural activities for both green and blue water, 12 categories of blue water consumption in livestock production, 7 blue water consumption categories in aggregated manufacturing sectors and 2 related to electricity production. For the 7 manufacturing and the 2 electricity production sectors, also data on withdrawal of blue water are provided. The WaterGAP model currently covers a time period 1950-2010. Values for 2011 were extrapolated. Currently published Water Footprint data cover the period 1996-2005 – with an average value provided for 2007 being used to up- and downscale data on agricultural production for the years 1995-2011. Furthermore, the data were extended in the area of water requirements for grazing.

1 Introduction

Task 5.2b in the DESIRE project was devoted to the compilation of macro-resource accounts. Point 4) under 5.2b concerns the resource category of "water accounts", i.e. the compilation of a data set reflecting the abstraction and hydrological consumption (abstraction minus return flows) of water for economic purposes (see Box for terminologies).

Blue water: Fresh surface and groundwater - water in freshwater lakes, rivers and aquifers.

Green water: Precipitation on land that does not run off or recharge the groundwater but is stored in the soil or temporarily stays on top of the soil or vegetation.

Grey water: Volume of freshwater required to assimilate the load of pollutants based on natural background concentrations and existing ambient water quality standards.

Water abstraction: Volume of freshwater withdrawal from surface or groundwater: in accounting terms, the amount of water abstracted from a water body for economic activities is called "water use", while the difference between abstraction and returns – often termed "consumptive use" is called "water consumption.

Water accounting: A systematic method of organizing and presenting information relating to the physical volumes and flows of water in the environment as well as the economic values of water through cost-benefit analysis.

Water consumption: Volume of freshwater used and then evaporated or incorporated into a product. (also: abstraction minus return flows)

Water appropriation: In this report, we use this term to when subsuming water use and consumption.

Watershed/catchment/river basin: The area of land drained by a river and its tributaries (the term is synonymous with drainage basin).

The compilation of the data set was strictly aligned with the UN-SEEA Water (United Nations, 2012b), the UN International Recommendations for Water Statistics (United Nations, 2012a) and the recent water accounting framework set up by members of the project team for Eurostat. However, as a data screening exercise already showed in the course of the CREEA project, real data on water abstraction and consumption are scarce – especially on the international level, which was the reason to use modelled data (Lutter et al., 2014).

For the compilation of the water use/consumption extensions for the EXIOBASE set up and compiled in the EXIOPOL and CREEA projects, the main data sources used were the ETH dataset (Pfister and Bayer, 2013; Pfister et al., 2011) and the Water Footprint dataset (Mekonnen and Hoekstra 2011) for agricultural water consumption and the WaterGAP model (Flörke et al. 2013) for industrial water use/consumption. These databases are currently among the most comprehensive global databases with the agricultural water consumption datasets encompassing a vast amount of agricultural categories and the WaterGAP data set covering a large number of livestock categories as well as manufacturing sectors – the latter being an area where special requirements of an MRIO system meet the general poor data coverage situation. In DESIRE, the two basic data sources used were the Water Footprint dataset (Mekonnen and Hoekstra

2011) for agricultural water consumption based on FAO data and the WaterGAP model (Flörke et al. 2013) for industrial water use and water consumption.

The water use/consumption extensions in the EXIOBASE encompass the following categories (see Table 1 in the next chapter). They include 13 categories for water consumption in agricultural activities for both green and blue water, 12 categories of blue water consumption in livestock production, 7 blue water consumption categories in aggregated manufacturing sectors and 2 related to electricity production. For the 7 manufacturing and the 2 electricity production sectors, also data on withdrawal of blue water are provided.

2 Method

In the following, we describe the data collection procedures on water abstraction and consumption applied for the main areas of water appropriation: agriculture, livestock breeding, manufacturing, electricity production, and domestic use. In this context, it has to be noted that methods and data used for the development of the EXIOBASE 2.0 (CREEA) were also used for the EXIOBASE 3.0. In some cases methodological improvements were applied or additional working steps introduced, which will be explained in the following chapters.

2.1 Agricultural water consumption

2.1.1 Data sources

For the EXIOBASE 3.0 extensions we retrieved data on water consumption in the agricultural sector from the Water Footprint dataset (Mekonnen and Hoekstra 2011). Data are provided on blue and green water consumption for a large number of countries and agricultural products.

Here we face a similar situation as in the case of the WaterGAP data which was used for the other sectors: currently published data cover a period which is shorter (1996-2005) than the one envisaged for DESIRE (1995-2011). Provided are average values, and in the course of the CREEA project these averages had been upscaled with data on agricultural production for the year 2007. We applied a similar approach for extending the data to the years 1995-2011. Hence, the data was up- and downscaled from the available Water Footprint data set with agricultural production data. Given the ongoing scientific collaboration with the University of Twente in the course of the CREEA project the best suited procedure was discussed and implemented.

To derive data for fodder crops, an approximation-method was applied. Using the average crop water use of fodder crops (averaged over the period 1996-2005) and dividing its values by the referring yields obtained from the FAO, and finally multiplying this outcome with production data obtained from the FAO, allows calculating an approximate for the water-consumption of fodder crops (consumption of green water and blue water) for several countries for the period 1995 to 2011. Due to the lack of annual data for the average crop water use, these values are assumed to be equal for all years of the considered period. Furthermore, the countries for which either data on yield or on the average crop water use was missing were excluded from the final data set.

Additionally, a crude estimate for water consumption of grazing was included in the final data set. The calculation was based on averaged water footprint data for the consumption of green water (averaged over the period 1996-2005) provided in literature (Mekonnen and Hoekstra, 2011). However, as no annual disaggregation is available, it is assumed that for each year an equal amount of green water is consumed of the considered countries, respectively.

2.1.2 Allocation of extensions to EXIOBASE sectors

The green and blue water footprint calculations were done at a detailed country and crop level. 206 individual countries and 146 crops were studied. In comparison, EXIOBASE's classification provides 44 individual countries and 5 world regions. The crops are further grouped into 8 EXIOBASE product and industry classes. Therefore, the final water footprint data were provided after aligning the detailed level of Footprint data with the EXIOBASE classification. The alignment of the FAO detailed crop list to the EXIOBASE classification is shown Table 1.

Table 1: Correspondence between FAO's crop classification and EXIOBASE product & industry classification

FAO classification		EXIOBASE classification					
FAOSTAT crop code	Crop	EXIOBASE product Code1	EXIOBASE product Code2	EXIOBASE Product	EXIOBASE Industry Code1	EXIOBASE Industry Code2	EXIOBASE Industry
27	Rice, paddy	C_PARI	p01.a	Paddy rice	A_PARI	i01.a	Cultivation of paddy rice
15	Wheat	C_WHEA	p01.b	Wheat	A_WHEA	i01.b	Cultivation of wheat
44	Barley	C_OCER	p01.c	Cereal grains nec	A_OCER	i01.c	Cultivation of cereal grains nec
89	Buckwheat						
101	Canary seed						
108	Cereals, nes						
94	Fonio						
56	Maize						
79	Millet						
103	Mixed grain						
75	Oats						
92	Quinoa						
71	Rye						
83	Sorghum						
97	Triticale						
216	Brazil nuts, with shell	C_FVEG	p01.d	Vegetables, fruit, nuts	A_FVEG	i01.d	Cultivation of vegetables, fruit, nuts
217	Cashew nuts, with shell						
220	Chestnuts						
221	Almonds, with shell						
222	Walnuts, with shell						
223	Pistachios						
225	Hazelnuts, with shell						
226	Areca nuts (betel)						
234	Nuts, nes						
358	Cabbages and other brassicas						
366	Artichokes						
367	Asparagus						
372	Lettuce and chicory						
373	Spinach						
388	Tomatoes						
393	Cauliflowers and broccoli						
394	Pumpkins, squash and gourds						
397	Cucumbers and gherkins						
399	Eggplants (aubergines)						
401	Chillies and peppers, green						
402	Onions (inc. shallots), green						
403	Onions, dry						
406	Garlic						
414	Beans, green						
417	Peas, green						
423	String beans						
426	Carrots and turnips						
430	Okra						
446	Maize, green						
461	Carobs						
463	Vegetables fresh nes						
486	Bananas						

FAO classification		EXIOBASE classification					
FAOSTAT crop code	Crop	EXIOBASE product Code1	EXIOBASE product Code2	EXIOBASE Product	EXIOBASE Industry Code1	EXIOBASE Industry Code2	EXIOBASE Industry
489	Plantains						
490	Oranges						
495	Tangerines, mandarins, clem.						
497	Lemons and limes						
507	Grapefruit (inc. pomelos)						
512	Citrus fruit, nes						
515	Apples						
521	Pears						
526	Apricots						
530	Sour cherries						
531	Cherries						
534	Peaches and nectarines						
536	Plums and sloes						
541	Stone fruit, nes						
544	Strawberries						
547	Raspberries						
549	Gooseberries						
550	Currants						
552	Blueberries						
554	Cranberries						
558	Berries Nes						
560	Grapes						
567	Watermelons						
568	Other melons (inc.cantaloupes)						
569	Figs						
571	Mangoes, mangosteens, guavas						
572	Avocados						
574	Pineapples						
577	Dates						
591	Cashewapple						
592	Kiwi fruit						
600	Papayas						
603	Fruit, tropical fresh nes						
619	Fruit Fresh Nes						
236	Soybeans	C_OILS	p01.e	Oil seeds	A_OILS	i01.e	Cultivation of oil seeds
242	Groundnuts, with shell						
249	Coconuts						
254	Oil palm fruit						
260	Olives						
265	Castor oil seed						
267	Sunflower seed						
270	Rapeseed						
280	Safflower seed						
289	Sesame seed						
292	Mustard seed						
296	Poppy seed						
299	Melonseed						
328	Seed cotton						
328	Seed cotton						
333	Linseed						
336	Hempseed						
339	Oilseeds, Nes						
156	Sugar cane	C_SUGB	p01.f	Sugar cane, sugar beet	A_SUGB	i01.f	Cultivation of sugar cane, sugar beet
157	Sugar beet						
161	Sugar crops, nec						
773	Flax fibre and tow	C_FIBR	p01.g	Plant-based fibers	A_FIBR	i01.g	Cultivation of plant-based fibers
777	Hemp Tow Waste						
780	Jute						
782	Other Bastfibres						
788	Ramie						
789	Sisal						
800	Agave Fibres Nes						
809	Manila Fibre (Abaca)						
821	Fibre Crops Nes						
116	Potatoes	C_OTCR	p01.h	Crops nec	A_OTCR	i01.h	Cultivation

FAO classification		EXIOBASE classification					
FAOSTAT crop code	Crop	EXIOBASE product Code1	EXIOBASE product Code2	EXIOBASE Product	EXIOBASE Industry Code1	EXIOBASE Industry Code2	EXIOBASE Industry
122	Sweet potatoes						of crops nec
125	Cassava						
135	Yautia (cocoyam)						
136	Taro (cocoyam)						
137	Yams						
149	Roots and Tubers, nes						
176	Beans, dry						
181	Broad beans, horse beans, dry						
187	Peas, dry						
191	Chick peas						
195	Cow peas, dry						
197	Pigeon peas						
201	Lentils						
203	Bambara beans						
205	Vetches						
210	Lupins						
211	Pulses, nes						
656	Coffee, green						
661	Cocoa beans						
667	Tea						
677	Hops						
687	Pepper (Piper spp.)						
689	Chillies and peppers, dry						
692	Vanilla						
693	Cinnamon (canella)						
698	Cloves						
702	Nutmeg, mace and cardamoms						
711	Anise, badian, fennel, corian.						
720	Ginger						
723	Spices, nes						
748	Peppermint						
826	Tobacco, unmanufactured						
836	Natural rubber						
	Fodder crops						

The final result was a table with the following data detail for every EXIOBASE country (group) disaggregated into specific spread sheets for each year:

- PhysicalTypeName (= Extension Name)
- ProductTypeCode
- CountryCode
- AccountingYear
- Amount
- UnitCode

2.2 Livestock breeding

2.2.1 Data sources

For the EXIOBASE 3.0 extensions we retrieved data on water use in the livestock breeding sector from the WaterGAP model which was designed to estimate current and future water withdrawals and consumption of the domestic, industrial, and agricultural sectors. Detailed methodological and model descriptions can be found in earlier deliverables for the EXIOPOL project (Lutter and Giljum, 2009) as well as in Flörke et al. (2013) and Alcamo et al. (2003).

The WaterGAP model currently covers a time period of 1950-2010, with most data being available since1990 and earlier years being estimated. The University of Kassel provided the EXIOPOL/CREEA team with the data for the years 2000 and 2007 and for DESIRE also provided the data for the missing years (1995-2010). Due to missing values for 2011 the values for 2010 were taken as the best available estimate for 2011.

As in previous versions of the EXIOBASE, for this sector the data delivered encompassed blue water use in mio m³ for the following livestock categories:

- Dairy cattle
- Non-dairy cattle
- Pigs
- Sheep
- Goats
- Buffaloes
- Camels
- Horses
- Chicken
- Turkeys
- Ducks
- Geese
- total livestock

2.2.2 Allocation of extensions to EXIOBASE products

These data were "translated" into water extensions. The following Table 2 illustrates the list of WaterGAP livestock categories and their allocation to DESIRE water extensions.

Table 2: WaterGAP livestock categories and allocation to DESIRE water extensions

WaterGAP category	EXIOBASE extension name	EXIOBASE extension code
Dairy cattle	Water Consumption Blue - Livestock - dairy cattle	WCB_1.14
Non-dairy cattle	Water Consumption Blue - Livestock - nondairy cattle	WCB_1.15
Pigs	Water Consumption Blue - Livestock - pigs	WCB_1.16
Sheep	Water Consumption Blue - Livestock - sheep	WCB_1.17
Goats	Water Consumption Blue - Livestock - goats	WCB_1.18
Buffaloes	Water Consumption Blue - Livestock - buffaloes	WCB_1.19
Camels	Water Consumption Blue - Livestock - camels	WCB_1.20
Horses	Water Consumption Blue - Livestock - horses	WCB_1.21
Chicken	Water Consumption Blue - Livestock - chicken	WCB_1.22
Turkeys	Water Consumption Blue - Livestock - turkeys	WCB_1.23
Ducks	Water Consumption Blue - Livestock - ducks	WCB_1.24
Geese	Water Consumption Blue - Livestock - geese	WCB_1.25

In a next step, the allocation of the WaterGAP livestock categories (and the respective extensions) had to be allocated to the relevant EXIOBASE products. Table 3 illustrates this allocation.

Table 3: WaterGAP livestock categories and allocation to EXIOBASE products

WaterGAP category	EXIOBASE product name	EXIOBASE product code1	EXIOBASE product code2
Dairy cattle	Cattle	p01.i	C_CATL
Non-dairy cattle	Cattle	p01.i	C_CATL
Pigs	Pigs	p01.j	C_PIGS
Sheep	Meat animals nec	p01.l	C_OMEA
Goats	Meat animals nec	p01.l	C_OMEA
Buffaloes	Meat animals nec	p01.l	C_OMEA
Camels	Meat animals nec	p01.l	C_OMEA
Horses	Meat animals nec	p01.l	C_OMEA
Chicken	Poultry	p01.k	C_PLTR
Turkeys	Poultry	p01.k	C_PLTR
Ducks	Poultry	p01.k	C_PLTR
Geese	Poultry	p01.k	C_PLTR

The final result was a table with the following data detail for every EXIOBASE country (group) disaggregated into specific spread sheets for each year:

- PhysicalTypeName (= Extension Name)
- ProductTypeCode
- CountryCode
- AccountingYear
- Amount
- UnitCode

2.3 Manufacturing

2.3.1 Data sources

For the EXIOBASE 3.0 extensions for the manufacturing sector we also retrieved data on water use and consumption from the WaterGAP model. Also in this case, the University of Kassel provided the DESIRE team with data for the period 1995-2010.Due to missing values for 2011 the values for 2010 were taken as the best available estimate for 2011.

For this sector the data delivered encompassed blue water withdrawals (= water use) as well as water consumption for the manufacturing sector as a whole in mio m^3. In a first step, as in the previous version of the EXIOBASE, the data were disaggregated into seven manufacturing sectors using the shares in total water use and consumption of the following sub-sectors from the pre-version of the water gap model (which had been used for the EXIOBASE 1.0):

- Food products, beverages and tobacco
- Textiles and textile products
- Pulp, paper, publishing and printing
- Chemicals, man-made fibres
- Non-metallic, mineral products
- Basic metals and fabrication of metals
- Other manufacturing

As for Croatia no disaggregation shares were available (not member of the EU in the year 2000, the base year of EXIOBASE 1.0), the shares of Slovenia were used for the neighbouring country. Due to the lack of more specific data only one "set of shares" for the total rest of the world was used for the different EXIOBASE rest of the world categories.

2.3.2 Allocation of extensions to EXIOBASE sectors

In a next step, the different manufacturing categories were allocated to the specific extension names and codes.

Table 4: WaterGAP manufacturing categories and allocation to DESIRE water extensions

WaterGAP category	EXIOBASE extension name	Extension code
Water Withdrawal food products, beverages and tobacco	Water Withdrawal Blue - Manufacturing - food products, beverages and tobacco	WWB_2.1
Water Withdrawal textiles and textile products	Water Withdrawal Blue - Manufacturing - textiles and textile products	WWB_2.2
Water Withdrawal pulp, paper, publishing and printing	Water Withdrawal Blue - Manufacturing - pulp, paper, publishing and printing	WWB_2.3
Water Withdrawal chemicals, man-made fibres	Water Withdrawal Blue - Manufacturing - chemicals, man-made fibres	WWB_2.4
Water Withdrawal non-metallic, mineral products	Water Withdrawal Blue - Manufacturing - non-metallic, mineral products	WWB_2.5
Water Withdrawal basic metals and fabrication of metals	Water Withdrawal Blue - Manufacturing - basic metals and fabrication of metals	WWB_2.6
Water Withdrawal other manufacturing	Water Withdrawal Blue - Manufacturing - other manufacturing	WWB_2.7
Water Consumption food products, beverages and tobacco	Water Consumption Blue - Manufacturing - food products, beverages and tobacco	WCB_2.1
Water Consumption textiles and textile products	Water Consumption Blue - Manufacturing - textiles and textile products	WCB_2.2
Water Consumption pulp, paper, publishing and printing	Water Consumption Blue - Manufacturing - pulp, paper, publishing and printing	WCB_2.3
Water Consumption chemicals, man-made fibres	Water Consumption Blue - Manufacturing - chemicals, man-made fibres	WCB_2.4
Water Consumption non-metallic, mineral products	Water Consumption Blue - Manufacturing - non-metallic, mineral products	WCB_2.5
Water Consumption basic metals and fabrication of metals	Water Consumption Blue - Manufacturing - basic metals and fabrication of metals	WCB_2.6
Water Consumption other manufacturing	Water Consumption Blue - Manufacturing - other manufacturing	WCB_2.7

Following that step, the quantities of water use and consumption in the different manufacturing sectors (and their respective extensions) were allocated to different product categories according to the physical output data also compiled in WP 5. Table 5 shows the allocation.

Table 5: WaterGAP manufacturing categories and allocation to EXIOBASE products

WaterGAP manufacturing sectors	EXIOBASE Product groups
Food products, beverages and tobacco	p15/16
Textiles and textile products	p17/18/19
Pulp, paper, publishing and printing	p21/22
Chemicals, man-made fibres	p24
Non-metallic, mineral products	p26
Basic metals and fabrication of metals	p27
Other manufacturing	p28-36

The final result was a table with the following data detail for every EXIOBASE country (group) disaggregated into specific spread sheets for each year:

- PhysicalTypeName (= Extension Name)
- ProductTypeCode
- CountryCode
- AccountingYear
- Amount
- UnitCode

2.4 Electricity production

2.4.1 Data sources

For the EXIOBASE 3.0 extensions for the electricity producing sectors we also retrieved data on water use and consumption from the WaterGAP model. Also in this case, the University of Kassel provided the DESIRE team with data for the period 1995-2010. Due to missing values for 2011 the values for 2010 were taken as the best available estimate for 2011.

For this sector the data delivered encompassed blue water withdrawals (= water use) as well as water consumption for electricity production with tower cooling and once-through cooling as well as for the electricity production as a whole in mio m^3. Based on data from the March 2012 version of the commercially available UDI World Electric Power Plants database (WEPP), a comprehensive inventory of electric power generating units with global coverage(Platts, 2012), an estimate was calculated how much of the electricity produced in a country comes from power plants with tower cooling, once-through cooling or systems without any cooling system installed (see Lutter et al., 2013). These shares calculated for the year 2007 (EXIOBASE 2.0) were applied to the physical quantities by type of produced electricity as identified in the physical SUTs, for all years of the period 1995-2011. Finally, the physical quantities of water abstracted and consumed through tower or once-through cooling were allocated to the different relevant types of electricity production via these relationships of electricity production. The following types of electricity production were assumed to be using water cooling:

- Electricity by coal
- Electricity by gas
- Electricity by nuclear
- Electricity by petroleum and other oil derivatives
- Electricity by biomass and waste
- Electricity by solar thermal
- Electricity by geothermal

For Croatia, similarly to the manufacturing dataset, the cooling shares of Slovenia were used, as Croatia had not been Member State of the EU in the year 2007 for which the cooling shares were calculated.

2.4.2 Allocation of extensions to EXIOBASE sectors

In the following step product codes and extension codes were allocated to ensure the water data are fed correctly into the MRIO network:

Table 6: Water extensions and allocation to EXIOBASE products for the electricity producing sector

EXIOBASE product name	EXIOBASE product code1	EXIOBASE product code1	EXIOBASE extension name	Extension code
Electricity by coal	p40.11.a	C_POWC	Water Withdrawal Blue - Electricity - tower - Electricity by coal	WWB_3.1
Electricity by gas	p40.11.b	C_POWG	Water Withdrawal Blue - Electricity - tower - Electricity by gas	WWB_3.1
Electricity by nuclear	p40.11.c	C_POWN	Water Withdrawal Blue - Electricity - tower - Electricity by nuclear	WWB_3.1
Electricity by petroleum and other oil derivatives	p40.11.f	C_POWP	Water Withdrawal Blue - Electricity - tower - Electricity by petroleum and other oil derivatives	WWB_3.1
Electricity by biomass and waste	p40.11.g	C_POWB	Water Withdrawal Blue - Electricity - tower - Electricity by biomass and waste	WWB_3.1
Electricity nec	p40.11.l	C_POWZ	Water Withdrawal Blue - Electricity - tower - Electricity nec	WWB_3.1
Electricity by gas	p40.11.b	C_POWG	Water Withdrawal Blue - Electricity - once-through - Electricity by gas	WWB_3.2
Electricity by nuclear	p40.11.c	C_POWN	Water Withdrawal Blue - Electricity - once-through - Electricity by nuclear	WWB_3.2
Electricity by petroleum and other oil derivatives	p40.11.f	C_POWP	Water Withdrawal Blue - Electricity – once-through - Electricity by petroleum and other oil derivatives	WWB_3.2
Electricity by biomass and waste	p40.11.g	C_POWB	Water Withdrawal Blue - Electricity - once-through - Electricity by biomass and waste	WWB_3.2
Electricity nec	p40.11.l	C_POWZ	Water Withdrawal Blue - Electricity - once-through - Electricity nec	WWB_3.2
Electricity by coal	p40.11.a	C_POWC	Water Consumption Blue - Electricity - tower - Electricity by coal	WCB_3.1
Electricity by gas	p40.11.b	C_POWG	Water Consumption Blue - Electricity - tower - Electricity by gas	WCB_3.1
Electricity by nuclear	p40.11.c	C_POWN	Water Consumption Blue - Electricity - tower - Electricity by nuclear	WCB_3.1
Electricity by petroleum and other oil derivatives	p40.11.f	C_POWP	Water Consumption Blue - Electricity – tower - Electricity by petroleum and other oil derivatives	WCB_3.1
Electricity by biomass and waste	p40.11.g	C_POWB	Water Consumption Blue - Electricity - tower - Electricity by biomass and waste	WCB_3.1
Electricity nec	p40.11.l	C_POWZ	Water Consumption Blue - Electricity - tower - Electricity nec	WCB_3.1
Electricity by gas	p40.11.b	C_POWG	Water Consumption Blue - Electricity - once-through - Electricity by gas	WCB_3.2
Electricity by nuclear	p40.11.c	C_POWN	Water Consumption Blue - Electricity - once-through - Electricity by nuclear	WCB_3.2
Electricity by petroleum and other oil derivatives	p40.11.f	C_POWP	Water Consumption Blue - Electricity – once-through - Electricity by petroleum and other oil derivatives	WCB_3.2
Electricity by biomass and waste	p40.11.g	C_POWB	Water Consumption Blue - Electricity - once-through - Electricity by biomass and waste	WCB_3.2
Electricity nec	p40.11.l	C_POWZ	Water Consumption Blue - Electricity - once-through - Electricity nec	WCB_3.2

The final result was a table with the following data detail for every EXIOBASE country (group) disaggregated into specific spread sheets for each year:

- PhysicalTypeName (= Extension Name)
- ProductTypeCode
- CountryCode
- AccountingYear
- Amount
- UnitCode

2.5 Domestic use

2.5.1 Data sources

For the EXIOBASE 3.0 extensions also for the electricity producing sectors we retrieved data on water use and consumption from the WaterGAP model. Also in this case, the University of Kassel provided the DESIRE team with data for the period 1995-2010, and values for 2011 were extrapolated on the basis of the complete time series.

2.5.2 Allocation of extensions to EXIOBASE sectors

For this sector the data delivered encompassed blue water withdrawals (= water use) as well as water consumption for the domestic sector in mio m³. The only necessary step was to allocate final demand category codes and extension code:

WaterGAP category	EXIOBASE final demand code1	EXIOBASE final demand code2	EXIOBASE extension name	Extension code
Domestic water withdrawal	y01	F_HOUS	Water Withdrawal Blue - Domestic - domestic Water Withdrawal Blue	WWB_4
Domestic water consumption	y01	F_HOUS	Water Consumption Blue - Domestic - domestic Water Consumption Blue	WCB_4

The final result was a table with the following data detail for every EXIOBASE country (group) disaggregated into specific spread sheets for each year:

- PhysicalTypeName (= Extension Name)
- ProductTypeCode (= Extension Code)
- CountryCode
- AccountingYear
- Amount
- UnitCode

3 Conclusion

The EXIOBASE 3.0 is one of the most extensive EE-MRIO systems available worldwide. Developments from version 2 to version 3 have added a lot of value with regard to its applicability to relevant ecological-economic (policy) issues – most importantly the coverage of a time series of 1995-2011. This holds also true for the water part (W-MRIO) where a large number of products are covered and an especially high level of spatial detail is provided with regard to agricultural water consumption.

However, as in the case of the previous version of the EXIOBASE, availability and quality of data on water withdrawals and consumption have still a large potential for improvement, especially with regard to real data collected by e.g. statistical institutions. As such quantitative data are lacking, modelled data have been used to quantify water appropriation in the areas of agriculture, livestock husbandry, electricity production, manufacturing, and domestic uses since the first version of EXIOBASE. These data – taken from the WaterGAP2 model (Alcamo et al., 2003) and from the Water Footprint datasets (Mekonnen and Hoekstra, 2011)– have the key advantage that they are available on a country level for all the countries world-wide.

Still, the experiences made in the course of the DESIRE project show that the open issues regarding water data for application in W-MRIO are still very similar to those when we finalised the previous version of EXIOBASE:

- Data coverage of water withdrawal/consumption: Efforts should be put into the collection and/or estimation of water consumption in industrial processes, in order to improve coverage and evaluate the robustness and meaningfulness of model results.
- The agricultural water consumption data are based on a number of globally available data such as climate, crop harvested area, irrigated area, and cropping seasons. Efforts to improve these would greatly improve the final result. Additional input data, such as available data for water consumption of fodder crops and grazing appear still as limited, nevertheless its consideration and further refinement might support the significance of the final results. Besides, inter-comparison of different models used in crop water use estimation and assessing the uncertainty involved is required to improve the reliability of the results.
- Data quality of water withdrawal/consumption: At least on the European level the aim should be to compile a comprehensive dataset on water withdrawal and consumption in the different sectors of the economy. The foundations for this data compilation effort have been laid e.g. by the SEEA Water (United Nations, 2012b) or the efforts of Eurostat to set up a system of water accounts. However, the accounting frameworks still lack the data to populate them.
- Geographical detail: In order to improve the meaningfulness of the EXIOBASE 3.0, or W-MRIO methodologies in general, the aim must be to also further disaggregate data on industrial water consumption to the watershed level. No doubt that this will require considerable effort, but it is essential to paint a complete picture.

The EXIOBASE 3.0 is at the forefront of W-MRIO models. However, the further development of the water extensions in the database reconfirmed the need for a number of methodological and especially data issues to be tackled in a next step, to ensure modelling results further improve in their meaningfulness and by that means foster the application of EXIOBASE in ecological-economic policy making.

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Development of a System of Indicators for a Resource efficient Europe

SEVENTH FRAMEWORK PROGRAMME

DESIRE

Development of a System of Indicators for a Resource Efficient Europe

D5.3 Integrated report on EE IO related macro resource indicator time series

Annex - Materials

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About DESIRE

DESIRE is a FP7 project that will develop and apply an optimal set of indicators to monitor European progress towards resource-efficiency. The project runs from September 2012 to February 2016. We propose a combination of time series of environmentally extended input output data (EE IO) and the DPSIR framework to construct the indicator set. Only this approach will use a single data set that allows for consistent construction of resource efficiency indicators capturing the EU, country, sector and product group level, and the production and consumption perspective including impacts outside the EU. The project will:

- Improve data availability, particularly by creating EE IO time series and now-casted data
- Improve calculation methods for indicators that currently still lack scientific robustness, most notably in the field of biodiversity/ecosystem services and critical materials. We further will develop novel reference indicators for economic success.
- Explicitly address the problem of indicator proliferation and limits in available data that have a 'statistical stamp'. Via scientific analysis we will select the smallest set of indicators giving mutually independent information, and show which shortcuts in (statistical) data inventory can be made without significant loss of quality.

The project comprises further Interactive policy analysis, indicator concept development via 'brokerage' activities, Management, and Conclusions and implementation including a hand over of data and indicators to the EU's Group of Four of EEA, Eurostat, DG ENV and DG JRC.

Partners are:

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2. Wuppertal Institute (WI), Wuppertal, Germany
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Summary

For the compilation of the material extensions in EXIOBASE v3.0, the main basic data source for the environmental extensions related to material extraction was the SERI/WU Global Material Flow Database (available at www.materialflows.net, SERI and WU, 2014). This database currently covers more than 300 different types of biotic and abiotic raw materials and more than 200 countries.

In the course of DESIRE's WP 5 work, updates of this database were performed to include the years 2010 and 2011. In addition to the data update, various improvements of the underlying data and calculation routines were performed, for example, a split between industrial roundwood and firewood, in order to be in line with the land use data; and a completion of minerals data using various geological data sources.

Compared to earlier versions of EXIOBASE, the list of material extensions has been significantly extended. The list of material extensions now covers 222 items, of which 193 are extensions relate to biomass extraction (i.e. the full FAO product list), 12 refer to metal ore extraction, 8 categories relate to industrial and construction minerals, and 9 categories cover the extraction of fossil fuels (i.e. the full IEA list of primary products).

Significant work in DESIRE was also devoted to improve the concordance between various parts of EXIOBASE and the allocation of extensions to the EXIOBASE sectors. A new concordance table between FAO, CPA and EXIOBASE was developed, which is now applied across all parts of EXIOBASE (MSUTs, PSUTs and extensions) and thus ensures high consistency of data related to biomass flows.

In EXIOBASE v3.0, the extraction categories of fodder crops, grazing and crop residues were taken out of the sector "crops nec" and were allocated directly to the respective animal production sectors. In order to implement this approach, a new allocation scheme was developed using detailed data on fodder crop use by various animal production sectors from the AgroSAM database.

1 Introduction

Task 5.2b in the DESIRE project was devoted to the compilation of macro-resource accounts. Point 2) under 5.2b concerns the resource category of "material accounts", i.e. the compilation of a data set reflecting the extraction of abiotic and biotic raw materials for economic purposes.

The compilation of the data set followed the methodology of "economy-wide material flow accounting and analysis (EW-MFA)", as established by EUROSTAT in its regularly updated methodological handbooks (for the latest version see EUROSTAT, 2013).

For the compilation of the material extensions in EXIOBASE version 3, the main data source for the environmental extensions of "material extraction" was the SERI/WU Global Material Flow Database (available at www.materialflows.net, SERI and WU, 2014). The database currently covers around 220 countries and the full list of abiotic and biotic raw materials, i.e. more than 300 items in total. Available time series start in the year 1980. In the course of DESIRE's WP 5 work, updates of this database were performed to include the years 2010 and 2011 and thus cover the full time period of EXIOBASE v.3.

Compared to earlier versions of EXIOBASE, the list of material extensions has been significantly extended. The list of material extensions now covers 222 items, of which 193 are extensions relate to biomass extraction (i.e. the full FAO product list), 12 refer to metal ore extraction, 8 categories relate to industrial and construction minerals, and 9 categories cover the extraction of fossil fuels (i.e. the full IEA list of primary products). Full details on each of the material groups will be provided in the following chapters.

The material extensions include a data set on economically used material extraction (Domestic Extraction Used, DEU) in all EXIOBASE countries and regions. DEU is the basis to calculate consumption-based indicators such as Raw Material Consumption (RMC) (also termed Material Footprint). In addition the extensions include estimations on Unused Domestic Extraction (UDE), which are – together with DEU – a requirement to calculate indicators such as Total Material Consumption (TMC).

2 Method

In the following, we describe the data collection procedures on Domestic Used Extraction (DEU) applied for each of the four major material categories, i.e. biomass, metal ores, minerals and fossil fuels. This is followed by a description of the procedures applied to estimate Unused Domestic Extraction (UDE).

2.1 Biomass

The data section on biomass covers the following 6 sub-categories:

- Primary crops
- Crop residues
- Fodder crops
- Grazing
- Forestry
- Fishery

2.1.1 Data sources and data transformations

Data for agricultural production of **primary crops** was retrieved from the FAO database (FAO, 2014). Data are reported in tonnes of fresh weight and are directly included in the material extensions without further transformations.

For **crop residues**, used as fodder or straw, it is assumed that, in addition to the agricultural harvest of biomass for direct use, i.e. the main product, further biomass is available as co-product, including e.g. leaves or stems. This amount can partly be used for feed purposes, partly as straw; the remaining rest is accounted for as "unused biomass extraction" (see below). In a first step the harvested biomass is multiplied with a so-called "harvest-factor" to calculate the amount of available additional biomass. This value is then distributed into the three categories by-product feed, by-product straw and unused biomass. Finally, in alignment with the regular categories of biomass for feed, the value of by-product used as feed is transformed into 15% moisture content (from a base value of dry matter). The applied harvest, straw, feed and unused biomass factors stem mainly from two publications, i.e. Jölli and Giljum (2005) and Krausmann et al. (2009).

In alignment to current EW-MFA guidelines (EUROSTAT, 2013) data for **fodder crops** were were retrieved from the FAO database (2014) and transformed to a standard of 15% water content on the basis of moisture contents as published by Krausmann et al. (2009).

For the estimation of biomass directly taken up by animals (**grazing**), we applied a demand-based approach, which calculates grazing demand as the difference between (a) feed demand and (b) the supply of market and non-market feed (with the latter including fodder crops and crop residues) in each country. The resultant amount of biomass is called the "grazing gap", which is the amount of feed required by the livestock of a country that is not supplied from other sources (Krausmann et al., 2008). The grazing gap, i.e. the difference between total feed demand and supply, was assumed to equal the global volume of biomass harvested on grazing land. This number was finally converted from dry matter into fresh weight assuming 15% moisture content in accordance with the MFA guidelines (EUROSTAT, 2013).

In the **forestry** section, primary data was also taken from the FAO website and database (FAO, 2014). In the category "Industrial Roundwood" FAO reports on different roundwood products dividing them into coniferous and non-coniferous products. The following factors were applied for all countries, in order to transform the data from m³ to tonnes: 0.52 tons per m³ for coniferous wood and 0.68 tons per m³ for non-coniferous wood. In order to better align with the land extensions in EXIOBASE, an additional split between industrial roundwood and firewood was applied, thus the basic MFA data contained 4 entries for the forestry sub-group.

Regarding data of **fisheries**, data was taken from the FAO website and database (Fisheries and Aquaculture Department; Global Production Statistics). Some of the data in the FAO database is not reported in tonnes but in numbers of caught animals (e.g. whales, seals and other aquatic mammals); these values were transformed into tonnes using the following average factors: blue-wales & fin-whales at 100 tonnes, seals & walruses at 0.5 tonnes and sperm-whales and pilot-whales at 15 tonnes.

2.1.2 Material extensions

In the course of WP 5 work, it was decided to significantly increase the number of material extension categories in the biomass area, in order to reflect the full FAO product list. Providing such a level of detail in the material extensions can be important for third users, who aim at calculating e.g. environmental impacts related to biomass consumption. Such a calculation requires detailed primary data in order to calculate robust environmental impact factors of product groups. EXIOBASE v.3 now include 193 material extensions related to biomass extraction (see 2.1.4 below for full list).

2.1.3 Allocation of extensions to EXIOBASE sectors

Significant work in DESIRE was also devoted to improve the concordance between various parts of EXIOBASE and the allocation of extensions to the EXIOBASE sectors. A new concordance table between FAO, EXIOBASE and CPA was developed, which is applied across all parts of EXIOBASE (MSUTs, PSUTs and extensions) and thus ensures high consistency of data related to biomass flows. In Annex 1 of this document, the full concordance table is presented.

Regarding the allocation of biomass extensions to EXIOBASE sectors, the allocation is straight-forward regarding most of the biomass items from primary crops, forestry and fishery. However, for the categories of fodder crops, crop residues and grazing, specific allocation schemes were developed. For **fodder crops**, the WP 5 team decided to use the information from the AgroSAM database (Müller et al., 2009), which specifies the value of fodder crops consumed by five animal sectors (i.e. Raw milk, Cattle, Pigs, Poultry and Meat animals nec) for all EU-27 countries in 2007. Based on this, we calculate the fodder crop intensities of the EU animal sectors (i.e. fodder inputs per monetary output of the animal sectors) assuming a fully homogeneous fodder crop sector (in terms of the value-weight ratio). These intensities are then applied to all countries and years and scaled to the available fodder crop volume reported in agricultural statistics.

By this procedure, the different composition of the 5 sectors in each non-EU country could be maintained, while the overall number of fodder crops matches exactly the total extraction of fodder crops in that respective country. By applying this procedure, the different fodder intensities of meat cattle versus dairy cattle could be much better elaborated compared to the allocation approach in EXIOBASE 2, where fodder crops were allocated to the sectors "Cattle" and "Raw milk" according to their shares in total combined output. Table 1 illustrates that cattle now has a significantly higher intensities compared to raw milk.

Table 1: Comparison of the intensities resulting from the EXIOBASE 2 (below) and EXIOBASE 3 (above) allocation procedure for fodder crops

		Austria	Germany	France	Slovakia	USA
AgroSAM- Allocation	Cattle	1.68	5.96	2.11	4.26	3.96
	Raw milk	0.29	1.34	0.74	0.41	1.16
	Products of meat cattle	0.51	1.80	0.98	1.80	3.27
	Dairy products	0.09	0.44	0.25	0.10	0.45
Cattle/Milk- Allocation	Cattle	0.96	4.12	1.49	1.31	3.53
	Raw milk	0.87	4.09	1.43	1.27	2.38
	Products of meat cattle	0.30	1.27	0.70	0.57	2.91
	Dairy products	0.25	1.31	0.49	0.30	0.91

As by applying this approach we attribute fodder crops directly to the using animal sectors, the fodder crop extensions were removed from the sector "Crops nec". As a consequence, also in the monetary SUTs, the monetary values representing the deliveries from "Crops nec" to the animal sectors were retrieved, in order to avoid misallocation of other crops in this sector.

Straw and crop residues were also allocated to the 5 animal producing sectors as explained for the case of fodder crops above. **Grazing** was allocated only to three of the 5 sectors, assuming that the sectors "Pigs" and "Poultry" do not use grazed biomass for their production activities.

2.1.4 List of materials, extensions and sectors

The following Table 2 contains the full list of material categories, related environmental extensions in EXIOBASE v.3 and the concordance with the EXIOBASE sectors. The table is illustrated for DEU, i.e. used material extraction. UDE data follows the same format.

Table 2: MFA commodities, EXIOBASE material extensions and products for the case of biomass extraction

SERI/WU MFA database: Commodity Name	EXIOBASE: Material extension ID	EXIOBASE: Material extension Name	EXIOBASE: Product ID	EXIOBASE: Product abbreviation	Commentary
Rice, Paddy	DEU_1.01.001	Domestic Extraction Used - Primary Crops - Rice	p01.a	C_PARI	
Wheat (and spelt)	DEU_1.02.001	Domestic Extraction Used - Primary Crops - Wheat	p01.b	C_WHEA	
Barley	DEU_1.03.001	Domestic Extraction Used - Primary Crops - Barley	p01.c	C_OCER	
Buckwheat	DEU_1.03.002	Domestic Extraction Used - Primary Crops - Buckwheat	p01.c	C_OCER	
Canary Seed	DEU_1.03.003	Domestic Extraction Used - Primary Crops - Canary Seed	p01.c	C_OCER	
Maise (grain maize)	DEU_1.03.004	Domestic Extraction Used - Primary Crops - Maize	p01.c	C_OCER	
Millet	DEU_1.03.005	Domestic Extraction Used - Primary Crops - Millet	p01.c	C_OCER	
Mixed Grain	DEU_1.03.006	Domestic Extraction Used - Primary Crops - Mixed Grain	p01.c	C_OCER	
Oats	DEU_1.03.007	Domestic Extraction Used - Primary Crops - Oats	p01.c	C_OCER	
Rye	DEU_1.03.008	Domestic Extraction Used - Primary Crops - Rye	p01.c	C_OCER	
Sorghum	DEU_1.03.009	Domestic Extraction Used - Primary Crops - Sorghum	p01.c	C_OCER	
Triticale	DEU_1.03.010	Domestic Extraction Used - Primary Crops - Triticale	p01.c	C_OCER	
Cereals nec (including Pop Corn, Fonio and Quinoa)	DEU_1.03.011	Domestic Extraction Used - Primary Crops - Cereals nec	p01.c	C_OCER	
Fonio	DEU_1.03.012	Domestic Extraction Used - Primary Crops - Fonio	p01.c	C_OCER	
Quinoa	DEU_1.03.013	Domestic Extraction Used - Primary Crops - Quinoa	p01.c	C_OCER	
Potatoes	DEU_1.04.001	Domestic Extraction Used - Primary Crops - Potatoes	p01.d	C_FVEG	
Sweet Potatoes	DEU_1.04.002	Domestic Extraction Used - Primary Crops - Sweet Potatoes	p01.d	C_FVEG	
Yams	DEU_1.04.003	Domestic Extraction Used - Primary Crops - Yams	p01.d	C_FVEG	
Lentils	DEU_1.04.004	Domestic Extraction Used - Primary Crops - Lentils	p01.d	C_FVEG	
Lupins	DEU_1.04.005	Domestic Extraction Used - Primary Crops - Lupins	p01.d	C_FVEG	
Vetches	DEU_1.04.006	Domestic Extraction Used - Primary Crops - Vetches	p01.d	C_FVEG	
Pulses nec	DEU_1.04.007	Domestic Extraction Used - Primary Crops - Pulses nec	p01.d	C_FVEG	
Olives	DEU_1.04.008	Domestic Extraction Used - Primary Crops - Olives	p01.d	C_FVEG	
Artichokes	DEU_1.04.009	Domestic Extraction Used - Primary Crops - Artichokes	p01.d	C_FVEG	
Asparagus	DEU_1.04.010	Domestic Extraction Used - Primary Crops - Asparagus	p01.d	C_FVEG	
Cabbages	DEU_1.04.011	Domestic Extraction Used - Primary Crops - Cabbages	p01.d	C_FVEG	
Carrots	DEU_1.04.012	Domestic Extraction Used - Primary Crops - Carrots	p01.d	C_FVEG	
Cauliflower	DEU_1.04.013	Domestic Extraction Used - Primary Crops - Cauliflower	p01.d	C_FVEG	

Chillies and peppers, green	DEU_1.04.014	Domestic Extraction Used - Primary Crops - Chillies and peppers, green	p01.d	C_FVEG
Cucumbers and Gherkins	DEU_1.04.015	Domestic Extraction Used - Primary Crops - Cucumbers and Gherkins	p01.d	C_FVEG
Eggplants	DEU_1.04.016	Domestic Extraction Used - Primary Crops - Eggplants	p01.d	C_FVEG
Garlic	DEU_1.04.017	Domestic Extraction Used - Primary Crops - Garlic	p01.d	C_FVEG
Leeks and other Alliac. Veg.	DEU_1.04.018	Domestic Extraction Used - Primary Crops - Leeks and other Alliac. Veg.	p01.d	C_FVEG
Lettuce	DEU_1.04.019	Domestic Extraction Used - Primary Crops - Lettuce	p01.d	C_FVEG
Mushrooms	DEU_1.04.020	Domestic Extraction Used - Primary Crops - Mushrooms	p01.d	C_FVEG
Peas, Green	DEU_1.04.021	Domestic Extraction Used - Primary Crops - Peas, Green	p01.d	C_FVEG
Pumpkins, Squash, Gourds	DEU_1.04.022	Domestic Extraction Used - Primary Crops - Pumpkins, Squash, Gourds	p01.d	C_FVEG
Spinach	DEU_1.04.023	Domestic Extraction Used - Primary Crops - Spinach	p01.d	C_FVEG
Tomatoes	DEU_1.04.024	Domestic Extraction Used - Primary Crops - Tomatoes	p01.d	C_FVEG
Vegetables Fresh nec (including Okra)	DEU_1.04.025	Domestic Extraction Used - Primary Crops - Vegetables Fresh nec	p01.d	C_FVEG
Apples	DEU_1.04.026	Domestic Extraction Used - Primary Crops - Apples	p01.d	C_FVEG
Apricots	DEU_1.04.027	Domestic Extraction Used - Primary Crops - Apricots	p01.d	C_FVEG
Avocados	DEU_1.04.028	Domestic Extraction Used - Primary Crops - Avocados	p01.d	C_FVEG
Blueberries	DEU_1.04.029	Domestic Extraction Used - Primary Crops - Blueberries	p01.d	C_FVEG
Carobs	DEU_1.04.030	Domestic Extraction Used - Primary Crops - Carobs	p01.d	C_FVEG
Cherries	DEU_1.04.031	Domestic Extraction Used - Primary Crops - Cherries	p01.d	C_FVEG
Currants	DEU_1.04.032	Domestic Extraction Used - Primary Crops - Currants	p01.d	C_FVEG
Dates	DEU_1.04.033	Domestic Extraction Used - Primary Crops - Dates	p01.d	C_FVEG
Figs	DEU_1.04.034	Domestic Extraction Used - Primary Crops - Figs	p01.d	C_FVEG
Gooseberries	DEU_1.04.035	Domestic Extraction Used - Primary Crops - Gooseberries	p01.d	C_FVEG
Grapefruit and Pomelos	DEU_1.04.036	Domestic Extraction Used - Primary Crops - Grapefruit and Pomelos	p01.d	C_FVEG
Grapes	DEU_1.04.037	Domestic Extraction Used - Primary Crops - Grapes	p01.d	C_FVEG
Kiwi Fruit	DEU_1.04.038	Domestic Extraction Used - Primary Crops - Kiwi Fruit	p01.d	C_FVEG
Lemons and Limes	DEU_1.04.039	Domestic Extraction Used - Primary Crops - Lemons and Limes	p01.d	C_FVEG
Oranges	DEU_1.04.040	Domestic Extraction Used - Primary Crops - Oranges	p01.d	C_FVEG
Peaches and Nectarines	DEU_1.04.041	Domestic Extraction Used - Primary Crops - Peaches and Nectarines	p01.d	C_FVEG
Pears	DEU_1.04.042	Domestic Extraction Used - Primary Crops - Pears	p01.d	C_FVEG
Persimmons	DEU_1.04.043	Domestic Extraction Used - Primary Crops - Persimmons	p01.d	C_FVEG
Pineapples	DEU_1.04.044	Domestic Extraction Used - Primary Crops - Pineapples	p01.d	C_FVEG
Plums	DEU_1.04.045	Domestic Extraction Used - Primary Crops - Plums	p01.d	C_FVEG

Quinces	DEU_1.04.046	Domestic Extraction Used - Primary Crops - Quinces	p01.d	C_FVEG
Raspberries	DEU_1.04.047	Domestic Extraction Used - Primary Crops - Raspberries	p01.d	C_FVEG
Sour Cherries	DEU_1.04.048	Domestic Extraction Used - Primary Crops - Sour Cherries	p01.d	C_FVEG
Strawberries	DEU_1.04.049	Domestic Extraction Used - Primary Crops - Strawberries	p01.d	C_FVEG
Tang. Mand Clement. Satsma	DEU_1.04.050	Domestic Extraction Used - Primary Crops - Tang. Mand Clement. Satsma	p01.d	C_FVEG
Berries nec (including Cranberries)	DEU_1.04.051	Domestic Extraction Used - Primary Crops - Berries nec	p01.d	C_FVEG
Citrus Fruit nec	DEU_1.04.052	Domestic Extraction Used - Primary Crops - Citrus Fruit nec	p01.d	C_FVEG
Stone Fruit nec,	DEU_1.04.053	Domestic Extraction Used - Primary Crops - Stone Fruit nec,	p01.d	C_FVEG
Almonds	DEU_1.04.054	Domestic Extraction Used - Primary Crops - Almonds	p01.d	C_FVEG
Chestnuts	DEU_1.04.055	Domestic Extraction Used - Primary Crops - Chestnuts	p01.d	C_FVEG
Hazelnuts (Filberts)	DEU_1.04.056	Domestic Extraction Used - Primary Crops - Hazelnuts	p01.d	C_FVEG
Pistachios	DEU_1.04.057	Domestic Extraction Used - Primary Crops - Pistachios	p01.d	C_FVEG
Walnuts	DEU_1.04.058	Domestic Extraction Used - Primary Crops - Walnuts	p01.d	C_FVEG
Cassava	DEU_1.04.059	Domestic Extraction Used - Primary Crops - Cassava	p01.d	C_FVEG
Roots and Tubers, nes	DEU_1.04.060	Domestic Extraction Used - Primary Crops - Roots and Tubers, nes	p01.d	C_FVEG
Taro (cocoyam)	DEU_1.04.061	Domestic Extraction Used - Primary Crops - Taro	p01.d	C_FVEG
Yautia (cocoyam)	DEU_1.04.062	Domestic Extraction Used - Primary Crops - Yautia	p01.d	C_FVEG
Bambara beans	DEU_1.04.063	Domestic Extraction Used - Primary Crops - Bambara beans	p01.d	C_FVEG
Beans, dry	DEU_1.04.064	Domestic Extraction Used - Primary Crops - Beans, dry	p01.d	C_FVEG
Beans, green	DEU_1.04.065	Domestic Extraction Used - Primary Crops - Beans, green	p01.d	C_FVEG
Broad beans, horse beans, dry	DEU_1.04.066	Domestic Extraction Used - Primary Crops - Broad beans, horse beans, dry	p01.d	C_FVEG
Chick peas	DEU_1.04.067	Domestic Extraction Used - Primary Crops - Chick peas	p01.d	C_FVEG
Cow peas, dry	DEU_1.04.068	Domestic Extraction Used - Primary Crops - Cow peas, dry	p01.d	C_FVEG
Peas, dry	DEU_1.04.069	Domestic Extraction Used - Primary Crops - Peas, dry	p01.d	C_FVEG
Pigeon peas	DEU_1.04.070	Domestic Extraction Used - Primary Crops - Pigeon peas	p01.d	C_FVEG
String beans	DEU_1.04.071	Domestic Extraction Used - Primary Crops - String beans	p01.d	C_FVEG
Coconuts	DEU_1.04.072	Domestic Extraction Used - Primary Crops - Coconuts	p01.d	C_FVEG
Okra	DEU_1.04.073	Domestic Extraction Used - Primary Crops - Okra	p01.d	C_FVEG
Onions (inc. shallots), green	DEU_1.04.074	Domestic Extraction Used - Primary Crops - Onions	p01.d	C_FVEG
Onions, dry	DEU_1.04.075	Domestic Extraction Used - Primary Crops - Onions, dry	p01.d	C_FVEG
Other melons (inc.cantaloupes)	DEU_1.04.076	Domestic Extraction Used - Primary Crops - Other melons	p01.d	C_FVEG
Watermelons	DEU_1.04.077	Domestic Extraction Used - Primary Crops - Watermelons	p01.d	C_FVEG

Bananas	DEU_1.04.078	Domestic Extraction Used - Primary Crops - Bananas	p01.d	C_FVEG
Cashewapple	DEU_1.04.079	Domestic Extraction Used - Primary Crops - Cashewapple	p01.d	C_FVEG
Cranberries	DEU_1.04.080	Domestic Extraction Used - Primary Crops - Cranberries	p01.d	C_FVEG
Fruit Fresh Nes	DEU_1.04.081	Domestic Extraction Used - Primary Crops - Fruit Fresh Nes	p01.d	C_FVEG
Fruit, tropical fresh nes	DEU_1.04.082	Domestic Extraction Used - Primary Crops - Fruit, tropical fresh nes	p01.d	C_FVEG
Mangoes, mangosteens, guavas	DEU_1.04.083	Domestic Extraction Used - Primary Crops - Mangoes, mangosteens, guavas	p01.d	C_FVEG
Papayas	DEU_1.04.084	Domestic Extraction Used - Primary Crops - Papayas	p01.d	C_FVEG
Plantains	DEU_1.04.085	Domestic Extraction Used - Primary Crops - Plantains	p01.d	C_FVEG
Arecanuts	DEU_1.04.086	Domestic Extraction Used - Primary Crops - Arecanuts	p01.d	C_FVEG
Brazil nuts, with shell	DEU_1.04.087	Domestic Extraction Used - Primary Crops - Brazil nuts, with shell	p01.d	C_FVEG
Cashew nuts, with shell	DEU_1.04.088	Domestic Extraction Used - Primary Crops - Cashew nuts, with shell	p01.d	C_FVEG
Kolanuts	DEU_1.04.089	Domestic Extraction Used - Primary Crops - Kolanuts	p01.d	C_FVEG
Nuts, nes	DEU_1.04.090	Domestic Extraction Used - Primary Crops - Nuts, nes	p01.d	C_FVEG
Leguminous vegetables, nes	DEU_1.04.091	Domestic Extraction Used - Primary Crops - Leguminous vegetables, nes	p01.d	C_FVEG
Maize, green	DEU_1.04.092	Domestic Extraction Used - Primary Crops - Maize, green	p01.d	C_FVEG
Pome fruit, nes	DEU_1.04.093	Domestic Extraction Used - Primary Crops - Pome fruit, nes	p01.d	C_FVEG
Cassava leaves	DEU_1.04.094	Domestic Extraction Used - Primary Crops - Cassava leaves	p01.d	C_FVEG
Groundnuts in Shell	DEU_1.05.001	Domestic Extraction Used - Primary Crops - Groundnuts in Shell	p01.e	C_OILS
Hempseed	DEU_1.05.002	Domestic Extraction Used - Primary Crops - Hempseed	p01.e	C_OILS
Linseed	DEU_1.05.003	Domestic Extraction Used - Primary Crops - Linseed	p01.e	C_OILS
Melonseed	DEU_1.05.004	Domestic Extraction Used - Primary Crops - Melonseed	p01.e	C_OILS
Mustard Seed	DEU_1.05.005	Domestic Extraction Used - Primary Crops - Mustard Seed	p01.e	C_OILS
Poppy Seed	DEU_1.05.006	Domestic Extraction Used - Primary Crops - Poppy Seed	p01.e	C_OILS
Rapeseed (rape and turnip rape)	DEU_1.05.007	Domestic Extraction Used - Primary Crops - Rapeseed	p01.e	C_OILS
Safflower Seed	DEU_1.05.008	Domestic Extraction Used - Primary Crops - Safflower Seed	p01.e	C_OILS
Sesame Seed	DEU_1.05.009	Domestic Extraction Used - Primary Crops - Sesame Seed	p01.e	C_OILS
Soybeans	DEU_1.05.010	Domestic Extraction Used - Primary Crops - Soybeans	p01.e	C_OILS
Sunflower Seed	DEU_1.05.011	Domestic Extraction Used - Primary Crops - Sunflower Seed	p01.e	C_OILS
Oilseeds nec (including Castor Beans, Kapokseed in Shell, Karite Nuts /Sheanuts/,Tung Nuts, Coconuts)	DEU_1.05.012	Domestic Extraction Used - Primary Crops - Oilseeds nec	p01.e	C_OILS
Oil Palm Fruit	DEU_1.05.013	Domestic Extraction Used - Primary Crops - Oil Palm Fruit	p01.e	C_OILS

Castor oil seed	DEU_1.05.014	Domestic Extraction Used - Primary Crops - Castor oil seed	p01.e	C_OILS
Karite Nuts (Sheanuts)	DEU_1.05.015	Domestic Extraction Used - Primary Crops - Karite Nuts	p01.e	C_OILS
Tung Nuts	DEU_1.05.016	Domestic Extraction Used - Primary Crops - Tung Nuts	p01.e	C_OILS
Jojoba Seeds	DEU_1.05.017	Domestic Extraction Used - Primary Crops - Jojoba Seeds	p01.e	C_OILS
Tallowtree Seeds	DEU_1.05.018	Domestic Extraction Used - Primary Crops - Tallowtree Seeds	p01.e	C_OILS
Cottonseed	DEU_1.05.019	Domestic Extraction Used - Primary Crops - Cottonseed	p01.e	C_OILS
Sugar Beets	DEU_1.06.001	Domestic Extraction Used - Primary Crops - Sugar Beets	p01.f	C_SUGB
Sugar Cane	DEU_1.06.002	Domestic Extraction Used - Primary Crops - Sugar Cane	p01.f	C_SUGB
Sugar Crops nes	DEU_1.06.003	Domestic Extraction Used - Primary Crops - Sugar Crops nes	p01.f	C_SUGB
Cotton Lint	DEU_1.07.001	Domestic Extraction Used - Primary Crops - Cotton Lint	p01.g	C_FIBR
Flax Fibre and Tow	DEU_1.07.002	Domestic Extraction Used - Primary Crops - Flax Fibre and Tow	p01.g	C_FIBR
Hemp Fibre and Tow	DEU_1.07.003	Domestic Extraction Used - Primary Crops - Hemp Fibre and Tow	p01.g	C_FIBR
Abaca (Manila Hemp)	DEU_1.07.004	Domestic Extraction Used - Primary Crops - Abaca	p01.g	C_FIBR
Agave Fibres nes	DEU_1.07.005	Domestic Extraction Used - Primary Crops - Agave Fibres nes	p01.g	C_FIBR
Coir	DEU_1.07.006	Domestic Extraction Used - Primary Crops - Coir	p01.g	C_FIBR
Fibre Crops nes	DEU_1.07.007	Domestic Extraction Used - Primary Crops - Fibre Crops nes	p01.g	C_FIBR
Ramie	DEU_1.07.008	Domestic Extraction Used - Primary Crops - Ramie	p01.g	C_FIBR
Sisal	DEU_1.07.009	Domestic Extraction Used - Primary Crops - Sisal	p01.g	C_FIBR
Kapok Fibre	DEU_1.07.010	Domestic Extraction Used - Primary Crops - Kapok Fibre	p01.g	C_FIBR
Jute and Jute-like Fibres	DEU_1.07.011	Domestic Extraction Used - Primary Crops - Jute and Jute-like Fibres	p01.g	C_FIBR
Other Bastfibres	DEU_1.07.012	Domestic Extraction Used - Primary Crops - Other Bastfibres	p01.g	C_FIBR
Anise, Badian, Fennel	DEU_1.08.001	Domestic Extraction Used - Primary Crops - Anise, Badian, Fennel	p01.h	C_OTCR
Chicory Roots	DEU_1.08.002	Domestic Extraction Used - Primary Crops - Chicory Roots	p01.h	C_OTCR
Coffee, Green	DEU_1.08.003	Domestic Extraction Used - Primary Crops - Coffee, Green	p01.h	C_OTCR
Hops	DEU_1.08.004	Domestic Extraction Used - Primary Crops - Hops	p01.h	C_OTCR
Peppermint	DEU_1.08.005	Domestic Extraction Used - Primary Crops - Peppermint	p01.h	C_OTCR
Pyrethrum, Dried Flowers	DEU_1.08.006	Domestic Extraction Used - Primary Crops - Pyrethrum, Dried Flowers	p01.h	C_OTCR
Tea	DEU_1.08.007	Domestic Extraction Used - Primary Crops - Tea	p01.h	C_OTCR
Spices nec (including Cinnamon,Ginger,Nutmeg,Mace,Cardamons, Pepper,Vanilla,Cloves)	DEU_1.08.008	Domestic Extraction Used - Primary Crops - Spices nec	p01.h	C_OTCR
Cocoa Beans	DEU_1.08.009	Domestic Extraction Used - Primary Crops - Cocoa Beans	p01.h	C_OTCR
Mate	DEU_1.08.010	Domestic Extraction Used - Primary Crops - Mate	p01.h	C_OTCR

Tobacco Leaves	DEU_1.08.011	Domestic Extraction Used - Primary Crops - Tobacco Leaves	p01.h	C_OTCR	
Natural Rubber	DEU_1.08.012	Domestic Extraction Used - Primary Crops - Natural Rubber	p01.h	C_OTCR	
Cinnamon (canella)	DEU_1.08.013	Domestic Extraction Used - Primary Crops - Cinnamon	p01.h	C_OTCR	
Cloves	DEU_1.08.014	Domestic Extraction Used - Primary Crops - Cloves	p01.h	C_OTCR	
Ginger	DEU_1.08.015	Domestic Extraction Used - Primary Crops - Ginger	p01.h	C_OTCR	
Nutmeg, mace and cardamoms	DEU_1.08.016	Domestic Extraction Used - Primary Crops - Nutmeg, mace and cardamoms	p01.h	C_OTCR	
Vanilla	DEU_1.08.017	Domestic Extraction Used - Primary Crops - Vanilla	p01.h	C_OTCR	
Pepper (Piper spp.)	DEU_1.08.018	Domestic Extraction Used - Primary Crops - Pepper	p01.h	C_OTCR	
Chillies and peppers, dry	DEU_1.08.019	Domestic Extraction Used - Primary Crops - Chillies and peppers, dry	p01.h	C_OTCR	
Tea nes	DEU_1.08.020	Domestic Extraction Used - Primary Crops - Tea nes	p01.h	C_OTCR	
Crop Residues Straw	DEU_1.09.001	Domestic Extraction Used - Crop residues - Straw	p01.i	C_CATL	Allocated according to shares of 5 sectors calculated based on AgroSAM
Crop Residues Straw	DEU_1.09.001	Domestic Extraction Used - Crop residues - Straw	p01.j	C_PIGS	
Crop Residues Straw	DEU_1.09.001	Domestic Extraction Used - Crop residues - Straw	p01.k	C_PLTR	
Crop Residues Straw	DEU_1.09.001	Domestic Extraction Used - Crop residues - Straw	p01.l	C_OMEA	
Crop Residues Straw	DEU_1.09.001	Domestic Extraction Used - Crop residues - Straw	p01.n	C_MILK	
Crop Residues Feed	DEU_1.09.002	Domestic Extraction Used - Crop residues - Feed	p01.i	C_CATL	Allocated according to shares of 5 sectors calculated based on AgroSAM
Crop Residues Feed	DEU_1.09.002	Domestic Extraction Used - Crop residues - Feed	p01.j	C_PIGS	
Crop Residues Feed	DEU_1.09.002	Domestic Extraction Used - Crop residues - Feed	p01.k	C_PLTR	
Crop Residues Feed	DEU_1.09.002	Domestic Extraction Used - Crop residues - Feed	p01.l	C_OMEA	
Crop Residues Feed	DEU_1.09.002	Domestic Extraction Used - Crop residues - Feed	p01.n	C_MILK	
Alfalfa for Forage and Silage	DEU_1.10.001	Domestic Extraction Used - Fodder crops - Alfalfa for Forage and Silage	p01.i	C_CATL	Allocated according to shares of 5 sectors calculated based on AgroSAM
Alfalfa for Forage and Silage	DEU_1.10.001	Domestic Extraction Used - Fodder crops - Alfalfa for Forage and Silage	p01.j	C_PIGS	
Alfalfa for Forage and Silage	DEU_1.10.001	Domestic Extraction Used - Fodder crops - Alfalfa for Forage and Silage	p01.k	C_PLTR	
Alfalfa for Forage and Silage	DEU_1.10.001	Domestic Extraction Used - Fodder crops - Alfalfa for Forage and Silage	p01.l	C_OMEA	
Alfalfa for Forage and Silage	DEU_1.10.001	Domestic Extraction Used - Fodder crops - Alfalfa for Forage and Silage	p01.n	C_MILK	
Beets for Fodder	DEU_1.10.002	Domestic Extraction Used - Fodder crops - Beets for Fodder	p01.i	C_CATL	Allocated according to shares of 5 sectors calculated based on AgroSAM
Beets for Fodder	DEU_1.10.002	Domestic Extraction Used - Fodder crops - Beets for Fodder	p01.j	C_PIGS	
Beets for Fodder	DEU_1.10.002	Domestic Extraction Used - Fodder crops - Beets for Fodder	p01.k	C_PLTR	
Beets for Fodder	DEU_1.10.002	Domestic Extraction Used - Fodder crops - Beets for Fodder	p01.l	C_OMEA	
Beets for Fodder	DEU_1.10.002	Domestic Extraction Used - Fodder crops - Beets for Fodder	p01.n	C_MILK	
Cabbage for Fodder	DEU_1.10.003	Domestic Extraction Used - Fodder crops - Cabbage for Fodder	p01.i	C_CATL	Allocated according to
Cabbage for Fodder	DEU_1.10.003	Domestic Extraction Used - Fodder crops - Cabbage for Fodder	p01.j	C_PIGS	

Cabbage for Fodder	DEU_1.10.003	Domestic Extraction Used - Fodder crops - Cabbage for Fodder	p01.k	C_PLTR	shares of 5 sectors calculated based on AgroSAM
Cabbage for Fodder	DEU_1.10.003	Domestic Extraction Used - Fodder crops - Cabbage for Fodder	p01.l	C_OMEA	
Cabbage for Fodder	DEU_1.10.003	Domestic Extraction Used - Fodder crops - Cabbage for Fodder	p01.n	C_MILK	
Carrots for Fodder	DEU_1.10.004	Domestic Extraction Used - Fodder crops - Carrots for Fodder	p01.i	C_CATL	Allocated according to shares of 5 sectors calculated based on AgroSAM
Carrots for Fodder	DEU_1.10.004	Domestic Extraction Used - Fodder crops - Carrots for Fodder	p01.j	C_PIGS	
Carrots for Fodder	DEU_1.10.004	Domestic Extraction Used - Fodder crops - Carrots for Fodder	p01.k	C_PLTR	
Carrots for Fodder	DEU_1.10.004	Domestic Extraction Used - Fodder crops - Carrots for Fodder	p01.l	C_OMEA	
Carrots for Fodder	DEU_1.10.004	Domestic Extraction Used - Fodder crops - Carrots for Fodder	p01.n	C_MILK	
Clover for Forage and Silage	DEU_1.10.005	Domestic Extraction Used - Fodder crops - Clover for Forage and Silage	p01.i	C_CATL	Allocated according to shares of 5 sectors calculated based on AgroSAM
Clover for Forage and Silage	DEU_1.10.005	Domestic Extraction Used - Fodder crops - Clover for Forage and Silage	p01.j	C_PIGS	
Clover for Forage and Silage	DEU_1.10.005	Domestic Extraction Used - Fodder crops - Clover for Forage and Silage	p01.k	C_PLTR	
Clover for Forage and Silage	DEU_1.10.005	Domestic Extraction Used - Fodder crops - Clover for Forage and Silage	p01.l	C_OMEA	
Clover for Forage and Silage	DEU_1.10.005	Domestic Extraction Used - Fodder crops - Clover for Forage and Silage	p01.n	C_MILK	
Maize for Forage and Silage (green maize)	DEU_1.10.006	Domestic Extraction Used - Fodder crops - Maize for Forage and Silage	p01.i	C_CATL	Allocated according to shares of 5 sectors calculated based on AgroSAM
Maize for Forage and Silage (green maize)	DEU_1.10.006	Domestic Extraction Used - Fodder crops - Maize for Forage and Silage	p01.j	C_PIGS	
Maize for Forage and Silage (green maize)	DEU_1.10.006	Domestic Extraction Used - Fodder crops - Maize for Forage and Silage	p01.k	C_PLTR	
Maize for Forage and Silage (green maize)	DEU_1.10.006	Domestic Extraction Used - Fodder crops - Maize for Forage and Silage	p01.l	C_OMEA	
Maize for Forage and Silage (green maize)	DEU_1.10.006	Domestic Extraction Used - Fodder crops - Maize for Forage and Silage	p01.n	C_MILK	
Other grasses (incl. Pumpkins for Fodder)	DEU_1.10.007	Domestic Extraction Used - Fodder crops - Other grasses	p01.i	C_CATL	Allocated according to shares of 5 sectors calculated based on AgroSAM
Other grasses (incl. Pumpkins for Fodder)	DEU_1.10.007	Domestic Extraction Used - Fodder crops - Other grasses	p01.j	C_PIGS	
Other grasses (incl. Pumpkins for Fodder)	DEU_1.10.007	Domestic Extraction Used - Fodder crops - Other grasses	p01.k	C_PLTR	
Other grasses (incl. Pumpkins for Fodder)	DEU_1.10.007	Domestic Extraction Used - Fodder crops - Other grasses	p01.l	C_OMEA	
Other grasses (incl. Pumpkins for Fodder)	DEU_1.10.007	Domestic Extraction Used - Fodder crops - Other grasses	p01.n	C_MILK	
Rye Grass, Forage and Silage	DEU_1.10.008	Domestic Extraction Used - Fodder crops - Rye Grass, Forage and Silage	p01.i	C_CATL	Allocated according to shares of 5 sectors calculated based on AgroSAM
Rye Grass, Forage and Silage	DEU_1.10.008	Domestic Extraction Used - Fodder crops - Rye Grass, Forage and Silage	p01.j	C_PIGS	
Rye Grass, Forage and Silage	DEU_1.10.008	Domestic Extraction Used - Fodder crops - Rye Grass, Forage and Silage	p01.k	C_PLTR	
Rye Grass, Forage and Silage	DEU_1.10.008	Domestic Extraction Used - Fodder crops - Rye Grass, Forage and Silage	p01.l	C_OMEA	
Rye Grass, Forage and Silage	DEU_1.10.008	Domestic Extraction Used - Fodder crops - Rye Grass, Forage and Silage	p01.n	C_MILK	

Sorghum for Forage and Silage	DEU_1.10.009	Domestic Extraction Used - Fodder crops - Sorghum for Forage and Silage	p01.i	C_CATL	Allocated according to shares of 5 sectors calculated based on AgroSAM
Sorghum for Forage and Silage	DEU_1.10.009	Domestic Extraction Used - Fodder crops - Sorghum for Forage and Silage	p01.j	C_PIGS	
Sorghum for Forage and Silage	DEU_1.10.009	Domestic Extraction Used - Fodder crops - Sorghum for Forage and Silage	p01.k	C_PLTR	
Sorghum for Forage and Silage	DEU_1.10.009	Domestic Extraction Used - Fodder crops - Sorghum for Forage and Silage	p01.l	C_OMEA	
Sorghum for Forage and Silage	DEU_1.10.009	Domestic Extraction Used - Fodder crops - Sorghum for Forage and Silage	p01.n	C_MILK	
Swedes for Fodder	DEU_1.10.010	Domestic Extraction Used - Fodder crops - Swedes for Fodder	p01.i	C_CATL	Allocated according to shares of 5 sectors calculated based on AgroSAM
Swedes for Fodder	DEU_1.10.010	Domestic Extraction Used - Fodder crops - Swedes for Fodder	p01.j	C_PIGS	
Swedes for Fodder	DEU_1.10.010	Domestic Extraction Used - Fodder crops - Swedes for Fodder	p01.k	C_PLTR	
Swedes for Fodder	DEU_1.10.010	Domestic Extraction Used - Fodder crops - Swedes for Fodder	p01.l	C_OMEA	
Swedes for Fodder	DEU_1.10.010	Domestic Extraction Used - Fodder crops - Swedes for Fodder	p01.n	C_MILK	
Turnips for Fodder	DEU_1.10.011	Domestic Extraction Used - Fodder crops - Turnips for Fodder	p01.i	C_CATL	Allocated according to shares of 5 sectors calculated based on AgroSAM
Turnips for Fodder	DEU_1.10.011	Domestic Extraction Used - Fodder crops - Turnips for Fodder	p01.j	C_PIGS	
Turnips for Fodder	DEU_1.10.011	Domestic Extraction Used - Fodder crops - Turnips for Fodder	p01.k	C_PLTR	
Turnips for Fodder	DEU_1.10.011	Domestic Extraction Used - Fodder crops - Turnips for Fodder	p01.l	C_OMEA	
Turnips for Fodder	DEU_1.10.011	Domestic Extraction Used - Fodder crops - Turnips for Fodder	p01.n	C_MILK	
Vegetables and Roots, Fodder	DEU_1.10.012	Domestic Extraction Used - Fodder crops - Vegetables and Roots, Fodder	p01.i	C_CATL	Allocated according to shares of 5 sectors calculated based on AgroSAM
Vegetables and Roots, Fodder	DEU_1.10.012	Domestic Extraction Used - Fodder crops - Vegetables and Roots, Fodder	p01.j	C_PIGS	
Vegetables and Roots, Fodder	DEU_1.10.012	Domestic Extraction Used - Fodder crops - Vegetables and Roots, Fodder	p01.k	C_PLTR	
Vegetables and Roots, Fodder	DEU_1.10.012	Domestic Extraction Used - Fodder crops - Vegetables and Roots, Fodder	p01.l	C_OMEA	
Vegetables and Roots, Fodder	DEU_1.10.012	Domestic Extraction Used - Fodder crops - Vegetables and Roots, Fodder	p01.n	C_MILK	
Forage Products nec	DEU_1.10.013	Domestic Extraction Used - Fodder crops - Forage Products nec	p01.i	C_CATL	Allocated according to shares of 5 sectors calculated based on AgroSAM
Forage Products nec	DEU_1.10.013	Domestic Extraction Used - Fodder crops - Forage Products nec	p01.j	C_PIGS	
Forage Products nec	DEU_1.10.013	Domestic Extraction Used - Fodder crops - Forage Products nec	p01.k	C_PLTR	
Forage Products nec	DEU_1.10.013	Domestic Extraction Used - Fodder crops - Forage Products nec	p01.l	C_OMEA	
Forage Products nec	DEU_1.10.013	Domestic Extraction Used - Fodder crops - Forage Products nec	p01.n	C_MILK	
Grasses nec for Forage and Silage	DEU_1.10.014	Domestic Extraction Used - Fodder crops - Grasses nec for Forage and Silage	p01.i	C_CATL	Allocated according to shares of 5 sectors calculated based on AgroSAM
Grasses nec for Forage and Silage	DEU_1.10.014	Domestic Extraction Used - Fodder crops - Grasses nec for Forage and Silage	p01.j	C_PIGS	
Grasses nec for Forage and Silage	DEU_1.10.014	Domestic Extraction Used - Fodder crops - Grasses nec for Forage and Silage	p01.k	C_PLTR	
Grasses nec for Forage and Silage	DEU_1.10.014	Domestic Extraction Used - Fodder crops - Grasses nec for Forage and Silage	p01.l	C_OMEA	

Grasses nec for Forage and Silage	DEU_1.10.014	Domestic Extraction Used - Fodder crops - Grasses nec for Forage and Silage	p01.n	C_MILK	
Leguminous nec for forage and Silage	DEU_1.10.015	Domestic Extraction Used - Fodder crops - Leguminous nec for forage and Silage	p01.i	C_CATL	Allocated according to shares of 5 sectors calculated based on AgroSAM
Leguminous nec for forage and Silage	DEU_1.10.015	Domestic Extraction Used - Fodder crops - Leguminous nec for forage and Silage	p01.j	C_PIGS	
Leguminous nec for forage and Silage	DEU_1.10.015	Domestic Extraction Used - Fodder crops - Leguminous nec for forage and Silage	p01.k	C_PLTR	
Leguminous nec for forage and Silage	DEU_1.10.015	Domestic Extraction Used - Fodder crops - Leguminous nec for forage and Silage	p01.l	C_OMEA	
Leguminous nec for forage and Silage	DEU_1.10.015	Domestic Extraction Used - Fodder crops - Leguminous nec for forage and Silage	p01.n	C_MILK	
Green Oilseeds for Fodder	DEU_1.10.016	Domestic Extraction Used - Fodder crops - Green Oilseeds for Fodder	p01.i	C_CATL	Allocated according to shares of 5 sectors calculated based on AgroSAM
Green Oilseeds for Fodder	DEU_1.10.016	Domestic Extraction Used - Fodder crops - Green Oilseeds for Fodder	p01.j	C_PIGS	
Green Oilseeds for Fodder	DEU_1.10.016	Domestic Extraction Used - Fodder crops - Green Oilseeds for Fodder	p01.k	C_PLTR	
Green Oilseeds for Fodder	DEU_1.10.016	Domestic Extraction Used - Fodder crops - Green Oilseeds for Fodder	p01.l	C_OMEA	
Green Oilseeds for Fodder	DEU_1.10.016	Domestic Extraction Used - Fodder crops - Green Oilseeds for Fodder	p01.n	C_MILK	
Grazing	DEU_1.10.017	Domestic Extraction Used - Grazing	p01.i	C_CATL	Allocated according to shares of 3 sectors calculated based on AgroSAM
Grazing	DEU_1.10.017	Domestic Extraction Used - Grazing	p01.l	C_OMEA	
Grazing	DEU_1.10.017	Domestic Extraction Used - Grazing	p01.n	C_MILK	
Coniferous wood - Industrial roundwood	DEU_1.11.001	Domestic Extraction Used - Forestry - Coniferous wood - Industrial roundwood	p02	C_FORE	
Coniferous wood - Wood fuel	DEU_1.11.002	Domestic Extraction Used - Forestry - Coniferous wood - Wood fuel	p02	C_FORE	
Non-coniferous wood - Industrial roundwood	DEU_1.11.003	Domestic Extraction Used - Forestry - Non-coniferous wood - Industrial roundwood	p02	C_FORE	
Non-coniferous wood - Wood fuel	DEU_1.11.004	Domestic Extraction Used - Forestry - Non-coniferous wood - Wood fuel	p02	C_FORE	
Raw materials other than wood	DEU_1.11.005	Domestic Extraction Used - Forestry - Raw materials other than wood	p02	C_FORE	
Kapok Fruit	DEU_1.11.006	Domestic Extraction Used - Forestry - Kapok Fruit	p02	C_FORE	
Natural Gums	DEU_1.11.007	Domestic Extraction Used - Forestry - Natural Gums	p02	C_FORE	
Aquatic plants	DEU_1.12.001	Domestic Extraction Used - Fishery - Aquatic plants	p05	C_FISH	
Marine fish catch	DEU_1.12.002	Domestic Extraction Used - Fishery - Marine fish catch	p05	C_FISH	
Inland waters fish catch	DEU_1.12.003	Domestic Extraction Used - Fishery - Inland waters fish catch	p05	C_FISH	
Other (e.g. Aquatic mammals)	DEU_1.12.004	Domestic Extraction Used - Fishery - Other (e.g. Aquatic mammals)	p05	C_FISH	

2.2 Metal ores

2.2.1 Data sources and data transformations

Almost all **primary data** for metal extraction were taken from the data base "World Mineral Statistics" developed by the British Geological Survey (BGS, 2014), which provides comprehensive data on the extraction of metals and minerals in all countries world-wide. In order to increase the coverage of metal extraction, BGS data are complemented with data from the International Minerals Statistics and Information published by the US Geological Survey (USGS, 2014) as well as with data from the 'World Mining Data' (WMD) of the Austrian Ministry for Economy and Labour (Reichl et al., 2014). Additionally, we compared the different sources with regard to similarities or differences in the magnitude of the reported values.

Concerning data on metal extraction, BGS and other statistical sources report the majority of the different metal types in metal content contained in the extracted primary ores. In these cases, **factors** need to be applied, in order **to calculate the corresponding extraction of gross ore (run of mine)**, which is the relevant category in economy-wide material flow accounting. Information on concentrations of metals in crude ores was obtained through interviews with experts and a literature survey of more than 300 publications, in particular country and metal reports from the German Federal Geological Institute and the US Geological Survey as well as recent scientific literature (for more information see SERI and WU, 2014).

In the Earth crust, a large number of metal ores occur in combination with other metals – and are also extracted and refined in a coupled process. For instance, lead is usually found in ores, which include also other metals, such as zinc. In the database, in the majority of the cases where coupled production is known this phenomenon is taken into account by calculating the amount of gross ore extracted only for the main metal in this "**coupled production**" and allocating the gross ore only to this metal. The other metal(s), i.e. the by-products, do not receive any gross ore. However, for lead and zinc we have started to apply the approach suggested by Eurostat foreseen for cases of coupled production (EUROSTAT, 2012): Via the ore grades reported for each metal in each country the amount of gross ore is calculated. Theoretically, assuming that the two ores are always extracted together, the two values of gross ores calculated should be equal, as both metals are contained in the same "block" of ore. However, in data reality this is not the fact. Hence, as a next step, the metal contents of both metals are multiplied with the average annual prices of each metal. The higher of the two values identifies the main metal produced and determines which calculated gross ore value is selected. In the final step, the allocation of the selected amount of gross ore to the two metals is done following the monetary relationship of the absolute amounts of economic value.

2.2.2 Material extensions

The number of material extensions regarding metal ores was slightly extended compared to EXIOBASE v.2 and now comprises 12 extensions. In EXIOBASE v.2, the group of precious metals was reported in aggregated form, in EXIOBASE v.3, gold, silver and PGM ores, respectively, are separately listed.

2.2.3 Allocation of extensions to EXIOBASE sectors

In EXIOBASE, 8 product groups are related to the extraction of metal ores. The 12 categories of material extensions thus had to be slightly aggregated to fit to the 8-sector structure of EXIOBASE.

2.2.4 List of materials, extensions and sectors

The following Table 3 contains the full list of material categories, related environmental extensions in EXIOBASE v.3 and the concordance with the EXIOBASE sectors for the section on metal ore extraction. As with biomass above, the table is illustrated for the case of DEU, i.e. used material extraction. UDE data follows the same format.

Table 3: MFA commodities, EXIOBASE material extensions and products for the case of metal ore extraction

SERI/WU MFA database: Commodity Name	EXIOBASE: Material extension ID	EXIOBASE: Material extension Name	EXIOBASE: Product ID	EXIOBASE: Product abbreviation
Uranium	DEU_2.1	Domestic Extraction Used - Metal Ores - Uranium and thorium ores	p12	C_ORAN
Iron ores	DEU_2.2	Domestic Extraction Used - Metal Ores - Iron ores	p13.1	C_IRON
Copper	DEU_2.3	Domestic Extraction Used - Metal Ores - Copper ores	p13.20.11	C_COPO
Nickel	DEU_2.4	Domestic Extraction Used - Metal Ores - Nickel ores	p13.20.12	C_NIKO
Bauxite (Aluminium)	DEU_2.5	Domestic Extraction Used - Metal Ores - Bauxite and aluminium ores	p13.20.13	C_ALUO
Gold	DEU_2.6.01	Domestic Extraction Used - Metal Ores - Gold ores	p13.20.14	C_PREO
Platinum-group (PGM)	DEU_2.6.02	Domestic Extraction Used - Metal Ores - PGM ores	p13.20.14	C_PREO
Silver	DEU_2.6.03	Domestic Extraction Used - Metal Ores - Silver ores	p13.20.14	C_PREO
Lead	DEU_2.7.01	Domestic Extraction Used - Metal Ores - Lead ores	p13.20.15	C_LZTO
Tin	DEU_2.7.02	Domestic Extraction Used - Metal Ores - Tin ores	p13.20.15	C_LZTO
Zinc	DEU_2.7.03	Domestic Extraction Used - Metal Ores - Zinc ores	p13.20.15	C_LZTO
Antimony	DEU_2.8	Domestic Extraction Used - Metal Ores - Other non-ferrous metal ores	p13.20.16	C_ONFO
Arsenic	DEU_2.8	Domestic Extraction Used - Metal Ores - Other non-ferrous metal ores	p13.20.16	C_ONFO
Beryllium	DEU_2.8	Domestic Extraction Used - Metal Ores - Other non-ferrous metal ores	p13.20.16	C_ONFO
Bismuth	DEU_2.8	Domestic Extraction Used - Metal Ores - Other non-ferrous metal ores	p13.20.16	C_ONFO
Cadmium	DEU_2.8	Domestic Extraction Used - Metal Ores - Other non-ferrous metal ores	p13.20.16	C_ONFO
Caesium	DEU_2.8	Domestic Extraction Used - Metal Ores - Other non-ferrous metal ores	p13.20.16	C_ONFO
Chromium	DEU_2.8	Domestic Extraction Used - Metal Ores - Other non-ferrous metal ores	p13.20.16	C_ONFO
Cobalt	DEU_2.8	Domestic Extraction Used - Metal Ores - Other non-ferrous metal ores	p13.20.16	C_ONFO
Gallium	DEU_2.8	Domestic Extraction Used - Metal Ores - Other non-ferrous metal ores	p13.20.16	C_ONFO
Germanium	DEU_2.8	Domestic Extraction Used - Metal Ores - Other	p13.20.16	C_ONFO

		non-ferrous metal ores		
Indium and Thallium	DEU_2.8	Domestic Extraction Used - Metal Ores - Other non-ferrous metal ores	p13.20.16	C_ONFO
Lithium	DEU_2.8	Domestic Extraction Used - Metal Ores - Other non-ferrous metal ores	p13.20.16	C_ONFO
Magnesium	DEU_2.8	Domestic Extraction Used - Metal Ores - Other non-ferrous metal ores	p13.20.16	C_ONFO
Manganeese	DEU_2.8	Domestic Extraction Used - Metal Ores - Other non-ferrous metal ores	p13.20.16	C_ONFO
Mercury	DEU_2.8	Domestic Extraction Used - Metal Ores - Other non-ferrous metal ores	p13.20.16	C_ONFO
Molybdenum	DEU_2.8	Domestic Extraction Used - Metal Ores - Other non-ferrous metal ores	p13.20.16	C_ONFO
Niobium + Tantalum	DEU_2.8	Domestic Extraction Used - Metal Ores - Other non-ferrous metal ores	p13.20.16	C_ONFO
Rare Earths Metals	DEU_2.8	Domestic Extraction Used - Metal Ores - Other non-ferrous metal ores	p13.20.16	C_ONFO
Selenium	DEU_2.8	Domestic Extraction Used - Metal Ores - Other non-ferrous metal ores	p13.20.16	C_ONFO
Sillicium	DEU_2.8	Domestic Extraction Used - Metal Ores - Other non-ferrous metal ores	p13.20.16	C_ONFO
Strontium	DEU_2.8	Domestic Extraction Used - Metal Ores - Other non-ferrous metal ores	p13.20.16	C_ONFO
Tellurium	DEU_2.8	Domestic Extraction Used - Metal Ores - Other non-ferrous metal ores	p13.20.16	C_ONFO
Titanium (incl/ Ilmenite and Rutile)	DEU_2.8	Domestic Extraction Used - Metal Ores - Other non-ferrous metal ores	p13.20.16	C_ONFO
Tungsten	DEU_2.8	Domestic Extraction Used - Metal Ores - Other non-ferrous metal ores	p13.20.16	C_ONFO
Vanadium	DEU_2.8	Domestic Extraction Used - Metal Ores - Other non-ferrous metal ores	p13.20.16	C_ONFO
Zirconium and Hafnium	DEU_2.8	Domestic Extraction Used - Metal Ores - Other non-ferrous metal ores	p13.20.16	C_ONFO

2.3 Minerals

2.3.1 Data sources and data transformations

The data compartment of mineral extraction can be broadly divided into Industrial Minerals and Construction Minerals. However, a clear distinction is often difficult to apply, as the same commodity might be used for both industrial and construction purposes. In its EW-MFA accounting manual, EUROSTAT therefore abandoned this distinction. In this report, we use it in a descriptive way, but the distinction has no implications for the MFA work in the context of EXIOBASE, as the material extraction categories are allocated to the corresponding EXIOBASE sectors independent from their use.

For the section of **Industrial Minerals** we used primary data available from BGS, WMD, and USGS (see full references in the metal section above). In contrast to the necessary conversion of reported metal extraction, industrial minerals are mined in their processable form and as such do not have to be converted using any factors.

Coverage of **Construction Minerals** in official statistics is still unsatisfactory, even in industrialised countries, but in particular with regard to non-OECD countries, where huge data gaps were identified and in many cases, no data on the extraction of construction minerals at all is available from published statistics.

Therefore, a 3-step methodology was developed (for more information see SERI and WU, 2014):

1. For countries, which regularly publish accounts of material extraction including construction minerals, i.e. the EU-28 and the US, data was directly taken from official statistics.
2. For all other countries, for which USGS reported physical data on cement and bitumen (or asphalt) production, a method was applied, which estimates the corresponding amounts of the extraction of limestone, sand and gravel based on these physical production data using factors as reported in Krausmann et al. (2009). By this procedure, we cover around 50 % of all countries world-wide, including all the large consumers of construction minerals, such as China, India or Brazil.
3. For all remaining countries, mostly small developing countries, we estimate the values for extraction of construction minerals based on GDP/capita data. In total, less than 3% of all global construction minerals are estimated based on this third approach.

2.3.2 Material extensions

In the area of mineral extractions, 9 different material extensions are reported in EXIOBASE v.3. This is one category less compared to EXIOBASE v.2, as the two extensions of "other industrial minerals" and "other construction minerals" are now summed up, acknowledging the difficulties to allocate a certain commodity to either of the two uses (see also above).

2.3.3 Allocation of extensions to EXIOBASE sectors

EXIOBASE distinguishes 3 sectors related to the extraction of minerals: extraction of (1) stones, (2) sand and clays and (3) chemical and fertilizer minerals, salt and other mining and quarrying products nec. Each commodity included in the nine material extensions thus was aggregated into one of the three EXIOBASE extraction sectors.

2.3.4 List of materials, extensions and sectors

The following Table 4 illustrates all material categories, related environmental extensions in EXIOBASE v.3 and the concordance with the EXIOBASE sectors for the section on mineral extraction. Again, UDE data follows the same format.

Table 4: MFA commodities, EXIOBASE material extensions and products for the case of mineral extraction

SERI/WU MFA database: Commodity Name	EXIOBASE: Material extension ID	EXIOBASE: Material extension Name	EXIOBASE: Product ID	EXIOBASE: Product abbreviation
Calcite	DEU_3.8	Domestic Extraction Used - Non-Metallic Minerals - Other minerals	p14.1	C_STON
Chalk	DEU_3.3	Domestic Extraction Used - Non-Metallic Minerals - Limestone, gypsum, chalk, dolomite	p14.1	C_STON
Chert and flint	DEU_3.8	Domestic Extraction Used - Non-Metallic Minerals - Other minerals	p14.1	C_STON
Dolomite	DEU_3.3	Domestic Extraction Used - Non-Metallic Minerals - Limestone, gypsum, chalk, dolomite	p14.1	C_STON
Igneous rock	DEU_3.8	Domestic Extraction Used - Non-Metallic Minerals - Other minerals	p14.1	C_STON
Limestone	DEU_3.3	Domestic Extraction Used - Non-Metallic Minerals - Limestone, gypsum, chalk, dolomite	p14.1	C_STON
Sandstone	DEU_3.8	Domestic Extraction Used - Non-Metallic Minerals - Other minerals	p14.1	C_STON
Slate including fill (incl. roof slate)	DEU_3.5	Domestic Extraction Used - Non-Metallic Minerals - Slate	p14.1	C_STON
Crushed stone	DEU_3.8	Domestic Extraction Used - Non-Metallic Minerals - Other minerals	p14.1	C_STON
Marble, travertines etc.	DEU_3.6	Domestic Extraction Used - Non-Metallic Minerals - Building stones	p14.1	C_STON
Turfaceous rock	DEU_3.6	Domestic Extraction Used - Non-Metallic Minerals - Building stones	p14.1	C_STON
Asphalt	DEU_3.8	Domestic Extraction Used - Non-Metallic Minerals - Other minerals	p14.1	C_STON
Ball clay	DEU_3.2	Domestic Extraction Used - Non-Metallic Minerals - Clays and kaolin	p14.2	C_SDCL
Bentonite, sepiolite and attapulgite	DEU_3.2	Domestic Extraction Used - Non-Metallic Minerals - Clays and kaolin	p14.2	C_SDCL
Fire, refactory and flint clay, Andalusite, kyanite and sillimanite	DEU_3.2	Domestic Extraction Used - Non-Metallic Minerals - Clays and kaolin	p14.2	C_SDCL
Fuller's earth	DEU_3.2	Domestic Extraction Used - Non-Metallic Minerals - Clays and kaolin	p14.2	C_SDCL
Kaolin	DEU_3.2	Domestic Extraction Used - Non-Metallic Minerals - Clays and kaolin	p14.2	C_SDCL
Potter clay	DEU_3.2	Domestic Extraction Used - Non-Metallic Minerals - Clays and kaolin	p14.2	C_SDCL
Special clay	DEU_3.2	Domestic Extraction Used - Non-Metallic Minerals - Clays and kaolin	p14.2	C_SDCL
Slate clay	DEU_3.2	Domestic Extraction Used - Non-Metallic Minerals - Clays and kaolin	p14.2	C_SDCL
Industrial sand	DEU_3.8	Domestic Extraction Used - Non-Metallic Minerals - Other minerals	p14.2	C_SDCL
Sillica sand (quartzsand)	DEU_3.8	Domestic Extraction Used - Non-Metallic Minerals - Other minerals	p14.2	C_SDCL
Siliceous earth	DEU_3.8	Domestic Extraction Used - Non-Metallic Minerals - Other minerals	p14.2	C_SDCL
Common clay, clay for bricks etc.	DEU_3.2	Domestic Extraction Used - Non-Metallic Minerals - Clays and kaolin	p14.2	C_SDCL
Loam	DEU_3.2	Domestic Extraction Used - Non-Metallic Minerals - Clays and kaolin	p14.2	C_SDCL
Lavasand	DEU_3.8	Domestic Extraction Used - Non-Metallic Minerals	p14.2	C_SDCL

		- Other minerals		
Sand and gravel	DEU_3.7	Domestic Extraction Used - Non-Metallic Minerals - Gravel and sand	p14.2	C_SDCL
Construction Minerals nec	DEU_3.8	Domestic Extraction Used - Non-Metallic Minerals - Other minerals	p14.2	C_SDCL
Vermiculite	DEU_3.8	Domestic Extraction Used - Non-Metallic Minerals - Other minerals	p14.3	C_CHMF
Wollastonite	DEU_3.8	Domestic Extraction Used - Non-Metallic Minerals - Other minerals	p14.3	C_CHMF
Rock salt	DEU_3.4	Domestic Extraction Used - Non-Metallic Minerals - Salt	p14.3	C_CHMF
From brine	DEU_3.4	Domestic Extraction Used - Non-Metallic Minerals - Salt	p14.3	C_CHMF
In brine, sold or used as such	DEU_3.4	Domestic Extraction Used - Non-Metallic Minerals - Salt	p14.3	C_CHMF
Boiled salt	DEU_3.4	Domestic Extraction Used - Non-Metallic Minerals - Salt	p14.3	C_CHMF
Solar salt	DEU_3.4	Domestic Extraction Used - Non-Metallic Minerals - Salt	p14.3	C_CHMF
Peat for agricultural use	DEU_3.8	Domestic Extraction Used - Non-Metallic Minerals - Other minerals	p14.3	C_CHMF
Abrasives, natural (puzzolan, pumice, volcanic cinder etc.)	DEU_3.8	Domestic Extraction Used - Non-Metallic Minerals - Other minerals	p14.3	C_CHMF
Amber	DEU_3.8	Domestic Extraction Used - Non-Metallic Minerals - Other minerals	p14.3	C_CHMF
Barite	DEU_3.1	Domestic Extraction Used - Non-Metallic Minerals - Chemical and fertilizer minerals	p14.3	C_CHMF
Borate minerals	DEU_3.1	Domestic Extraction Used - Non-Metallic Minerals - Chemical and fertilizer minerals	p14.3	C_CHMF
Diamonds, gems	DEU_3.8	Domestic Extraction Used - Non-Metallic Minerals - Other minerals	p14.3	C_CHMF
Diamonds, industrial	DEU_3.8	Domestic Extraction Used - Non-Metallic Minerals - Other minerals	p14.3	C_CHMF
Diatomite	DEU_3.8	Domestic Extraction Used - Non-Metallic Minerals - Other minerals	p14.3	C_CHMF
Feldspar	DEU_3.8	Domestic Extraction Used - Non-Metallic Minerals - Other minerals	p14.3	C_CHMF
Fluorspar	DEU_3.1	Domestic Extraction Used - Non-Metallic Minerals - Chemical and fertilizer minerals	p14.3	C_CHMF
Graphite, natural	DEU_3.8	Domestic Extraction Used - Non-Metallic Minerals - Other minerals	p14.3	C_CHMF
Iron ore for pigments	DEU_3.8	Domestic Extraction Used - Non-Metallic Minerals - Other minerals	p14.3	C_CHMF
Magnesite	DEU_3.8	Domestic Extraction Used - Non-Metallic Minerals - Other minerals	p14.3	C_CHMF
Mica	DEU_3.8	Domestic Extraction Used - Non-Metallic Minerals - Other minerals	p14.3	C_CHMF
Ochre and pigment earths	DEU_3.8	Domestic Extraction Used - Non-Metallic Minerals - Other minerals	p14.3	C_CHMF
Pegmatite sand	DEU_3.8	Domestic Extraction Used - Non-Metallic Minerals - Other minerals	p14.3	C_CHMF
Phosphate rock (natural phosphates)	DEU_3.1	Domestic Extraction Used - Non-Metallic Minerals - Chemical and fertilizer minerals	p14.3	C_CHMF
Potash	DEU_3.1	Domestic Extraction Used - Non-Metallic Minerals - Chemical and fertilizer minerals	p14.3	C_CHMF
Qartz and quartzite	DEU_3.8	Domestic Extraction Used - Non-Metallic Minerals - Other minerals	p14.3	C_CHMF
Strontium minerals	DEU_3.8	Domestic Extraction Used - Non-Metallic Minerals - Other minerals	p14.3	C_CHMF

Sulphur	DEU_3.1	Domestic Extraction Used - Non-Metallic Minerals - Chemical and fertilizer minerals	p14.3	C_CHMF
Sulphur from pyrites	DEU_3.1	Domestic Extraction Used - Non-Metallic Minerals - Chemical and fertilizer minerals	p14.3	C_CHMF
Sulphur as a by-product of natural gas etc.	DEU_3.1	Domestic Extraction Used - Non-Metallic Minerals - Chemical and fertilizer minerals	p14.3	C_CHMF
Talc (steatite, soapstone, pyrophyllite)	DEU_3.8	Domestic Extraction Used - Non-Metallic Minerals - Other minerals	p14.3	C_CHMF
Talcous slate	DEU_3.8	Domestic Extraction Used - Non-Metallic Minerals - Other minerals	p14.3	C_CHMF
Asbestos	DEU_3.8	Domestic Extraction Used - Non-Metallic Minerals - Other minerals	p14.3	C_CHMF
Gluesand	DEU_3.8	Domestic Extraction Used - Non-Metallic Minerals - Other minerals	p14.3	C_CHMF
Gypsum and anhydrite	DEU_3.3	Domestic Extraction Used - Non-Metallic Minerals - Limestone, gypsum, chalk, dolomite	p14.3	C_CHMF
Perlite	DEU_3.8	Domestic Extraction Used - Non-Metallic Minerals - Other minerals	p14.3	C_CHMF

2.4 Fossil fuels

2.4.1 Data sources and data transformations

Data on fossil fuel extraction are taken from energy production statistics from the International Energy Agency (IEA, 2014a, b) and complemented with by USGS (USGS, 2014). The IEA dataset is the most comprehensive currently available data set reporting on fossil fuel extraction and energy use of all countries world-wide. Data can be easily compiled and retrieved with a Pivot-type tool provided by IEA.

The IEA reports all categories included in the Global Material Flow database (hard coal, lignite/brown coal, crude oil, natural gas, natural gas liquids, peat for energy use) in primary units of 1000 tonnes. Only the values of natural gas have to be converted from TJ into 1000t (kt), using a conversion factor provided by IEA itself (0.018 kt/TJ).

2.4.2 Material extensions

The number of material extensions follows the full IEA list of primary products, which distinguishes the following 9 products: Anthracite, Coking Coal, Other bituminous coal, Sub-bituminous coal, Lignite, Peat for energy use, Crude oil, Natural gas and Natural gas liquids.

2.4.3 Allocation of extensions to EXIOBASE sectors

As EXIOBASE has been created to mirror the IEA product structure, allocation of fossil fuel extraction to the EXIOBASE sectors is a one-to-one exercise.

2.4.4 List of materials, extensions and sectors

Table 5 below illustrates all material categories, related environmental extensions in EXIOBASE v.3 and the concordance with the EXIOBASE sectors for the section on fossil fuel extraction. Again, UDE data follows the same format.

Table 5: MFA commodities, EXIOBASE material extensions and products for the case of fossil fuel extraction

SERI/WU MFA database: Commodity Name	EXIOBASE: Material extension ID	EXIOBASE: Material extension Name	EXIOBASE: Product ID	EXIOBASE: Product abbreviation
Anthracite	DEU_4.1	Domestic Extraction Used - Fossil Fuels - Anthracite	p10.a	C_ANTH
Coking Coal	DEU_4.2	Domestic Extraction Used - Fossil Fuels - Coking coal	p10.b	C_COKC
Other bituminous coal	DEU_4.3	Domestic Extraction Used - Fossil Fuels - Other bituminous coal	p10.c	C_OTBC
Sub-bituminous coal	DEU_4.4	Domestic Extraction Used - Fossil Fuels - Sub-bituminous coal	p10.d	C_SUBC
Lignite	DEU_4.5	Domestic Extraction Used - Fossil Fuels - Lignite/brown coal	p10.f	C_LIBC
Peat for energy use	DEU_4.6	Domestic Extraction Used - Fossil Fuels - Peat	p10.h	C_PEAT
Crude oil	DEU_4.7	Domestic Extraction Used - Fossil Fuels - Crude oil	p11.a	C_COIL
Natural gas	DEU_4.8	Domestic Extraction Used - Fossil Fuels - Natural gas	p11.b	C_GASE
Natural gas liquids	DEU_4.9	Domestic Extraction Used - Fossil Fuels - Natural gas liquids	p11.b.1	C_GASL

2.5 Unused domestic extraction

In addition to the compilation of data on used domestic extraction of various biotic and abiotic raw materials, the SERI/WU database also contains estimations on corresponding unused extraction. These estimations have also been integrated into EXIOBASE delivering a set of Unused Domestic Extraction (UDE) for all material extensions. Unused materials include for example overburden for mining activities and unused residuals of biomass extraction (OECD, 2008).

UDE is generally estimated by multiplying used extraction with factors expressing amounts of unused materials per used materials (in tonne/tonne). Factors and data sources used in the SERI/WU database were cross-checked and harmonised with the database on factors for unused material extraction developed by the Wuppertal Institute in Germany. In order to be able to calculate unused values for all commodities in all countries, similar to the metal section for used extraction, the availability of the following types of factors was checked, and the respective factors were used in the following order of priorities:

National factor ➔ continental average factor ➔ world average factor

For a more detailed description of the sources for UDE factors by material categories, refer to SERI and WU (2014).

It has to be emphasised that data availability and quality for unused material extraction is still unsatisfying for many countries (in particular, non-OECD countries) and improvement of UDE estimates across all countries world-wide will require significant efforts.

3 Conclusion

This Annex reported on the work undertaken in DESIRE WP 5.2b on the compilation of material extraction data and corresponding material extensions included in the EXIOBASE version 3. Work in this area followed international guidelines for economy-wide material flow accounting (EW-MFA) such as determined by EUROSTAT.

However, despite the significant methodological and data advancements in the past years, data quality still varies widely across the various parts of the EW-MFA accounts. While data availability and robustness is high for some material categories, such as fossil fuels, there are still areas with significant impact on the overall MFA results, where several estimations procedures are available. Biomass uptake by animals (grazing) as well as extraction of construction minerals such as sand and gravel are prominent examples for these categories.

In the following Table 6 we present an evaluation of data quality of the different data sources used across the various material groups, as perceived during the data compilation works. Information for unused extraction is generally of low quality on the global level, therefore Table 6 only concerns used extraction.

Table 6: Evaluation of data quality of primary data sources for the major material groups

Data source	Quality	Comment
Fossil Fuels		
IEA	++	Most comprehensive data source; no open access
USGS	+	Valuable data for filling IEA gaps
Metal ores		
BGS	++	Very comprehensive database
USGS	++	Very comprehensive database
WMD	+	Comprehensive database
Minerals		
Industrial Minerals		
BGS	++	Very comprehensive database
USGS	++	Very comprehensive database
WMD	+	Comprehensive database
Construction Minerals		
Eurostat	+/-	Data of differing quality and low level of disaggregation
BGS	+	Good coverage but occasionally questionable values
USGS	+	Good coverage but in general underestimating mineral extraction
WMD	+/-	Low coverage of construction minerals
Estimation method 1 (based on cement/bitumen production)	+	Independent from GDP, but data not available for all countries
Estimation method 2 (based on GDP per capita)	+/-	Applicable for all countries in the world but tends to underestimate; direct relation to national GDP

Biomass		
Agriculture		
FAO	++	Very high coverage
By-products of harvest		
FAO / Estimation method	+/-	Method in accordance with MFA guide; however, average values for the whole world
Grazing		
FAO / Estimation method	+	Grazing is calculated based on a range of regionally specific data on feed demand and feed supply. Big differences e.g. in feed demand and crop residue recovery coefficients in the literature, however, indicate high variations and related uncertainties in the calculations.
Forestry		
FAO	+	Immense coverage; however, critique has been raised about the accuracy of FAO data on forestry
Fishing		
FAO	++	Very high coverage

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5 Annex

Table 7: Concordance table between FAP items, EXIOBASE products and CPA codes

FAO item name	FAO item code	EXIOBASE product	CPA name	CPA Code(s)
Rice, Paddy	27	Paddy rice	Rice, not husked	01.11.14
Wheat	15	Wheat	Durum wheat; Soft wheat and meslin	01.11.11; 01.11.12
Barley	44	Cereal grains nec	Barley	01.11.15
Maize	56	Cereal grains nec	Maize (corn)	01.11.13
Popcorn	68	Cereal grains nec	Other cereals	01.11.17
Rye	71	Cereal grains nec	Rye, oats	01.11.16
Oats	75	Cereal grains nec	Other cereals	01.11.17
Millet	79	Cereal grains nec	Other cereals	01.11.17
Sorghum	83	Cereal grains nec	Other cereals	01.11.17
Buckwheat	89	Cereal grains nec	Other cereals	01.11.17
Quinoa	92	Cereal grains nec	Other cereals	01.11.17
Fonio	94	Cereal grains nec	Other cereals	01.11.17
Triticale	97	Cereal grains nec	Other cereals	01.11.17
Canary Seed	101	Cereal grains nec	Other cereals	01.11.17
Grain, mixed	103	Cereal grains nec	Other cereals	01.11.17
Cereals, nes	108	Cereal grains nec	Other cereals	01.11.17
Coconuts	249	Vegetables, fruit, nuts	Dates, figs, bananas, coconuts, Brazil nuts, cashew nuts, pineapples, avocados, mangoes, guavas	01.13.21
Carobs	461	Vegetables, fruit, nuts	Dried leguminous vegetables, shelled	01.11.22
Bananas	486	Vegetables, fruit, nuts	Dates, figs, bananas, coconuts, Brazil nuts, cashew nuts, pineapples, avocados, mangoes, guavas	01.13.21
Plantains	489	Vegetables, fruit, nuts	Dates, figs, bananas, coconuts, Brazil nuts, cashew nuts, pineapples, avocados, mangoes, guavas	01.13.21
Oranges	490	Vegetables, fruit, nuts	Citrus fruit	01.13.22
Tangerines, mandarins, clementines, satsumas	495	Vegetables, fruit, nuts	Citrus fruit	01.13.22
Lemons and Limes	497	Vegetables, fruit, nuts	Citrus fruit	01.13.22
Grapefruit (inc. pomelos)	507	Vegetables, fruit, nuts	Citrus fruit	01.13.22
Fruit, citrus nes	512	Vegetables, fruit, nuts	Citrus fruit	01.13.22
Apples	515	Vegetables, fruit, nuts	Other fruit, locust beans	01.13.23
Pears	521	Vegetables, fruit, nuts	Other fruit, locust beans	01.13.23
Quinces	523	Vegetables, fruit, nuts	Other fruit, locust beans	01.13.23
Apricots	526	Vegetables, fruit, nuts	Other fruit, locust beans	01.13.23
Cherries, sour	530	Vegetables, fruit, nuts	Other fruit, locust beans	01.13.23
Cherries	531	Vegetables, fruit, nuts	Other fruit, locust beans	01.13.23
Peaches and Nectarines	534	Vegetables, fruit, nuts	Other fruit, locust beans	01.13.23
Plums and sloes	536	Vegetables, fruit, nuts	Other fruit, locust beans	01.13.23
Fruit, stone nes	541	Vegetables, fruit, nuts	Other fruit, locust beans	01.13.23

Fruit, pome nes	542	Vegetables, fruit, nuts	Other fruit, locust beans	01.13.23
Strawberries	544	Vegetables, fruit, nuts	Other fruit, locust beans	01.13.23
Raspberries	547	Vegetables, fruit, nuts	Other fruit, locust beans	01.13.23
Gooseberries	549	Vegetables, fruit, nuts	Other fruit, locust beans	01.13.23
Currants	550	Vegetables, fruit, nuts	Other fruit, locust beans	01.13.23
Blueberries	552	Vegetables, fruit, nuts	Other fruit, locust beans	01.13.23
Cranberries	554	Vegetables, fruit, nuts	Other fruit, locust beans	01.13.23
Berries nes	558	Vegetables, fruit, nuts	Other fruit, locust beans	01.13.23
Grapes	560	Vegetables, fruit, nuts	Table grapes; Other grapes, fresh	01.13.11; 01.13.12
Figs	569	Vegetables, fruit, nuts	Dates, figs, bananas, coconuts, Brazil nuts, cashew nuts, pineapples, avocados, mangoes, guavas	01.13.21
Mangoes, mangosteens, guavas	571	Vegetables, fruit, nuts	Dates, figs, bananas, coconuts, Brazil nuts, cashew nuts, pineapples, avocados, mangoes, guavas	01.13.21
Avocados	572	Vegetables, fruit, nuts	Dates, figs, bananas, coconuts, Brazil nuts, cashew nuts, pineapples, avocados, mangoes, guavas	01.13.21
Pineapples	574	Vegetables, fruit, nuts	Dates, figs, bananas, coconuts, Brazil nuts, cashew nuts, pineapples, avocados, mangoes, guavas	01.13.21
Dates	577	Vegetables, fruit, nuts	Dates, figs, bananas, coconuts, Brazil nuts, cashew nuts, pineapples, avocados, mangoes, guavas	01.13.21
Persimmons	587	Vegetables, fruit, nuts	Other fruit, locust beans	01.13.23
Cashewapple	591	Vegetables, fruit, nuts	Other fruit, locust beans	01.13.23
Kiwi Fruit	592	Vegetables, fruit, nuts	Other fruit, locust beans	01.13.23
Papayas	600	Vegetables, fruit, nuts	Other fruit, locust beans	01.13.23
Fruit, tropical fresh nes	603	Vegetables, fruit, nuts	Other fruit, locust beans	01.13.23
Fruit, fresh nes	619	Vegetables, fruit, nuts	Other fruit, locust beans	01.13.23
Brazil nuts, with shell	216	Vegetables, fruit, nuts	Dates, figs, bananas, coconuts, Brazil nuts, cashew nuts, pineapples, avocados, mangoes, guavas	01.13.21
Cashew nuts, with shell	217	Vegetables, fruit, nuts	Dates, figs, bananas, coconuts, Brazil nuts, cashew nuts, pineapples, avocados, mangoes, guavas	01.13.21
Chestnut	220	Vegetables, fruit, nuts	Olives and other nuts	01.13.24
Almonds, with shell	221	Vegetables, fruit, nuts	Olives and other nuts	01.13.24
Walnuts, with shell	222	Vegetables, fruit, nuts	Olives and other nuts	01.13.24
Pistachios	223	Vegetables, fruit, nuts	Olives and other nuts	01.13.24
Kola nuts	224	Vegetables, fruit, nuts	Olives and other nuts	01.13.24
Hazelnuts, with shell	225	Vegetables, fruit, nuts	Olives and other nuts	01.13.24
Areca nuts	226	Vegetables, fruit, nuts	Olives and other nuts	01.13.24
Nuts, nes	234	Vegetables, fruit, nuts	Olives and other nuts	01.13.24
Beans, dry	176	Vegetables, fruit, nuts	Vegetables cultivated for their fruits	01.12.12
Broad beans, horse beans, dry	181	Vegetables, fruit, nuts	Vegetables cultivated for their fruits	01.12.12
Peas, dry	187	Vegetables, fruit, nuts	Vegetables cultivated for their fruits	01.12.12
Chick peas	191	Vegetables, fruit, nuts	Vegetables cultivated for their fruits	01.12.12
Cow peas, dry	195	Vegetables, fruit, nuts	Vegetables cultivated for their fruits	01.12.12
Pigeon peas	197	Vegetables, fruit, nuts	Vegetables cultivated for their fruits	01.12.12

Lentils	201	Vegetables, fruit, nuts	Dried leguminous vegetables, shelled	01.11.22
Bambara beans	203	Vegetables, fruit, nuts	Vegetables cultivated for their fruits	01.12.12
Vetches	205	Vegetables, fruit, nuts	Vegetables cultivated for their fruits	01.12.12
Lupins	210	Vegetables, fruit, nuts	Vegetables cultivated for their fruits	01.12.12
Pulses, nes	211	Vegetables, fruit, nuts	Vegetables cultivated for their fruits	01.12.12
Beans, green	414	Vegetables, fruit, nuts	Vegetables cultivated for their fruits	01.12.12
String beans	423	Vegetables, fruit, nuts	Vegetables cultivated for their fruits	01.12.12
Potatoes	116	Vegetables, fruit, nuts	Potatoes	01.11.21
Sweet Potatoes	122	Vegetables, fruit, nuts	Potatoes	01.11.21
Cassava	125	Vegetables, fruit, nuts	Edible roots and tubers with high starch or inulin content	01.11.23
Yautia (cocoyam)	135	Vegetables, fruit, nuts	Root and tuber vegetables	01.12.11
Taro (cocoyam)	136	Vegetables, fruit, nuts	Root and tuber vegetables	01.12.11
Yams	137	Vegetables, fruit, nuts	Root and tuber vegetables	01.12.11
Roots and Tubers, nes	149	Vegetables, fruit, nuts	Root and tuber vegetables	01.12.11
Olives	260	Vegetables, fruit, nuts	Olives and other nuts	01.13.24
Cabbages and other brassicas	358	Vegetables, fruit, nuts	Other vegetables n.e.c.	01.12.13
Artichokes	366	Vegetables, fruit, nuts	Other vegetables n.e.c.	01.12.13
Asparagus	367	Vegetables, fruit, nuts	Other vegetables n.e.c.	01.12.13
Lettuce and chicory	372	Vegetables, fruit, nuts	Other vegetables n.e.c.	01.12.13
Spinach	373	Vegetables, fruit, nuts	Other vegetables n.e.c.	01.12.13
Cassava leaves	378	Vegetables, fruit, nuts	Edible roots and tubers with high starch or inulin content	01.11.23
Tomatoes	388	Vegetables, fruit, nuts	Vegetables cultivated for their fruits	01.12.12
Cauliflowers and broccoli	393	Vegetables, fruit, nuts	Other vegetables n.e.c.	01.12.13
Pumpkins, squash and gourds	394	Vegetables, fruit, nuts	Vegetables cultivated for their fruits	01.12.12
Cucumbers and Gherkins	397	Vegetables, fruit, nuts	Vegetables cultivated for their fruits	01.12.12
Eggplants (aubergines)	399	Vegetables, fruit, nuts	Other vegetables n.e.c.	01.12.13
Chillies and peppers, green	401	Vegetables, fruit, nuts	Other vegetables n.e.c.	01.12.13
Onions, shallots, green	402	Vegetables, fruit, nuts	Root and tuber vegetables	01.12.11
Onions, dry	403	Vegetables, fruit, nuts	Root and tuber vegetables	01.12.11
Garlic	406	Vegetables, fruit, nuts	Root and tuber vegetables	01.12.11
Leeks, other alliaceous vegetables	407	Vegetables, fruit, nuts	Root and tuber vegetables	01.12.11
Peas, Green	417	Vegetables, fruit, nuts	Vegetables cultivated for their fruits	01.12.12
Vegetables, leguminous nes	420	Vegetables, fruit, nuts	Vegetables cultivated for their fruits	01.12.12
Carrots and turnips	426	Vegetables, fruit, nuts	Root and tuber vegetables	01.12.11
Okra	430	Vegetables, fruit, nuts	Other vegetables n.e.c.	01.12.13
Maize, green	446	Vegetables, fruit, nuts	Other vegetables n.e.c.	01.12.13
Mushrooms and truffles	449	Vegetables, fruit, nuts	Other vegetables n.e.c.	01.12.13
Vegetables, fresh nes	463	Vegetables, fruit, nuts	Other vegetables n.e.c.	01.12.13
Watermelons	567	Vegetables, fruit, nuts	Vegetables cultivated for their fruits	01.12.12

Melons, other (inc.cantaloupes)	568	Vegetables, fruit, nuts	Vegetables cultivated for their fruits	01.12.12
Soybeans	236	Oil seeds	Soy beans	01.11.31
Groundnuts, with shell	242	Oil seeds	Ground nuts	01.11.32
Oil, palm fruit	254	Oil seeds	Oil seeds and oleaginous fruits n.e.c.	01.11.35
Karite Nuts (Sheanuts)	263	Oil seeds	Olives and other nuts	01.13.24
Castor oil seed	265	Oil seeds	Oil seeds and oleaginous fruits n.e.c.	01.11.35
Sunflower Seed	267	Oil seeds	Sunflower, sesamum, safflower, rape, colza and mustard seeds	01.11.33
Rapeseed	270	Oil seeds	Sunflower, sesamum, safflower, rape, colza and mustard seeds	01.11.33
Tung Nuts	275	Oil seeds	Oil seeds and oleaginous fruits n.e.c.	01.11.35
Jojoba seed	277	Oil seeds	Oil seeds and oleaginous fruits n.e.c.	01.11.35
Safflower Seed	280	Oil seeds	Sunflower, sesamum, safflower, rape, colza and mustard seeds	01.11.33
Sesame Seed	289	Oil seeds	Sunflower, sesamum, safflower, rape, colza and mustard seeds	01.11.33
Mustard Seed	292	Oil seeds	Sunflower, sesamum, safflower, rape, colza and mustard seeds	01.11.33
Poppy Seed	296	Oil seeds	Oil seeds and oleaginous fruits n.e.c.	01.11.35
Melonseed	299	Oil seeds	Oil seeds and oleaginous fruits n.e.c.	01.11.35
Tallowtree seed	305	Oil seeds	Oil seeds and oleaginous fruits n.e.c.	01.11.35
Cottonseed	329	Oil seeds	Cotton seed	01.11.34
Linseed	333	Oil seeds	Oil seeds and oleaginous fruits n.e.c.	01.11.35
Hempseed	336	Oil seeds	Oil seeds and oleaginous fruits n.e.c.	01.11.35
Oilseeds nes	339	Oil seeds	Oil seeds and oleaginous fruits n.e.c.	01.11.35
Sugar cane	156	Sugar cane, sugar beet	Sugar cane	01.11.52
Sugar beet	157	Sugar cane, sugar beet	Sugar beet	01.11.51
Sugar crops, nes	161	Sugar cane, sugar beet	Sugar beet	01.11.51
Cotton Lint	767	Plant-based fibers	Cotton, whether or not ginned	01.11.71
Flax Fibre and Tow	773	Plant-based fibers	Flax and true hemp; sisal and other textile fibres of the genus Agave, raw	01.11.73
Hemp tow waste	777	Plant-based fibers	Flax and true hemp; sisal and other textile fibres of the genus Agave, raw	01.11.73
Jute	780	Plant-based fibers	Jute and other textile bast fibres, except flax, true hemp and ramie	01.11.72
Bastfibres, other	782	Plant-based fibers	Jute and other textile bast fibres, except flax, true hemp and ramie	01.11.72
Ramie	788	Plant-based fibers	Flax and true hemp; sisal and other textile fibres of the genus Agave, raw	01.11.73
Sisal	789	Plant-based fibers	Flax and true hemp; sisal and other textile fibres of the genus Agave, raw	01.11.73
Agave Fibres nes	800	Plant-based fibers	Flax and true hemp; sisal and other textile fibres of the genus Agave, raw	01.11.73
Manila fibre (abaca)	809	Plant-based fibers	Flax and true hemp; sisal and other textile fibres of the genus Agave, raw	01.11.73
Coir	813	Plant-based fibers	Flax and true hemp; sisal and other textile fibres of the genus Agave, raw	01.11.73
Fibre Crops nes	821	Plant-based fibers	Flax and true hemp; sisal and other textile fibres of the genus Agave, raw	01.11.73
Chicory Roots	459	Crops nec	Other raw vergetable materials	01.11.93
Coffee, Green	656	Crops nec	Coffee, not roasted, not decaffeinated	01.13.31
Cocoa, beans	661	Crops nec	Cocoa beans	01.13.34
Tea	667	Crops nec	Green tea (not fermented), black tea	01.13.32

			(fermented) and partly fermented tea, in immediate packings of a content > 3 kg	
Maté	671	Crops nec	Mate	01.13.33
Tea nes	674	Crops nec	Green tea (not fermented), black tea (fermented) and partly fermented tea, in immediate packings of a content > 3 kg	01.13.32
Hops	677	Crops nec	Other raw vegetable materials	01.11.93
Pepper (Piper spp.)	687	Crops nec	Spices, not processed	01.13.40
Chillies and peppers, dry	689	Crops nec	Spices, not processed	01.13.40
Vanilla	692	Crops nec	Spices, not processed	01.13.40
Cinnamon (canella)	693	Crops nec	Spices, not processed	01.13.40
Cloves	698	Crops nec	Spices, not processed	01.13.40
Nutmeg, mace and cardamoms	702	Crops nec	Spices, not processed	01.13.40
Anise, badian, fennel, coriander	711	Crops nec	Spices, not processed	01.13.40
Ginger	720	Crops nec	Spices, not processed	01.13.40
Spices, nes	723	Crops nec	Spices, not processed	01.13.40
Peppermint	748	Crops nec	Spices, not processed	01.13.40
Pyrethrum, dried	754	Crops nec	Plants used primary in perfumery, in pharmacy, or for insecticidal, fungicidal or similar purposes	01.11.91
Tobacco, unmanufactured	826	Crops nec	Unmanufactured tobacco	01.11.40
Rubber, natural	836	Crops nec	Natural rubber	01.11.80
Forage and silage, maize	636	div. animal sectors	Straw and forage	01.11.60
Forage and silage, sorghum	637	div. animal sectors	Straw and forage	01.11.60
Forage and silage, rye grass	638	div. animal sectors	Straw and forage	01.11.60
Forage and silage, grasses nes	639	div. animal sectors	Straw and forage	01.11.60
Forage and silage, clover	640	div. animal sectors	Straw and forage	01.11.60
Forage and silage, alfalfa	641	div. animal sectors	Straw and forage	01.11.60
Forage and silage, green oilseeds	642	div. animal sectors	Straw and forage	01.11.60
Forage and silage, legumes	643	div. animal sectors	Straw and forage	01.11.60
Cabbage for Fodder	644	div. animal sectors	Straw and forage	01.11.60
Pumpkins for Fodder	645	div. animal sectors	Straw and forage	01.11.60
Turnips for Fodder	646	div. animal sectors	Straw and forage	01.11.60
Beets for Fodder	647	div. animal sectors	Straw and forage	01.11.60
Carrots for Fodder	648	div. animal sectors	Straw and forage	01.11.60
Swedes for Fodder	649	div. animal sectors	Straw and forage	01.11.60
Forage Products	651	div. animal sectors	Straw and forage	01.11.60
Vegetables and roots fodder	655	div. animal sectors	Straw and forage	01.11.60
Kapok Fruit	310	Products of forestry, logging and related services	Vegetable materials n.e.c., for plaiting, stuffing, padding, dyeing or tanning; vegetable products n.e.c.	02.01.42
Gums, natural	839	Products of forestry, logging and related services	Balata, gutta-percha, guayula, chicle and similar natural gums; Lac, natural gums, resins, gum-resins and balsams	02.01.21; 02.01.22

Development of a System of Indicators for a Resource efficient Europe	

DESIRE

Development of a System of Indicators for a Resource Efficient Europe

D5.3 Integrated report on EE IO related macro resource indicator time series

Annex Land-use

Authors:

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About DESIRE

DESIRE is a FP7 project that will develop and apply an optimal set of indicators to monitor European progress towards resource-efficiency. The project runs from September 2012 to February 2016. We propose a combination of time series of environmentally extended input output data (EE IO) and the DPSIR framework to construct the indicator set. Only this approach will use a single data set that allows for consistent construction of resource efficiency indicators capturing the EU, country, sector and product group level, and the production and consumption perspective including impacts outside the EU. The project will:

- Improve data availability, particularly by creating EE IO time series and now-casted data
- Improve calculation methods for indicators that currently still lack scientific robustness, most notably in the field of biodiversity/ecosystem services and critical materials. We further will develop novel reference indicators for economic success.
- Explicitly address the problem of indicator proliferation and limits in available data that have a 'statistical stamp'. Via scientific analysis we will select the smallest set of indicators giving mutually independent information, and show which shortcuts in (statistical) data inventory can be made without significant loss of quality.

The project comprises further Interactive policy analysis, indicator concept development via 'brokerage' activities, Management, and Conclusions and implementation including a hand over of data and indicators to the EU's Group of Four of EEA, Eurostat, DG ENV and DG JRC.

Partners are:

1. The Netherlands Organisation for Applied Scientific Research (TNO), Delft, Netherlands
2. Wuppertal Institute (WI), Wuppertal, Germany
3. Alpen Adria University - Institute of Social Ecology (UNI-KLU), Vienna, Austria
4. Institute of Environmental Sciences, University of Leiden (UL-CML), Leiden, Netherlands
5. Sustainable Europe Research Institute (SERI), Vienna, Austria
6. Norwegian University of Technology (NTNU), Trondheim, Norway
7. Radboud University (RU), Nijmegen, Netherlands
8. Fundação da Faculdade de Ciências da Universidade de Lisboa (FFCUL), Lisbon, Portugal
9. Vienna University of Economics and Business (WU), Vienna, Austria
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Executive Summary

Land-use data are integrated into the EXIOBASE 3 model in a time series for every year from 1995 to 2011. The scope was to develop a consistent land-use framework based on a combination of statistical data (e.g., FAOSTAT 2014) and spatially-explicit datasets (e.g. Erb et al. 2007; Hansen et al. 2013). In the EXIOBASE extension the land-use data for each nation or region will add up to country's/region's total area. Additionally, the presented land-use framework and the specific allocations to 20 industrial sectors (also named extraction types) are consistent with a spatially-explicit land use dataset for the year 2000 that was developed in parallel for WP 7. These spatially-explicit data are used to establish relationships between biodiversity loss and the EXIOBASE sectors. The land use data is also fully consistent with the material flow data in the EXIOBASE model.

The main data source for the land use extensions in EXIOBASE 3 is the FAO's online statistical database FAOSTAT (2014). The FAOSTAT database is the most comprehensive database with regard to national level statistics on agricultural production and land use. FAOSTAT data are available for about 250 countries on a yearly basis from 1961 onwards. In addition to the FAOSTAT data, we used country specific information from various sources (e.g., Council of Agriculture 2011; Krausmann et al. 2013; Erb et al. 2007) to complete missing data points or to account changes in country boarders during the time series.

The land-use accounts are compiled along five major land-use categories: cropland, grazing land/pasture, forest land, settlement areas and other land. Cropland data is further split up into eight subcategories, in line with the sectors available in EXIOBASE: two sectors corresponding to a single crop (rice, wheat) and five sectors representing aggregates of crop types (e.g., other cereals and oil crops). In our data we also account for national-level differences in cropping frequencies: a plot of land may be harvested more than once per year (in multi-cropping systems) or less than once (in fallow systems). The FAOSTAT provides data on annually harvested areas, thus counting double-cropped areas twice and omitting fallow areas. We developed a procedure to correct for multi-cropping and fallow and arrive at values matching the reported overall agricultural cropland areas at the national level: for fallow land we assume regionalised crop rotations and allocate the fallow land to crops cultivated within the rotations. In case of multi-cropping, we lower the areas of crop types typically cropped more than once a year in the respective regions and countries.

To match land area used for the cultivation of fodder crops and for livestock grazing with the EXIOBASE sectors, we develop a procedure to allocate these land-use types to five livestock sectors: raw milk, cattle meat, pig meat, poultry and other meat. The same procedure is applied to the material flow data.

The land-use category forest is divided into used forest and unused forest. While the latter land area is not integrated into the EXIOBASE 3 model used forest areas are further differentiated into land used for the production of industrial roundwood and for wood fuel. This two different wood removals are both allocated to EXIOBASE's forestry sector. However, in a later version "wood fuel land" could be directly allocated to final household consumption (based on statistics on the share of wood fuel consumed by households). The category settlement areas includes land used for transportation infrastructure and for human settlements based on data provided by Krausmann et al. (2013) and is directly allocated to the final demand sector.

1 Introduction

Land area data are integrated to the EXIOBASE model in a time series for every year from 1995 to 2011. The scope was to develop a consistent framework for land-use data based on a combination of statistical data (e.g., FAOSTAT 2014) and spatially-explicit datasets (e.g., Erb et al. 2007; Hansen et al. 2013) as well as consistent with the other environmental extensions. The EXIOBASE land use data for each nation or region adds up to a country's/region's total area.

The main data source for the land use extensions in EXIOBASE v3.1 is the FAO's statistical database FAOSTAT (2014), which is the most comprehensive database with regard to agricultural production and all related physical flows. The FAO land-use data were allocated to the 20 industrial sectors of the EXIOBASE model. Because land-use data and biomass extraction (part of material flow data) are strongly related, the same allocation procedure was applied to the biomass extraction. Additionally, land use data were linked to a spatially-explicit land dataset for the year 2000 developed for WP 7.

Land use data are compiled along five main categories of land use and land cover: arable land (cropland), permanent pasture/grazing, forest land, settlements and other land. These main categories were further split in order to fit to the EXIOBASE industry structure. Table 1.1 shows the land use categories and their allocation to the 20 industrial sectors in the EXIOBASE model. Other land was not integrated in the EXIOBASE model but served as a cross check category after subtracting the different aggregates of arable land, pasture and meadows, woodland and settlement area from the national country area.

The following sections describe the approach to establish a systematic and consistent land-use dataset in time series for 16 years (1995-2011). In addition (as part of WP 7) we also establish global 5 arc min (c. 10 x 10 km) resolution land-use maps consistent with the land use data presented here.

Table 1.1 Land use classification and list of land use categories used in the EXIOBASE v3.1

	ExtractionTypeName	Product/FinalDemandTypeCode	Product/FinalDemandTypeName
1	Land use - Arable Land - Rice	p01.a	Paddy rice
2	Land use - Arable Land - Wheat	p01.b	Wheat
3	Land use - Arable Land - Other cereals	p01.c	Cereal grains nec
4	Land use - Arable Land - Vegetables, fruits, nuts	p01.d	Vegetables, fruit, nuts
5	Land use - Arable Land - Oil crops	p01.e	Oil seeds
6	Land use - Arable Land - Sugar crops	p01.f	Sugar cane, sugar beet
7	Land use - Arable Land - Fibres	p01.g	Plant-based fibers
8	Land use - Arable Land - Other crops	p01.h	Crops nec
9	Land use - Arable Land - Fodder crops	p01.i	Cattle
10	Land use - Arable Land - Fodder crops	p01.j	Pigs
11	Land use - Arable Land - Fodder crops	p01.k	Poultry
12	Land use - Arable Land - Fodder crops	p01.l	Meat animals nec
13	Land use - Arable Land - Fodder crops	p01.n	Raw milk
14	Land use - Permanent pasture	p01.i	Cattle
15	Land use - Permanent pasture	p01.l	Meat animals nec
16	Land use - Permanent pasture	p01.n	Raw milk
17	Used Forest Land - Industrial roundwood	p02	Products of forestry, logging and related services
18	Used Forest Land - Wood fuel	p02	Products of forestry, logging and related services
19	Used Forest Land - Wood fuel	y01	Final consumption expenditure by households
20	Infrastructure Land	y01	Final consumption expenditure by households

2 Methods

The basic methodology for creating a land-use dataset as yearly extension for the period 1995 to 2011 for EXIOBASE v3.1 originated from earlier work (Krausmann et al. 2013, e.g.; Haberl, Erb, Plutzar, et al. 2007; K.-H. Erb et al. 2009). Our main data source was the agriculture and forestry database from FAO (FAOSTAT 2014). Since the FAO database provides extensive details for different crop items and land-use categories, the following sections show how we modified and aggregated data, how we dealt with caveats and how we linked it to the industrial sectors of the IO model in order to provide consistency over the whole time series.

2.1 Cropland

The cropland area extension is based on FAO data for 178 crop items. Rice and wheat are accounted for as separate categories (see Table 1.1). The other crop items are aggregated to the following groups:

1) other cereals (7 crop items)
2) vegetables, fruit, nuts (92 crop items)
3) oil crops (19 crop items)
4) sugar crops (3 crop items)
5) fibres (9 crop items)
6) other crops (19 crop items)
7) fodder crops (12 crop items)

Arable land for the cultivation of fodder crops fed to animals including e.g., alfa, maize or forage products is not allocated to one but three different industries (or products) as described in the section below or shown in Table 3.6. A detailed list of the allocation of the primary crops and to the specific extraction types in the EXIOBASE is shown in the Land-Appendix.

Areas on which seed cotton and kapok fruit are grown were treated differently. We allocated the total area partly to the oil crops category and partly to fibres. The allocation follows technical conversion factors provided by the FAO (2003).

Table 2.1 Allocation factor for specific oil crops and fibres according to FAO 2003

FAO crop item	Allocation factor
Kapok fruit > kapok seed in shell (p01.e oil crops)	0.66
Kapok fruit > kapok fibres (p0.1.g fibres)	0.34
Seed cotton > cotton seed (p01.e oil crops)	0.63
Seed cotton > cotton lint (p0.1.g fibre)	0.37

2.1.1 Fallow land and land with multiple cropping

The FAOSTAT provides data on annually harvested areas according to specific crops; in their reporting, the FAO counts areas that are cropped twice two times and on the other hand omits fallow areas. In order to get a land use dataset that counts one hectare only once, we developed a procedure to correct for multi-cropping and fallow; the resulting land area figures match the overall agricultural cropland area reported at the national level.

Fallow land and multi-cropping areas were considered throughout the time series and are included in the area accounts of the different categories of arable land. We integrated the average national fallow land or multi-cropping area for every year according to the following formula:

$$fallow\ land\ or\ multiple\ cropped\ area_{\text{per year}} = \sum arable\ land\ area_{\text{FAO}} + \sum permanent\ cro\ areas_{\text{FAO}} - \sum primary\ crops_{FAO,harvested\ area}$$

A positive result indicates the existence of national fallow areas, whereas a negative outcome indicates the existence of areas that are used more than once a year. Numbers on total arable land and land for permanent crops are taken from FAO's land resource statistics. The total sum of primary crops includes cereals, rice, vegetables, fruits and fodder crops but excludes items connected to pasture use such as forage and silage, grasses nes and rye grass, which are allocated to the categories fodder crops and permanent pasture.

Among the countries with a negative result (multi-cropping area) are China, Bangladesh, Nigeria and India, all with a high proportion of harvested rice areas. Apart from rice, we assumed that also wheat and other cereals potentially are cropped more than once especially in countries with little or no reported harvested rice area and countries located in tropical regions. We also assumed, that sugar cane is potentially multi-cropped. Brazil and India for example reported high numbers of harvested sugar cane area[1].

The overall national multi-cropping area was calculated with the equation above. In a next step, the multi-copping area was proportionally allocated to rice, wheat, other cereals and sugar cane (included in sugar crops,) according to the respective shares of the sum of the four crops' harvested area (Table 2.2). The resulting multi-cropping area of the four crops is then subtracted from the harvested areas of these f land use categories (p01.a, p01.b, p01.c, p01.d). The four cropland categories rice, wheat, other cereals and sugar crops where therefore adapted by the factors shown in Table 2.2.

Table 2.2 Examples of country and crop specific multi-cropping factors (shares)

DESIRE Code	Name	Rice	Wheat	Other cereals	Sugar cane
31	China	0.35	0.31	0.33	0.01
33	South Korea	0.92	0.00	0.08	0.00
35	India	0.42	0.26	0.28	0.04
45	RoW Asia and Pacific	0.33	0.24	0.28	0.16
48	RoW Africa	0.15	0.06	0.73	0.07

The same procedure was applied for fallow land and for the crops wheat, other cereals, oil crops, sugar crops and other crops.

[1] However, according to the equation above we only found multi-cropping areas for sugar can in the region "Rest of Asia and Pacific".

The FAO documentation regarding the data coverage and number of harvest events per hectare and crop etc. was not very detailed. Lack of information thus might result in double counting of fallow land or multiple cropped areas. With the above described cross checking we highlighted possible double counting with the aim of minimizing inconsistencies.
National average fallow land according to the equation above was allocated based on a mean-average to crop groups (Table 1.1). The country specific fallow area calculated was proportionally allocated and added to wheat, other cereals, oil crops, sugar crops and other crops. We did not consider fallow land for the cultivation of rice, vegetables, fruits, nuts and fibres.

Table 2.3 Examples of country and crop specific fallow factors

DESIRE code	Name	Wheat	Other cereals	Oil crops	Sugar crops	Other crops
6	Germany	0.3	0.5	0.1	0.1	0.0
9	Spain	0.2	0.4	0.3	0.0	0.0
11	France	0.5	0.3	0.2	0.0	0.0
14	Hungary	0.3	0.5	0.1	0.0	0.0
16	Italy	0.4	0.3	0.3	0.0	0.0
22	Poland	0.3	0.6	0.0	0.0	0.0
23	Portugal	0.2	0.3	0.4	0.0	0.0
29	United States	0.2	0.4	0.4	0.0	0.0
30	Japan	0.3	0.2	0.2	0.2	0.1
32	Canada	0.4	0.3	0.3	0.0	0.0
34	Brazil	0.0	0.3	0.4	0.1	0.1
37	Russia	0.5	0.4	0.1	0.0	0.0
38	Australia	0.6	0.3	0.1	0.0	0.0
40	Turkey	0.6	0.3	0.1	0.0	0.0
43	Indonesia	0.0	0.2	0.4	0.0	0.3
44	South Africa	0.1	0.7	0.1	0.1	0.0

The corrections of multi-cropping areas and fallow land for the specific crop group is done dynamically for every year of the period 1995 – 2011.

2.2 Livestock sectors: allocation of fodder crops and permanent pasture

The land-area used for the production of fodder crops is not integrated into EXIOBASE v3.1 as one single extension, but allocated to different sectors which represents a major improvement in the further calculation in the IO model.

Land area used to grow fodder crops, such as fodder beets, maize silage or forage products were taken from the FAO database and aggregated to the land-use category fodder crops (see Table 1.1 and tables in the Land-Appendix for additional information details). After balancing the land use categories with the specific land area of each nation, other land showed negative values for some of the countries. This included especially Germany, some of the sub-Saharan African countries and nations from the former Soviet Union. We did cross check with the data of the FAO resource statistics and found that the different land use categories did not fit within the FAO database for some

of the African nations such as Gabon or Mozambique. In the case of Germany it was evident that the area of several fodder crop items had a significant effect on the highly negative balance for other land. The following fodder crop items were identified to have caused this problem: grasses nes; green oilseeds; rye grass; pumpkins for fodder. The reason for this problem may be a double counting issue, as the various types of grasses might be reported both in the cropland (fodder crops) and in the permanent pastures category.
We therefore decided to exclude the areas of the above mentioned fodder crop items from the land use category "fodder crops" for all nations. After this adjustment negative values in the category other land were no longer a problem. Land-use data for permanent pastures and meadows (e.g. grazing) was taken from the FAO resource database (FAOSTAT 2014).

EXIOBASE v3.1 includes five livestock sectors: raw milk, cattle meat, pig meat, poultry and other meat. We applied the same procedure used for the allocation of biomass extraction based on AgroSAM for land use data (for details see Annex Materials). Fodder crops are allocated to five animal sectors, grazing to three animal sectors. Table 2.4 shows the allocation factors at the example of selected countries. AgroSAM is only available for EU-27 countries, wherefore we had to transfer European intensities (i.e. fodder inputs per monetary output of the animal producing sectors) to all other countries in the EXIOBASE model. An average European fodder crop intensity of animal sectors is applied to non-European countries by multiplying with the gross output. The fodder crop requirements are compared to domestic fodder crop extraction (DEU) from the global material flow database[2]. Intensities are scaled down or up in order to meet the DEU based on a zero trade assumption.

The allocation is static over the period from 1995-2011 based on the AgroSAM database shares for the year 2007.

Table 2.4 Allocation factors for fodder crop and permanent pasture land, examples

	ProductCode	Austria	Germany	China	Brazil	USA
Allocation Fodder Crops						
Cattle	p01.i	0.7	0.4	0.3	0.7	0.8
Pigs	p01.j	0.1	0.0	0.2	0.1	0.0
Poultry	p01.k	0.0	0.3	0.1	0.1	0.1
Meat animals nec	p01.l	0.0	0.1	0.1	0.1	0.0
Raw milk	p01.n	0.2	0.2	0.2	0.2	0.2
		1.0	1.0	1.0	1.0	1.0
Allocation Grazing/Permanent Pasture						
Cattle	p01.i	0.8	0.6	0.5	0.8	0.8
Meat animals nec	p01.l	0.0	0.1	0.2	0.0	0.0
Raw milk	p01.n	0.2	0.3	0.3	0.2	0.2
		1.0	1.0	1.0	1.0	1.0

[2] www.materialflows.net

2.3 Forestry

There are huge uncertainties about (de)forestation and actual land used for timber production (see e.g. Erb et al. 2007; Hansen et al. 2013).

Since not all forest-areas are used by humans, we differentiated between used and unused forest land, where the latter is defined according to Erb et al. (2007). Unused forest land was not included in the EXIOBASE v3.1 land extension but used for closing the balance of the total land area accounts. In a second step, used forest area is further differentiated into land area used for the production of industrial round wood and wood fuel. This differentiation is based on round wood harvest for industrial round wood and round wood harvested used as wood fuel. Figures for round wood are taken from the FAO (FAOSTAT 2014). In the further development of the land use data, a shared allocation of the wood fuel land area to the forest sector and to the final demand could be implemented (see outlook 2.7).

A major challenge in the allocation of forestry land to an IO model is the identification of the best data source for forest land out of the available datasets (Hansen et al. 2013; FAO 2010; FAO 2001; K. H. Erb et al. 2007). The annual area data on woodland were taken from the FAO database and crosschecked with number from the forest resource assessment (FRA; FAO 2010). The areas are consistent with the numbers given in the Forest Resource Assessment reports (FRA; FAO 2000, 2005, 2010). Since 2005, the FRA provides information on the designated functions of forests such as percentage of productive forest, protection of soil and water, conservation of biodiversity, multiple use or productive plantations. Thus, a factor for unused forest areas was necessary to split the number of total forest land reported by the FAO. This was done based on work of Erb et al. (2007) who developed a consistent spatially explicit land-use data set for the year 2000 comparing remote sensing and census data at country level. Erb et al (2007) differentiated between used forests and untouched areas and assumed that all forest areas outside wilderness areas are used, although maybe very extensively. We derived country specific factors for used forests for 161 countries from this dataset for the year 2000. We assumed that the share of used forests remains the same in every year of the DESIRE time series and hold the allocation static over the whole period based on 2000.

2.4 Settlement area

All developed land, including transportation infrastructure and human settlements is allocated to the category settlements. We used country specific urban settlement and infrastructure area data from Krausmann et al (2013) which were available for the years 1990, 2000 and 2005. Rural settlement area was calculated based on per capita demand and population density and urban settlement area was taken from the GLC 2000 land cover data set (www-gvm.jrc.it/glc2000; Haberl, Erb, Krausmann, et al. 2007). The data were interpolated between these years and from 2005 onwards extrapolated. Settlement area was allocated to the final demand sector.

2.5 Other land

The land use category “other land” is not integrated in the EXIOBASE v3.1 model, but used for cross checking after subtracting the different aggregates of arable land, pasture and meadows, woodland and settlement area from the national total area according to the FAOstat. We assumed that other land results in positive values only after subtracting all other land use categories from the total land area provides by the FAO resource statistics. In general, the category other land consist of unproductive areas such as deserts and lands used for periodic livestock grazing.

Table 2.5 Balance of global land-use numbers

	Area [km^2]
Total World Area	129,672,931
Land use - Arable Land – Rice	1,263,241
Land use - Arable Land – Wheat	3,322,901
Land use - Arable Land - Other cereals	4,360,886
Land use - Arable Land - Vegetables, fruits, nuts	2,225,850
Land use - Arable Land - Oil crops	2,924,340
Land use - Arable Land - Sugar crops	373,660
Land use - Arable Land – Fibres	150,009
Land use - Arable Land - Other crops	375,768
Land use - Arable Land - Fodder crops	554,278
Land use - Permanent pasture	34,019,580
Used Forest Land	34,334,789
Unused Forest Land - not allocated	6,415,977
Infrastructure Land	1,320,067
Other land	38,031,587

Other land resulted in negative values when using total forest area reported by the FRA (2010) for some countries such as Gambia, Mozambique, Paraguay and Romania. To overcome this effect we applied the allocation factors for used areas derived from Erb et al. (2007) to the total forest area.

2.6 Other specific adjustments

Land use accounts for countries and regional aggregates follow the DESIRE classification for 28 European nation, 16 important trading partners and 5 regional aggregates (see Stadler et al. 2015). FAO land-use data for Belgium and Luxembourg is reported as an aggregate from 1995 to 1999. We used the country land area relation of 2000 to proportionally disaggregate all land use categories. We assumed that the proportion of the harvest area e.g. for wheat reported for Belgium-Luxembourg is 0.92 for Belgium and 0.08 for Luxembourg. We kept these factors constant for all land use categories over the period from 1995 to 1999.

FAO's resource statistic report reports only one number for all land area used in China. We had to split these numbers to P.R. China and Taiwan. National statistical data for Taiwan is used, in particular Taiwan's national census data from the statistical yearbooks for the estimation of total land area, paddy rice area, (permanent) cropland and forest land (Council of Agriculture, Executive Yuan R.O.C 2011). Numbers for permanent meadows and pastures were taken from worldstat[3]. Primary crops area for Taiwan is taken from the FAO production statistic. In order to make country area checks, Taiwan's national data derived from the mentioned source is subtracted from the FAOs number for China.

[3] http://en.worldstat.info/Asia/Taiwan/Land

2.7 Conclusion and outlook

In the compilation of the land use data, the aim was to develop a comprehensive land-use data set for 1995-2011 and consistently link it to the EXIOBASE v3.1 model as well as to a spatially-explicit map for the year 2000. So far, the time series is in itself consistent and provides a suitable baseline for the calculation of any kind of indicators derived from the model runs within the EXIOBASE.
During the work on the land use data, some issues were identified were further improvement could be achieved. The data on forest area will be evaluated and checked as soon as some first EXIOBASE model runs are available; this applies in particular to the results for spatially-explicit land-use patterns and accounts. Second, an evaluation of the EXIOBASE v2.2 showed, that the patterns of monetary IO data did not match well with the physical land input data. We found that a significant number of woods is directly consumed by households in some major countries such as Indonesia, Russia and African countries. The before mentioned disaggregation of the wood fuel data and the allocation of a fraction of wood fuel directly to final demand will be checked and could improve the link of the land use data to the IO model.

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4 Land-Appendix

Arable land related to crop items of the group p01.c "other cereals"

FAO item code	Name
44	Barley
89	Buckwheat
101	Canary seed
108	Cereals, nes
94	Fonio
103	Grain, mixed
56	Maize
79	Millet
75	Oats
92	Quinoa
71	Rye
83	Sorghum
97	Triticale

Arable land related to crop items of the group p01.d "vegetables, fruit, nuts"

FAO item code	Name
221	Almonds, with shell
515	Apples
526	Apricots
226	Areca nuts
366	Artichokes
367	Asparagus
572	Avocados
203	Bambara beans
486	Bananas
176	Beans, dry
414	Beans, green
558	Berries nes
552	Blueberries
216	Brazil nuts, with shell
181	Broad beans, horse beans, dry
358	Cabbages and other brassicas
461	Carobs
426	Carrots and turnips
217	Cashew nuts, with shell
591	Cashewapple
125	Cassava
393	Cauliflowers and broccoli
531	Cherries

530	Cherries, sour
220	Chestnut
191	Chick peas
459	Chicory roots
401	Chillies and peppers, green
195	Cow peas, dry
554	Cranberries
397	Cucumbers and gherkins
550	Currants
577	Dates
399	Eggplants (aubergines)
569	Figs
512	Fruit, citrus nes
619	Fruit, fresh nes
542	Fruit, pome nes
541	Fruit, stone nes
603	Fruit, tropical fresh nes
406	Garlic
549	Gooseberries
507	Grapefruit (inc. pomelos)
560	Grapes
225	Hazelnuts, with shell
592	Kiwi fruit
224	Kola nuts
407	Leeks, other alliaceous vegetables
497	Lemons and limes
201	Lentils
372	Lettuce and chicory
210	Lupins
446	Maize, green
571	Mangoes, mangosteens, guavas
568	Melons, other (inc.cantaloupes)
449	Mushrooms and truffles
234	Nuts, nes
430	Okra
403	Onions, dry
402	Onions, shallots, green
490	Oranges
600	Papayas
534	Peaches and nectarines
521	Pears
187	Peas, dry
417	Peas, green
587	Persimmons
197	Pigeon peas
574	Pineapples

223	Pistachios
489	Plantains
536	Plums and sloes
116	Potatoes
211	Pulses, nes
394	Pumpkins, squash and gourds
523	Quinces
547	Raspberries
149	Roots and tubers, nes
373	Spinach
544	Strawberries
423	String beans
122	Sweet potatoes
495	Tangerines, mandarins, clementines, satsumas
136	Taro (cocoyam)
388	Tomatoes
463	Vegetables, fresh nes
420	Vegetables, leguminous nes
205	Vetches
222	Walnuts, with shell
567	Watermelons
137	Yams
135	Yautia (cocoyam)

Arable land related to crop items of the group p01.e "oil crops"

FAO item code	Name
265	Castor oil seed
249	Coconuts
242	Groundnuts, with shell
336	Hempseed
277	Jojoba seed
263	Karite nuts (sheanuts)
333	Linseed
299	Melonseed
292	Mustard seed
339	Oilseeds nes
260	Olives
296	Poppy seed
270	Rapeseed
280	Safflower seed
289	Sesame seed
236	Soybeans
267	Sunflower seed
305	Tallowtree seed
275	Tung nuts

Arable land related to crop items of the group p01.f "surgar crops"

FAO item code	Name
157	Sugar beet
156	Sugar cane
161	Sugar crops, nes

Arable land related to crop items of the group p01.g "fibres"

FAO item code	Name
800	Agave fibres nes
782	Bastfibres, other
821	Fibre crops nes
773	Flax fibre and tow
777	Hemp tow waste
780	Jute
809	Manila fibre (abaca)
788	Ramie
789	Sisal

Arable land related to crop items of the group p01.h "other crops"

FAO item code	Name
711	Anise, badian, fennel, coriander
689	Chillies and peppers, dry
693	Cinnamon (canella)
698	Cloves
661	Cocoa, beans
656	Coffee, green
720	Ginger
677	Hops
671	Maté
702	Nutmeg, mace and cardamoms
687	Pepper (piper spp.)
748	Peppermint
754	Pyrethrum, dried
836	Rubber, natural
723	Spices, nes
667	Tea
674	Tea nes
826	Tobacco, unmanufactured
692	Vanilla

Arable land related to crop items of the group p01.i "fodder crops"

FAO item code	Name
647	Beets for fodder
644	Cabbage for fodder
648	Carrots for fodder

641	Forage and silage, alfalfa
640	Forage and silage, clover
643	Forage and silage, legumes
636	Forage and silage, maize
637	Forage and silage, sorghum
651	Forage products
649	Swedes for fodder
646	Turnips for fodder
655	Vegetables and roots fodder

Development of a System of Indicators for a Resource efficient Europe

DESIRE

Development of a System of Indicators for a Resource Efficient Europe

D5.3 Integrated report on EE IO related macro resource indicator time series

Annex – Waste accounts

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About DESIRE

DESIRE is a FP7 project that will develop and apply an optimal set of indicators to monitor European progress towards resource-efficiency. The project runs from September 2012 to February 2016. We propose a combination of time series of environmentally extended input output data (EE IO) and the DPSIR framework to construct the indicator set. Only this approach will use a single data set that allows for consistent construction of resource efficiency indicators capturing the EU, country, sector and product group level, and the production and consumption perspective including impacts outside the EU. The project will:

- Improve data availability, particularly by creating EE IO time series and now-casted data
- Improve calculation methods for indicators that currently still lack scientific robustness, most notably in the field of biodiversity/ecosystem services and critical materials. We further will develop novel reference indicators for economic success.
- Explicitly address the problem of indicator proliferation and limits in available data that have a 'statistical stamp'. Via scientific analysis we will select the smallest set of indicators giving mutually independent information, and show which shortcuts in (statistical) data inventory can be made without significant loss of quality.

The project comprises further Interactive policy analysis, indicator concept development via 'brokerage' activities, Management, and Conclusions and implementation including a hand over of data and indicators to the EU's Group of Four of EEA, Eurostat, DG ENV and DG JRC.

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1 Summary

Waste is assumed to be the materials, processed or not, that enter into the activities but that are not incorporated in their outputs, neither discharged as emissions. In this way, the waste is what assures that the law of the conservation of the mass is respected within each and any activity of national economies. Therefore, in DESIRE waste has a wider meaning than that commonly used because it includes both waste residuals and waste products (UNCEEA, 2011; Schmidt et al. 2012). As in CREEA (Wood et al., 2015), waste is defined as 'material for treatment' (Schmidt et al. 2012) that includes all the materials that need further re-processing in order to be turned into new products, emissions or stock addition in landfills. This treatment may be re-processing of scrap into new materials that can substitute virgin materials, it may be waste incineration, landfill, waste water treatment, composting, or just storage of uncontrolled discharged waste in the environment involving emissions from degradation.
The idea behind the adoption of this definition is that the 'recycling' can be properly modelled. Indeed, the recycling is the processing of waste and scrap and other articles, whether used or not, into secondary raw material. A transformation process is required, either mechanical or chemical. This definition of waste is fully in line with the technical principle widely used in the LCA's community (Weidema et al. 2011, p 30). Instead, this definition diverges from an economic perspective that considers, for example, homogenous scraps with a positive economic value as products and not as waste (UNCEEA, 2011). **Error! Reference source not found.** shows the approach adopted.

Figure 1.1 Input- and output flows for a generic activity. The output of 'materials for treatment' is the calculated balancing item from which waste accounts are derived.

Waste accounts are divided into two sets, the first concerns with the users of waste, while the second with the producers. Waste treatment activities are essentially filling the first account, while all the activities and final consumers the second one. Trade of waste is also taken into account. However, in practice a third account is produced showing the unregistered waste that is equal to the supply of waste less the use of waste. This third account contains residual values.
Waste accounts are resulting from a general procedure determining PSUTs, or better the Hybrid SUTs (HSUTs) which includes the physical layer. The module of the HSUTs-generation procedure that concerns the determination of the waste accounts is based on what developed within the Forwast project (Schmidt et al., 2010) plus the further developments developed within the CREEA project (Schmidt et al. 2012; Merciai et al., 2013).
In the Forwast project time-series of waste accounts were determined, hence in the DESIRE project that methodology is fully applied. In CREEA only one accounting period, i.e. 2007, was considered hence it was not possible to develop the full Forwast procedure.
The Forwast procedure (Schmidt et al., 2010) includes the account of stock addition to whom is applied a degradation function to estimate the delayed production of waste. As a consequence, the supply of waste in an accounting period is the sum of the commodities

purchased and discharged within the accounting period, plus what traded in previous periods and become obsolete. The use of waste is what emerges from statistic sources plus some own estimations for detailing or extending the data coverage.

The final version of waste accounts will be provided when the PSUTs, or better the Hybrid SUTs (HSUTs) which includes the physical layer, are determined because they result from the same algorithm. The HSUTs algorithm needs the finalized version of MSUTs to start running, hence only after few months from the final delivery of MSUTs the hybrid version could be ready. This is planned to be in June 2015.
However an estimation of the use of waste accounts is introduced in the final version of MSUTs. This estimation is expected not to change considerably from the final version determined within the HSUTs-generation procedure. On the contrary, an estimation of the supply of waste accounts is not possible to be done without running the algorithm, hence it will be delivered in the next months.

2 Introduction

In the following sessions the procedure for the calculation of PSUTs and the waste accounts is briefly explained. A more exhaustive report will be published in June 2015.

The procedure is a further refinement of the approaches developed in the FORWAST project (Schmidt et al., 2010) and in the CREEA project (Schmidt J. et al., 2012; Merciai et al., 2014). Nakamura et al. (2007) have developed procedures that are somehow related/similar. In the FORWAST project, time-series of waste accounts were determined so as in the DESIRE project. Therefore the FORWAST procedure is here fully applied. In CREEA only the year 2007 was considered, hence the FORWAST procedure was only partially used. Yet, in CREEA there have been some improvements in the balancing procedure respect to FORWAST that are adopted in the current approach.The main goal in DESIRE is to have an input-output framework where all the accounts, such as the waste accounts, emissions and resource extractions, are organically incorporated in it and where the mass balance is one of the main requirement for the construction of the tables. All this, along with the detailed waste treatment activities classifications, allows to perform MFA where all the cause-effects relations can be easily disclosed.

PSUTs are the equivalent of MSUTs but where mass unit, i.e. tonne, is used in place of the currency. PSUTs are then a subset of Hybrid SUTs (HSUTs) that are accounted in tonne, TJ and currency altogether. The tonne is used for any mass flows, then the TJ for intangible energy flows and the currency for all the remaining ones. By doing so all the flows exchanged within and between economies, and with the environment, are accounted into the framework and a mass balance can be calculated.

3 Procedure for the PSUTs generation and for the waste accounts

The framework adopted is the shown in Figure 3.1. The framework can be considered as the equivalent to MSUTs but where mass unit and energy units replace the currency in the transaction matrix.

Starting from the top of the Figure 3.1, matrix **V'** indicates the commodities produced by domestic activities while $\mathbf{M_c}$ and $\mathbf{M_w}$ show the import of products and materials for treatment, respectively. Matrix **ΔS** includes the additions to stocks, i.e. products with a lifetime longer than the accounting period. Notice that it includes also products accounted in the intermediate uses or in the household's purchases that have not become materials for treatment within the accounting period. The supply of waste ($\mathbf{W_V}$) indicated an output flow from a human activity that remains in the technosphere and cannot directly (i.e. without further processing or emissions) displace another principal product of an activity. Finally $\mathbf{\Delta S_W}$ indicated the addition of materials for treatment at the end of the period, e.g. in landfills.

In the lower part uses are described. Matrix **U** accounts the use of intermediate products of domestic activities, **Y** the purchases of households and other final consumers, $\mathbf{S_+}$ stock formation and change of inventories and exported $\mathbf{E_c}$ products and $\mathbf{E_w}$ materials for treatment. Finally, $\mathbf{W_U}$ shows the use of materials for treatment matrix and **R** the input of natural resources.

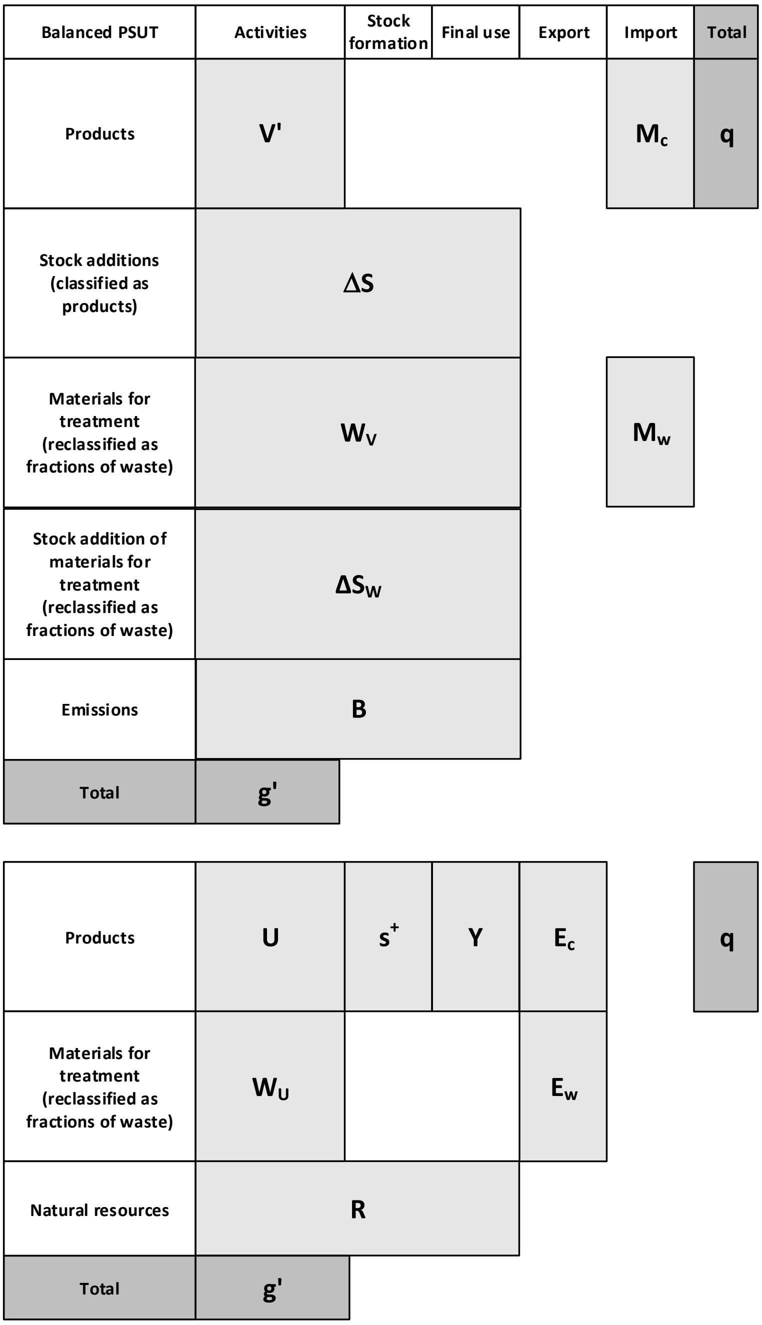

Figure 3.1 Format of the PSUTs

A mass balanced is performed for each productive activity and households. The idea behind is that an input that is not incorporated in the output product, neither in the emissions, can only be either waste or stock addition. Figure 3.2 shows what just said.

The PSUTs procedure makes use of an enormous amount of data that includes all the information of MSUTs:

- transfer coefficients, i.e how much of an input is incorporated in a output product;
- dry matter coefficients, i.e. the ratio of mass excluding water;
- emission coefficients, i.e. how much of an input becomes a specific emission;
- resource coefficients, i.e. how much of a natural resource is required for unit of a specific output;
- etc.

A more detailed list of data used will be included in a specific report on the calculation of PSUTs.

PSUTs are constructed in dry matter and for a determined accounting period, usually one year, and for a given geographical area, typically a country. Trade between economies is included.

Since there are goods that have a lifetime longer than a year and so they are accumulated at the end of the accounting period, there is a link between PSUTs in time series. Single year-accounted PSUTs are connected to PSUTs of the previous years because stock accumulated can be still in the economy for some periods. In other words, what happened yesterday influences the economy of today that, in addition, influences what will be tomorrow.

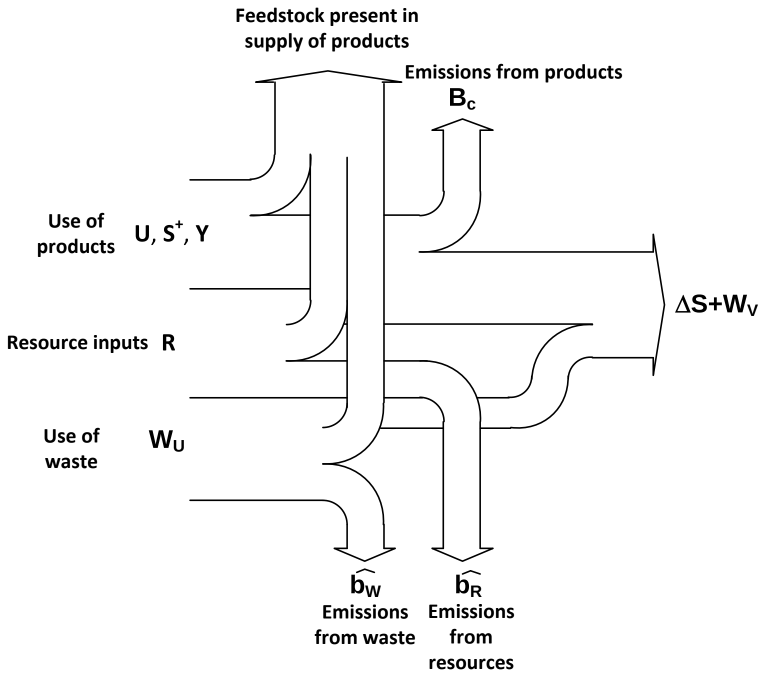

Figure 3.2 Principal fate of any input to an activity.

4 Waste accounts

One of the main objective of the PSUTs is to calcutade waste accounts together with the rest of the other accounts by imposing the mass balance to any activity.

In DESIRE, so as in CREEA, waste is defined as 'material for treatment' (Schmidt et al. 2012) that includes all the materials that need further re-processing in order to be turned into new products, emissions or stock addition in landfills. This treatment may be re-processing of scrap into new materials that can substitute virgin materials, it may be waste incineration, landfill, waste water treatment, composting, or just storage of uncontrolled discharged waste in the environment involving emissions from degradation.

One of the drivers behind the adoption of this definition is that the 'recycling' can be properly modelled. Indeed, the recycling is the processing of waste, scrap and other articles, whether used or not, into secondary raw material. A transformation process is required, either mechanical or chemical. This definition of waste is fully in line with the technical principle widely used in the LCA's community (Weidema et al. 2011). Instead, this definition diverges from that used in the official statistics (UNCEEA, 2011) where an economic perspective is adopted. The latter considers, for example, homogenous scraps with a positive economic value as products and not as waste (UNCEEA, 2011).

Waste accounts indicates two sets, the first concerns with the use of waste, while the second with the production of waste. Waste treatment activities shape the first account, while all the activities and final consumers the second one. However, also a third account is produced showing the unregistered waste that is equal to the supply of waste less the use of waste. This third account contains residual values and should include most of the illegally discharged waste.

An estimation of the use of waste accounts is introduced in the final version of MSUTs. This estimation is expected not to change considerably from the final version determined within the PSUTs-generation procedure in June 2015. On the contrary, an estimation of the supply of waste accounts is not possible to be done without running the algorithm, hence it will be delivered in the next months.

The rows of the waste accounts are the same for both the sets and show the homogenous waste fractions, while the columns are the same of the monetary framework. A list of waste fractions is included in Table 4.1.

Table 4.1 – List of waste fractions included in the waste accounts

Food waste	Precious metal waste
Manure waste	Aluminum waste
Textile waste	Lead waste
Wood waste	Copper waste
Paper waste	Non-ferrous metal waste
Plastics waste	Construction waste
Glass waste	Oils and hazardous waste
Ashes	Sewage waste

Steel waste	Unregistered waste

4.1 Supply of waste account

Figure 3.2 above shows the procedure to obtain the supply of waste account and stock addition in a specific accounting period. These two aggregates are initially obtained simultaneously and are summed up in one single account. In a second step a 'degradation function' will determine what belongs to the waste account, which is the waste produced in the accounting period, and what belongs to stock addition account.

However, the total supply of waste includes also the waste produced from goods previously produced and accumulated in the economy, and that become waste in the current period.

$$\begin{matrix} Total\ supply \\ of\ waste \\ in\ the\ period\ \boldsymbol{t} \end{matrix} = \begin{matrix} Waste\ from\ product \\ consumed \\ in\ the\ period\ \boldsymbol{t} \end{matrix} + \begin{matrix} Waste\ from\ product \\ accumulated\ in\ the\ periods\ before\ \boldsymbol{t} \\ and\ degradated\ in\ \boldsymbol{t} \end{matrix}$$

The approach here adopted implies the construction of the degradation matrix (or product lifetime tables) **L** that indicates how much of a specific stock addition becomes waste in a certain year of its lifetime. In other words, **L** indicates, for each year of the lifetime of a stock product, the ratio that degrades and becomes waste. Therefore, the format of **L** is number of lifetime years (y) by type of stock (p), which can be called *stock products*. The stock products have the same classification adopted for products in the general framework. Because a stock product degrades completely during its lifetime, the sum of ratios over the years is equal to 1.

$$\sum_{y} \boldsymbol{L}(y,p) = 1 \qquad \nabla\, p\, \epsilon\, P$$

Where $\boldsymbol{L}(y,p)$ is a generic component of the matrix **L** and *P* is the set of stock products. The adopted product lifetime table consist of average lifetimes of the products. With regard to the distribution of the degradation, as a default, symmetric triangular distribution around the average is used.

In an accounting period *t,* the total quantity of waste produced by the product *p* accumulated in the periods previous to *t*, i.e. $\boldsymbol{W}_v^t(p,-)$, is calculated according to the following formula:

$$\boldsymbol{W}_v^t(p,-) = \sum_{k=1}^{t} [\boldsymbol{\Delta S^k}(p,-) \cdot\ \boldsymbol{L}(t-k+1,p)]$$

Where $\boldsymbol{\Delta S^k}(p,-)$ is the total stock of the product *p* accumulated in the period *k.* The supply of waste account will be delivered in June 2015 when the PSUTs will be calculated.

4.2 Use of waste

The approach used for the time series of the use of waste accounts consists of collecting data for only some years and then a linear trend is built. The effort was put in the search of data referred, at least, to a year in the beginning periods of the time series (1990-

1995) and one at the end (2008-2012). When this has not been possible, trends determined by an average of waste accounts of European countries, whose data are quite exhaustive, were used along with data referred to 2007 that were collected in the CREEA project (Merciai et al., 2013).

Therefore, the use of waste accounts is essentially derived from statistical sources whenever are available while assumptions are applied for the assessment of the other data.

Table 4.2 - Data sources used for the use of waste accounts

Waste treatment service:	Source:
Manure (conventional treatment)	FAOSTAT(2014); IPCC (2006); own elaborations;
Manure (biogas treatment)	FAOSTAT(2013); IPCC (2006); AEBIOM (2009); own elaborations;
Secondary paper for treatment, Re-processing of secondary paper into new pulp	EUROSTAT (2014); EPA (1995; 2003; 2008; 2010); WRAP (2011); Hyder consulting (2009); OECD (2010); Perele and Solovyeva (2011); DETEC-FOEN (2008); Ecolamancha (2008) ; own elaborations;
Wood material for treatment, Re-processing of secondary wood material into new wood material	EUROSTAT (2014); EPA (1995; 2003; 2008; 2010); Hyder consulting (2009); FAOSTAT(2013); Ecolamancha (2008) ; own elaborations;
Secondary plastic for treatment, Re-processing of secondary plastic into new plastic	EUROSTAT (2014); EPA (1995; 2003; 2008; 2010); Hyder consulting (2009); OECD (2010); CEMPRE (2010); Statistics Canada(2008); Perele R. and Solovyeva S. (2011); DETEC-FOEN (2008); Ecolamancha (2008) ; own elaborations;
Secondary glass for treatment, Re-processing of secondary glass into new glass	EUROSTAT (2014); EPA (1995; 2003; 2008; 2010); Hyder consulting (2009); CEMPRE (2010); Statistics Canada(2008); DETEC-FOEN (2008); Ecolamancha (2008) ; own elaborations;
Ash for treatment, Re-processing of ash into clinker	Smith I. (2005); own elaborations;
Secondary construction material for treatment, Re-processing of secondary construction material into aggregates	UEPG (2008); EPA (2003); Statistics Canada(2008); Hyder consulting (2009); BGS (2012); own elaborations;
Secondary steel for treatment, Re-processing of secondary steel into new steel	Worldsteel Association (2010); USGS (2014);
Secondary preciuos metals for treatment, Re-processing of secondary preciuos metals into new preciuos metals	USGS (2014);
Secondary aluminium for treatment, Re-processing of secondary aluminium into new aluminium	USGS (2014);
Secondary lead for treatment, Re-processing of secondary lead into new	USGS (2014);

lead	
Secondary copper for treatment, Re-processing of secondary copper into new copper	ICSG (2010); USGS (2014);
Secondary other non-ferrous metals for treatment, Re-processing of secondary other non-ferrous metals into new other non-ferrous metals	USGS (2014);
Bottles for treatment, Recycling of bottles by direct reuse	JCPRA(2013); Heinisch J. (2009); Brewers of Europe (2010); own elaborations;
Incineration of waste: Food	EUROSTAT (2014); EPA (1995; 2003; 2008; 2010);Hyder consulting (2009); Statistics Canada(2008); National Bureau of Statistics China (2008; 2013); Chen X. et al. (2010); Huang et al. (2006); Perele R. and Solovyeva S. (2011); IEA (2010); Christensen T. H. (1998); Kawamoto (2008); own elaborations;
Incineration of waste: Paper	EUROSTAT (2014); EPA (1995; 2003; 2008; 2010); DETEC-FOEN (2008); Statistics Canada(2008); National Bureau of Statistics China (2008; 2013); Chen X. et al. (2010); Huang et al. (2006); Huang et al. (2006); Perele R. and Solovyeva S. (2011); IEA (2010); Christensen T. H. (1998); Kawamoto (2008); own elaborations;
Incineration of waste: Plastic	EUROSTAT (2014); EPA (1995; 2003; 2008; 2010); DETEC-FOEN (2008); Statistics Canada(2008); National Bureau of Statistics China (2008; 2013); Chen X. et al. (2010); Huang et al. (2006); Perele R. and Solovyeva S. (2011); IEA (2010); Christensen T. H. (1998);Kawamoto (2008); own elaborations;
Incineration of waste: Metals and Inert materials	EUROSTAT (2014); EPA (1995; 2003; 2008; 2010); DETEC-FOEN (2008); Statistics Canada(2008); National Bureau of Statistics China (2008; 2013); Chen X. et al. (2010); Huang et al. (2006); Perele R. and Solovyeva S. (2011); IEA (2010); Christensen T. H. (1998); Kawamoto (2008); own elaborations;
Incineration of waste: Textiles	EUROSTAT (2014); EPA (1995; 2003; 2008; 2010); DETEC-FOEN (2008); Statistics Canada(2008); National Bureau of Statistics China (2008; 2013); Chen X. et al. (2010); Huang et al. (2006); Perele R. and Solovyeva S. (2011); IEA (2010); Christensen T. H. (1998); Kawamoto (2008); own elaborations;

Incineration of waste: Wood	EUROSTAT (2014); EPA (1995; 2003; 2008; 2010);DETEC-FOEN (2008); Statistics Canada(2008); National Bureau of Statistics China (2008; 2013); Chen X. et al. (2010); Huang et al. (2006); Perele R. and Solovyeva S. (2011); IEA (2010); Christensen T. H. (1998); Kawamoto (2008); own elaborations;
Incineration of waste: Oil/Hazardous waste	EUROSTAT (2014); EPA (1995; 2003; 2008; 2010); DETEC-FOEN (2008); Statistics Canada(2008); National Bureau of Statistics China (2008; 2013); Chen X. et al. (2010); Huang et al. (2006); Perele R. and Solovyeva S. (2011); IEA (2010); Christensen T. H. (1998); Kawamoto (2008); own elaborations;
Biogasification of food waste, incl. land application	Levis J.W. et al., (2010); AEBIOM (2009); EUROSTAT (2014); EPA (2010; 2011); own elaborations;
Biogasification of paper, incl. land application	Levis J.W. et al., (2010); AEBIOM (2009); EUROSTAT (2014); EPA (2010; 2011); own elaborations;
Biogasification of sewage slugde, incl. land application	Levis J.W. et al., (2010); AEBIOM (2009); EUROSTAT (2014); EPA (2010; 2011); own elaborations;
Composting of food waste, incl. land application	EUROSTAT (2014); EPA (1995; 2003; 2008; 2010); OECD(2010); IBGE (2002); Statistics Canada(2008); Chen X. et al. (2010); Huang et al. (2006); own elaborations;
Composting of paper and wood, incl. land application	EUROSTAT (2014); EPA (1995; 2003; 2008; 2010); IBGE (2002); Statistics Canada(2008); Chen X. et al. (2010); Huang et al. (2006); own elaborations;
Waste water treatment, food	EUROSTAT (2014); EPA (1995; 2003; 2008; 2010); FAOSTAT(2013); DETEC-FOEN (2008); Statistics Canada(2008); own elaborations;
Waste water treatment, other	EUROSTAT (2014); EPA (1995; 2003; 2008; 2010); DETEC-FOEN (2008); Statistics Canada(2008); own elaborations;
Landfill of waste: Food	EUROSTAT (2014); EPA (1995; 2003; 2008; 2010); Hyder consulting (2009); Statistics Canada(2008); National Bureau of Statistics China (2008; 2013); Zhang D. Q et al. (2010); Huang et al. (2006); Jelenska E. (2010); CEMPRE (2010); Ecolamancha (2008) ; Christensen T. H. (1998); Kawamoto (2008); own elaborations;
Landfill of waste: Paper	EUROSTAT (2014); EPA (1995; 2003; 2008; 2010); Hyder consulting (2009); Statistics Canada(2008); National Bureau of Statistics China (2008; 2013); Zhang D. Q et al. (2010);

	Huang et al. (2006); Jelenska E. (2010); CEMPRE (2010); Ecolamancha (2008) ; Christensen T. H. (1998); Kawamoto (2008); own elaborations;
Landfill of waste: Plastic	EUROSTAT (2014); EPA (1995; 2003; 2008; 2010); Hyder consulting (2009); Statistics Canada(2008); National Bureau of Statistics China (2008; 2013); Zhang D. Q et al. (2010); Huang et al. (2006); Jelenska E. (2010); CEMPRE (2010); Ecolamancha (2008) ; Christensen T. H. (1998); Kawamoto (2008); own elaborations;
Landfill of waste: Inert/metal/hazardous	EUROSTAT (2014); EPA (1995; 2003; 2008; 2010); Hyder consulting (2009); Statistics Canada(2008); National Bureau of Statistics China (2008; 2013);Zhang D. Q et al. (2010); Huang et al. (2006); Jelenska E. (2010); CEMPRE (2010); Ecolamancha (2008) ; Christensen T. H. (1998); Kawamoto (2008); own elaborations;
Landfill of waste: Textiles	EUROSTAT (2014); EPA (1995; 2003; 2008; 2010); Hyder consulting (2009); Statistics Canada(2008); National Bureau of Statistics China (2008; 2013); Zhang D. Q et al. (2010); Huang et al. (2006); Jelenska E. (2010); CEMPRE (2010); Ecolamancha (2008) ; Christensen T. H. (1998); Kawamoto (2008); own elaborations;
Landfill of waste: Wood	EUROSTAT (2014); EPA (1995; 2003; 2008; 2010); Hyder consulting (2009); Statistics Canada(2008); National Bureau of Statistics China (2008; 2013); Zhang D. Q et al. (2010); Huang et al. (2006); Jelenska E. (2010); CEMPRE (2010); Ecolamancha (2008) ; Christensen T. H. (1998); Kawamoto (2008); own elaborations;

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Development of a System of Indicators for a Resource efficient Europe

DESIRE

Development of a System of Indicators for a Resource Efficient Europe

D5.3 Integrated report on EE IO related macro resource indicator time series

Annex - Labour

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- Improve data availability, particularly by creating EE IO time series and now-casted data
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Summary

This report describes the collection, processing, and presentation of the socioeconomic extension for EXIOBASE 3. The socioeconomic accounts are comprised of total employment and of vulnerable employment, both in persons and in hours. For total persons in employment and for hours in total employment, the indicators were further disaggregated in gender and skill levels. Labour and hours worked accounts were collected from the International Labour Organization (ILO)'s LABORSTA and ILOSTAT databases and from the OECD's Statistics Database. Vulnerable employment consists of self-employed persons and unpaid family workers. Skill levels – high-, medium-, and low-skilled work – correspond to that of the International Standard Classification of Occupations.

Socioeconomic indicators were collected for the period from 1995 to 2012. Adjustments were made to disaggregate and combine different data sources and industry classifications throughout the period. Those adjustments are detailed on section 2.5 of this report.

1 Introduction

This report describes the collection, processing, and presentation of the socioeconomic extension for EXIOBASE 3.

Socioeconomic data in EXIOBASE 3 consist of labour indicators collected for 44 countries plus five ‘rest of the world’ regions and for the period between 1995 and 2012. The indicators available are: compensation of employees distributed by skill level, total employment and hours worked distributed by skill level and gender, and vulnerable employment and hours worked by persons in vulnerable employment.

These indicators represent an expansion of the labour indicators in EXIOBASE 2. The labour data was extended from availability by skill levels to the availability by both skill levels and gender. Vulnerable employment is also a new addition to the socioeconomic indicators in EXIOBASE 3.

During EXIOBASE 2 it was noted that the heterogeneity of labour types in each industry and country presented an important indicator for labour quality, at the same time that recognized the limitations of these indicators in a static MRIO model. These limitations have been reduced in EXIOBASE 3, with the introduction of a time series that allows the evaluation of structural changes in the labour force. It is important, however, to take into account uncertainties, which are discussed in item 2.5.

In the following sections we describe the indicators used, their characteristics, and data sources. It follows a discussion about the adjustments of the time series, uncertainties, and key assumptions used to fill in the existing gaps in available statistics.

2 Method

2.1 Indicators and data sources

The socioeconomic indicators are labour-related data collected for each country and economic sector. These data reflect, all together, not only the labour quantity but also the labour quality.

Standard measures of labour inputs quantify the dimension of labour impacts of consumption and production in the MRIO model, as well as show how the labour force is allocated between the industries in the domestic industries in the period. Those are compensation of employees, total employment, and hours worked.

In order to analyse the composition of the labour force in each industry and country, we used labour quality indicators. We thus present a breakdown of the labour force and hours worked between skill levels and gender, as well as estimate the number of persons and hours worked in total employment which correspond to vulnerable employment situation.

All the socioeconomic indicators available in EXIOBASE 3 are presented in table 1.

Table 1. Socioeconomic indicators in EXIOBASE 3

Code	Description
w01	Compensation of employees: low-skilled
w02	Compensation of employees: medium-skilled
w03	Compensation of employees: high-skilled
s01.a_m	Total employment: low-skilled male
s01.a_f	Total employment: low-skilled female
s01.b_m	Total employment: medium-skilled male
s01.b_f	Total employment: medium-skilled female
s01.c_m	Total employment: high-skilled male
s01.c_f	Total employment: high-skilled female
s02.a_m	Employment hours: low-skilled male
s02.a_f	Employment hours: low-skilled female
s02.b_m	Employment hours: medium-skilled male
s02.b_f	Employment hours: medium-skilled female
s02.c_m	Employment hours: high-skilled male
s02.c_f	Employment hours: high-skilled female
s03	Vulnerable employment
s04	Hours in vulnerable employment

Compensation of employees comprises wages, salaries, and employers' social contribution. For each country, this indicator was disaggregated from the National Accounts tables into 163 industries. It was used then to disaggregate employment and hours worked into the EXIOBASE industries, as detailed in section 2.2. The total compensation of employees was estimated for three skill levels – low-skilled, medium-skilled, and high-skilled. The skill levels are detailed in section 2.3.

Sector-level data for total employment, paid employees, and hours worked were obtained by labour force surveys and industry surveys, collected from the International Labour Organization (ILO) and the Organisation for Economic Co-operation and Development (OECD) databases (ILO, 2014, 2013a; OECD, 2014).

Total employment refers to total persons engaged in each industry. It covers both employees and self-employed persons. Employees are all persons with formal job attachment, even if in temporarily paid or unpaid leave. Self-employed persons include employers, own-account workers, members of producers' cooperatives, unpaid family workers at work, and persons engaged in the production of economic goods and services for own household consumption. In labour databases, employment can be given in both numbers of persons and of jobs. We consider, in this database, the numbers of persons in work. It must be highlighted the fact that multiple job holders can correspond to more than 5% of employed persons (Lequiller, 2004).

Persons in vulnerable working conditions are those with large economic risks associated with their jobs. They are less likely to have formal arrangements, and are more at risks to economic cycles and environmental disasters. We use the ILO's definition of vulnerable employment, which comprises unpaid contributing family workers and own-account workers (ILO, 2013b). We use workers without employee status as a proxy for vulnerable employment. We assume that most of workers that are not in formal paid employment, that is, are not classified as paid employees, are potentially in a vulnerable employment condition, especially those in developing countries.

Hours worked can be classified in four different types, which vary according to which hours are accounted for:

- *Hours actually worked* covers all types of workers, and relates to all the time that the persons spent on work activities during the reference period, whether paid or unpaid, but excluding time not worked, such as in annual, parental or sick leaves, public holidays, meal breaks, and commuter travel;
- *Hours paid for* include all hours paid for, whether worked or not. It comprises all paid leaves, and excludes hours not paid for, such as unpaid overtime;
- *Normal hours of work* covers only paid employees, and refers to hours of work established in agreements and labour regulation, and differ from hours paid for by excluding all overtime;
- *Hours usually worked* relates to average hours most commonly worked per week in paid and self-employment during a reference period, including usual paid and unpaid overtime.

The use of each category will depend on the aim of the research. For the purpose of this project, we consider *hours actually worked*, since it reflects the productivity of the industry, and are the usual output of hours worked in labour force surveys. While OECD Stats offer total hours worked for each industry, ILO gives average weekly hours worked by person for each sector. For hours worked in each industry in non-OECD countries, we multiplied average weekly hours by the number of persons employed and by 52 weeks.

When available, we use different weekly hours worked for total employment and for employees. Hours worked by persons in vulnerable employment for each year correspond to the difference between hours worked in total employment and those worked by employees. We used, however, same hours worked per week for male and female workers and per skill level.

2.2 Disaggregation of labour accounts into EXIOBASE classification

Labour inputs were disaggregated from broader economic sectors into the industry classification for EXIOBASE. That is because the aggregation level for labour statistics varied from 9 to 68, depending on the country. We adjusted the data in two steps.

First, we adjusted the time series to a same level of disaggregation. Data available for a same country could have come from three different surveys, for different periods. That led to different industry classifications throughout the time series (usually from ISIC2 to ISIC3 then to ISIC4). We disaggregated employment and employees data for all period based on the most detailed classification available. For that, we kept the data for the broad sector from the previous years and estimated the distribution between the different sub-sectors as being the same as the first available year[1]. An example would be the disaggregation of the "Wholesale and retail trade and restaurants and hotels" from ISIC2 to the two separate sectors of "Wholesale and retail trade; repair of motor vehicles and motorcycles" and "Accommodation and food service activities" in ISIC4.

We then disaggregated the data from the most detailed classification available for each country into the industry classification for EXIOBASE. This step was done taking into reference the compensation of employees. It was assumed that, inside a same broad (less detailed) sector, all workers would earn similar hourly salaries and compensations, as well as work similar amount of hours. For example, for the "*pulp, paper and paper products*" broad sector from the labour statistics, which comprises the industries "*pulp*", "*re-processing of secondary paper into new pulp*" and "*paper*" in EXIOBASE, the total number of persons engaged was divided proportionally between the EXIOBASE industries according to their shares in total compensation of employees in the broad sector (eq. 1). This assumption was also applied for persons and hours worked in vulnerable employment.

$$E_i = E_b^{data}\left(COE_i \,/\, \sum_i^b COE_b\right) \qquad (1)$$

Where:
E_i = Total disaggregated employment in industry *i,* in EXIOBASE
E_b^{data} = Total employment in the broad industry sector *b*, from labour statistics
COE_i = Compensation of employees in industry *i*, in EXIOBASE
COE_b = sum of compensation of employees in all sectors in EXIOBASE which belong to broad sector *b*

[1] In exceptional cases, the values were adjusted. That happened when there was a significant difference between two surveys which was not explained just by new classification of industries. These adjustments will be explained further in section 2.5.

2.3 Labour types: skill levels and gender

Labour inputs are divided for gender and skill types. We use three skill types (low-, medium-, and high-skilled), based on occupations and educational attainment levels. For occupations, we use the definition from the *International Standard Classification of Occupations* (ILO, 2012a) and, for educational attainment, the *International Standard Classification of Education* (UNESCO, 2012). The correlation between the skill levels and occupations and education attainments is presented in table 2.

Table 2. Correlation between skill types, occupations, and educational attainment levels

Skill type	Occupations	Educational attainment levels
Low-skilled	9 Elementary occupations	0 Less than primary education 1 Primary education 2 Lower secondary education
Medium-skilled	4 Clerical support workers 5 Services and sales workers 6 Skilled agricultural, forestry and fishery workers 7 Craft and related trades workers 8 Plant and machine operators, and assemblers	3 Upper secondary education 4 Post-secondary non-tertiary education
High-skilled	1 Managers 2 Professionals 3 Technicians and associate professionals	5 Short-cycle tertiary education 6 Bachelor's or equivalent level 7 Master's or equivalent level 8 Doctoral or equivalent level

We provide industry-level information on labour types for persons engaged and hours worked. We also present a breakdown of compensation of employees per skill level. The availability of such a level of detail of labour types reflects the heterogeneity of labour force and the differences in remuneration of workers.

The main source for gender and skill types information was labour force surveys, gathered from ILO LABORSTA and ILOSTAT databases. Though number of workers by skill type is often available from these surveys, they usually do not account for hours worked or wages. Therefore, we assume no distinction in hours worked per week for different skill types.

To calculate the distribution of compensation of employees, we use relative wages inside a sector. That means that the relative difference between wages for high- and low-skilled workers would be similar inside a broad sector, even if the absolute wages are not similar. Relative wages were calculated from earning and income surveys, collected from national statistics offices. The relative wages for skill types are considered to be the same for EXIOBASE 2 (Wood et al., 2014).

Due to the high aggregation level for this data, labour types were calculated as shares of total inputs. We assume that the distribution of skilled workers would not differ greatly among industries in a broad sector[2], and therefore, same distribution of gender and skill types can be applied inside a broad economic sector. It should be noted that, whilst for

[2] Although there can be large differences among industries in the manufacturing sector, most of available information was highly aggregated for total manufacturing.

manufacturing sectors no skill data was available, the gender distribution was usually available. Table 3 presents the aggregate industry sectors for which labour types shares were calculated.

Table 3. Aggregated industries available for labour types

Code	Industry
A & B	Agriculture, forestry, hunting and fishing
C	Mining and quarrying
D	Manufacturing
E	Electricity, gas and water supply
F	Construction
G	Wholesale and retail trade
H	Hotels and restaurants
I	Transport, storage and communication
J	Financial intermediation
K	Real estate, renting and business activities
L	Public administration and defence; compulsory social security
M	Education
N	Health and social work
O	Other community, social and personal services
P	Private households with employed persons

2.4 Estimating labour in Rest of the World

The labour accounts for the Rest of the World (RoW) were divided in the same way as the EXIOBASE classification, in five regions: RoW Asia and Pacific, RoW Latin America and the Caribbean, RoW Europe, RoW Africa, and RoW Middle East. For estimating labour accounts for these regions, it was first estimated the total employment for each of them.
For estimating total employment, we used estimates from the ILO for total employment per broad sector (agriculture, industry, and services) for each region for the years 2000, 2007, 2010, and estimates for 2011 (ILO, 2012b). Employment for the period 1995-1999 and for 2012 were estimated using the same growth rate as population for the region (The World Bank, 2014). For the period between 2000 and 2007, and that between 2007 and 2010, it was estimated linear growth in employment numbers for each sector.

The ILO regions were aggregated into the EXIOBASE RoW regions and subtracted the data for the EXIOBASE countries. Then, a proxy country was used to estimate hours worked, labour types, and share of total workers in vulnerable employment in the three broad sectors. The proxy is an EXIOBASE country that represents an average closest to most populated countries in the rest of the region regarding average share of women in non-agricultural sectors and educational attainment of the population (The World Bank, 2014). The correlation between the EXIOBASE and the ILO regions, as well and EXIOBASE countries subtracted for each region and proxy country for labour hours, types, and vulnerable employment are presented in table 4.

Table 4. Assumptions for Rest of the World labour accounts

Rest of the World Regions	Regions in ILO	Countries in EXIOBASE	Proxy for labour types
RoW Asia and Pacific	East Asia Southeast Asia and the Pacific South Asia	Australia China India Indonesia Japan South Korea Taiwan	Indonesia
RoW Latin America and the Caribbean	Latin America and the Caribbean	Brazil Mexico	Mexico
RoW Europe	Central and South-Eastern Europe (non-EU) and CIS	-	Spain
RoW Africa	North Africa Sub-Saharan Africa	South Africa	South Africa
RoW Middle East	Middle East	Turkey	Turkey

2.5 Adjustments to the data and further uncertainties

The main challenge to integrate the labour data for the time series was the variety of industry classification and source for labour data.

Industry classification varied from just 9 industries (top level ISIC rev.2) to 68 industries (moderately to highly detailed ISIC rev.4). Most data was available in two different classifications throughout the time series (ISIC rev.3 and ISIC rev.4), and thus had to be combined in one single classification. The disaggregation of older data into latest, more detailed industry classification carries uncertainties regarding potential changes in industry classification throughout the time period. The disaggregation of labour data into more detailed industry classification was performed by using the older data and redistributing it into different sectors based on data available.

Detailed data for labour in different manufacturing industries for most of the countries was only available, however, for paid employees and until 2008. It was assumed, then, that total employment followed the same distribution. In other words, it was assumed a constant ratio of employees per total employment in the manufacturing sector. For data following 2008, it was assumed similar distribution of total manufacturing data for the latest year available.

Besides uncertainties regarding changes in industry classification throughout the time series, highest uncertainties come from different – and sometimes inconsistent – data sources. Main source of labour data was national accounts questionnaires from national statistical offices and labour force surveys. However, various records come also from official estimates, population surveys, and establishment surveys. In cases of high inconsistency between labour data, we maintained the latest values, assumed to be more reliable, and estimated the past time series. The estimation of past values was based on past growth rates for each sector.

Missing data was estimated according to the closest available values for each sector. When gaps were located between known values, it was assumed a linear growth. In cases where either previous or subsequent values were unknown or highly inconsistent, data was estimated based on labour force growth. For estimating missing data on vulnerable employment, it was assumed a linear growth on the share of employees in total employment.

With few exceptions, labour data had to be combined from different sources and classifications. Only seven countries presented a consistent industry classification throughout the entire time series. Table 5 summarizes the integration and estimated data for EXIOBASE countries throughout the time series.

Table 5. Combination of different industry classification and estimated data for throughout the time series for labour accounts

		EXIOBASE countries
Combination of different industry classifications	No combination	AT, BE, CZ, DE, FR, IT, RU,
	Two	AU, BR, CA, DK, EE, ES, FI, GB, GR, HR, HU, IN, IE, KR, LT, LU, LV, MT, MX, NL, NO, PL, PT, RO, SE, SI, SK, TW, US
	Three	BG, CH, CN, CY, ID, JP, TR, ZA
Estimated data	Estimated data from past growth rates (inconsistency in data sources)	BG, CN, ID, IE, LT, RU, TW, US, ZA
	Estimated missing data	BR, HR, CY, HU, IN, JP, LV, MT, MX, PL, ZA

Division in skill levels, also, was not available for the entire period and for all the countries. Data for skill level division per gender was only available until 2008. For years not covered, the same distribution of skill levels between genders and sectors from the closest year available was used, combining with known gender distribution for the year.

It should also be highlighted that data on employment quantity and quality has higher uncertainty in smaller sectors.

3 Conclusion

The labour accounts in EXIOBASE 3 provide an extension to that of the previous version, EXIOBASE 2. It provides a further breakdown from skill levels to gender, for both total employment as for hours worked. It also provides a new indicator, which is vulnerable employment, in both persons and hours. The analysis of this time series will allow the quantification of the changes in labour structure over the entire period, in the amount and conditions of the workforce.

Adjustments and assumptions were made to fill in gaps in data and normalize different labour surveys and industry classifications throughout the period. The breakdown of compensation for employees per skill level, however, is based on data for the period between 2005 and 2008. For the next update of EXIOBASE 3, version 3.2, we hope to improve the data on relative wages per skill level using detailed information gathered from national statistics offices. With this, we hope to reduce uncertainties and provide a better picture of the wage gap between skill levels.

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DESIRE

Development of a System of Indicators for a Resource Efficient Europe

D5.3 Integrated report on EE IO related macro resource indicator time series

Annex – Now casting

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Summary

The Europe 2020 Strategy strives to ensure a smart, sustainable and inclusive growth of Europe (European Commission 2011a). Clearly, multiply policies needs to be set in place and adjusted to reach that goal. That also implies, that timely assessments of current environmental and social impacts of economic production and consumption are required to gauge the effectiveness of current policies. The now-casted EXIOBASE system aims to provide such a feedback mechanism.

The monetary supply use tables (MSUTs) of the historic EXIOBASE 3 time series were now-casted based on the macro-economic estimates of the World Economic Outlook Database of the International Monetary Fund ("IMF World Economic Outlook Database List" 2015). This entails, that macro-economic growth rates in the now-casted EXIOBASE years are consistent with the estimates of the IMF. Structural changes in the economy were projected by forecasting the last available data point with the estimated mean change for each technical coefficients of the MSUTs. Resource usage for the now-casted years was estimated based on the last available data point on resource efficiency in the historic time series and overall activity level in the nowcasted MSUT account. Emissions were recalculated using the latest available emission factors and the now-casted emission relevant energy use. The now-casted years were incorporated in the new EXIOBASE 3 database, providing a time series of EE MRIOs ranging from 1995 to 2016 with a consistent level of detail.

1 Introduction

Global environmental extended (EE) multi regional (MR) input output (IO) tables have emerged as the main accounting tool for linking the environmental (and social) consequences of production to the final consumer (Davis and Caldeira 2010; Arnold Tukker et al. 2014; Simas et al. 2014; Galli et al. 2012). They are based on a complete description of the global economy (the MRIO part) linked to the environmental stressors associated with productions (the 'satellite' accounts or extensions – the EE part). Through the MRIO system it is possible to trace the flow of goods and services from the place of production to the actual consumer. The EE part accounts for the direct environmental and social requirements of each of these flows. Therewith EE MRIO tables allow, besides the classical production centric accounting of impacts, to emphasize the role of the consumer as primary cause for production and its environmental consequences (Peters and Hertwich 2006; Peters and Hertwich 2008; Wiedmann 2009). This consumption based accounting (aka 'footprinting') approach currently gains momentum for the design of policies and assessing the sustainability of countries and regions (eg. Roelich et al. 2013; United Nations University and International Human Dimensions Programme on Global Environmental Change 2012).

EE MRIO analysis depends on an adequate description of the global economy (in terms of monetary flows between sectors and regions) coupled with consistent satellite data on environmental and social accounts (such as water use, material extraction, emissions, employment).

Multiple data sources provides the raw data for compiling an integrated EE MR Supply Use table (SUT) that can be transformed into a EE MRIO system (eg. National accounts, international databases on energy use – IEA, trade databases). These databases do not provide up to date data (Table 1.1). Consequently, all EE MRIO databases available are based on a base year several years in the past (Table 1.2). This time gap makes it difficult for policy makers and stakeholders to assess up-to-date environmental pressures of the socio-economic system as well as to evaluate the economic and environmental impacts of recent policy initiatives. To overcome this time gap, DESIRE aims to provide a now-casted version of an EE MRIO.

Database	Time lag
UN SNA	2 to 3 years
Eurostat ESA 95 SUT or IO tables	3 to 4 year
Non-Eurostat SUT or IO tables	1-8years
FAOstat	1year
Comtrade/BACI	1/2 year
UN service trade	Few months
UNIDO	2 to 3 years
ProdCom	Few months
GHG Inventory Subm.	1 year
IEA extended energy balances	1 year, the last point often incomplete or based on estimates

Table 1.1: Time lag of commonly used data sources for EE MRIO compilation.

EE MRIO database	Base year
GRAM	2000, 2004, 2010
WIOD	1995 - 2011
EXIOBASE	2000 (v1), 2007 (v2), 1995-2012 (v3)
EORA	1990 - 2011
GTAP-MRIO	1990, 1992, … , 2004, 2007
OPEN:EU (based on GTAP)	2004
IDE-JETRO	1975 - 2005

Table 1.2: Base years of currently available global EE MRIO databases (updated from A. Tukker and Dietzenbacher 2013)

Within work package 5 of DESIRE, the EE MRIO database EXIOBASE has been updated to version 3. The main improvement of this update include an EE MRIO time series, ranging from 1995 to 2012. This time series forms the basis for the now-casting procedures described in this report. Hereby we define now-casting as the process of estimating a current value of a certain target variable (in this case the EE MRIO system) by exploiting information which get published earlier than the data underlying the target variable.

The rest of this annex report unfolds as follows. The following section describes the data sources of the now-casting, the now-casting algorithm and the compilation of the updated Multi-Regional Supply Use and Input Output system. Section three presents the characteristics of the now-casted years in EXIOBASE. We close with some final remarks about the now-casting procedure and the relevance of now-casting for policy-makers.

2 Methods

2.1 Now-casting monetary SUT

2.1.1 Data sources

The fundamental principle in the compilation of EXIOBASE 3 is to provide a database consistent with published macro-economic constraints. For that purpose, a macro-economic database (building upon the UN National Accounts Main Aggregates Database: "United Nations Statistics Division - National Accounts" 2013) was compiled at the beginning of the project (see Annex report Monetary Supply-Use tables). For the now-casting exercise, this database was updated with estimates regarding change in GDP and trade given by the World Economic Outlook Database of the International Monetary Fund ("IMF World Economic Outlook Database List" 2015). This database is updated twice a year and includes now- and fore-casts of several macro-economic data up to 2019 for 187 countries (including Taiwan and Croatia).

Alternative databases considered include the Economic outlook, analysis and forecasts of OECD ("Economic Outlook Annex Tables - OECD" 2015) and the indicators provided by the World Bank ("The World Bank" 2013). However, these data sources were discarded because they either did not include the full EXIOBASE country set (OECD database) or did not provide fully now-casted data (World Bank). However, the World Economic Situation and Prospects from the UN DESA ("UN DESA | DPAD | World Economic Situation and Prospects" 2015) provides roughly the same data as the World Economic Outlook Database from the IMF and could be used as alternative data source.

2.1.2 Now-casting procedure

The now-casting of the monetary SUT started with building an updated version of the macroeconomic database compiled for the initial time series (see 2.1.1 – Data sources). To do so, the change in GDP and trade was applied to the latest available datapoint in the original database. Afterwards, value added per broad sector (ISIC A-B, ISIC C-E, ISIC D, ISIC F, ISIC G-H, ISIC I, ISIC J-P) and final demand per category (households, government, gross capital formation) were scaled to match the updated GDP and trade values. The macro economic data was then used to estimate the current trade and industry output values based on last available shares in the initial time series. These data were combined with the now-casted SUT coefficients (see 2.3) to compile the initial now-casted SUT table. This SUT was balanced using the same mathematical programming approach used for the initial time series. A final estimate of the SUT system $\mathbf{Z}_{m,j,t}$ is created from minimizing differences (the objective value $o(\mathbf{Z},\mathbf{Z}^0)$) from the initial estimate of the Supply Use system $\mathbf{Z}^0_{m,j,t}$

$$o(\mathbf{Z},\mathbf{Z}^0) = \sum_{m,j,t} \mathbf{SW}_{m,j,t} * \left(\mathbf{Z}_{m,j,t} - \mathbf{Z}^0_{m,j,t}\right)^2$$

with *m, j, t* representing rows (products and value added), columns (industries and final demand) and layers (supply table, use table basic prices domestic and import use, taxes, transport and trade margins) of the SUT system. A QP target function was chosen to minimize $o(\boldsymbol{Z},\boldsymbol{Z}^0)$. Weights $\boldsymbol{SW}_{m,j,t}$ were defined as the inverse of $\boldsymbol{Z}^0_{m,j,t}$. The QP function was constrained by:

1. Product output of the supply table equals product output of the use table (basic prices)
2. Industry output of the supply table equals industry output of the use table (basic prices)
3. The amount of import equals the import use.
4. Final demand of households (purchaser prices) equals the value given in the updated macro-economic database.
5. Final demand of governments (purchaser prices) equals the value given in the updated macro-economic database.
6. Gross capital formation (purchaser prices) equals the value given in the updated macro-economic database
7. Imports and exports (f.o.b.) equals the values given in the updated macro-economic database
8. Value added per broad ISIC sector equals the value given in the updated macro-economic database
9. The columns sums of trade and transport margins must be zero.
10. The column sum of the tax margins must equal the taxes and subsidies given in the basic price value added plus taxes block.
11. Intermediate and final demand (except capital formation) were restricted to be positive.

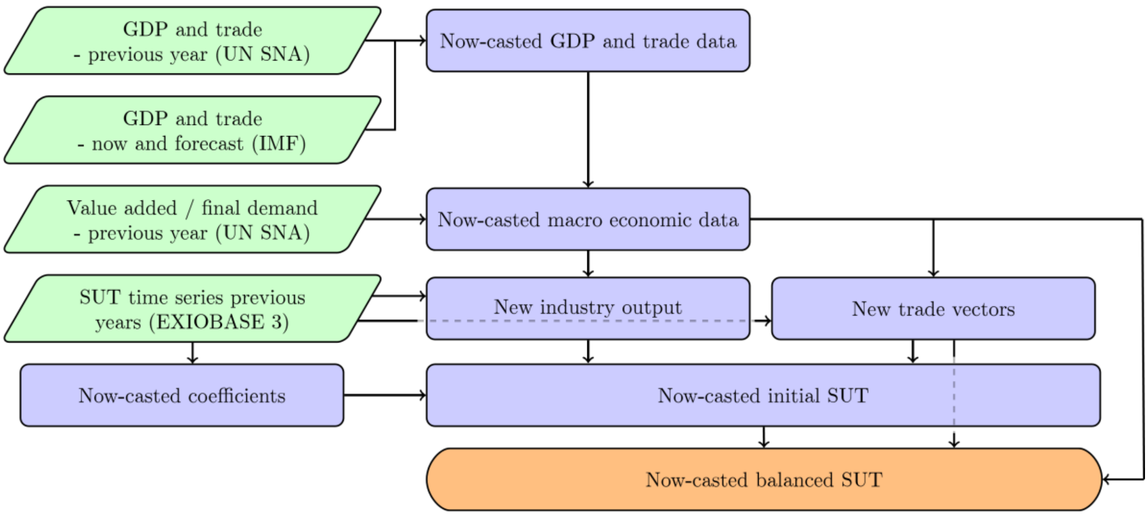

Figure 1: Now-casting monetary SUT tables

2.2 Extensions

For the now-casting of environmental extensions, two principal methodological approaches are available:

1. Identifying specific predictor variables for various environmental extensions
2. Calculating intensity coefficients based on the now-casted data in the monetary part of EXIOBASE

The advantages and disadvantages of both options shall be briefly discussed in the following.

2.2.1 Approach 1: Specific predictor variables

The first approach aims at identifying specific predictor variables for as much environmental categories as possible. The DG Environment study «Nowcasting of and target setting for resource efficiency indicators» (Rademaekers et al. 2013) is an example for such an approach. In this study, the authors aimed at identifying best-suited predictor variables for a number of resource use categories. The following table provides an example showing various categories of material flows.

Disaggregated material category	Proposed predictor	Source	Data availability (T+ months from end of last year)
Crops and crops residues	Agricultural Production Data (harvested production)	Eurostat (crops production database, fruits and vegetables database)	T+4
Wood	Forestry production data	Eurostat (for_remov)	T+11
Metal ores	Production volume for selected product codes	PRODCOM	T+7
Non-metallic minerals	Production volume for selected product codes	PRODCOM	T+7
Coal and other solid energy materials/carriers	Energy Statistics – Solid fuels	Eurostat (Primary production of all solid fuels)	T+11
Liquid and gaseous energy materials/carriers	Energy Statistics – Liquid and Gaseous Fuels	Eurostat (Primary production of total petroleum products and total gas	T+11

Table 2.1: Now-casting predictors for selected material flow categories (modified from Rademaekers et al. 2013).

In this example, various European data sources, such as PRODCOM, energy as well as agricultural statistics, have been identified as best-suited predicting variables to now-cast material categories using. The variables are available between 4 and 11 months after the end of each year.

The advantages and disadvantages of now-casting approach 1 can be summarised as:

Advantages of approach 1	Disadvantages of approach 1
• Predictor variables have high specificity for each environmental category, which is separately now-casted	• High efforts due to need for identifying specific data sources for each now-casted environmental category • Potential inconsistency with other now-casted variables in the monetary part of EXIOBASE

2.2.2 Approach 2: Coefficients based on monetary predictors

The second approach is particularly suited for an EE-MRIO framework, as it uses the now-casted monetary data, in particular on sectoral outputs, to now-cast the corresponding environmental categories. For doing this, environmental intensity coefficients are applied to the now-casted monetary output data. Two principal approaches exist for estimating environmental intensity coefficients:

1. They can be estimated based on historical relations (e.g. material, energy or water input per sector output). In order to reflect technological changes in the past, the mean annual change of the environmental intensity can be calculated for the historical time series and applied to the now-casted time series. In case of resource efficiency gains, the mean change is closely related to a de-coupling factor and can be interpreted as the annual resource-efficiency gain. The advantage of this approach is that historic trends in resource efficiency change are continued for the now-casted years. However, if no clear trend can be determined, this approach leads to artificial estimated trends – there is a certain proxy to assume a trend. One further disadvantage is, that pricing mechanisms are difficult to control for. Either constant price data or product group specific deflator data should be used to capture trends over time without being subject to artificial price fluctuations.
2. The last available data point for resource efficiency in the historic time series can be used to estimate resource usage for all now-casted years. This approach assumes, that within the now-casted years, no further resource decoupling will occur. This assumption may be valid for certain environmental stressors (eg. Land use, material extraction) but certainly not for others (energy use). One the plus side, this approach leads to a consistent and more conservative now-cast; no artificial trend in resource decoupling will be estimated.

The advantages and disadvantages of now-casting approach 2 can be summarised as:

Advantages of approach 2	Disadvantages of approach 2
• Lower efforts, as all environmental now-casts are performed based on the same data framework • High consistency among the environmental extensions nowcasted and with now-casts of monetary parts of EXIOBASE	• Low specificity for specific environmental categories, as only broad monetary growth trends in volume terms (e.g. growth rate of a certain economic sector) are applied to all individual products (e.g. agricultural goods). • Depending on the approach taken, either price deflators are required for specific products, or if latest technology is assumed, no decoupling will be estimated in the now-casted years.

For the now-casting of environmental extensions in the DESIRE project, the team has decided to apply approach 2, in particular to ensure consistency between the now-casted monetary and extensions parts of EXIOBASE. For version 3.1 we chose the conservative approach and now-cast the resource usage based on the latest available data-point on resource efficiency in the historic time series. Within wp9 the now-cast based on this approach will be analysed and compared to the now-casted based on estimating trends in resource efficiency.

The concrete working steps following this approach were:

1. Calculate the lasts available environmental intensity coefficients of the historic time series.
2. Calculate the now-casted monetary variables, in particular sector output data (see above).
3. Multiply the environmental intensity coefficients with the now-casted sector output data to receive the now-casted environmental variables in absolute terms.

While a high consistency across all now-casted variables in EXIOBASE is ensured by this approach, it is important to note that the now-casts (or projections) of resource efficiency indicators will only reflect economic developments and will not be influenced by trends and changes in the environmental domains themselves. It is important to consider this when interpreting the now-casted environmental extensions and the derived resource use indicators.

2.3 Now-casting of technical – and stressor coefficients

Temporal change in economic structure underpins all forecasting models used in for example computable general equilibrium models and econometric forecasting models. Whilst for a now-casting approach, we are not concerned with long-run projections, but instead only in short-run updates of missing data. As such, we do not focus on substitutability of new technologies and new products, but only on the short-term extrapolation of existing trends. In order to inform the short-term extrapolations, we rely on trends in structural change in recent history. A rich research field centres around looking at impacts of structural change through structural decomposition analysis (Dewick, Green, and Miozzo 2004; Yamakawa and Peters 2011; Yamakawa and Peters 2009; Wood 2011), looking at the trends in historic coefficient change at the individual coefficient level is less well described. We hence take a conservative approach to extracting average trends for interpolation, before balancing to available data.

Technical coefficients (column coefficients of the monetary SUT) and stressor coefficients of the satellite accounts (both denoted as *c*) were updated following the same algorithm. First, monetary flows and total stressor were normalized by

$$c_{m,j,t} = \frac{z_{m.j,t}}{\sum_j z_{m,j,t}}$$

with *m, j, t* representing rows (products and value added or stressor values), columns (industries and final demand) and years of the initial SUT system. Next, the mean coefficients for all the pairs of *m* and *j* of the whole initial time series was calculated by

$$c^0_{m,j} = \frac{\sum_t c_{m.j,t}}{t_l - t_f}$$

where t_f and t_l are the first and the last years of the initial time series. This mean coefficient corresponds to the mean time point t^0 :

$$t^o = \frac{t_l - t_f}{2}$$

Similarly, the mean coefficient $c^e_{m,j}$ was calculated for the last four years (three years in case of missing 2012 values for some extensions) of the time series as well as the time points of the mean t^e. The average change was then calculated by

$$r_{m,j} = \frac{c^e_{m,j} - c^0_{m,j}}{t^e - t^0}$$

and used to now-cast each coefficient by

$$c_{m,j,t} = c_{m,j,t-1} + r_{m,j}$$

for all now-casted years *t* ($t > t_l$).
Where *l* denotes the last available year of the time series. In case, the describe procedure result in negative coefficients, the values were replaced with the last available data point before the negative estimate. The updated coefficients where than multiplied with the updated industry output and final demand per sector/category. This gives the now-casted flow for the full SUT system as well as the absolute values of the social and environmental interventions.

2.4 Compilation

Monetary SUT and most of the extension were now-casted as described above. One exception were the emission satellite account. Emission of combustion accounts in EXIOBASE are based on emission relevant energy use. This data was than multiplied with emission factors to obtain the actual emission account. Instead of now-casting this data directly, the emission relevant energy use was now-casted and subsequently multiplied with the latest available emission factors.

Following the now-casting of the monetary SUTs and the satellite accounts, the datasets were compiled into a Multi-Regional Supply Use System (MR SUT). This was subsequently checked for trade-balance and transformed into a Multi-Regional Input Output System using the industry technology assumption (for product by product tables) or the product technology assumption (for industry by industry tables), as per the non-now-casted years.

3 Results

The procedure described in section 2 provides a now-casted time series of EE MRIOs in the industry by industry and product by product classification. The now-casting starts with the first year after the initial time-series and currently includes data up to 2016. All data set available in the initial EXIOBASE 3 time series were updated, thus ensuring a consistent level of detail for all years (see table 3.1 for a full overview of the now-casted years).

	EXIOBASE 3
Now casted years	**2011/2012 – 2016** *)
Products	**200**
Industries	**163**
Countries	**44** (28 EU member plus 16 major economies)
Rest of the world regions	**5** (Europe, Asia, Africa, America, Middle East)
Water accounts	**172** (Water blue and green per source, including final demand)
Material accounts	**189** (Energy products, including final demand) **215** (Used extractions) **193** (Unused extractions)
Land accounts	**14** (Including build up land for final demand)
Emissions	**26** (from combustion including final demand) **11** (non-combustion) **3** (HFC, PFC, SG6)
Social accounts	**14** (Employment per skill level and gender; vulnerable employment)

Table 3.1: Characteristics of the now-casted years of EXIOBASE 3. For a detailed list of all items included see the corresponding annex reports. *) Now-casting start can vary for the satellite accounts based on the latest available data point in the original EXIOBASE time series.

Some first results showing the now-casted environmental stressors are shown in the main report.

4 Conclusion

Global EE MRIO databases aim to provide policy-makers with a comprehensive assessment of the environmental and social impacts of current economic activity. The compilation of an EE MRIO is a data-intensive task using multiply data-sources which often require several steps of refinement. Both points imply that EE MRIOs consistent with these data sources cannot be published before the data sources are available and processed. However, as an, alternative approach, more up-to-date data sources can be utilized for now-casting existing EE MRIO time series. This reports described the data bases and the algorithms used for now-casting the various components of EXIOBASE.

Macro-economic growth rates used for now-casting EXIOBASE are consistent with the estimates of the World Economic Outlook Database of the International Monetary Fund (IMF). This goes in line with the approach chosen for the initial EXIOBASE 3 time series, which is also consistent with macro-economic data provided by international databases (as the UN SNA main aggregates database). Changes in the structure of the economy were estimated from observed trends in the initial time series. Resource usage was based on the conservative assumption that there are no major improvements for the now-casted years. To what extent information on recource efficiency gain can be extrapolated and used for the now-casting of resource usage will be further explored in work package 9. Whereas the energy data in the original time series was balanced, the now casting procedure most certainly disrupts this balance. Future efforts to improve the procedure should assess the importance of that issue and rebalance the energy data if required. In theory, the issue would affect material footprints (through the use of energy products) and all footprints based on emission relevant energy use (e.g carbon footprint). Practically, we expect only minor deviation due to the imbalanced energy data.

The now-casted years were incorporated in the new EXIOBASE 3 database, providing a time series of EE MRIOs ranging from 1995 to 2016 with a consistent level of detail. This pushes the current state of the art of global EE MRIO; to date, EXIOBASE 3 is the only available now-casted global EE MRIO database.

This new database provides policy-makers with a unique tool to timely assess the outcome of policies set in place to reduce environmental impacts and increase resource efficiency. With its high sectorial detail and the wide spectrum of environmental data consistently included in EXIOBASE, the now-casted EXIOBASE provides a very valuable tool for a range of environmental-economic assessments. Most importantly, EXIOBASE can assist in the implementation of the Resource Efficiency Roadmap (European Commission 2011a) both with economy-wide assessments, e.g. to produce aggregated headline indicators, as well as on assessments of the Roadmap’s priority areas, such as energy, food, buildings and mobility. EXIOBASE is also of high importance for assessments in the context of the transformation towards a competitive, low-carbon, economy (European Commission 2011b), as well as specific environmental strategies such as the EU Blueprint to safeguard Europe's Waters (European Commission 2012) or EU’s biodiversity strategy (European Commission 2011c).

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