Looking for Empirical Evidence about the Socio-Economic Activity of Countries with Social Accounting Matrices

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Abstract

In looking for empirical evidence about the socio-economic activity of countries, a proposal is made for studying it through the use of Social Accounting Matrices (SAMs).SAMs are presented as tools that have specific features for conducting studies in several different areas, as well as for supporting policy decision processes. Based on methodological principles that are derived mainly from the works of Stone and Pyatt, emphasis is placed on the desirability of working in a matrix format, which simultaneously includes activities (or industries), products, factors of production and institutions. This is considered to be a way of capturing the relevant network of linkages and the corresponding multiplier effects in the subsequent modelling of the socio-economic activity of the countries studied.The exposition is accompanied by the example of a SAM applied to Portugal.

Keywords: Social Accounting Matrix; National Accounts.

1. Introduction

SAMs are tools that have specific features for studying the socio-economic activity of countries. Such features allow for the reading and interpretation of the reality under study, leading to the production of an empirical work that is not only capable of highlighting specific aspects of that activity, but also offers the chance to experiment with different interventions in regard to its functioning. A presentation will be made of a proposal for a basic SAM, together with an explanation of possible alternative taxonomies, showing how SAMs can be used as an alternative support for studies being undertaken in several areas, as well as for the work of those taking part in the policy decision process.

In stating that knowledge of the socio-economic activity of countries involves the use of national accounts, Section 2 justifies the decision to use the matrix form for studying the empirical evidence of that same activity.
Section 3 adopts a methodological framework based on the works of Richard Stone and Graham Pyatt, outlining the main features of the SAM-based approach, according to which the SAM can describe the activity of countries either empirically or theoretically, depending on whether it is presented in a numerical or an algebraic version, respectively. In keeping with the conclusions outlined in the latest work by Pyatt and Round, stress will be placed on the recommendation for "the design and the construction of SAMs prior to their use in modelling" (Pyatt& Round, 2012: 272)

Based on the latest version of the System of National Accounts (2008 SNA), Section 4 presents the proposal for a numerical version of a SAM. Firstly, Section 4.1 presents a basic structure and emphasises the need to ensure its consistency with the whole system. Such emphasis is then reinforced through the analysis of possible disaggregations and extensions to that basic structure (Section 4.2). Section 4.3 discusses the different forms of analysis made possible by the use of aggregates, indicators and balancing items that can be calculated from such a version and which lie outside the matrix format. This precedes two examples of policy-type questions that can be addressed using the proposed version (Section 4.4). In order to test the feasibility of adopting this proposal for different countries, an application is made of the construction of a numerical SAM to Portugal.

Section 5 systematises the main ideas of the other sections and makes some concluding remarks in an attempt to illustrate to what extent countries can use SAMs to study (socio-) economic systems and support their policy decision processes.

2. Looking for empirical evidence about the socio-economic activity of countries

Statistics record facts. The activity of a country is a series of facts. Therefore, any attempt to gain knowledge of those facts calls for the use of statistics. However, the complexity of such activity and the innumerable facts and statistics that serve to record it frequently make this task rather difficult, and sometimes render our efforts unfeasible. The challenge lies in defining the best hierarchy of facts, identifying the correct network of linkages between them, ensuring the availability of statistics and making use of good working tools. Those working tools should enable us to read the reality under study and to produce an empirical work that is not only capable of highlighting specific aspects of that activity, but also offers the chance to simulate different interventions in regard to its functioning.

In the preface to the book "Understanding National Accounts", Giovannini, E. states: "(…) today's national accounts are the core of a modern system of economic statistics, and they provide the conceptual and actual tool to bring coherence to hundreds of statistical sources available in developed countries" (Lequiller F. & Blades D., 2006: 3). If we accept the truthfulness of this statement, then a plausible statistical base source of information for studying the activity of a country ought to be its national accounts. This methodology can also be applied to countries that are not considered to be developed, but nonetheless seek to produce national accounts. However, we should also bear in mind that underlying the national accounts is a system that defines which facts should be observed and how these same facts should be recorded. The existence of such a system will certainly influence the challenge outlined above. Even so, we will adopt it as a starting point.

On the other hand, working with the accounts in a matrix format can be seen as a convenient way of considering the above-mentioned network of linkages and thus achieving greater analytical content. The matrix format will also allow for the use of the matrix algebra in possible mathematical treatments associated with the above-mentioned empirical work, enabling us to experiment with different interventions in regard to the functioning of reality. Some other advantages to be gained from the use of the matrix format will be mentioned in Section 4.
In looking for empirical evidence about thesocio-economic activity of countries, our proposal of a SAM will make use of the specific hierarchy of the facts that are supposedly observed through the system of national accounts. This will make it possible to identify networks of linkages that can be worked upon with different purposes in mind, always operating within a macro framework. From that work, which exhaustively explores the features of the national accounts and their underlying system, further work can be carried out, discovering alternative hierarchies of facts, identifying the importance of the non-observed facts, and criticising the way in which the observed facts are recorded, etc.As the behaviour of facts is explained by theories, our empirical work will also allow us to either test or better define these theories.

3. The SAM-based approach

Richard Stone, Graham Pyattand Jeffery Round in particular played a key role in the in the study and dissemination of the SAM-based approach.

In the foreword to the book that can now be regarded as a pioneering work in terms of the SAM-based approach, "Social Accounting for Development Planning with special reference to Sri Lanka", Stone stated that the framework of the system of national accounts can be rearranged and "the entries in a set of accounts can be presented in a matrix in which, by convention (…), incomings are shown in the rows and outgoings are shown in the columns; and in which, reflecting the fact that accounts balance, each row sum is equal to the corresponding column sum". That matrix, with an equal number of rows and columns, is the SAM, in the construction of which "it may be possible to adopt a hierarchical approach, first adjusting the entries in a summary set of national accounts and then adjusting subsets of estimates to these controlling totals". (Pyatt and Roe, 1977: xix, xxiii).
In turn, in the abstract to his article "A SAM approach to modeling", Pyatt says: "Given that there is an accounting system corresponding to every economic model, it is useful to make the accounts explicit in the form of a SAM. Such a matrix can be used as the framework for a consistent dataset and for the representation of theory in what is called its transaction form".In that transaction form (or TV (transaction value) form), the SAM can be seen "(…) as a framework for theory" and its cells "(…) can be filled instead with algebraic expressions, which describe in conceptual terms how the corresponding transaction values might be determined". Thus, the SAM is used as "the basic framework for model presentation". (Pyatt, 1988: 327; 337).

Looking at the question from the perspectives outlined above, it can be said that a SAM can have two versions: a numerical version, which describes the activity of a country empirically; and an algebraic version, which describes that same activity theoretically. In the former version, each cell has a specific numerical value, with the sums of the rows being equal to the sums of the columns. In the latter version, each cell is filled with algebraic expressions that, together with those of all the other cells, form a SAM-based model, the calibration of which involves a replication of the numerical version.

In the words of Pyatt, "the essence of (...) the SAM approach to modelling is to use the same SAM framework for both the empirical and the theoretical description of an economy". (Pyatt, 1988: 337).In 1953, with the first and most fundamental contribution written by Stone, the United Nations recommended the System of National Accounts (SNA), which continued to be published in successive versions until 2008. Also working on the last two versions of that system, published in 1993 and 2008, were, besides the United Nations, the International Monetary Fund, the World Bank, the Organisation for Economic Cooperation and Development and the Statistical Office of the European Communities (Eurostat). Together, they formed the Inter-Secretariat Working Group on National Accounts (ISWGNA). This system establishes the rules for measuring the socio-economic activity of countries or groups of countries, which, in turn, have been adopted and adapted to specific realities by the corresponding statistical offices. The construction of algebraic versions (or SAM-based models) can be seen, among others, in Pyatt (2001; 1988), Pyatt and Roe (1977), Pyatt and Round (1985; 2012) and Santos (2010; 2009).

In their latest article, Pyatt and Round (2012) explore and derive conditions for a phenomenon that they identify as distributional invariance within a SAM-based model. That phenomenon, which they also call "the Stone phenomenon", is associated with the study of a component of the multiplier effects identified during research into the interrelationship between the structure of production and the distribution of income in the context of economic development. The implications of those conditions were identified by the authors in the design of SAMs and in the consequent quality of results generated via subsequent modelling. Consequently, they conclude by appealing for renewed efforts to be made in the design and construction of SAMs with a view to obtaining a more realistic starting point for subsequent modelling.

4. Constructing numerical versions of SAMS from the SNA: application to Portugal

The latest versions of the SNA have devoted a number of paragraphs to discussing the question of SAMs. The 2008 version mentions SAMs in Section D of its Chapter 28, entitled "Input-output and other matrix-based analysis" (ISWGNA, 2009: 519-522), in which a matrix representation is presented of the accounts identified and described in the whole SNA. This representation is not, however, to be identified with the SAM presented in this paper, although they both cover practically all the flows recorded by those accounts.In turn, the European System of National and Regional Accounts in the European Union of 2010[1] (the adaptation for Europe of the 2008 version of the SNA) makes a reference to the SAM, stating that, among other features, it can be thought of as an expanded system of labour (satellite) accounts (Chapter 22).

The SAM that will be presented below results from the work that the author has undertaken within the methodological framework presented in Section 3, based especially on the works of Graham Pyatt and his associates (Pyatt, 1988 and 1991; Pyatt& Roe, 1977; Pyatt& Round, 1985 and 2012), as well as from the efforts made to reconcile that framework with what has been defined by (the successive versions of) the SNA (Pyatt, 1985 and 1991a; Round, 2003; Santos, 2009). Thus, the author will propose a version of the SAM that seeks to be as exhaustive as possible regarding the flows observed by the SNA. Pyatt (1999) and Round (2003) also approach this same issue with the use of their own versions.

The following proposal will be accompanied by an applications made of the SAM to Portugal in 2009. In that year, the Portuguese national accounts adopted the European System of National and Regional Accounts in the European Community of 1995 – the adaptation for Europe of the 1993 version of the SNA. Because the general differences between the accounts identified in this application and described in the 1993 and 2008 versions of the SNA are not significant, they will be used to illustrate the following exposition.

[1] At the time when this article was written, the system was outlined in the form of a Proposal for a Regulation of the European Parliament and of the Council on the European system of national and regional accounts in the European Union (/* COM/2010/0774 final - COD 2010/0374 */).

Thus, returning to the description provided in Section 3, a square matrix will be worked upon, in which the sum of the rows is equal to the corresponding sum of the columns. In keeping with what is conventionally accepted, and after some adjustments have been made to adapt this to the SNA, resources, incomes, receipts or changes in liabilities and net worth will be represented in the entries made in the rows, while uses, outlays, expenditures or changes in assets will be represented in the entries made in the columns. Each flow will therefore be recorded only once, in a cell of its own. The following description will be made in accordance with the 2008 SNA.

The starting point for the construction of a numerical SAM should be its design, i.e. the classification or taxonomy of its accounts. That taxonomy and the levels of disaggregation adopted will depend on the purposes for which the SAM is to be used, as well as on the way that the available information is organised. Adopting the national accounts as the base source of information, a basic structure is proposed below, which takes into account the underlying SNA and highlights the consistency of the whole system. The flexibility of that basic structure will be shown, together with the possibilities that it presents for characterising problems and for achieving specific purposes. These will also be seen as possibilities for going beyond the SNA, which is considered as a starting point, as mentioned in Section 2.

In this respect, we are aware of the dangers associated with the adoption of international standards and systems of classification and their failure to recognise important issues and realities. This problem is also mentioned by Pyatt and Round when they consider the choice of taxonomies within a SAM framework and the strategic influence that these can have on the potential usefulness of subsequent applications. According to those authors: "the taxonomies that are embedded within [the SAM framework] predetermine what any subsequent modelling exercise might have to say in response to specific distributional questions" (Pyatt& Round, 2012: 270).

4.1. The SAM's basic structure and its consistency with the whole system

Adopting the working method recommended by Stone in the second paragraph of Section 3 of this paper, the basic structure for the SAM presented here will be a summary set of the national accounts and the controlling totals for the other levels of disaggregation, which will later be analysed in Section 4.2. Thus, in keeping with the conventions and nomenclatures defined by the SNA, besides a rest of the world account, the proposed SAM will also include both production and institutional accounts.

Table1. The Basic SAM by blocks

	p	*a*	f	dic	dik	dif	rw	total
p – products	TTM ($t_{p,p}$)	IC ($t_{p,a}$)	0	FC ($t_{p,dic}$)	GCF ($t_{p,dik}$)	0	EX ($t_{p,rw}$)	AD ($t_{p.}$)
a – activities	P ($t_{a,p}$)	0	0	0	0	0	0	VPT ($t_{a.}$)
f – factors	0	CFP_GAV ($t_{f,a}$)	0	0	0	0	CFP ($t_{f,rw}$)	AFIR ($t_{f.}$)
dic – (domestic) institutions' current account	NTP ($t_{dic,p}$)	NTA ($t_{dic,a}$)	CFP_GNI ($t_{dic,f}$)	CT ($t_{dic,dic}$)	0	0	CT ($t_{dic,rw}$)	AI ($t_{dic.}$)
dik – (domestic) institutions' capital account	0	0	0	S ($t_{dik,dic}$)	KT ($t_{dik,dik}$)	NLB ($t_{dik,dif}$)	KT ($t_{dik,rw}$)	INVF ($t_{dik.}$)
dif – (domestic) institutions' financial account	0	0	0	0	0	FT ($t_{dif,dif}$)	FT ($t_{dif,rw}$)	TFTR ($t_{dif.}$)
rw – rest of the world	IM&NTP ($t_{rw,p}$)	NTA ($t_{rw,a}$)	CFP ($t_{rw,f}$)	CT ($t_{rw,dic}$)	KT ($t_{rw,dik}$)	FT ($t_{rw,dif}$)	0	TVRWP ($t_{rw.}$)
total	AS ($t._{p}$)	VCT ($t._{a}$)	AFIP ($t._{f}$)	AIP ($t._{dic}$)	AINV ($t._{dik}$)	TFTP ($t._{dif}$)	TVRWR ($t._{rw}$)	

Source: Santos (2009; 2010)

Note: The first three accounts (p = products (or goods and services), *a* = activities (or industries) and f = factors (of production)) are the production accounts of the economy and the next three accounts (dic = current; dik = capital; dif = financial) are the accounts of the (domestic) institutions. The last account (rw = rest of the world) represents the "outside" part of the (domestic) economy.

Table 1 shows the above-mentioned basic structure, representing the nominal transactions ("t") with which two indexes are associated. The location of these transactions within the matrix framework is described by those indexes, the first of which represents the row account while the second represents the column account. Each cell of this matrix will be converted into a submatrix, with the number of rows and columns corresponding to the level of disaggregation of the row and column accounts. This same table also identifies blocks, which are submatrices or sets of submatrices with common characteristics. The specification of these blocks will be made below and involves an identification of the flows of the National Accounts, which will continue to be the same even if some disaggregation is performed – thereby preserving the consistency of the whole system.

Description of the blocks (included in the texts are letters followed by numbers between brackets, which are the flow codes of the National Accounts, in accordance with the 2008 SNA):

a) Production – P (cell: $t_{a,p}$) – represents the output of goods and services (P1).

b) Domestic Tradeis represented by the value of domestically transacted products, which can be either domestically produced or imported.

b.1) Intermediate Consumption – IC (cell: $t_{p,a}$) **–** consists of the value of the goods and services consumed as inputs by a process of production, excluding those fixed assets whose consumption is recorded as consumption of fixed capital (P2).

b.2) Final Consumption – FC (cell: $t_{p,dic}$) **–** consists of the expenditure incurred by resident institutional units on goods or services that are used for the direct satisfaction of individual needs or wants, or the collective needs of members of the community (P3).

b.3) Gross Capital Formation – GCF (cell: $t_{p,dik}$) – includes gross fixed capital formation, changes in inventories, and acquisitions less disposals of valuables (P5).

c) External Trade includes the transactions in goods and services from non-residents to residents, also known as imports (P7), or IM (cell: $t_{rw,p}$), and the transactions in goods and services from residents to non-residents, also known as exports (P6), or EX (cell: $t_{p,rw}$).

d) Trade and Transport Margins – TTM (cell: $t_{p,p}$) **–** amounts to zero and, when it is disaggregated and takes the form of a submatrix, it allocates the output of the trade and transport services used in the domestic trade to the supplied products.

e) Net taxes on production and imports

e.1) Net Taxes on Production – NTA (cells: $t_{dic,a}$; $t_{rw,a}$) **–** represents the (other) taxes on production (D29) minus the (other) subsidies to production (D39).

e.2) Net Taxes on Products – NTP (cells: $t_{dic,p}$; $t_{rw,p}$) **–** represents the taxes on products (D21) minus the subsidies on products (D31).

f) Compensation of Factors of Production – CFP(cells: $t_{f,a}$; $t_{dic,f}$; $t_{f,rw}$; $t_{rw,f}$) **–** consists of the income of the institutional sectors originating from the compensation of employees (D1) and the compensation of employers and/or own-account (or self-employed) workers, and the compensation of capital, including property income (D4; B2g-B3g). The functional distribution is represented by the Gross Added Value – GAV (cell: $t_{f,a}$), whereas the institutional distribution is represented by the Gross National Income – GNI (cell: $t_{dic,f}$).

g) Current Transactions – CT (cells: $t_{dic,dic}$; $t_{dic,rw}$; $t_{rw,dic}$) – includes: current taxes on income, wealth, etc. (D5); net social contributions (D61); social benefits other than social transfers in kind (D62); other current transfers (D7); and the adjustment made for the change in pension entitlements (D8).

h) Capital Transactions – KT (cells: $t_{dik,dik}$; $t_{dik,rw}$;$t_{rw,dik}$) – includes: capital taxes (D91); investment grants (D92); other capital transfers (D99); and acquisitions less disposals of non-financial non-produced assets (NP1-3).

i) Financial Transactions – FT (cells: $t_{dif,dif}$; $t_{dif,rw}$; $t_{rw,dif}$) – includes: monetary gold and special drawing rights (F1); currency and deposits (F2); debt securities (F3); loans (F4); equity and investment fund shares (F5); insurance, pension and standardised guarantee schemes (F6); financial derivatives and employee stock options (F7); and other accounts receivable/payable (F8).

j) Gross Saving – S (cell: $t_{dik,dic}$) **–** measures the portion of aggregate income that is not used for final consumption expenditure and current transfers to domestic institutions or to the rest of the world (B9g).

k) Net Borrowing/Lending – NLB (cell: $t_{dik,dif}$)

The net lending or borrowing of the total economy is the sum of the net lending or borrowing of the institutional sectors. It represents, respectively, the net resources that the total economy makes available to the rest of the world or the net resources that it receives from the rest of the world to finance the corresponding needs of investment funds (B9).

Here, those amounts are recorded in the row(s) of the capital account, i.e. as changes in liabilities and net worth, and in the column(s) of the financial account, i.e. as changes in assets. This is why the mathematical signs of this item have been changed in relation to the SNA.

The construction of a SAM is easier when it is performed by blocks.

The totals of each account represent the corresponding sums of the cells in rows and in columns, with the following description:

- Products account (p): Aggregate Demand – AD, the row sum (cell: $t_{p.}$); Aggregate Supply – AS, the column sum (cell: $t._{p}$).
- Activities account (*a*): Production Value – VPT, the row sum (cell: $t_{a.}$); Total Costs – VCT, the column sum (cell: $t._{a}$).
- Factors of Production (f): Aggregate Factors Income (Received) – AFIR, the row sum (cell: $t_{f.}$); Aggregate Factors Income (Paid) – AFIP, the column sum (cell: $t._{f}$).
- Current account of (domestic) institutions (dic): Aggregate Income (received) – AI, the row sum (cell: $t_{dic.}$); Aggregate Income (Paid) – AIP, the column sum (cell: $t._{dic}$).
- Capital account of (domestic) institutions (dik): Investment Funds – INVF, the row sum (cell: $t_{dik.}$); Aggregate Investment – AINV, the column sum (cell: $t._{dik}$).
- Financial account of (domestic) institutions (dif): Total Financial Transactions (Received) – TFTR, the row sum (cell: $t_{dif.}$); Total Financial Transactions (Paid) – TFTP, the column sum (cell: $t._{dif}$).
- Rest of the world account (rw): Value of Transactions to the Rest of the World (Paid) – TVRWP, the row sum (cell: $t_{rw.}$); Value of Transactions from the Rest of the World (Received) – TVRWR, the column sum (cell: $t._{rw}$).

The Integrated Economic Accounts Table is equivalent to a summary of what is observed by the SNA. According to the 2008 SNA: "The integrated economic accounts use (…) three of the conceptual elements of the SNA (...) [institutional units and sectors, transactions, and assets and liabilities] together with the concept of the rest of the world to form a wide range of accounts. These include the full sequence of accounts for institutional sectors, separately or collectively, the rest of the world and the total economy… This table shows, simultaneously, the general accounting structure of the SNA and presents a set of data for the institutional sectors, the economy as a whole and the rest of the world" (ISWGNA, 2009: 23; 29). Based on this table and the previous description (adapted to the previous version of the SNA), it was possible to construct the basic SAM presented in Table 2, representing the highest possible level of aggregation of the activity of Portugal observed by the national accounts in 2009.

Table 2. Basic SAM of Portugal in 2009 (unit: 10^6 euros)

	p	*a*	f	dic	dik	dif	rw	total
p – products	0	162 661		146 934	34 051		47 236	390 882
a – activities	311 365							311 365
f – factors		149 403					9 039	158 443
dic– (domestic) institu-tions' current account	19 694	522	141 423	85 711			4 581	251 931
dik – (domestic) institu-tions' capital account				15 865	1 536	16 222	2 232	35 856
dif – (domestic) institu-tions' financial account						36 659	37 209	73 868
rw – rest of the world	59 823[(a)]	- 1 222	17 019	3 421	268	20 987		100 297
total	390 882	311 365	158 443	251 931	35 856	73 868	100 297	

Sources: Statistics Portugal (INE); Portuguese Central Bank (Banco de Portugal).

[(a)]59 717 (imports) + 106 (net taxes on products sent to the institutions of the European Union)

Therefore, as mentioned above, and again using the words of Stone, the basic SAM that has just been described can be considered as the most aggregate "summary set of national accounts", representing a first level of the intended hierarchical method, with all the controlling totals for the next level of that hierarchy. From here the consistency of the whole (supposedly) observed system can be ensured.
From the above description, two further advantages of the matrix presentation of the national accounts can be highlighted: each transaction represents a single entry and can be characterised by its position; each account is represented by a row and a column, whose balance is ensured by the equality of their sums.

4.2. Disaggregations and extensions

Since the national accounts cover all the details covered by the basic structure presented in Section 4.1, some other levels of the hierarchical method, mentioned in Section 3, can be identified within the national accounts, providing other controlling totals for greater levels of disaggregation. As will be seen below, this disaggregation can be made at the levels of the production, institutional and rest of the world accounts either within the scope of the SNA conventions or not. Reverse reasoning can be applied to the case of aggregation. Therefore, besides the above-mentioned advantages of presenting the national accounts in the form of a matrix, it is also possible to make an easier aggregation and disaggregation of the accounts, in accordance with the specific requirements of the exercise and the available information, without losing the consistency of the system.

In the words of Round, in his Foreword to Santos (2009): "The key to constructing a useful SAM and developing an effective SAM-based model is the SAM design. A SAM need not be dimensionally large as long as it represents the most significant features of economy-wide interdependence. More precisely, this means designing the SAM so that the key sectors, markets and institutions are as fully represented as is practicable. Estimation of the transactions between accounts is obviously also important but this needs to go in tandem with the SAM design" (Santos, 2009: xiv). It is also worth mentioning that, although the quarterly national accounts are not as complete as the annual ones, it will nonetheless be possible to make some further disaggregations from these in terms of time.

Furthermore, disaggregations can be made in terms of space, since regional accounts are also considered. In that case, it is possible to work with regions and countries, either individually or as a group. Round (1994; 1991), for example, experimented with the case of Europe. It would even be possible to think in world terms, if the SNA could be adopted worldwide.

Extensions are also possible, either from the national accounts or from other sources of information, with the convenient adjustment to, or connection with, the whole system in order to maintain its consistency. The 2008 SNA dedicates its Chapter 29 to "Satellite accounts and other extensions" (ISWGNA, 2009: 523-544)[2], where the main idea is to serve specific analytical purposes, in a way that is consistent with the central framework, although not fully integrated into it (ISWGNA, 2009: 37-38).

[2] The 2010 ESA dedicates its Chapter 22 to that same subject (see footnote 1).

In this respect, the author would like to support Steven Keuning and Willem Ruijter's idea of a "complete data set" which "could be tentatively labelled: a System of Socio-economic Accounts" (Keuning and Ruijter, 1988: 73).

4.2.1. Production accounts

In the basic structure proposed in Section 4.1, the production accounts are the accounts of products, activities and factors of production. These accounts correspond respectively to the SNA accounts of goods and services, production and the primary distribution of income. Thus, within these accounts and depending on the available level of disaggregation, it can be seen how the available products are used, with some details being provided about the process of production and about the way in which the incomes resulting from that process and the ownership of assets are distributed among institutions and activities.

As described above, in the characterisation of the block representing the compensation of the factors of production, the disaggregation that can be made from the already mentioned tables of the national accounts is between labour (or the compensation of employees) and what has been referred to as the compensation of other factors, which includes the compensation of employers and/or own-account (or self-employed) workers, and the compensation of capital, namely property income. Such information can only be derived from the Integrated Economic Accounts Table if the products and activities accounts are not disaggregated, or from the Supply and Use Table if those same accounts are disaggregated. Table 3, which contains the above-mentioned application to Portugal, in which the products and activities accounts are not disaggregated, presents the possible disaggregation of the factors of production accounts based on the Integrated Economic Accounts Table.

Regarding the design of SAMs and in order to establish a connection between the taxonomies dealt with in this section and in the next, it should be mentioned that in their latest work, besides a rest of the world account, Pyatt and Round identify accounts for goods and non-factor services and factor services, as well as, accounts for institutions. In the latter, they identify private and public sector current accounts and combined capital accounts. About this classification, they say the following: "taxonomies for goods and services serve to distinguish different markets and should therefore be constructed in ways that recognise significant market failures and segmentation. In contrast, the institutions within the private sector are differentiated by the assets they own (or do not own…) and the productive activities they are responsible for…. Factors of production and the assets that provide them are therefore the defining feature of institutions." (Pyatt& Round, 2012: 268).

4.2.2. Institutions and rest of the world accounts

In the basic structure proposed in Section 4.1, the domestic institutions are divided into current, capital and financial accounts. These accounts correspond, respectively, to the following SNA accounts: secondary distribution of income, redistribution of income in kind and use of income; capital; and financial accounts. Within these accounts, depending on the level of disaggregation available, the current accounts show how the national income is transformed into disposable income through the receipt and payment of current transfers, and how the latter is distributed between final consumption and saving. In turn, the capital account records the transactions linked to acquisitions of non-financial assets and capital transfers involving the redistribution of wealth, whereas the financial account records the transactions in financial assets and liabilities between institutional units, and between these and the rest of the world. All the linkages between the domestic economy and the rest of the world, i.e. all the transactions between resident and non-resident units, are recorded both in the SAM and in the SNA through the rest of the world account.

At the first level of disaggregation, the accounts of the institutions, as well as the rest of the world account, are part of the Integrated Economic Accounts Table. Higher levels of disaggregation, whenever these are possible, are usually published in the separate accounts of institutions. Even at the first level of disaggregation, any work conducted with the institutional sectors when there are transactions involving more than one row or column of the SAM also requires the so-called "from whom to whom matrices".These matrices make it possible to fill in the cells of the submatrices of transactions taking place within domestic institutions and between institutions and the rest of the world, recorded in the above-described blocks of current, capital, and financial transactions (Section 4.1 g-i).The disaggregation of specific institutional sectors makes it possible to analyse the most diverse aspects of the corresponding roles in the activity of countries (Santos (2004) and (2007) are examples of studies on the role of the general government and its subsectors – central government, local government and social security funds).

Table 3. SAM of Portugal in2009, with disaggregated factors of production and the (domestic) institutions' current and capital accounts (unit: 10^6 euros)

Outlays (expenditures) / Incomes (receipts)				PRODUCTION		FACTORS			INSTITUTIONS CURRENT ACCOUNT					
				PRODUCTS	ACTIVITIES	Labour (employees)	Other	Total	Households	Nonfinancial corporations	Financial corporations	Government	NPISH	Total
				1	2	3	4		5	6	7	8	9	
PRODUCTION	PRODUCTS		1	0	162 661	0	0	0	106 206	0	0	37 160	3 568	146 934
	ACTIVITIES		2	311 365	0	0	0	0	0	0	0	0	0	0
	FACTORS	Labour (employees)	3	0	85 888	0	0	0	0	0	0	0	0	0
		Other	4	0	63 515	0	0	0	0	0	0	0	0	0
		Total		0	149 403	0	0	0	0	0	0	0	0	0
INSTITUTIONS	CURRENT ACCOUNT	Households	5	0	0	85 757	34 258	120 015	801	1 830	5 226	28 998	95	36 949
		Nonfinancial corporations	6	0	0	0	14 615	14 615	1 830	0	613	171	0	2 613
		Financial corporations	7	0	0	0	5 990	5 990	5 289	519	131	42	32	6 013
		Government	8	19 694	522	0	- 34	- 34	31 224	5 684	671	8	22	37 610
		NonProfitInstitutionsServing Households(NPISH)	9	0	0	0	837	837	324	154	50	1 997	0	2 525
		Total		19 694	522	85 757	55 666	141 423	39 468	8 187	6 690	31 215	150	85 711
	CAPITAL ACCOUNT	Households	10	0	0	0	0	0	13 728	0	0	0	0	13 728
		Nonfinancial corporations	11	0	0	0	0	0	0	8 903	0	0	0	8 903
		Financial corporations	12	0	0	0	0	0	0	0	5 283	0	0	5 283
		Government	13	0	0	0	0	0	0	0	0	- 11 695	0	- 11 695
		NonProfitInstitutionsServing Households(NPISH)	14	0	0	0	0	0	0	0	0	0	- 354	- 354
		Total		0	0	0	0	0	13 728	8 903	5 283	- 11 695	- 354	15 865
	FINANCIAL ACCOUNT		15	0	0	0	0	0	0	0	0	0	0	0
REST OF THE WORLD			16	59 823	- 1 222	370	16 649	17 019	1 345	240	110	1 726	0	3 421
TOTAL				390 882	311 365	86 127	72 315	158 443	160 747	17 331	12 082	58 407	3 363	251 931

Sources: Statistics Portugal (INE); Portuguese Central Bank (Banco de Portugal).

Table 3. SAM of Portugal in2009, with disaggregated factors of production and the (domestic) institutions' current and capital accounts (unit: 10^6 euros)
(Continued)

Outlays (expenditures) / Incomes (receipts)				INSTITUTIONS							REST OF THE WORLD	TOTAL
				CAPITAL ACCOUNT						FINANCIAL ACCOUNT		
				Households	Nonfinancial corporations	Financial corporations	Government	NPISH	Total			
				10	11	12	13	14		15	16	
PRODUCTION	PRODUCTS		1	7 269	19 812	1 064	5 071	834	34 051	0	47 236	390 882
	ACTIVITIES		2	0	0	0	0	0	0	0	0	311 365
	FACTORS	Labour (employees)	3	0	0	0	0	0	0	0	239	86 127
		Other	4	0	0	0	0	0	0	0	8 800	72 315
		Total		0	0	0	0	0	0	0	9 039	158 443
INSTITUTIONS	CURRENT ACCOUNT	Households	5	0	0	0	0	0	0	0	3 783	160 747
		Nonfinancial corporations	6	0	0	0	0	0	0	0	103	17 331
		Financial corporations	7	0	0	0	0	0	0	0	79	12 082
		Government	8	0	0	0	0	0	0	0	615	58 407
		NonProfitInstitutionsServing Households(NPISH)	9	0	0	0	0	0	0	0	1	3 363
		Total		0	0	0	0	0	0	0	4 581	251 931
	CAPITAL ACCOUNT	Households	10	0	0	53	139	0	192	- 9 004	177	5 093
		Nonfinancial corporations	11	0	0	0	795	0	795	11 407	924	22 029
		Financial corporations	12	0	0	53	24	0	77	- 4 157	0	1 202
		Government	13	3	95	28	0	2	129	17 135	1 118	6 687
		NonProfitInstitutionsServing Households(NPISH)	14	0	0	0	344	0	344	840	14	844
		Total		3	95	135	1 301	2	1 536	16 222	2 232	35 856
	FINANCIAL ACCOUNT		15	0	0	0	0	0	0	36 659	37 209	73 868
REST OF THE WORLD			16	- 2 179	2 122	3	315	8	268	20 987		100 297
TOTAL				5 093	22 029	1 202	6 687	844	35 856	73 868	100 297	

Sources: Statistics Portugal (INE); Portuguese Central Bank (Banco de Portugal).

The detailed study of the specific accounts of domestic institutions and their corresponding transactions also makes it possible to analyse specific aspects of that same activity: the distribution and redistribution of income, using the current account; the redistribution of wealth, using the capital account; investment, its financing, and the implicit levels of the financing requirements and availability of the institutional sectors and the whole economy, using the capital and financial accounts. In turn, the rest of the world account can provide many possibilities for studying the international economic relations of the domestic economy.

Table 3 presents the possible disaggregation of the institutions' current and capital accounts, made from the Integrated Economic Accounts Table and the "from whom to whom matrices", for the above-mentioned application to Portugal. Due to the unavailability of "from whom to whom matrices" for financial transactions, the financial account could not be disaggregated. Just as the matrix form of the production accounts may be easily worked on from the supply and use tables, it would also be possible to work on the matrix form of the institutional accounts if some kind of "from whom to whom tables" were made official. This would be a crucial factor for implementing the SAM-based approach, in which SAMs with production and institutional accounts, conveniently capturing the circular flow of income and the underlying network of linkages, would form the basis for macroeconomic models capable of reproducing the multiplier processes implicit in the activity of countries.

4.3. Aggregates, indicators and balancing items

As was seen above, practically all the transactions of the national accounts are covered by the SAM, so that macroeconomic aggregates, indicators and balancing items can be identified from it (see the description of the cells or blocks in Table 1, as well as Tables 2 and 3 for the application to Portugal).

Gross Domestic Product at market prices (GDP_{pm}), which is usually considered the main macroeconomic aggregate, can be calculated in the three known approaches:

- Production approach: $GDP_{pm} = P - IC + NTP = t_{a,p} - t_{p,a} + (t_{dic,p} + (\text{part of})t_{rw,p})$;
- Expenditure approach: $GDP_{pm} = FC + GCF + Ex - IM = t_{p,dic} + t_{p,dik} + t_{p,rw} - (\text{part of})\ t_{rw,p}$;
- Income approach: $GDP_{pm} = GAV + NTP + NTA = t_{f,a} + (t_{dic,p} + (\text{part of})\ t_{rw,p}) + (t_{dic,a} + t_{rw,a})$.

The Portuguese GDP_{pm}in 2009 was 168 504 * 10^6 euros, which can be calculated from these three approaches as follows:

- Production approach: $GDP_{pm} = 311\ 365 - 162\ 661 + (19\ 694 + 106)$;
- Expenditure approach: $GDP_{pm} = 146\ 934 + 34\ 051 + 47\ 236 - 59\ 717$;
- Income approach: $GDP_{pm} = 149\ 403 + (19\ 694 + 106) + (522 - 1\ 222)$.

Domestic Product can be converted into National Product by adding the compensation of factors received from the rest of the world and deducting the compensation of factors and the net indirect taxes (on both products and production) sent to the rest of the world, when these exist. Thus, from the described cells of the basic SAM, GDP_{pm} can be converted into Gross National Product at market prices (GNP_{pm}) or Gross National Income (GNI_{pm}), as follows: $GDP_{pm} + t_{f,rw} - t_{rw,f} - t_{rw,a} - (\text{part of})\ t_{rw,p}$. On the other hand, as the SAM directly provides Gross National Income, this can also be calculated just by adding the net indirect taxes (on both products and production) received by domestic institutions: $t_{dic,f} + t_{dic,p} + t_{dic,a}$. The corresponding amount for Portugal in 2009 is 161 639 * 10^6 euros, for which the underlying calculations are as follows: GNP_{pm}= 168 504 + 9 039 – 17 019 – (– 1 222) – 106; GNI_{pm}= 141 423 + 19 694 + 522.

Disposable Income (Domestic or National) is also very important and can be calculated by adding to GNI_{pm} the net current transactions received by domestic institutions: $GNI_{pm} + ((\text{received})t_{dic,dic} + t_{dic,rw}) - ((\text{paid})\ t_{dic,dic} + t_{rw,dic})$. In our application to Portugal: 161 639 + (85 711 + 4 581) – (85 711 + 3 421) = 162 800 * 10^6 euros. In turn, gross aggregates can be converted into net aggregates (and balancing items) by deducting the consumption of fixed capital, which lies outside the basic SAM but is part of the integrated economic accounts.Gross Saving (S) and Net Lending or Borrowing (NLB) are given directly by the SAM, through $t_{dik,dic}$ and $t_{dik,dif}$, respectively, which in the case of Portugal in 2009 are: 15 865 and 16 222 * 10^6 euros. As explained in Section 3.1 - k), the latter amount represents Net Borrowing.
It is also possible to calculate structural indicators of the functional and institutional distribution of generated income, as well as indicators of the use of disposable income.

In the functional distribution of generated income, the distribution of gross added value – GAV – among the factors of production is given by the structure of the submatrix in cell $t_{f,a}$ of the basic structure, with its level of detail depending on the disaggregation of the activities (column account) and of the factors of production (row account). Table 4 shows the results for the applications to Portugal.

Table 4. Portuguese functional distribution of the income generated in 2009 (in percentage terms)

	%
Factors of Production (generated income = gross added value or gross domestic product)	
Labour (employees)	57.5
Other (employers and own-account workers; capital)	42.5
Total	100.0

Source: Table 3

In the institutional distribution of generated income, the distribution of gross national income – GNI – isgiven by the structure of the submatrix in cell $t_{dic,f}$ of the basic structure. In this case, the level of detail will depend on the disaggregation of the factors of production (column account) and of the current account of the domestic institutions (row account). Table 5 shows the results of our application.

Table 5. Portuguese institutional distribution of the income generated in 2009 (in percentage terms)

	Factors of Production		
	Labour (employees)	Other (employers and own-account workers; capital)	Total
Institutions (generated income = gross national income)			
Households	100.0	61.5	84.9
Non-financial corporations		26.3	10.3
Financial corporations		10.8	4.2
General government		- 0.1	0.0
Non-profit institutions serving households		1.5	0.6
Total	100.0	100.0	100.0

Source: Table 3

As described above for the whole economy, the disposable income of the institutional sectors can be calculated in the same way, and then its distribution and use can also be studied – see Table 6.

Table 6.Portuguese distribution and use of disposable income among institutions in 2009(in percentage terms)

		Distribution of Disposable Income	Use of Disposable Income	
			Final Consumption Expenditure	Saving
Portugal	Households	73.7	88.6	11.4
	Non-financial corporations	5.5	---	100.0
	Financial corporations	3.2	---	100.0
	General government	15.6	145.9	- 45.9
	Non-profit institutions serving households	2.0	111.0	- 11.0
	Total	100.0	90.3	9.7

Source: Table 3.

The main items in the revenue and expenditure of the institutional sectors and of the rest of the world can be calculated from the respective rows and columns of the SAM. In the case of institutional sectors, the total balancing item is the net lending/borrowing (NLB) of the respective institutional sector, with an opposite mathematical sign to the one registered in the SAM; the current balancing item is the respective gross saving (S); and the capital balancing item is the difference between the first and the second.Tables 7 and 8 (not considering the columns "relative importance of D5 and D62 in…") illustrate the revenue and expenditure of the government and households for Portugal in 2009.

4.4. Examples of policy-type questions that can be addressed using a SAM

From what was seen above, by covering practically all the representative nominal flows of the part of the country's activity observed by the national accounts (if it is assumed that this is sufficiently representative), the SAM can be used to support the policy decision process in several ways, given the flexibility of the already described basic structure and the possibilities of specifying various aspects of the underlying systems.

For example, under the scope of the social policy measures, we may wish to work with specific flows in which government and households intervene directly, namely the current transfers between them both. Let us consider the case of the direct taxes on income, paid by the households to the government, and the case of the social benefits, paid by the government to the households. Identifying the absolute and relative importance of these flows in the corresponding revenue and expenditure may be a first step. Tables 7 and 8 show the application to Portugal. On the other hand, comparisons with macroeconomic aggregates and some SAM values can complement that knowledge. For instance, in our application to Portugal, the current taxes on income and wealth, etc., paid by households to the government, represent 6.3% of the aggregate income of the former (the row/column total of its current account); or, alternatively, the benefits other than social transfers in kind, paid by the government to the households, represent 23.7% of the households' disposable income.

From here, different scenarios can be studied using SAM-based model(s). The distributional effects of social policy measures directed to specific flows (for example, direct taxes on income or social benefits) can be studied not only at the level of the institutional sectors involved, but also at the level of the part of the country's activity that is quantified by the SAM (Santos (2010) and (2012) perform related experiments).

Table 7. Revenue and expenditure of Portuguese Government in 2009 and the relative importance of current taxes on income, wealth, etc., (transactions D5) received from households and of social benefits other than social transfers in kind (transaction D62) paid to the households.

	Resources or Revenue (SAM row)			Uses or Expenditure (SAM column)			Balancing item
		10^6 euros	Relative importance of D5 in.. (%)		10^6 euros	Relative importance of D62 in.. (%)	10^6 euros
1. Current Account (a)		58 407	17.3		70 102	40.6	-11 695
	Gross National Income	- 34		Final Consumption	37 160		
	Net taxes on production	522		Current transactions to domestic institutions - D62 paid to households	31 215 28 483	91.2	
	Net taxes on products	19 694		Current transactions to the RW	1 726		
	Current transactions from domestic institutions - D5 received from households	37 610 10 107	26.9				
	Current transactions from the RW	615					
2. Capital Account		1 246			6 687		-5 441
	Capital transactions from domestic institutions	128		Gross Capital Formation	5 071		
	Capital transactions from the RW	1 181		Capital transactions to domestic institutions	1 301		
				Capital transactions to the RW	315		
3 = 1 + 2 (b)		59 653	16.9		76 788	37.1	-17 135

Sources: Table 3 (rows/columns 8 and 13); Statistics Portugal (INE)

(a) Balancing item = Gross saving

(b) Balancing item = - Net lending (+)/borrowing (-)

Table 8. Revenue and expenditure of Portuguese Households in 2009 and the relative importance of current taxes on income, wealth, etc., (transactions D5) paid to the government and of social benefits other than social transfers in kind (transaction D62) received from the government.

	Resources or Revenue (SAM row)			Uses or Expenditure (SAM column)			Balancing item
		10^6 euros	Relative importance of D62 in.. (%)		10^6 euros	Relative importance of D5 in.. (%)	10^6 euros
1. Current Account (a)		160 747	17.7		147 019	6.9	13 728
	Gross National Income	120 015		Final Consumption	106 206		
	Current transactions from domestic institutions - D62 received from the government	36 949 28 483	77.1	Current transactions to domestic institutions - D5 paid to the government	39 468 10 107	25.6	
	Current transactions from the RW	3 783		Current transactions to the RW	1 345		
2. Capital Account		369			5 093		-4 724
	Capital transactions from domestic institutions	192		Gross Capital Formation	7 269		
	Capital transactions from the RW	177		Capital transactions to domestic institutions	3		
				Capital transactions to the RW	-2 179		
3 = 1 + 2 (b)		161 116	17.7		152 112	6.6	9 004

Sources: Table 3 (rows/columns 5, and 10); Statistics Portugal (INE)

(a) Balancing item = Gross saving

(b) Balancing item = - Net lending (+)/borrowing (-)

5. Concluding remarks

Social Accounting Matrices (SAM) are tools for working with thesocio-economic activity of countries either empirically and theoretically, depending on whether they are presented in a numerical or algebraic version. This is the so-called SAM-based approach for studying (measuring and modelling) thesocio-economic activity of countries.

Assuming that the national accounts are the core of the statistics representing the socio-economic activity of countries, their adoption is recommended, at least as a starting point, for any study that is looking for empirical evidence about that activity. This will enable us to work with, and gain greater knowledge about, the activity that is (supposedly) observed by the national accounts, which in a SAM framework will benefit from the increased analytical content provided by the matrix format and the possibility of capturing and working with networks of linkages not captured and worked on otherwise.

From the 2008 SNA, a basic structure is proposed for a numerical version of a SAM. That basic structure is considered as a summary set of the flows that the SNA assumes to be observed and the controlling totals for other levels of disaggregation. From that structure, it is possible to study specific aspects and maintain the consistency of the whole system.

That basic structure can be filled in from an integrated economic accounts table, which represents the general structure of the SNA, identifying the institutional sectors in the economy as a whole, besides the rest of the world. That table (complemented with the institutional accounts, for higher levels of detail) and the "from whom to whom matrices", for specific transactions, allow for the disaggregation of the institutions accounts and for some work with the factors of production account. In turn, disaggregations at the level of the accounts of products and activities are made from the supply and use tables.

Disaggregations of the proposed structure do not affect the consistency of the whole system. Extensions, either from the national accounts or from other sources of information, pass through the convenient adjustment to, or the connection with, the whole system in order to maintain its consistency. This concern with consistency is a condition for ensuring that the network of linkages that underlies the socio-economic activity of countries is complete. Such consistency is only possible when production and institutions are worked on together. That network of linkages can only be identified and worked on in a matrix form in a tool like the SAM, which can be worked on not only for the observed but also for the non-observed activity of countries through the national accounts. The convenient coverage of that network of linkages is a necessary condition for capturing multiplier effects in subsequent modelling, which can provide important knowledge.

From the proposed structure, it is also proposed that work should be performed outside the matrix format with aggregates, indicators and balancing items, which can be seen as elements extracted from our working tool in order to empirically highlight our purposes. Depending on the detail of the SAM, we can therefore calculate more or less detailed aggregates, such as Gross Domestic Product (GDP), Gross National Income, Disposable Income, etc. The same thing happens in the case of the structural indicators of the functional and institutional distribution of generated income, as well as the indicators of the use of disposable income. On the other hand, the ease with which the main items in the revenue and expenditure of the institutional sectors and of the rest of the world can be extracted from the respective rows and columns of the SAM can also be seen as a great advantage.

The SAM from which all those aggregates, indicators and balancing items are extracted can be the numerical version of the reality under study or the replication(s) after running a SAM-based model(s) in order to try out policy measures. In the latter case, we will have one or more scenarios representing the impacts of those policy measures, which, when compared with the reality under study, can support the processes of policy decision-making and policy decision-taking.

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