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Social Accounting Matrices: basic aspects and main steps for estimation

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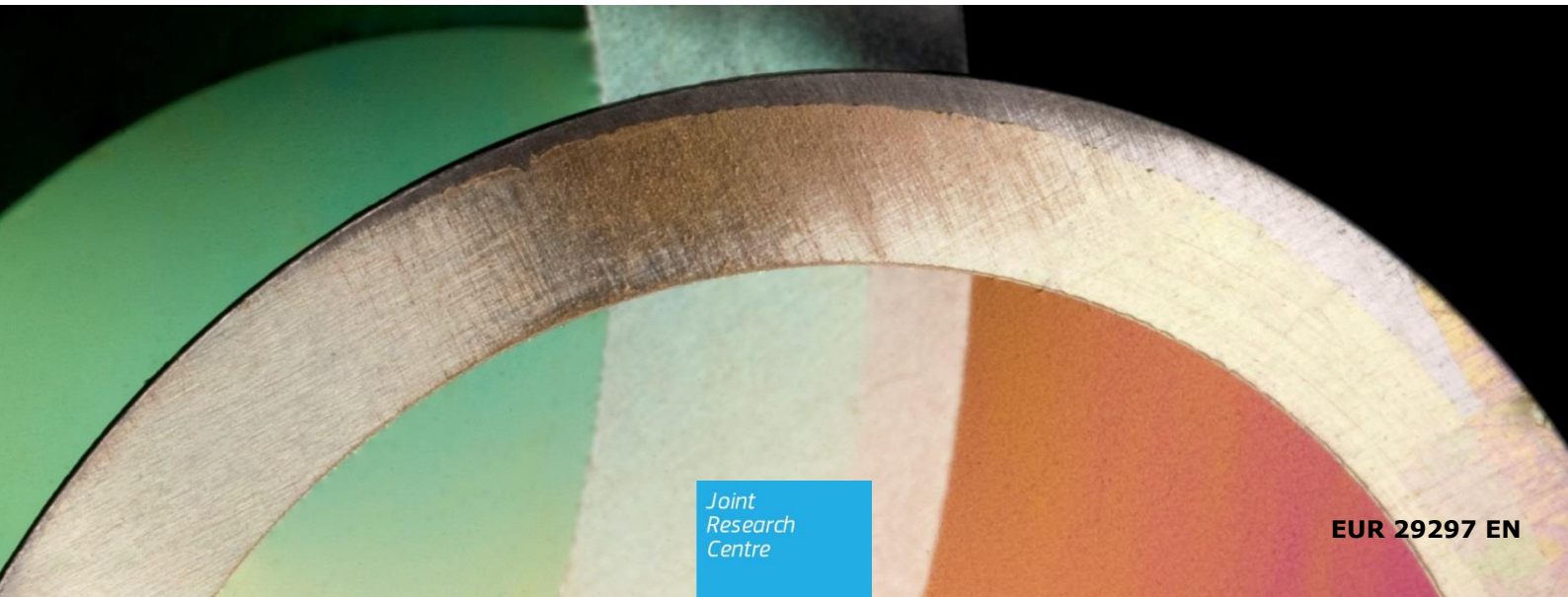
2018



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EUR 29297 EN

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JRC Science Hub
https://ec.europa.eu/jrc

JRC112075

EUR 29297 EN

ISBN 978-92-79-89846-4 ISSN 1831-9424 doi:10.2760/010600

Luxembourg: Publications Office of the European Union, 2018

How to cite this report: Mainar-Causapé, A.J.; Ferrari, E.; McDonald, S. *Social accounting matrices: basic aspects and main steps for estimation*, EUR 29297 EN, JRC Technical Reports. Publications Office of the European Union, Luxembourg, 2018, doi:10.2760/010600.

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Acknowledgements

We are grateful to colleagues from the European Commission for comments during the different phases of the report, especially Pierre Boulanger, Hasan Dudu and Martina Sartori (JRC-D.4 Unit CGE Team members).

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Abstract

A Social Accounting Matrix (SAM) is a comprehensive and economy-wide database recording data about all transactions between economic agents in a specific economy for a specific period of time. A SAM extends the classical Input-Output framework, including the complete circular flow of income in the economy.

SAMs interest is twofold: they are the standard database for most whole economy modellers as they provide data for economic modelling (multi-sectorial linear models or the more complex Computable General Equilibrium –CGE- Models) and they show a complete but intuitive snapshot of the economy at hand.

This report introduces the concept of a Social Accounting Matrix, describes its structure in detail and shows the basics in the elaboration of a SAM, indicating some extensions and modifications.

1 Introduction. Social Accounting Matrices concept.

The Directorate Sustainable Resources of the Joint Research Centre (JRC) of the European Commission provides the scientific knowledge for EU policies related to the sustainable use of resources and related socio-economic aspects: to focus on food security, land, soil, water, forest, bio-diversity, critical raw materials and related ecosystem services; to highlight the threats to our existing resources and to explore alternatives such as those related to oceans; to monitor and analyse agricultural production; to support the development of a sustainable bio-economy in Europe. The Directorate mainly serves Agricultural and Rural Development, Development and Cooperation, Environment, Maritime Affairs and Fisheries policy areas but will also support policies related to climate change, growth and trade.

The Economics of Agriculture Unit of the Directorate Sustainable Resources provides scientific support to the EU policy-makers in assessing through macro and micro socio-economic analyses the development of the Agricultural and Food sector and related sectors including rural development, food security, trade and technological innovation in the EU and globally but also with special emphasis on Africa.

As part of this remit, the unit maintain and develop multipliers and Computable General Equilibrium (CGE) models designed to address EU and developing country specific issues. These models are designed for calibration using a reduced form of a Social Accounting Matrix (SAM) that broadly conforms to the United Nations System of National Accounts (SNA). For this purpose, several SAMs have been recently developed: Müller et al., (2009), Müller and Ferrari (2012), Ferrari and Boulanger (2014), Philippidis et al. (2014), Osman et al., (2015a), Álvarez-Martínez and López-Cobo (2016), Mainar-Causapé et al. (2017b), Boulanger et al., (2017), Mainar-Causapé et al., (2018) and Mainar-Causapé and Philippidis (2018).

Building on all these experiences, this report records the general steps and possible data source needed to estimate a typical SAM. The distinctive features relate to the account structure and are determined by the necessity of ensuring that the SAMs are fully consistent with the "law of one price", while recognising the constraints imposed by the SNA's production boundary.

A Social Accounting Matrix (SAM) is a comprehensive and economy-wide database recording data on transactions between economic agents in a certain economy during a certain period of time. Its interest is twofold: it provides data for economic modelling (multi-sectorial linear models or the more complex Computable General Equilibrium – CGE- Models) and it shows a complete but intuitive snapshot of the economy at hand.

The concept of Social Accounting Matrices begins with Stone (1947), whose pioneering work on social accounting includes most of the conventions which will later be followed by economic and statistical organisations. Pyatt and Thorbecke (1976) subsequently formalised the concept of what is a SAM and thereby facilitated its use as a formal framework for economic analysis and planning (see also Pyatt and Round, 1985).

The underlying a SAM is the concept of the circular flow of income. The concept of the 'circular-economy' or 'circular-flow' goes back to Boulding (1966) who employed space travel as a metaphor to represent the finite resource limitations facing the Earth's population ([1]) (Mainar-Causapé et al., 2017a), and even to the Physiocrats, being Quesnay its main reference ([2]) (Stone, 1984; Pyatt and Round, 1985).

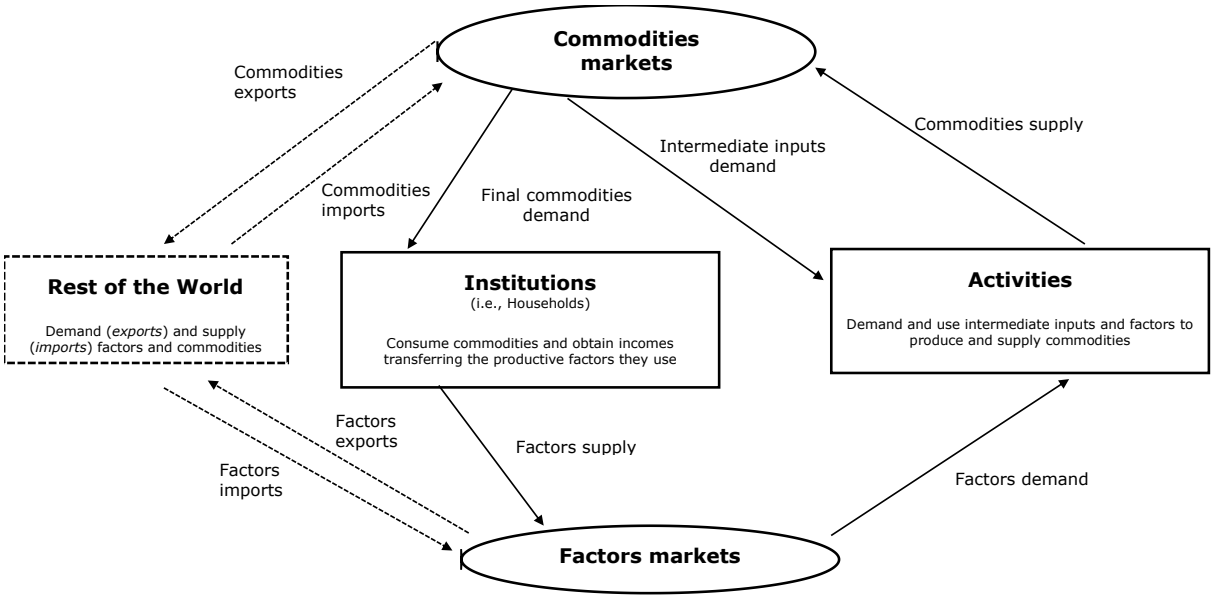
([1]) Boulding (1966) postulated that for the crew (i.e. world's population) to attempt a long journey through space, required a fundamental understanding of the 'first law of thermodynamics' to conceptualise a model of 'everything as an input into everything else' and a formal recognition of the assimilative capacity of the Earth's ecosystem. The first law of thermodynamics states that energy and matter cannot be created or destroyed. Thus, raw materials used in production processes are not destroyed, but rather are converted or dissipated into an alternative form (e.g., liquid, gas) within the environmental system (Pearce and Turner, 1990).

([2]) In 1758 Francois Quesnay, Louis XV's physician, conceived his ingenious Tableau Économique, (Quesnay, 1972) which is regarded as the beginning of the analysis of intersectoral flows.

A simplified version of the economy circular flow is represented ([3]) in Figure 1. Institutions (households, government,...) own factor services and transfer (selling or renting) them in factor markets to activities (producers, industries, etc.). Activities employ factors paying an amount, generating flows of incomes to the institutions. Then, institutions use these incomes to acquire final commodities (goods and services) produced by the activities. The activities collect part of their income from the sale of final commodities to institutions; the rest comes from the sale to other activities as intermediate commodities on the product markets. Hence, a circular flow is generated between institutions and activities linked via factors and product markets. Besides, institutions can transfer their factor services to domestic or foreign (Rest of the World) activities, while activities can hire factor services from domestic or foreign institutions. Similarly, domestic institutions can buy final commodities from domestic or foreign activities, while domestic activities can buy intermediate commodities from domestic or foreign activities. Thus, flows recorded in a SAM include all transaction: purchasing of intermediate goods, hiring of factors, current account transactions of institutions (transfers, consumption expenditure, savings and investments and any foreign transaction including direct investment and international trade).

The estimation of a SAM contributes to the study of any economic system, since it collects in detail all economic transactions. Its value as a database is enormous, both in the direct application of multi-sector linear models (multipliers) and for the calibration of CGE models. It is also flexible in its structure and in its geographical area (national, regional, multi-regional, etc.) and time frame, allowing its use in the analysis of a multitude of economic issues.

Figure 1. The circular flow (simple version)



Source: Own elaboration

([3]) The circular flow is actually more complicated, existing multiple transactions between institutions (savings, direct taxes, transfers, etc.) other flows as taxes on commodities or activities, but basics of the circular flow remain.

The rest of the report is structured as follows: Section 2 introduces more accurately the structure of a Social Accounting Matrix; Section 3 shows the basic stages in the elaboration of a SAM, indicating in section 4 some extensions and modifications.

2 General issues and structure of a SAM

A SAM is a square matrix in which each account (representative of an activity, commodity, factor or institutional sector) is represented by a row and a column. Each cell shows the payment by column account to the account in the row. Therefore, "receipts" or incomes of an account are shown along the row and "expenditures/payments" by the column. Because the double entry system of accounting ([4]), for each SAM account total revenues correspond exactly to the total payments, and, as a result, the total of each row corresponds to the corresponding column total.

A SAM is an extension of the Symmetric Input-Output Table (SIOT). The traditional Input-Output framework is a key tool in the economic analysis since its origins (Leontief, 1936) as it provides useful description of inter-sectorial relations ([5]). Nevertheless, the usefulness of these analyses is limited as they lack the complete behaviour of the economic system and do not incorporate all economic transactions of the system. A SAM overcomes some IOT limitations.

To build a SAM, inter-industry tables should be extended, (not using satellite accounts) in an integrated way, using more disaggregated income and expenditure structure reflecting the integration of the links of the institutional sectors with productive activities, commodities (goods and services) and intermediate inputs. The main data sources to achieve this aim are statistical systems of National Accounts, together with socio-economic statistical operations, such as household budget surveys and similar, labour force surveys or those dealing with the behaviour of foreign sector and trade. A SAM is a coherent framework to analyse jointly the aspects relating to production and monetary flows between institutions, representing in a full, flexible and disaggregated form all transactions of a socio-economic system. This is the main difference with the Input-Output and Supply-Use frameworks, because they do not provide information about the income generation by institutions or the transactions between them or with the rest of the world. A SAM reflects the full process of production, trade, income generation and redistribution among institutional sectors (Pyatt and Round, 1985; Pyatt and Thorbecke, 1976). This allows analyses about the distribution of wealth and income. But a SAM does not solve all of an IOT.

A SAM provides an appropriate database for the analysis of the key socio-economic issues such as employment, poverty, growth and income distribution, trade, etc. By the integration of data on households' behaviour in National Accounts, a SAM captures macro transactions of an economic system based on micro level transfers between all agents in the economy (Pyatt and Round, 1985; Roland-Holst and Reinert, 1997). It can incorporate various dimensions that are descriptive of the income distribution by disaggregating the households using socio-economic characteristics (e.g. income level, rural-urban division, etc.).

The estimation of a SAM implies access to data and estimates beyond those included in standard national accounts. These data and information are rarely available from a single source, but come from different sources and must be compiled in a systematic way. This process is valuable because it highlights inconsistencies between the statistical sources and identifies areas where the reliability of data could be improved (sometimes with a

([4]) Regarding the principle of double entry bookkeeping, for every income or receipt there is a corresponding expenditure or outlay, and the national or macroeconomic accounts of any country should be based on this (Reinert and Roland-Holst, 1997). But if national accounts are performed with the aid of T-accounts (with debit and credit entries and balanced individually), a SAM goes further and ensures that all accounts are simultaneously balanced, so a it can be described as complete and consistent (Pauw, 2003).

([5]) Input-output analysis primary aim is to provide a tool to analyse the production side of the economy, focussing on the intermediate input requirements and final outputs of industries.

little effort in handling of the micro-data). SAMs provide databases for simple linear (multiplier) models and sophisticated Computable General Equilibrium (CGE) models, which can be used for the analyses of environment, employment, taxation, productivity, trade, poverty and inequality, development, technological change, etc., issues. SAMs are also useful for the comparison, over time or space, of socio-economic systems.

The estimation of a SAM requires a considerable amount of statistical information. It is necessary to take as a basis the information from the interrelations between productive sectors provided by I-O frameworks of each economic unit. These inter-linkages can be obtained directly from the intermediate consumption matrix symmetrical and assuming homogeneous productive branches (Symmetric Input Output Table, SIOT), or can be extracted from modern frameworks with the most detailed Supply and Use tables (Supply and Use Input Output Tables, SUIOT). In this case, a distinction is made between productive sectors (activities) and the goods and services produced (commodities), as proposed in the current guidelines of national accounts (i.e. the European System of National and Regional Accounts, ESA 2010 - European Commission, 2013-). Obviously, this approach increases the user-friendliness of complex economic models. In any case, due to the basic source of information, SUIOT or SIOT, most of the SAMs are estimated for the same base year of relevant existing I-O frameworks.

2.1 Structure of a SAM

Typically, a Social Accounting Matrix has six basic groups of accounts:

- Activities and/or Commodities
- (Production) Factors
- (Private) Institutions - Households and Corporations/Enterprises-
- Government (public institution)
- (Combined) Capital accounts
- Accounts for the Rest of the World.

The final dimension of the matrix is determined by the level of disaggregation of these six basic groups. Figure 2 shows the basic structure of a standard SAM and illustrates the work necessary to compile it ([6]). Concepts and assumptions underpinning the construction of a SAM are flexible and several alternative structures could be considered. The order of types or groups of account is irrelevant to the information content ([7]), although the order implied above is typical.

Two further aspects should be taken into account before describing in detail the structure of a SAM: the existence of "collecting" accounts and the possibility of negative values. The formers are used to describe processes determining the distribution of known origin and destination, but not the detail of their flows. A good example is the estimation of property income. Normally, National Accounts provide information on the total sums paid and received by the institutional sectors, but not on the size and direction of flows. A more suitable option for a modelling analysis (the one adopted here in the corresponding sub-matrix) is to estimate these flows with additional information and using an optimizing process or algorithm. A second option would be the use of a "collecting" account: its row contains the amounts paid by each sector and through its column shows the received by them, obviously, with same total amounts of the row and column ([8]). This practice greatly simplifies the process of estimation, but it entails a loss of

([6]) Anyway, the general characteristic of this structure, as well as specific issues of its definition and composition can be found in Miller and Blair (2009), Eurostat (2008a) and European Commission (2013).

([7]) Reason for starting here with the commodity accounts stems from the notion of 'consumer sovereignty', which implies that production activities supply outputs in response to consumption choices, but it is up to the researcher to choose the most appropriate order to understand the analysis (it has no other purpose).

([8]) An example of the use this alternative can be found in Álvarez-Martínez and López-Cobo (2016).

information and limits the analytical capacity a SAM for certain topics (e.g., distribution of income, etc.).

With regard to negative values, these are unusual, but may appear at different types of flows, depending on each specific case. Most of the values are positive as a SAM indicates transactions between agents involving expenditures and incomes expressed in opposite directions (columns and rows respectively). However, certain cells or sub-matrices represent one or more accounts balances (Government savings, stock changes, subsidies, etc.) or can be expressed in net terms (taxes less subsidies, net operating surplus, etc.). Negative values do not represent a problem if they are interpreted correctly. Occasionally, they can lead to error or, more importantly, be a mathematical problem for the implementation of certain analysis. In these cases, if an entry is transposed and the sign is changed, the SAM remains balanced and the information content is preserved (a negative income is an expenditure, etc.), although some caution may be needed when interpreting the information.

Figure 2. A Social Accounting Matrix (SAM) standard structure

	Commodities	**Margins**	**Activities**	**Factors**	**Households**	**Enterprises / Corporations**	**Government**	**Savings-Investment**	**Rest of the World**	***Total***
Commodities (C)		$\mathbf{T_{C,M}}$ Transaction costs (trade / transport)	$\mathbf{T_{C,A}}$ Intermediate (inputs) consumption		$\mathbf{T_{C,H}}$ Household consumption		$\mathbf{T_{C,G}}$ Government expenditure	$\mathbf{T_{C,S\text{-}I}}$ Investment and stock changes	$\mathbf{T_{C,RoW}}$ Exports	*Demand*
Margins (M)	$\mathbf{T_{M,C}}$ Transaction costs (trade / transport)									*Margins*
Activities (A)	$\mathbf{T_{A,C}}$ Domestic production									*Gross output / Production (activity income)*
Factors (F)			$\mathbf{T_{F,A}}$ Remuneration of factors / Factor income						$\mathbf{T_{F,RoW}}$ Factor income from RoW	*Factor income*
Households (H)				$\mathbf{T_{H,F}}$ Factor income distribution to households	$\boldsymbol{(T_{H,H})}$ *(Inter Households transfers)*	$\mathbf{T_{H,E}}$ Distribution of corporations income to households	$\mathbf{T_{H,G}}$ Government transfers to households		$\mathbf{T_{H,RoW}}$ Transfers to Households from RoW	*Household income*
Enterprises / Corporations (E)				$\mathbf{T_{E,F}}$ Factor income distribution to enterprises			$\mathbf{T_{E,G}}$ Government transfers to enterprises		$\mathbf{T_{E,RoW}}$ Transfers to Enterprises from RoW	*Enterprise income*
Government (G)	$\mathbf{T_{G,C}}$ Net taxes on products		$\mathbf{T_{G,A}}$ Net taxes on production	$\mathbf{T_{G,F}}$ Factor income to Government / Factor taxes	$\mathbf{T_{G,H}}$ Direct Household taxes / Transfers to Government	$\mathbf{T_{G,E}}$ Direct Enterprise taxes / Transfers to Government			$\mathbf{T_{G,RoW}}$ Transfers to Government from RoW	*Government income*
Savings-Investment (S-I)				$\boldsymbol{(T_{S\text{-}I,F})}$ *(Depreciation)*	$\mathbf{T_{S\text{-}I,H}}$ Household savings	$\mathbf{T_{S\text{-}I,E}}$ Enterprise savings	$\mathbf{T_{S\text{-}I,G}}$ Government savings	$\boldsymbol{(T_{S\text{-}I,S\text{-}I})}$ *(Capital accounts transfers)*	$\mathbf{T_{S\text{-}I,RoW}}$ Capital transfers from RoW (Balance of Payments)	*Savings*
Rest of the World (RoW)	$\mathbf{T_{RoW,C}}$ Imports			$\mathbf{T_{RoW,F}}$ Factor income distribution to RoW	$\mathbf{T_{RoW,H}}$ Household transfers to RoW	$\mathbf{T_{RoW,E}}$ Corporations income to Row	$\mathbf{T_{RoW,G}}$ Government transfers to RoW			*Payments to RoW*
Total	*Supply*	*Margins*	*Costs of production activities*	*Expenditure on factors*	*Household expenditure*	*Enterprise expenditure*	*Government expenditure*	*Investment*	*Incomes from RoW*	

Source: Round (2003) and own elaboration.

2.2 Economic agents and accounts

2.2.1 Activities and Commodities (goods and services)

The Activities accounts represent all the agents producing Commodities (goods and services). Actually, an activity or an industry must be understood here as a process. The sum of values of Activities represents the domestic production; adding imports, net taxes on products and margins gives the total supply of commodities. Supplied commodities are sold domestically or exported.

The definition of Activities is important. Productive activities are defined as all processes within an economy that can and/or do use factors to produce commodities, i.e., goods and services. This is relatively straightforward when referred to industries, e.g., farming, manufacturing and services. The definition is less transparent when a non-activity agent employs factors. For instance, the government final demand account should not include direct payments to factors, but rather there should be one or more activity accounts, e.g., education, defence, etc., that employ factors and sell their output to the government. Thus, the government can be classified as both an agent and one or more activities through which it employs factors and produces goods and services – education, justice, defence, etc.

Activity accounts detail the cost structures of production and payments to factors. Activity expenditures report the use of Commodities as intermediate inputs, and the use of factors of production (labour, capital, etc., quantified by salaries, wages, mixed income, rents, interest, etc.). The sum of factors remuneration plus taxes and subsidies on production is the value added by Activities. Activity incomes report the value of the Commodities produced, in basic prices.

Commodity expenditures report the domestic production by Activities, imports (Rest of the World accounts) and payment of taxes -including VAT ([9]) - or receipt of subsidies on products, domestic and imported, (Government accounts). Commodity supply is valued at purchaser prices. Commodity incomes record intermediate consumption (by Activities) and final demand: consumption of institutional sectors (households and Government) as well as investments and exports.

Commodities consumed domestically are all valued at the same price (purchaser prices), which is inclusive of all sales taxes and tariffs. Thus, all prices along the row are the same irrespective of which agent purchases the commodity -this is the so-called 'law of one price' ([10])-. Exports are, in most cases, valued at export prices, determined by the world prices. Exports, and export taxes, are treated as Commodities accounts, so taxes are paid by domestic agents with the RoW paying free on board (fob) prices, which are inclusive of export taxes.

Demand for commodities must equal supply (the Commodity row and column account totals equate). Sometimes demand and supply of commodities do not equate due to the presence of stock variations; the inclusion of an account for stock changes as a sub account in the capital account ([11]) accommodates this inequality.

([9]) VAT (Value Added Tax) is a tax on (final demand) commodities and NOT a tax on value added. Almost all VAT is included as being paid on final demand (mostly on household consumption). See SNA 2008, World Bank (2009).

([10]) By definition, the price for any transaction in a row is the same for any agent represented in columns, so the quantities in any row are homogenous and can be summed so that the row totals are defined as the product of the respective price and the sum of the quantities that are recorded in each transaction in the row. That applies to any SAM and is important for its understanding and its use to calibrate any model and its underlying system of prices (Pauw, K., 2003).

([11]) Note that a SAM does not contain information that allows the user to track the evolution of stocks. If an entry for stock changes is negative it indicates that a stock has been drawn down, and if it is positive that a stock has been added to. But, the transactions provide no information on the size of the stocks. A zero entry does not imply that there are no stocks.

The distinction between Activities and Commodities is a very important issue when constructing a SAM. Thus, if these transactions are collected in the form of an input-output table (commodities by commodities or activities by activities), the modelling of flows, as well as the treatment of trade, is limited. It also complicates or precludes the analysis of by-products or secondary productions, as well as the existence of different production functions for similar goods. It should be noted that considering secondary production or by-products, the number of productive Activities do not necessarily coincide with the number of Commodities in the economy, condition that must be fulfilled if the SAM is based on an input output table rather than a Supply – Use framework. Also, SNA 2008 (World Bank, 2009) recommends that data are collected as SUIOT and then SIOT are derived tables ([12]).

2.2.1.1 Valuation and prices

Depending on how transport, wholesaler or retailer margins, taxes and subsidies on products are recorded, different types of prices can be defined. Typically, methods of valuation described in the SNA 2008 (World Bank, 2009) are used. Prices defined in SNA 2008 are ([13]):

- *The **basic price** is the amount receivable by the producer from the purchaser for a unit of a good or service produced as output minus any tax payable, and plus any subsidy receivable, by the producer as a consequence of its production or sale. It excludes any transport charges invoiced separately by the producer.*

- *The **producer's price** is the amount receivable by the producer from the purchaser for a unit of a good or service produced as output minus any VAT, or similar deductible tax, invoiced to the purchaser. It excludes any transport charges invoiced separately by the producer.*

- *The **purchaser's price** is the amount paid by the purchaser, excluding any VAT or similar tax deductible by the purchaser, in order to take delivery of a unit of a good or service at the time and place required by the purchaser. The purchaser's price of a good includes any transport charges paid separately by the purchaser to take delivery at the required time and place.*

Raw data used on production and output data are valued at basic (or at producers') prices and data on intermediate and final consumption use are valued at purchasers' prices, although SUIOT should be valued at basic prices (Eurostat, 2008). The availability of data type can force to make previous additional estimations or to choose specific structures for the SAM. For instance, information disaggregated by activity sectors and commodities on commercial (wholesaler or retailer) and transport margins is not always

([12]) There are various ways to obtain IOT from SUT, with or without additional information about sectors and transactions (see Eurostat 2008a).

([13]) In a way, basic prices and producer's prices are different versions of the *farm gate* price concept (that is, the real value received by the farmer/producer), with different nuances. Something similar happens with purchaser'prices and *market* prices, but here exists more relevant differences. Although *market* prices are perhaps the most adequate when it comes to modelling the behaviour of commodities (see Pyatt, 1994), there are some important issues regarding the application of VAT: the traditional concept of the *market* price is blurred under a deductible taxes system because there may be two different prices for the same transaction (one from the seller's point of view and another from the purchaser's) depending upon whether or not the tax is deductible, something especially important because same commodity can be an input (mostly with VAT deductible) or a final consumption product (mostly with VAT not deductible).

available, which may require some kind of prior estimation or to assume a specific sub-matrix of margins (see section 3.2).

Figure 3. Purchaser's, producer's and basic prices

Purchasers' prices (excluding any deductible VAT)
- Non-deductible VAT
- Trade and transport margins
= Producers' prices
- Taxes on products (excl. VAT)
+ Subsidies on products
= Basic prices

Source: Eurostat (2008a) and World Bank (2009)

2.2.1.2 Classification systems

A main issue when estimating a SAM is the way to classify economic activities and the commodities that result from them. This classification would consider two factors: the classification of the databases employed to build the SAM and the needs of the analysis.

Regarding economic activities, it is usual to make a first estimate of the SAM using the original classifications of data sources (or aggregations from them) and on that first estimate to perform the specific disaggregation was necessary. Mostly, the classifications of activities follow what is established in the *International Standard Industrial Classification of All Economic Activities Revision 4* (ISIC, Rev.4) (United Nations, 2008a) ([14]), while for the products the reference classification is the *Central Product Classification Version 2* (CPC) 2 (United Nations 2008b) ([15]). Although each office or statistical agency can make variations or adaptations of these classifications to adapt them to the idiosyncrasy of the economy of the country of reference, these classifications are usually the basis of all of them ([16]).

When considering a classification, it is necessary to remind that an activity is a process that takes place in particular locations, so an activity or industry can be thought of as collections of establishments which have some common denominators. For example, establishments that have the same principal activity are grouped into industries according to the reference classification (ISIC, Rev.4, for example).

Regarding commodities, the data referring to consumption usually comes from Households Budget Surveys or similar sources, which use functional classifications (food, clothing and wear, housing, transport, etc.), generally classified according to the classification of individual by purpose (COICOP) (United Nations, 2000). In these cases, some transformation is usually necessary to find a concordance between this classification and that followed by the commodities classified according to their origin (production). Something similar can happen with foreign trade data, which can follow very different classifications.

2.2.1.3 Trade and transport (marketing margins)

In a SAM, trade flows might be computed adding transaction costs (trade and transport). For each product, the SAM records costs associated with costs of marketing and

([14]) Or its adaptation NACE Rev. 2 - Statistical classification of economic activities (Eurostat, 2008b)
([15]) Or its adaptation CPA 2008 - Statistical Classification of Products by Activity (Eurostat, 2008c)
([16])For example, in the BioSAMs (Mainar and Philippidis, 2018), a standard SAM is first estimated with the classification of activities of the Eurostat SUT framework (Nace Rev 2 and CPA 2008) and then the specific sectors of the Bio-economy are disaggregated following the classification necessary for the analysis of this part of the economy.

transportation. Trade and transport margins for domestic production sold on the domestic market or exported represent the cost of moving the product from producers (factory gate) to consumers or dock gate. For imported products, margins represent the cost of transferring the goods from dock gate to domestic consumers ([17]).

Trade and transport margins are part of the costs of supplying commodities. They represent entries in the column accounts, but they are also part of the demand for commodities, i.e., commodities used to produce the services and are therefore entries in the row accounts. The sum of the entries in Margins account(s) must be balanced with the incomes. The sum of the entries in this sub matrix must be zero, which indicates that at least one entry will be negative, i.e., a demand (usually in the commodities linked with the activities that provide "margins" services: trade, transport, etc.). The negative entries arise because the supply of marketing margins must be matched by demands (expenditures equal incomes) for marketing services, which are recorded as negative expenditures in the columns for the commodities that make up marketing services.

Alternative representations which do not use specific Margins accounts and records correspondent amounts directly as transfers between Commodities accounts are possible.

2.2.2 Factors

The production factors consist essentially in capital and labour, although other factors may be added, such as land or other natural resources. The disaggregation of production factors is very important depending on the objective of the analysis. The breakdown of labour (by occupation groups, education level or social characteristics, income distribution, etc.) allows a more detailed analysis of employment issues, and the capital factor can also be disaggregated in accordance with their use i.e. agricultural/non-agricultural capital. Any factor breakdown should be consistent with the breakdown of institutional sectors which receive remuneration for the use of these factors. For instance, if there are multiple factor types but only one household type, changes in the incomes of different factors are not reflected in changes in the incomes of different households hence changes in factor incomes do not affect demand associated with differences in preferences across households.

The production factors receive income from productive activities and the Rest of the World. These incomes (wages, rent, etc.) are distributed (as expenditures by factor accounts) to owners of factors of production: domestic institutional sectors: Households – as labour income and distributed profits-, incorporated business enterprises –as non-distributed profits- and Government – as taxes and payment for owned resources-, and the Rest of the World ([18]).

2.2.3 Households

Families/Households receive income from Factors supplied on domestic or foreign markets (as owners of labour, capital and land or natural resources) and transfers from Government, Enterprises, the Rest of the World and (possible) other households. Household incomes from Enterprises are basically distributed profits (and sometimes direct transfers), while from Government are mostly direct transfers. Payments from abroad come usually for labour services (capital services are most often paid to enterprises).

Households' revenues are employed to consume commodities (goods and services, marketed and valued at purchaser prices including margins and taxes), payment of direct taxes (income taxes, etc.) and transfers to other institutions (domestic and foreign, including other groups of households when they are broken down). The difference (or the

([17]) In trade statistics, Exports are valued FOB (Free On Board) and Imports are valued CIF (Cost, Insurance and Freight), so no explicit international margins unless imports are valued FOB and then international margins are the difference between CIF and FOB valuations.

([18]) See Pyatt (1991) and Defourney and Thorbecke (1984).

need of financing, if applicable) between income and expenditure represents the savings (negative, if applicable). Given the difficulty of obtaining data on savings by households, the SAM entries are often derived as residuals.

A SAM traditionally adopts the concept of Representative Household Group (RHG) where different households group are represented by an aggregated account. The assumption is that all individual households in a RHG are, on average, affected in the same manner by a policy shock. Thus, in forming household groups, it is very important to consider similar preferences and characteristics (similar households are more likely to be affected similarly by economic shocks).

The classification and disaggregation of Household accounts is among the most important issues in the development of a SAM ([19]) and crucial for the analysis of socio-economic problems (e.g., unemployment, poverty, income distribution, social development, gender and intergenerational issues, environmental issues, etc.). This breakdown can follow economic (level of income or expenditure), social (e.g. education, age, gender, etc.), geographical (regions, specific areas, etc.) or other criteria (e.g. ownership of factors). These criteria will depend on the objectives of the analysis, the country or region described by the SAM, data availability, etc. Anyway, any choice should be based on relative stable characteristics that are reliable and easily measured; and available from existing data sources (Decaluwé et al., 1999; Pauw, 2005).

2.2.4 Incorporated Business Enterprises (Corporations)

Corporations are institutions that own activities and receive payments related to asset ownership (i.e., capital and land or natural resources) and transfers from other institutions. Those revenues are employed to pay direct taxes (corporation tax), transfers to other institutions or converted in savings. Generally corporations do not consume any goods (they represent the institutional part of the productive sector).

Incorporated enterprises are in many economies the principal recipients of the profits - returns on capital - from activities. Thus, while incorporated enterprises are ultimately owned by other (domestic) institutions - primarily households but also by government (parastatals and nationalised companies) - they should be included in a SAM, since they are important institutions in terms of their responsibility for a large proportion of domestic savings and in the pathways by which factor incomes are translated into disposable incomes of domestic institutions.

Typically farms are not owned by corporations, especially in developing and/or peasant based economies, and therefore returns to land and capital used in agriculture overwhelmingly are paid directly to RHGs from the respective factor accounts.

Companies can be disaggregated to show differences between for example, financial and non-financial corporations or public/private enterprises.

2.2.5 Government and Public Sector

Government accounts refer to the Public Administration institutional sector. Its share as "productive activity" (public corporations) and marketed goods and services resulting from its activities are recorded in the respective accounts of Activities and Commodities. General government as institutional sector can be represented by a single account which collects incomes for transferring owned production factors, transfers and taxes. However, it is typically subdivided into an account for the sector itself and in other accounts representing different types of taxes, allowing a better analysis of fiscal policies and a better interpretation of economic flows.

([19]) The main dimension of any SAM, and hence its name "social", is the disaggregation of the household account. However, is very common to name SAMs databases in which the household sector is not disaggregated, particularly if they focus on disaggregating specific sectors (e.g. AgroSAMs (Müller et al., 2009) or BioSAMs (Mainar and Philippidis, 2018)). The proper name of matrices without households disaggregation is National Accounting Matrices (NAMs).

Ideally tax transactions are recorded in sufficient detail to identify the major different types of possible instruments. Although it is very unlikely to separate all possible instruments as separate accounts, all tax revenues must be recorded. Taxes on commodities separately identify import duties, export taxes, VAT, general sales taxes (GST), excise taxes, etc. Taxes on activities include taxes on output and factor use – individually or in aggregate, taxes on factors include national insurance contributions paid directly by the factor ([20]) and taxes on institutions include direct (income) taxes. Negative taxes, i.e., subsidies, are also recorded (i.e. domestic agricultural support schemes in the European Union and United States).

Government employs its income to buy goods and services (consumption demand of public services), to transfer money to other institutions (households and corporations) or to other countries (development assistance or international aid, for example). Government consumption covers a limited range of good and services if they are represented also as an activity.

The difference between income and expenditure represent the government savings (public surplus) or dissaving (public deficit).

2.2.6 Saving-Investment (capital combined accounts)

This account records in its row the savings generated by all domestic institutions as well as transfers (positive or negative) of capital from foreign institutions (accounts of Rest of the World, balance on the capital account). The column records the investment expenditure in goods and services to produce new capital, the Gross Fixed Capital Formation (GFCF) and changes in inventories in the accounts of Commodities, including investment in the economy. Gross investment itself can be separated from the changes in inventories ([21]).

2.2.7 Rest of the World

The Rest of the World account's incomes, in the row, are the value of imports of goods and services (Commodities), payments to the factors of production from outside and transfers from the domestic institutions to institutional sectors elsewhere. Foreign sector accounts expenditures are the purchase of goods and services (exports), payments to national factors of production used abroad and transfers recorded from other economies ([22]). The balance reflects the current account (surplus or deficit) with the Rest of the World.

The Rest of the World account can be disaggregated according to the specific interest of the analysis or the geographical or political context of the economy concerned. Therefore, in cases of common markets, for example the European Union, foreign accounts can be divided into the rest of Member States and the Rest of the World. In the case of regional SAMs, two accounts are generally considered as 'foreign' sector: the rest of the country and the Rest of the World, but this can be subdivided by area.

The Rest of the World accounts record trade and other foreign transactions, including current and capital accounts, and visible and invisible trade. Imports are valued carriage insurance and freight (cif), while exports are recorded free on board (fob) ([23]). Visible trade - trade in goods and services – is relatively straightforward but only constitutes part of the current account. Other components of the current account are important and

([20]) Some contributions to such insurance schemes will be paid by the employer, i.e., activity, and are therefore part of the costs of employment incurred by activities.

([21]) Some SAMs split this accounts including one that show only GFCF (gross investments) and one recording only stock changes. Here stock changes could be negative, while GFCH is positive, so adding investment and stock change accounts can generate apparently negative investments.

([22]) The terms 'foreign' and 'abroad´ or Rest of the World could include the rest of the country in the case of SAMs of regional economies.

([23]) When a SAM is constructed to analyse trade issues that may involve changes in trade costs for imports then it may be appropriate to include multiple trade accounts with imports valued fob from the source regions and to include accounts that record trade costs by trade partner.

any transactions missing from it are likely to end up either being included in the balance on the capital account, which will then not be reconciled with the national accounts, or as distortions in the estimates of other transactions on the current account. If these transactions on the current account are relatively small this may not be an issue, but it is necessary to be cautious.

2.3 SAM sub-matrices composition and economic flows

The main sub-matrices that appear in a SAM (see Figure 2) are explained in the following sections. The method of assessing the different flows can change depending on the data, the issue being analysed, researcher criteria, etc. A first distinction should be drawn between "empty" cells or submatrix and zero value cells. Empty sub-matrix usually implies that the structure of the SAM does not consider a direct flow between referred groups of accounts (although there may be linked through circular economy flows). However a zero value implies that the direct link between two accounts is possible, although in the particular case of the economy in the reference period is zero.

2.3.1 ([Commodities] [Activities]) ($T_{C,A}$)

$T_{C,A}$ records the value of intermediate inputs used by Activities in the production process. Data come from the Use table (in a SUT framework, assuming multiproduct and by-product production and non-homogeneous Activities) or from the symmetrical intermediate consumption table in the traditional IOT framework (assuming each activity produces a single homogenous product)([24]).

The election of one of these frameworks, a key point in the estimation and development of the SAM, gives rise to two different types of SAM (*input-output* SAM the one obtained from the Input-output framework -see McDonald et al. (1997)-). The main difference between them is the consideration of multi-production and by-products and the possibility to incorporate differences in input structure for activities that can produce the same commodity. It is normally useful considering different activities producing the same commodity, and activities producing multiple commodities. Obviously, an *input-output* SAM limits this analysis because it supposes homogenous economic branches (commodities or activities) with a direct one by one mapping (one activity to one commodity).

If a SUT is not available or an *IOT* SAM is preferred ([25]) (for certain analyses, especially using linear models, it may be easier to handle) the SAM includes a single group representing activities and commodities that will refer to homogeneous branches of activity (in columns) producing each one only a commodity (in rows). A SUT SAM structure can be maintained, if required, by artificially distinguishing between Activities and Commodities and placing in $T_{C,A}$ the contents of the symmetric table and using a diagonal matrix with the domestic output at $T_{A,C}$ ([26]) (of course, being careful with the valuations used and applying the necessary transformations).

([24]) There may be a problem depending on the valuation of the transactions (at basic prices or at purchaser prices) in the standard IOT. Best option would be to estimate and provide separately identified the components of purchaser prices for each and every transaction in the IOT, but only a few research institutions (e.g. Centre of Policy Studies (CoPS) of Victoria University, Australia) or statistical offices elaborate this tables.

([25]) If a Supply Use frame is available but not a symmetric Input-output table, it can be derived from these and assuming certain assumptions (Eurostat, 2008a; Álvarez-Martínez and López-Cobo, 2016).

([26]) Anyway, the classification of firms/plants to activity could limit too this analysis even disposing Supply and Use tables, because a standard procedure (although there is many other) for the classification of firms to activity groups is by reference to the commodities they make. This procedure recognises that firms may make different commodities, hence the need for a Make matrix (the transpose of the Supply matrix), and then allocates them to activities by their principal product. Therefore, for each commodity category there is an activity category, and both the Make and Use matrices will be square and the elements on the principal diagonal of the Make matrix will dominate (Pyatt, 1994; McDonald et al., 1997).

2.3.2 ([Commodities] [Households]) ($T_{C,H}$)

This submatrix shows the Household final consumption of goods and services. When the account of Households is disaggregated (by demographic, geographic or socio-economic criteria), this matrix allows calculating direct consumption patterns and the distribution of expenditure. This is crucial to assess the impact of policy changes on welfare and consumption.

The ideal source for the estimation of this submatrix is a Household Budget Survey ([27]) (HBS) or similar surveys (in developing countries, these data are often collected in *poverty* level surveys). Microdata from these surveys allow customising disaggregation of households according to many socioeconomic criteria, maintaining coherence with disaggregation of the factor accounts, distribution of income, transfers with other institutions, etc. It is also possible to map between items quantified and valued in this surveys and commodities considered in SAMs.

It is also necessary to take into account the issue of self-consumption of own production of households. The consumption of non-marketed goods has to be measured at production prices. This concept is important in developing countries. Taking specific account of self-consumption leads to the consideration of a more complex structure of the SAM and to deduct its value from this matrix for incorporation into other special accounts (see Aragie, 2015).

2.3.3 ([Commodities] [Government]) ($T_{C,G}$)

This submatrix includes final consumption of general Government i.e., purchase of commodities for administrative issues, education, health and other public services. If the Government and Public Sector as producer of commodities are included within Activities, Government consumption expenditures will cover a limited range of good and services. In this case (which is so for SAMs based on SUT ([28])), expenditures on commodities are concentrated on utilities, administrative services, basic services such as education, health, sanitation, etc. and cultural activities.

2.3.4 ([Commodities] [Saving-Investment]) ($T_{C,S\text{-}I}$)

This account records the demand of goods and services needed to produce capital goods. The submatrix may be split into investments and stocks changes ([29]). In the stock change account, a reduction in stocks is a negative entry.

Data for the estimation of this sub-matrix come from Use table. Sometimes, specific satellite accounts referring to investment and capital formation (and stock changes) are provided by statistical offices. In fact, fully specified National Accounts would produce a capital composition matrix; this is less common nowadays ([30]). More detailed production and stock data for agricultural commodities are generally available

2.3.5 ([Commodities] [Rest of the World]) ($T_{C,RoW}$)

This is the Exports submatrix, which records exports of goods and services of domestic production, considered as incomes to the respective commodity account ([31]). It can contain external sales of domestic production and the value of commodities directly re-

([27]) Most of this surveys contains also important data about prices, employment, own consumption, households behaviour as producers, etc.

([28]) This is different in IOT format because of the conversion process.

([29]) If the combined capital and savings account is disaggregated between investment in fixed capital formation and changes in inventories (stock changes) then should be possible to record the transfers between those accounts in a $T_{S\text{-}I,S\text{-}I}$ sub-matrix

([30]) Eurostat 2008 does not explicitly mention such a matrix. although hints at one in some examples.

([31]) In a few (rare) cases, exports have been considered as income from activities, as in Dervis et al. (1982) - although with a one to one mapping between activities and commodities -, which instead of this matrix would exist a [Commodities] [Rest of the World] one.

exported (an important issue in certain products and economies ([32])). It may also contain direct purchases of final use commodities within the national territory by final non-national consumers ([33]).

The estimation of this submatrix is most frequently based on the Use table or on the final demand vectors of IOTs (which could imply different valuations). If RoW accounts are disaggregated into different countries or regions, the additional information could come either from the Use ([34]) (or Symmetric) table or from other specific sources of international bilateral and multilateral trade (i.e., customs statistics of analysed countries or regions).

2.3.6 ([Commodities] [Margins]) ($T_{C,M}$) - ([Margins] [Commodities]) ($T_{M,C}$)

The Activities accounts can be valued at basic prices or at purchasers' prices, but the final goods and services (Commodities) are always valued at purchasers' prices. If a SAM distinguish Activities and Commodities, then it is necessary to include accounts of Margins to include marketing and transportation costs. The row(s) of this account records the value of margins paid by each commodity (submatrix $T_{M,C}$). A single aggregated account for Margins could be defined or split it in different concepts (wholesale and/or retail trade, transport, etc.). The columns of this accounts forms submatrix $T_{C,M}$ with empty values except in the rows corresponding to the commodities providing the margins services (generally, trade and transport although this may vary according to the SAM disaggregation of commodities). The cells $T_{C,M}$ record the total value of these elements (i.e. collecting separately the total margins, transport and trade).

In a IOT SAM, the choice of one or other prices will be reflected in the different values of the matrix, which could incorporate the margins within the branches providing the services (basic prices), or add them (allocated as appropriate) to the rest of inputs used (purchaser's prices). In this case, there would be no sub-matrices $T_{C,M}$ and $T_{M,C}$. Intermediate or alternative solutions can be implemented in any of the two structures of the SAMs.

Data for the estimation of these two sub-matrices are sometimes specified directly in the IOTs (as additional information), while sometimes they are shown as additional columns in the Supply table, allowing (by adding taxes less subsidies on products data) the conversion of the value of the commodities at basic prices to purchasers prices in that table – i.e. Eurostat EU Supply tables, see Eurostat (2016)-. Statistical offices can (even if this is not done very often) facilitate a margin matrix including disaggregate data of transaction costs by commodity. Another option would be to estimate or split trade and transportation costs directly from the accounts identified as those providing the "margins" services (usually wholesale and/or retail trade, transport, etc.).

2.3.7 ([Activities] [Commodities]) ($T_{A,C}$)

This sub-matrix shows the allocation of the domestic production of Commodities by Activities, recording the value of the different Commodities supplied by each Activity (or, reading data by columns, shows which activities are supplying domestically each commodity). Usually it corresponds with the transposed Supply table (also known as Make matrix) of a SUT.

([32]) One alternative is to extract re-exports and, optionally, to record their aggregate value in no-sense $T_{RoW,RoW}$ submatrix. It requires assuming that re-exports have no positive effect in the domestic economy or, at least, split these effects and allocate them in the correspondent demanded commodities.

([33]) In most of the Input-Output, Supply-Use frameworks or National Accounts, the consumption of goods and services by non-residents appears aggregate and it is necessary to estimate their allocation among commodities if it is decided to incorporate their value (at domestic prices) as exports.

([34]) i.e. Eurostat EU Use tables distinguish exports to EU Member States (members of Euro Zone or not) and rest of the world.

It distributes by rows the domestic production of goods and services whose value for each activity is obtained as the sum of intermediate demand, Valued Added at factor costs plus taxes less subsidies, showing the value of each commodity supplied by each activity. By columns, it can be interpreted as the origin of each commodity produced by domestic activities.

If A SUT is not available, the submatrix will take the form of a diagonal matrix (with a one to one mapping between Activities and Commodities: each activity produces only one product, which is not produced by any other activities).

2.3.8 ([Government] [Commodities]) ($T_{G,C}$)

This account shows net taxes (taxes minus subsidies, which can also be broken down in other accounts) on products. This submatrix can either be a single row for a global Government account as a tax collector or many rows each for a single tax and/or subsidy instrument. These could include specific accounts for sales taxes or taxes/charges on imports.

To estimate this sub-matrix extra information from IOTs and SUTs are needed (see Eurostat, 2016). Although some ministries publish data about these taxes, usually they are not disaggregated enough and estimations based on official tax rates (not preferred) or distribution of commodities uses or sales are necessary.

The detail of the disaggregation of taxes (and subsidies if necessary) will depend both on the needs for analysis and on the availability of information and data. The institutional Government account can be used directly as all taxes collector or use a single catch-all account that collects and subsequent delivery to the Government for its use. The risk of this practice is that it mixes taxes of very different typology affecting different agents. In the case of taxes on products, taxes or tariffs (key in the analysis of foreign trade) on imports and Value Added Tax (VAT) are particularly relevant in any SAM.

2.3.9 ([Rest of the World] [Commodities]) ($T_{RoW,C}$)

This sub-matrix reflects the imports of commodities. RoW account or set of accounts include imports of Commodities, net of tariffs (included in the taxes on the importation, either on his own account, in aggregate catch-all one, or in the Government account –see $T_{G,C}$ reference above). It may include direct purchases abroad of final goods and services by domestic consumers ([35]).

One important issue about this sub-matrix is that it refers only to competitive imports. Most of SAMs presume that all imports are perfect substitutes so they are only recorded in this submatrix ([36]), defining the Use matrix to be inclusive of both imported and domestically supplied intermediate inputs (McDonald et al., 1997).

The information required for this submatrix will be usually in the Supply table, with same considerations than for exports if RoW accounts are disaggregated considering different countries or regions. In case of disposing only symmetric Input-Output table, data are direct too, but cautions mentioned before are necessary

Additional information could come from other trade data sources, national or international that can be used to disaggregate or map and adjust aggregate values.

([35]) See the note corresponding to commodities consumed by non-residents. As them, household expenditures abroad usually appear aggregate and it is necessary to estimate their allocation among commodities if it is decided to incorporate their value as imports.

([36]) In an input-output SAM it is implicitly presumed that imports are consumed in fixed proportions to outputs. Thus imported intermediate inputs are recorded as the total value of intermediate imports by each activity, which implies that imported intermediates are regarded as complementary and, imported intermediates are treated as another type of primary input (Stone, 1962; McDonald et al., 1997). In this way, Dervis et al. (1982) include exports as an income of Activities (so $T_{RoW,C}$ sub-matrix will be substituted by $T_{RoW,A}$.). In this sense, it is possible to classify intermediate imports according to whether they are 'competitive' or 'complementary', coexisting $T_{RoW,C}$ and $T_{RoW,A}$. Anyway, both options are not much used.

2.3.10 ([Factors] [Activities]) ($T_{F,A}$)

This part of SAM shows the payments for the use of production factors by productive activities. It usually contains as rows labour and capital and possible other kind of factors, as the natural resources (i.e. land).

The difficulties of estimating $T_{F,A}$ depends on the disaggregation of the factors. Use table or value added part of IOT contain the value of the payments to labour factor and the total remuneration of capital by activities -often identified as (*operating*) *surplus* ([37]). An account called *mixed income* could be incorporated. It refers to income received by self-employed workers, it therefore contains the remuneration for their work and for what could be consider remuneration of capital contribution owned by self-employed. The distribution of this income between labour and capital depends on the availability of additional information on these revenues in National Accounts or, mainly, in household surveys. It is very common (even if not correct from an economic point of view) to consider this account as labour income.

There are two main data sources to disaggregate labour factor: labour force surveys, with information about workers by activities (or groups of them), salaries and wages received and HBSs. The latter usually contains modules describing income sources of household members, including data about sector of activity, occupation and wages integrated with information on region of origin, education level, etc.

The capital account can also be split depending on origin, ownership and typology, etc., always maintaining coherence with the disaggregation of institutional sectors which receive the corresponding income. Data for this split are more difficult to obtain. For example, to disaggregate agricultural, non-agricultural capital and land, agricultural, specific surveys on agricultural activities or geographical data about types of land and soils should be available. Specific modules for agricultural production in households' surveys could be also utilised. In general, sectorial business statistics or surveys can be the basis for estimation of any capital disaggregation.

2.3.11 ([Government] [Activities]) ($T_{G,A}$)

This sub-matrix includes net taxes on production and may include as many accounts as necessary to distinguish the different tax or subsidy instruments. As described for $T_{G,C}$, it shows net taxes (taxes minus subsidies, but now on the production activity itself or on the use of factors ([38])).This submatrix can be estimated as a single row for a global Government account as a tax collector or include different taxes and subsidies accounts to define exhaustively many tax instruments on activities.

Main data source come from Use table (or value added accounts in IOTs), but, as in the case of commodities taxes, additional information from ministries or statistical offices would be necessary.

2.3.12 ([Factors] [Rest of the World]) ($T_{F,RoW}$) - ([Rest of the World] [Factors]) ($T_{RoW,F}$)

The submatrix $T_{F,RoW}$ includes payments received from abroad (and the rest of the country, in regional SAMs) by domestic factors. It mainly records wages and salaries of national workers employed outside the territory, although it could include remunerations for some types of capital ownership in other places. In some SAMs this sub-matrix can be empty and its values allocated as direct transfers from RoW account to institutional

([37]) One important issue is the consideration of net o gross operating surplus. If gross value is considered, then total depreciation can be recorded in a sub-matrix $T_{S\text{-}I,F}$ showing its corresponding part from capital remuneration, or directly be included in final savings of the institutions that receive capital incomes (this is the most usual choice, although then they could be negative). Anyway, both cases assume that depreciation rate is the same for all activities. If it will be necessary to distinguish different depreciation rates, depreciation values could be recorded directly for each activity in a $T_{S\text{-}I,A}$ sub-matrix.

([38]) It is important to highlight that, despite its name. VAT is not a tax on production, but on consumption.

sectors (i.e. labour payments for nationals working abroad are treated as direct remittances from RoW to Households).

Analogous reasoning could be applied to $T_{RoW,F}$, but in the opposite way. For both sub-matrices, main source will be National Accounts (usually in an aggregate value), but additional information to allocate the total amount (i.e. for wages and salaries in $T_{F,RoW}$) would be required from household surveys.

2.3.13 ([Household] [Factors]) ($T_{H,F}$) - ([Enterprises] [Factors]) ($T_{E,F}$) - ([Government] [Factors]) ($T_{G,F}$)

These three sub-matrices show the allocation of primary income. Activities pay factors which then distribute the collected amount to their owners.

$T_{H,F}$ records what households receive as income for their work (mostly) and as remuneration of their capital ([39]) and/or natural resources ownership. Mixed income is record in this matrix too. Households' labour income comes from the compensation paid to employees and to the revenues generated by the work of self-employed workers. The remuneration of capital received by households originates from the surplus obtained by self-employed workers and capital factors or natural resources.

The disaggregation of the Households accounts must be coherent with the one Factors (especially labour) to be useful in any economic analysis. The more disaggregated the accounts are, the more can be obtained from this sub-matrix ([40]). The availability of an HBS is the key to estimate this submatrix. Usually, HBSs include a module for employment (and self-employment) that can be linked with educational, social and personal characteristic of household's members, allowing estimating the distribution of income within different types of households (classified by specific criteria). Also, HBS could be used to estimate the capital income of households (with information extracted about production resources ownership).

$T_{E,F}$ sub-matrix shows the remuneration of the capital factor owned by corporate business, i.e. the value of operating surplus (gross or net). Normally, it is estimated directly from Use or IOTs considering a unique Enterprise/Corporations account. Split of this account will require additional information from National Accounts, business statistics or accounting records.

$T_{G,F}$ includes the remuneration received by Government as owner of capital and as operating surplus from its production activities. Data will be extracted from National Accounts, Use table or IOTs.

In some SAMs, $T_{G,F}$ may include labour taxes (as social contributions) if they has not been assigned directly in labour payments to households and then to Government as transfers or direct taxes. Labour taxes or other factor taxes (if exists) would be paid to a specific taxes account or directly to Government is there is no such split.

2.3.14 ([Household] [Enterprises]) ($T_{H,E}$)

This submatrix reflects the profits distributed to households by corporate companies, i.e. the payment of dividends, and can include other direct transfers from enterprises to households.

The main data source for this submatrix is a HBS (preferably an integrated one), if only one Enterprises account is considered ([41]). This sub-matrix of a SAM depicts the direct links between institutions and shows the secondary distribution of income. Given the lack

([39]) Income received for the ownership of corporate business is not included here, but usually in TH,E as a transfer from enterprises to Household.

([40]) For example, the use of an unique account for households will limit (or cancel) the information gives by an exhaustive disaggregation of labour, because effects of allocation of employment and its remuneration would not have any reflect in income distribution and subsequent consumption.

([41]) Anyway, if a HBS is available, it usually contains more information about the origin of this kind of income, allowing the split of this account (if required).

of data, it is sometimes necessary to first estimate an aggregate value from National Accounts using the integrated accounts or the institutional accounts. These accounts record data on total transfers paid or received by institutional sectors (Household, Enterprise, Government and Rest of the World) but not the distribution of these flows. It is normally necessary some estimation procedure (proportional, optimizer, based on expert's opinion…) to fill the submatrix ([42]).

2.3.15 ([Household] [Government]) ($T_{H,G}$)

$T_{H,G}$ shows the transfers from Government to Household. They mainly include social benefits other than social transfers in kind ([43]) and other kind of transfers.

As a secondary distribution of income matrix, an estimation procedure will be necessary (frequently) to distribute the value of transfers, collected by National Accounts or Government statistics to different households. Data from an integrated household survey (income modules of these surveys use to include detailed data of transfers received from public sector and Government) are required.

2.3.16 ([Household] [Rest of World]) ($T_{H,RoW}$)

This sub-matrix includes transfers to the household from other countries (regions if proceed) or institutions from outside (i.e. direct aids from international / non-governmental organizations, etc.) as the remittances received from nationals which reside in other countries ([44]).

Main data source for this sub-matrix will be a HBS (for disaggregate households accounts) while total value could be estimated from National Accounts.

2.3.17 ([Rest of World] [Household]) ($T_{RoW,H}$)

This sub-matrix shows transfers from domestic households to other households, institutions or organisations abroad (i.e. remittances of migrants to their country of origin, etc.).

National accounts record this aggregate data as transfers and an HBS is necessary to disaggregate by households ([45]). Depending on the treatment of direct expenditures of household abroad in the SAM, $T_{RoW,H}$ could incorporate this direct imports as an aggregate data by type of Household (

2.3.18 ([Government] [Household]) ($T_{G,H}$)

This sub-matrix includes the value of Household transfers to Government, including mainly direct taxes paid on household income, such as income tax. It also includes the payment of fees or charges for the use of certain services or public infrastructures.

Although National Accounts use to facilitate the aggregate value of direct taxes, the disaggregation by types of households it is not an easy task. Information on direct taxation is available in transfers' modules of household surveys (or as an expenditure item). This information should be integrated with data about income (or other criteria to delimitate direct tax, like wages received). Finance ministries or analogous organizations provide this tax rate or at least the elements to obtain a proxy (tax collection by

([42]) Taking into account that some flows are almost directly assigned (i.e., social transfers to households use to be only paid by Government and taxes are only received by that account). Each SAM will require a specific way to estimate these sub-matrices, depending mostly of the data disposal.

([43]) Social transfers in kind are recorded as expenditures of Government on commodities (sub-matrix $T_{C,G}$), which are made available to households as benefits.

([44]) Do not confuse with payments from abroad to labour factor, which correspond to payments to residents in the country (region) who eventually provide services or are employed abroad (or work for activities located abroad).

([45]) Depending on the treatment of direct expenditures of household abroad in the SAM, $T_{RoW,H}$ could incorporate this direct imports as an aggregate data by type of Household (although usually they are distributed in $T_{RoW,C}$ as imports).

categories of household, taxable income, household circumstance determining tax rate, etc.). Tax collection should be included in the specific defined accounts ([46]).

2.3.19 ([Saving-Investment] [Household]) ($T_{S\text{-}I,H}$)

$T_{S\text{-}I,H}$ (normally a row in the SAM) records household savings as a difference between their income and their expenditures. It can be negative when expenses exceed income. Savings by disaggregate households groups are very difficult to be estimated accurately[47], so ensuring *ex post* accounting identity they tend to be estimated as a residual, even if it would be better obtaining a coherent value reconciling accounts balance and (at least) aggregate estimated value.

2.3.20 ([Household] [Household]) ($T_{H,H}$)

This sub-matrix is empty if there is only one Household account. If households are disaggregated, direct transfers between groups of Households may be very useful in the analysis of distribution of wealth, property incomes or other socio-economic issues. Information needed should be found in an exhaustive household survey which might provide total values by households. An estimation procedure to obtain flows between households groups would then be necessary.

2.3.21 ([Enterprises] [Government]) ($T_{E,G}$)

This part of the SAM collects transfers by Government to domestic corporations (i.e. interests paid to financial corporations). It includes direct transfers to these institutions (for grants and analogous and other benefits, if they are not linked to productive activities –subsidies on production-).

The value can be estimated using total payments and incomes of institutional sectors in National Accounts and using additional estimations procedures or additional information if available. In case of disaggregated accounts for Enterprise or Government (institutional part), data from public or private accounting reports will be necessary.

2.3.22 ([Enterprises] [Rest of World]) ($T_{E,RoW}$) / ([Rest of World] [Enterprises]) ($T_{RoW,E}$)

$T_{E,RoW}$ contains property income and other transfers (i.e., direct aid for development) received by domestic corporations and enterprises from abroad. As others sub-matrix recording secondary income distribution, estimation, starting from institutional total payments and incomes data from National Accounts, would be required to fill the submatrix. $T_{RoW,E}$ becomes the same in opposite direction, although now should be include here the payments to foreign agents for dividends distributed by corporate business.

2.3.23 ([Government] [Enterprises]) ($T_{G,E}$)

This includes interest payments, from property (rent, etc.), income distributed by undertakings when the administration is engaged and social contributions paid by companies (where they are not already counted in payments Companies factors), although in this case is the use of an interim account of taxes on factors.

([46]) Although it is infrequent, some re-distribution policies could result in negative value of these cells (especially when very low income households groups are considered). In this case it is possible consider the aids as transfers in $T_{H,G}$, but this could generate confusion in effective tax rates and limits policy impact analysis.

([47]) Aggregate value is often available in National Accounts, although its definition could not exactly match with the difference between incomes and expenditures in the SAM, because of the consideration of time deferred payments or incomes, imputed values, etc. Also, additional information in HBS could be difficult to reconcile with the concept of saving as a residual, but can be use as proxy if available.

2.3.24 ([Saving-Investment] [Enterprises]) ($T_{S\text{-}I,E}$)

This submatrix (mostly a single element) records the value of Enterprises/Corporations savings as the difference between total of their resources and their expenditures. Savings are generally positive. Usually data are available in National Accounts.

2.3.25 ([Saving-Investment] [Government]) ($T_{S\text{-}I,G}$)

$T_{S\text{-}I,G}$ reflects the fiscal deficit or surplus of the government Usually, Government savings are presented as expenditure, so a negative entry shows the government's borrowings (an infrequent option is to record deficit as a positive value, but now in a $T_{G,S\text{-}I}$ entry, with an empty $T_{S\text{-}I,G}$). National Accounts provide data for this single element sub-matrix.

2.3.26 ([Government] [Rest of World]) ($T_{G,RoW}$) / ([Rest of World] [Government]) ($T_{RoW,G}$)

These two sub-matrices show the transaction between the Government and foreign agents. On one hand, $T_{G,RoW}$ shows the transfers received by the public sector from abroad, including international cooperation, ad hoc aid, etc. Typically, it will consist mainly of inter-government transfers, although it could include property incomes ([48]).$T_{RoW,G}$ reflects the transfers made by the public sector abroad, including international cooperation, development aid, etc.

Both matrices will usually be of a single element, which normally can be completed directly by National Accounts data.

2.3.27 ([Saving-Investment] [Rest of World]) ($T_{S\text{-}I,RoW}$)

This sub-matrix (most common a single value) shows the result of the Balance of Payments, recording the deficit or surplus of the capital account balance (negative in case of deficit and consequent surplus of the current account).

Data come from the Balance of Payments or from integrated National Accounts.

([48]) Dividends received or returns on investments abroad by public corporations will typically be recorded as income to the enterprise accounts.

3 Main steps for the development of a SAM. Data sources.

The first step in elaborating a SAM is to design its structure. Many specific structures can be introduced on top of a standard structure depending on the disaggregation of accounts. The selected structure should take into account two key aspects: the objectives of the analysis and data availability. Designing an account structure whose data cannot be estimated with available information ([49]) is unwise.

There are two main steps in the construction of a SAM for a given country/year. In a first step a so-called Macro-SAM is estimated ([50]), mainly with aggregated information coming from National Accounts and a few other different sources. The Macro-SAM is then disaggregated with the desired degree of details of economic activities, commodities, production factors, representative households groups (RHG), taxes and subsidies, institutional sectors and the rest of the World accounts. This second step produces a micro SAM, which is generally not balanced given that the use of different data sources will create non-consistent receipts and payments. To complete the procedure, it becomes necessary to estimate the transactions so as to produce a 'complete' (encompasses all transactions) and 'consistent' (total incomes and expenditures for all accounts equate) SAM (this commonly referred to as "balancing the SAM"), using additional statistical data or econometric optimization methods like RAS, Cross Entropy Method (CEM) (see Byron, 1978; Günlük-Senesen and Bates, 1988; McDougall, 1999; Robinson, Cattaneo, El-Said, 2001) or the Euro-method - especially for the part corresponding to Input-output framework- (Eurostat, 2008a; Beutel and Rueda-Cantuche, 2012) ([51]). Examples of a MacroSAM and a SAM can be found in Tables A1 and A2 in Annex.

To develop a complete and consistent SAM the following data and information sources are necessary:

- National Accounts, aggregated and by institutional unit, although a version of integrated accounts is a priority. Integrated accounts, while not having the form of a matrix, show, by institutional sectors, the flow of payments to and from institutions as double-entry accounts, from production to the primary and secondary distribution of income. It is advisable to always use the maximum sectorial or institutional disaggregation available.

([49]) For example, if the objective is to analyse the effects on the economy of certain tax measures (increasing or decreasing VAT, social contributions, incomes taxes, etc.) should be exhaustively split accounts for tax in as many types as possible. If the objective is to analyse the income tax, it will also consider exhaustively disaggregated household types depending on their income to account for progressivity, etc. Similarly, if the objective is to show the effect of agricultural subsidies (i.e. CAP), then it is necessary to consider many different activities and commodities of the primary sector, although other industries and products could be more aggregated.

([50])This way of proceeding, starting from a Macro-SAMcorresponds to a top-down approach in the elaboration of the SAM (this option is not defended by the SNA 2008). The other possibility is a bottom-up approach, starting directly from the National Accounts and the IOT or SUIOT framework and estimating the relationships between agents and institutions in a disaggregated way from the beginning, making the necessary transformations and adaptations later to achieve coherence with the corresponding macroeconomic aggregates. Both options are equally valid, but the first one has been preferred because starting from a Macro-SAM based on reliable or official data allows to maintain a coherence from the beginning in the estimation of the different sub-matrices which are disaggregated with the supply-use tables (or with the IO table.) and with the different data sources that are used. In countries or regions with good data availability and input-output framework, this is not so relevant and starting directly from these disaggregated data is relatively simple. When there is not much quality in these tables or data and there is disparity in the information (especially in developing countries), starting with the Macro-SAM can greatly facilitate the final estimation of the SAM.

([51]) It is very important to understand the difference between balancing and estimating a SAM. If there is no data for some SAM cells or entries, but the corresponding transaction should exists, it is necessary to estimate the missing values. However, balancing a SAM relate to eliminate differences in columns and rows totals for each account (if exists).

— An Input-Output framework, with the Supply and Use tables or the Symmetrical table (considering possible differences in the prices used), fully reconciled with the main macroeconomic accounts ([52]).

— Data on consumption patterns and household expenditure, as well as households' income. Household budget surveys or similar surveys (levels of poverty surveys –so frequent in developing countries-, time use surveys, etc.) are a basic and key source and sometimes as important as the Input-Output framework (especially to analyse socio-economic issues related to inequality of income distribution effects on welfare, etc.).

Sometimes, these surveys are integrated and include both aspects of household expenditure and income, but others provided very little information on income. It is then necessary to include specific surveys on components of income of households (as is the case, for example, of the European Community Household Panel, ECHP). It is particularly important (and almost mandatory for regionalized SAMs or highly disaggregated households or labour accounts) to use primary data directly coming from the survey interviews.

Some caution is needed when linking data from household surveys with macroeconomic data from National Accounts, since some information provided in the first may be biased by household characteristics (for example, in questions about savings in poorest households see Deaton, 1997-) and might need re-estimation or subsequent statistical treatment ([53]).

— Statistics on the labour market and their composition, in particular with respect to training, employment, wages, activities, characterisation of employed persons, etc. It is important to be able to distinguish between employees or self-employed, since the distribution of so-called mixed income, necessary for a proper analysis of the remuneration of labour (if required), will depend on this information. This information is usually provided in statistical operations such as surveys of the active population. On the other hand, the use of social security or job contracts (except in the absence of another source) database should be avoided since the information provided is often distorted ([54]). As in the case of the household surveys, micro-data use are strongly recommended.

— Ad hoc surveys on certain sectors and on specific socio-economic aspects ([55]):

- Population census
- Agricultural surveys and censuses
- Surveys of manufacturing and services activities
- Accounts of general government. Taxation data and statistics
- Databases relating to the economic flows with the rest of the world (or other regions): imports and exports of commodities (goods and services), trade data with CIF and FOB valuation, etc. ([56]) and balance of payments
- Other relevant surveys likely to be needed during the assessment of available data sources.

([52]) Sometimes, Supply and Use tables are presented by statistical offices including only total or aggregated values, excluding multi-sectorial relations and even including some inconsistencies with mainly macro data.

([53]) This is a clear example of how data can be evaluated from both the income and expenditure side and how it may be necessary to make choices about the reliability of different sources. Another example is data on tobacco and alcohol in Household Budget Surveys.

([54]) i.e., the number of contracts for the same actual job varies significantly from one sector of activity to another and even between different groups of workers.

([55]) Note these data are overwhelmingly collected on the same classification criteria as those used in SUT, i.e., they are not consistent with IOT without transformation. Same applies on labour market data and many other economic databases.

([56]) CIF: Cost, Insurance and Freight; FOB: Free on Board.

The process described above is time and resources consuming. Therefore, once a SAM for an economy is available for a given year, a new version of it including new macroeconomic data (i.e. GDP, value added, investment or savings, external balance, etc.) for subsequent years can be obtained with estimation procedures. This can be done assuming that the structural characteristics of the economy have not significantly changed (a very strong assumption as one of the key elements of a SAM is to capture the production technology and the links between the different sectors/institutions in the economy). The update of a SAM is inappropriate when it covers a period of structural transformation of the economy, but can be very useful in periods close in time from the base year when it is realistic to assume that the underlying structure is stable. Anyway, a correct update requires a rigorous systematic application, both in the method used and in the new data taken as reference. The first step is to select certain variables for which reliable up-to-date data are available and which will serve as control. Once these variables have been adequately updated, the SAM can be completely re-estimated in reference to them and there must always be checked that this control totals are respected, in an iterative process. These control variables can be totals or subtotals of accounts, by row or by column, complete submatrices or concrete cells.

When the SAM for an economy is not available for a given year or with the desired structure, it can be updated following a systematic process using specific and *ad hoc* information. Both, the procedure to be followed, and the information necessary, will vary depending on the analysis objectives or the original SAM. The basic steps in such cases are the following:

1. Define the desired structure of accounts/agents for the new micro SAM.
2. Identify and collect all data needed to update.
3. Compile/estimate a new Macro-SAM based on new available data.
4. Obtain disaggregated data from the selected sources in accordance with the accounts disaggregation of the new SAM.
5. Calculate a full prior micro SAM consistent with new MacroSAM.
6. Assess values in the prior micro SAM identifying entries and sub matrices which would benefit from additional information.
7. Implement, if necessary, some procedure or method for achieving a balanced SAM. Most used are RAS (bi-proportionate adjustment model) and Cross Entropy Method (CEM) –see Bacharach (1970), McDougall (1999) and Robinson et al. (2001) among others- ([57]).

There is also an important difference between balancing a SAM and estimating a SAM. When SAM-entries are missing, but there is reason to believe that the specific transaction did take place, it is necessary to estimate the missing value. Once all available data, whether observed or estimated, has been included in the SAM, it is still unlikely to have a balanced SAM due to data inconsistencies and estimation errors. Such a SAM then has to be balanced. Various statistical techniques can be used to remove 'small' errors, which will ensure that the SAM balances. The difficulty with balancing a SAM has to do with the fact that any change to row entries will automatically affect various column totals. Rows and columns must therefore be adjusted simultaneously.

([57]) McDougall shows that RAS is an entropy optimization method, and for the matrix balancing problem, RAS use to be the correct choice, but Entropy theory can solve problems where traditional matrix balancing framework does not work (McDougall, 1999). In the absence of specific cell entries, CEM use to be the best option.

4 Applications and extensions of the Social Accounting Matrices

SAMs can be used for many economic analyses linked to the economy as an inflow of interrelations: consumption, poverty, environment, employment, foreign trade or regional analysis. There are two main groups of models based on Social Accounting Matrices: models that assume fixed prices and those that allow for some or full price flexibility

The first ones are the linear models of multipliers based on the traditional Input-Output theory, with the improvements that enable the complete consideration in SAMs of the complete circular flow of income. The possibility of considering consumption, investment and all economic relations (intra and inter types of agents) as endogenous implies a substantial improvement in the explanatory capacity of these models. If it is also considered that a SAM itself must include some type of disaggregation of households, the increase in the utility of these models is strong ([58]). The other main group of models is the one that allows considering flexibility in prices, that is, the Computable General Equilibrium (CGE) models. These models are technically complex but undoubtedly have an enormous explanatory power as well as a huge capacity to simulate policy scenarios.

Although there is ample evidence that the preference for Leontief type multiplier models derived largely from the limits of computing power in the late 1960s and 1970, and that preference had shifted by the mid-1990s due to the hardware and software improvements, linear models are excellent descriptive tools and, appropriately, can provide relevant and useful information for analytical purposes, both by themselves, and in an initial approach before the application of complex CGE models. Both, the classical linear models from IOT (with embodied and vertically integrated effects) and the more complex and sophisticated CGE models, calibrated with these matrices, have shown high-capacity explaining key social and economic issues due to the large amount of information which a database of this kind provides on the links of production and consumption.

One of the topics where SAMs are most used is the study of environmental issues related to energy consumption, emissions of Greenhouse Gases and their mechanisms of generation in the economy, water and qater quality. Among many others, good examples of such applications can be found in Sánchez-Chóliz et al. (2007), Cardenete et al. (2012b), Duarte et al. (2012), Osman et al., (2015b). In general, it will be necessary to estimate, along with the SAM, some kind of matrix or vector which links the consumption by households or production activities (or imported commodities) with the use of energy or the generation of pollutants.

Analysis can be performed on employment and labour factor using similar techniques with data sources that relate the production activity with jobs, working hours, skills, intensity in the use of capital, etc. (i.e. Cardenete et al., 2012a or Fuentes and Mainar, 2015).

Other SAMs applications relate to welfare and economic development, from the point of view of poverty and gender inequality in income distribution, and from the perspective of its own process of growth in developing countries. With regard to the first of these aspects, the availability of highly disaggregated Household account allows calculations on effects on income distribution (Llop and Manresa (2004) and De Miguel and Manresa (2004)), and on poverty reduction (Thorbecke and Jung (1996)). For analysis of economic development see Subramanian and Sadoulet (1990), Thorbecke and Berrian (1992), Sadoulet and De Janvry (1995), and research studies based on SAMs conducted by the International Food Policy Research Institute (IFPRI) and the World Bank on developing countries (i.e. Thurlow et al., 2007,2008; World Bank, 2004). Innovations, such as the consideration of semi-subsistence economies in which households also act as

([58]) See Pyatt (2001), Pyatt and Round (1985) or Thorbecke and Jung (1996), among many others, as examples.

productive activity (typical of developing countries in Africa) can be incorporated into SAM analysis (Aragie and McDonald, 2014; Aragie, 2015). Information about the composition of households, especially their income sources, is crucial, as well as details on the production functions in key activities in developing countries, such as agriculture and basic manufactures.

A very important aspect that improves the versatility of SAMs is complementing it with other data source using **satellite accounts**. The usefulness of a SAM can be substantially increased by the modification or extension of its structure or simply by adding additional information by satellite accounts associated. Satellite accounts or systems allow the generalisation of the purpose analyse. Satellite accounts can be estimated for many questions, such as education, health, social indicators, investment, environmental issues (Greenhouse gas emission, water withdrawal, water quality), employment, growth, etc.

The use of satellite accounts has many advantages, because it allows including additional information about very significant issues (like social indicators or environmental impacts), preserving the connections with the main accounts system without disrupting or distorting it. Satellite accounts enable the linkage of physical data and analysis to the monetary accounting systems (key issue for environmental and ecological issues).

It is sometimes necessary to alter the standard structure of the SAM in order to carry out the analysis requested. For example, the above-mentioned issue of subsistence economies (Home Production for Home Consumption) need new accounts of households as productive activities to be incorporated, and the detailed split of some commodities (mostly agricultural) distinguishing marketed and own produced ones. Another issue in which it is necessary to modify the structure of the SAM is the multi-regional analysis. To consider simultaneously different regions or areas in a SAM, households, production factors or some activities accounts can be disaggregated by regional criteria ([59]), maintaining an aggregate level (national accounts) for the public sector, goods and services (optional), the external sector, etc. Naturally, one option is to work directly with the regional SAMs, but this can be very complex in the case of multi-regional models, since it requires a great deal of information that is usually not easy to find or estimate.

([59]) A SAM may relate to a country, region or complex zone (even to a city...). This kind of SAMs can be estimated *ad hoc* or from a higher geographical level SAM through estimation and balancing processes as RAS, CEM or Euro.

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List of abbreviations and definitions

A	Activities accounts
C	Commodities accounts
CAP	Common Agricultural Policy
CEM	Cross Entropy Method
CGE	Computable General Equilibrium
CIF	Cost, Insurance and Freight
E	Enterprise accounts
ECHP	European Community Household Panel,
F	Factors accounts
FOB	Free on Board
G	Government accounts
HBS	Household Budget Survey
H	Households accounts
IFPRI	International Food Policy Research Institute
M	Margins accounts
RHG	Representative Households Groups
RoW	Rest of the World accounts
S-I	Saving – Investment / Combined Capital accounts
SAM	Social Accounting Matrix
SIOT	Symmetric Input Output Table
SUIOT	Supply and Use Input Output Tables
VAT	Value Added Tax

List of figures

Annex

Annex 1. MacroSAM and SAM examples

Figure A1. A MacroSAM example

	Activities	Commodities	Labour	Capital	Households	Corporations	Goverment	I-S	RoW	*Total*
Activities		679,438								*679,438*
Commodities	349,467				206,252		73,905	84,850	91,949	*806,423*
Labour	180,492								396	*180,887*
Capital	148,626									*148,626*
Households			180,778	54,736		23,768	58,146		4,903	*322,331*
Corporations				84,967	13,666		5,249		8,895	*112,777*
Goverment	853	29,819		8,923	74,322	9,993			2,914	*126,825*
I-S					23,154	61,092	-13,389		13,993	*84,850*
Rest of the World		97,166	109		4,937	17,924	2,913			*123,049*
Total	*679,438*	*806,423*	*180,887*	*148,626*	*322,331*	*112,777*	*126,825*	*84,850*	*123,049*	

Source: Own elaboration

Figure A2. An abbreviate SAM example

		Activities			Margins	Commodities			Factors		Indirect taxes		Households	Corporations	Direct taxes	Government	Saving - Investment	Rest of the World	*Total*
		Agriculture	Industry	Services		Agriculture	Industry	Services	Labour	Capital	TLS-A	TLS-C							
Activities	Agriculture					14,137.9	429.6	404.5											*14,972.0*
	Industry						153,849.9	18,369.4											*172,219.3*
	Services					151.6	2,015.2	490,080.2											*492,247.0*
Margins						4,643.9	54,781.9	2,038.1											*61,463.8*
Commodities	Agriculture	902.1	9,647.7	1,168.1									5,636.4			56.3	432.4	4,040.7	*21,883.8*
	Industry	4,505.3	87,223.6	55,434.5									70,597.0			4,514.3	21,504.9	62,602.7	*306,382.3*
	Services	1,146.9	32,187.4	157,251.8	61,463.8								130,018.2			69,334.3	62,912.4	25,305.5	*539,620.4*
Factors	Labour	1,629.0	25,609.7	153,253.0														395.7	*180,887.3*
	Capital	8,637.7	17,766.7	122,222.0															*148,626.3*
Indirect taxes	TLS-A	-1,849.0	-215.7	2,917.7															*853.0*
	TLS-C					-50.4	16,107.4	14,276.3											*30,333.3*
Households									180,778.0	54,736.0				23,767.7		58,146.3		4,902.7	*322,330.8*
Corporations										84,967.0			13,665.6			5,249.4		8,894.7	*112,776.7*
Direct taxes													26,623.7	6,762.7				144.3	*33,530.7*
Government										8,923.3	853.0	29,818.7	47,698.6	3,230.4	33,530.7			2,770.0	*126,824.7*
Saving - Investment													23,154.0	61,092.0		-13,389.3		13,993.0	*84,849.7*
Rest of the World						3,000.7	79,198.3	14,451.9	109.3			514.7	4,937.3	17,923.8		2,913.3			*123,049.5*
Total		*14,972.0*	*172,219.3*	*492,247.0*	*61,463.8*	*21,883.8*	*306,382.3*	*539,620.4*	*180,887.3*	*148,626.3*	*853.0*	*30,333.3*	*322,330.8*	*112,776.7*	*33,530.7*	*126,824.7*	*84,849.7*	*123,049.5*	

Note: TLS stands for *Taxes less subsidies*: -A, on production; -C, on products

Source: Own elaboration

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KJ-NA-29297-EN-N

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Publications Office

doi:10.2760/010600

ISBN 978-92-79-89846-4