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An empirical and theoretical approach to a country's economic activity based on a Social Accounting Matrix. An application to Portugal

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Abstract

The economic flows measured by the national accounts, which are associated with transactions of goods, services, and assets, as well as transfers, all represent interactions between institutional units, to whom legal responsibility for their actions and the fulfilment of specific economic functions is recognized. These flows are defined by the underlying system – the System of National Accounts (SNA) as being transactions. When represented in the matrix form, depending on the classification and organization of the institutional units, at the origin and the destination of the corresponding flows, the "from-whom-to-whom" transactions can be measured and modelled, benefiting from the underlying network of linkages. By adopting the nomenclatures and rules of the current version of the above-mentioned system (SNA 2008), this study uses a top-down methodology to design a matrix representation of the above-mentioned transactions - the Social Accounting Matrix (SAM). Empirical and theoretical descriptions of the economic activity of a country (Portugal is used as the illustrative case), made possible by the use of the numerical and algebraic versions of a SAM, are adopted to approach the multiplier effects of policy measures and the corresponding economic adjustments.

JEL classification numbers: E01, E16, E65.
Keywords: National Accounts, Social Accounting Matrix, Economic Adjustments.

1 Introduction

A methodology to empirically and theoretically analyze a country's economic activity is proposed through the respective use of numerical and algebraic versions of a Social Accounting Matrix (SAM). Without ignoring the fact that limitations exist, both the potentialities, and the features of the methodology are exposed and are exemplified through an application which makes use of multiplier effects of policy measures and the corresponding economic adjustments[2].
Accordingly, in consonance with the national accounts and the underlying system, square matrices are constructed with row sums equal to column sums. Resources and changes in liabilities and net worth are represented in rows, with uses and changes in assets being represented in columns. With regards the terminology used by the authors who conceived this approach, the author designed versions where

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[2] The working paper underlying this paper can be seen in Santos (2021).

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inflows, incomes, or receipts are recorded in rows, and outflows, outlays, or expenditures are recorded in columns. Thus, each cell can have two readings, according to the respective row and column. Among the references which inspired the approach adopted for this study, the following are the most relevant: Stone (1986); Pyatt and Round (1985); Pyatt (1988, 1991).

Many SAM-based approaches have been applied to different aspects of the activity of different geographical territories. Such approaches are often conditioned by the scope of the study in question and the statistical information available, and, on the whole, they are close to the one that has been adopted for this study. As an example, we highlight the following works from among those published during the 21st century, presented in chronological order of publication. Tarp, F., Roland-Holst, D., and Rand, J. (2003), analyze the structure of Vietnam's economy using a numerical version of a SAM in 2000, which is cited as being the basis of an algebraic version - a CGE (Computable General Equilibrium) model, that is not presented. Pieters, J. (2010), analyzes how the sectoral structure of growth in India contributes to household income inequality, using a numerical version of a SAM in 2002, and two algebraic versions – accounting and fixed price multipliers models. Alikaj, M., and Alexopoulos, Y. (2014), analyze the structural characteristics of the economy of the Western Greece region and its dependence on the country's economy, using a numerical version of a SAM in 2010, and an algebraic version – an accounting multipliers model. Aray, H., Pedauga, L., and Velázquez, A. (2017), analyze the structure of distribution of income and wealth in Spain, using a numerical version of a SAM (dubbed 'Financial SAM') in 2009, and an algebraic version – an accounting multipliers model, which results are decomposed through the application of structural path analysis (SPA) methodology to better characterize the effects of the interactions among agents in the financial sector. Finally, Mainar-Causapé, A., Philippidis, G., and Sanjuán-López, A. (2021), carry out a detailed analysis of job and value-added creation, sustainable growth and the use of resources or environmental impacts in the European Union member states, using a numerical versions of SAMs (dubbed 'BioSAMs') in 2010 and adopt alternative methods to construct algebraic versions in order to classify bio-based sector wealth generating properties and to identify high performance ('key') sectors.

As mentioned above, we also chose to adopt a SAM-based approach in this study, in which a method to measure and model the activity of a country is systematized and applied to Portugal in 2017. Thus, the transactions of the national accounts that are associated with the generation, distribution, redistribution, use, and accumulation of income, are represented through the interconnection of the two main groups of accounts: those of the domestic economy, and those of the rest of the world. The domestic economy is comprised of factors of production, activities (industries), and products (goods and services) accounts that are integrated in the (process of) "production" (subgroup). Current, capital, and financial accounts are integrated in the "institutions" (subgroup) of the domestic economy. For each account of the institutions (sub)group, the following five institutional sectors are identified, all of which are also distinct (institutional) sub-sectors of the national accounts, namely: financial and non-financial corporations, general government, households, and non-profit institutions serving households. In turn, the rest of the world is comprised of a single account with the same name.

Section 2 describes and quantifies an aggregated – or one could say, basic – version of the SAM, which, by adopting a top-down method, is then disaggregated in Section 3. Firstly (Subsection 3.1), this is done through a numerical version, to provide an empirical description of specific aspects of the activity of the country in study, which subsequently enables the study of the real estate activities, namely, the income they generate and the taxes they pay. Secondly, (Subsection 3.2), an algebraic version of the SAM is produced, through the adoption of an accounting multipliers model, which provides a theoretical description of the above-mentioned activity and enables, thirdly (Subsection 3.3), the construction of a scenario resulting from an experiment of a change in net taxes on the production of real estate activities, which is subsequently summarized by the macro-effects that are reflected at the level of macroeconomic aggregates.

Finally (Section 4), some concluding remarks identify aspects of both the potential and the limitations of the approach adopted, as well as the underlying methodology.

2 Basic form within the central framework of the SNA 2008

As mentioned above, our SAM-based approach is supported by the transactions defined and measured by the latest version of the "System of National Accounts" (ISWGNA, 2009), which is hereinafter referred to in its abbreviated form as SNA 2008, or simply SNA. In turn, the application used to illustrate our study refers to Portugal, whose national accounts are based on the adaptation of the SNA to Europe, that is to say, the "European System of National and Regional Accounts in the European Union" (EU, 2013), which is referred to hereinafter in its abbreviated form as ESA 2010, or simply ESA.

The SNA mentions SAMs as being ways of expressing the sequence of (national) accounts in a matrix format, in which extra details and extensive adjustments can be incorporated. The incorporation of extra details, through the disaggregation of the accounts, is considered within the scope of its central framework, whereas the incorporation of extensive adjustments is considered within the scope of the satellite accounts.

The SAM that is proposed in this paper has many points in common with the matrix form proposed by the SNA, although some differences exist with regard the organization and description of the information contained[3].

Table 1 shows the basic form of our SAM, which represents the highest level of aggregation and is the starting point for the construction of the numerical version, which is described in this section. It also is the starting point for a disaggregated numerical version and an algebraic version, which is explained in full in the following section. Table 2 presents the description of the accounts, which are represented in each row and column, as well as how they correspond with the national accounts sequence, with discrepancies mentioned as a note.

Table 1: The SAM in the basic form

	f	a	p	dic	dik	dif	rw	Total
f		T(f,a)					T(f,rw)	*f.*
a			T(a,p)					*a.*
p		T(p,a)	T(p,p)	T(p,dic)	T(p,dik)		T(p,rw)	*p.*
dic	T(dic,f)	T(dic,a)	T(dic,p)	T(dic,dic)			T(dic,rw)	*dic.*
dik				T(dik,dic)	T(dik,dik)		T(dik,rw)	*dik.*
dif					T(dif,dik)	T(dif,dif)	T(dif,rw)	*dif.*
rw	T(rw,f)	T(rw,a)	T(rw,p)	T(rw,dic)	T(rw,dik)	T(rw,dif)		*rw.*
Total	*.f*	*.a*	*.p*	*.dic*	*.dik*	*.dif*	*.rw*	

Source: Own construction, following Santos (2018 and some previous).

Each cell of the SAM in the basic form, which is identified with a "T", is followed by the initials of the row and column accounts between brackets, which represent the transactions, as defined by the SNA. Accordingly, transactions related to goods and services (products), including (non-financial) produced assets, are represented in the cells of rows/columns "p" and "a"; distributive transactions are represented in the cells of rows/columns "f", "dic" and "dik"; and financial transactions are represented in the cells of row/column "dif"[4].

Our approach, therefore, does not consider both the other flows that are recorded in the other changes in

[3] See the correspondence and the differences between the SAM, and the matrix representation of the sequence of the national accounts, as proposed by the SNA, in Santos (2021).

[4] A complete description of the SAM's cells can be found in Santos (2021).

the volume of assets and revaluation accounts, of the accumulation accounts, and the stocks that are recorded in the balance sheets.

Table 2: Correspondence, description, and discrepancies between the SAM and the national accounts

SAM accounts			National Accounts	Description
Production	f	Factors of production[(a)]	Primary distribution of income	Distribution of incomes, which may be needed for production purposes, among institutions and activities
	a	Activities[(b)]	Production	Transactions that constitute the production process
	p	Products	Goods and services	Use of available products
(domestic) Institutions	dic	Current [(c)]	Secondary distribution of income, redistribution of income in kind account	Transformation of the balance of primary income (national income) into disposable income, through the receipt and payment of current transfers
			Use of income	Distribution of gross disposable income between final consumption and saving
	dik	Capital	Capital	Transactions linked to acquisitions of non-financial assets and capital transfers involving the redistribution of wealth
	dif	Financial	Financial	Transactions in financial assets and liabilities between institutional units, and between these and the rest of the world
rw		Rest of the world	Rest of the world	Transactions between resident and non-resident units

Sources: Own construction, following Santos (2018), ISWGNA (2009), and EU (2013).

Notes on the discrepancies between SAM and national accounts:

[(a)] (-) net taxes on production and imports and (+) net property income;
[(b)] (-) net taxes on products(total);
[(c)] (-) disposable income.

As shown in Table 3, the above description can be applied to a country that measures its activity by adopting the SNA 2008, or an adapted version, as is the case of Portugal - which adopts the ESA 2010 and will be used as an illustrative case hereinafter.

Table 3: The basic SAM for Portugal in 2017

Unit: million euros

	f	a	p	dic	dik	dif	rw	Total
f		168,756					6,731	175,487
a			347,793					347,793
p		178,151	0	160,214	33,755		83,717	455,837
dic	163,016	1,988	26,344	94,338			8,535	294,221
dik				35,717	5,210		1,683	42,610
dif					3,601	17,429	9,982	31,012
rw	12,471	- 1,101	81,700	3,952	44	13,583		110,648
Total	175,487	347,793	455,837	294,221	42,610	31,012	110,648	

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

Notes:

a) As shown in Santos (2021), this table was constructed from a complete sequence of non-financial and financial national accounts, provided by the mentioned sources.

b) Cell T(rw,a) = 81,739 (imports) - 39 (taxes on products sent to the rest of the world - subsidies on products received from the rest of the world).

The above presented SAM basic form includes all the transactions measured by the national accounts, and, therefore the corresponding macroeconomic aggregates and balancing items can be calculated or directly obtained from it, such as, in this example:

. Gross Domestic Product (GDP) - expenditure approach: final consumption [T(p,dic)] + gross capital formation [T(p,dik)] + net exports [T(p,rw) – (part of) T(rw,p)] = 195,947 million euros;

. Gross National Income (GNI): compensation of factors of production received by domestic institutions [T(dic,f)] + net taxes on production and on products received by domestic institutions [T(dic,a) + T(dic,p)] = 191,348 million euros;

. Disposable Income (DI): GNI + net current transfers received by domestic institutions from the rest of the world [T(dic,rw) - T(rw,dic)] = 195,931 million euros;

. Gross Saving (S): [T(dik,dic)] = 35,717 million euros;

. Net Lending (+) /Borrowing (-): [T(dif,dik)] = 3,601 million euros (NB).

Details on the above calculations and other related calculations can be found in Santos (2021).

From this basic form of the SAM, we can say that the 'grand' totals have been identified and that, consequently, the consistency of the data (and the system) can be ensured in further levels of disaggregation for the study of specific aspects of the economic activity of a country, as is shown in the following section.

3 A SAM-based approach

3.1 The numerical version and the empirical description

In the previous section, it was shown that the "production" group in the SAM accounts is composed of the factors of production, activities, and products accounts, and that this group also records the income generated through the involvement of institutions in the process of production and the corresponding (primary) distribution, as well as the use of the available goods and services. In turn, the "institutions" group is composed of the current, capital, and financial accounts, and it records the redistribution, use, and

accumulation of income. On the other hand, the rest of the world account records the transactions between the resident and non-resident institutional units.

When it comes to studying the specific aspects of the economic activity of a country, the national accounts provide a set of possibilities for the disaggregation of the above-mentioned accounts. Returning to the application to Portugal, as shown in Table 3, the basic SAM, which has seven rows and columns, is disaggregated and is converted into a matrix with 37 rows and columns[5]. This disaggregated version can be understood to be a possible snapshot of the reality under study - in this case, Portugal in 2017, from which specific aspects for an approach for the economic adjustments of policy measures can be identified.

Contemplating possible fiscal policy measures, we next focus our attention on the net taxes on both production and products. As defined by the SNA, the "net taxes on production", represent the (other) taxes on production, minus the (other) subsidies to production that are recorded in cells T(dic,a) and T(rw,a) of the SAM in the basic form. In turn, the "net taxes on products" represent the taxes on products, minus the subsidies on products that are recorded in cells T(dic,p) and T(rw,p) of the same SAM (Table 1, with due correspondence in Table 3).

Following the nomenclatures adopted by the SNA, these cells were then converted into submatrices in the disaggregated version, with ten groups of products (p) and of activities (a), and five institutional sectors in the current, capital and financial accounts of domestic institutions (dic) – while the rest of the world (rw) remained aggregated. It was thus possible to identify, with a certain level of detail, the taxes minus subsidies on the production process of activities (industries) and on the transaction of products (goods and services), received/paid by the general government, and by the rest of the world – in this case, European Union Institutions.

To better understand these amounts, taxes and subsidies were then analyzed separately and it was possible to see that, although the transactions of "real estate services" receive no subsidies and pay almost no taxes, "real estate activities" are responsible for the payment of 33% of the total paid as "(other) taxes on production". The relative meaning of such a position is clarified when it is confirmed that the second highest taxpaying group of activities for this category is the "wholesale and retail trade, repair of motor vehicles and motorcycles, transportation and storage, accommodation and food service activities", which pays 17% – almost half of the total paid by the "real estate activities".

The taxes referred to are "taxes imposed on the producer that do not apply to products, nor are levied on the profits of the producer… consist mainly of taxes on the ownership or use of land, buildings or other assets used in production or on the labor employed, or compensation of employees paid" (SNA 2008, Paragraphs 6.50 and 7.73, 7.97). In turn, real estate activities only receive 2% of the total of the "(other) subsidies to production".

From the empirical evidence on the activity of a country, as provided by the numerical version of a SAM which has been organized as explained above, it is also possible to specify the functional distribution of the income generated by industries, that is to say, the distribution of gross added value among factors of production. Thus, the role of the "real estate activities" can be complemented by the fact that they contributed with 12% of the generated income, with 97% of that contribution being compensation of employers and own-account workers and capital – which is almost the double of the domestic average (49%).

Additional statistical sources and information regarding the methods underlying all the worked data would lead to obtaining a better knowledge of the specificities identified above and would also help avoid possible biases of the analysis carried out. In truth, a large part of published data, both of national accounts and other sources of information, is only indirectly measured. Accordingly, the knowledge of the methods used for the estimation or imputation of the data being processed plays a relevant, if not a decisive role.

On the other hand, the identification of possible categories of information which are not measured by the

[5] See the details on the structure and construction in Santos (2021).

statistical sources being used should act as a motivation to both search other statistical sources and also identify the potential evidence of a hidden economy[6]. This would make all the difference, both in this, and in any other study.

3.2 The algebraic version and the theoretical description

As detailed above, a numerical version of the SAM was previously constructed from the national accounts. It was shown that all the flows representing transactions measured by the national accounts were part of this version, which was presented first in a basic form, and then disaggregated. From this disaggregated version, it was possible to adopt an empirical approach to the economic activity of the reality under study – Portugal in 2017. In this approach, the real estate activities and services that were identified within the activities and products (SAM) accounts and the net taxes on production were the object of our focus for experimenting a change that is representative of one or several policy measures.

Having adopted the SAM-based approach, the next step is to construct an algebraic version that makes it possible to quantify the macroeconomic effects of the above-mentioned change. Supported by an accounting multiplier model, this version is systematised below, in conjunction with the corresponding theoretical description of the economic activity of the reality under study.

a) The four main assumptions, namely:

a.1) structural features of the numerical version do not change;

a.2) resources' endowment is provided and there is no full employment;

a.3) production technology is provided; and

a.4) relevant transactions are those that are measured by the national accounts, as defined by the underlying system.

b) Static analysis, at current prices.

c) SAM accounts and the corresponding transactions are organised into two main groups:

c.1) endogenous, if defined in the modelling process; and

c.2) exogenous, if defined outside the modelling process and if exerts an influence on the endogenous group.

d) Description and formalisation of the network of linkages between accounts.

To simplify: resources and changes in liabilities and net worth, represented in rows, are only mentioned as resources; uses and changes in assets, represented in columns, are only mentioned as uses.

Multiplications are identified by ".", if they are not at the end of a sentence.

d-1) Transactions within endogenous accounts: N = matrix; n = (column) vector of the corresponding row sums.

d-2) Transactions within exogenous accounts: R = matrix; r = (column) vector of the corresponding row sums.

d-3) Uses of exogenous in endogenous accounts, or injections into endogenous from exogenous accounts: X = matrix; x = (column) vector of the corresponding row sums.

d-4) Resources of exogenous from endogenous accounts, or leakages from endogenous into exogenous accounts: L= matrix; l = (column) vector of the corresponding row sums.

d-5) Total injections into endogenous accounts from exogenous accounts = total leakages from

[6] Which is understood to be undeclared and unobserved by the statistical system, although it is associated with legal and productive activities. These activities are associated with the so-called 'underground production', which is not officially declared, in order to avoid paying taxes and other contributions, in compliance with certain legal requirements and administrative procedures.

endogenous accounts into exogenous accounts:

$$i'.x = i'.l, \quad (1)$$

with i'= unitary (row) vector.

d-6) Total resources of the endogenous accounts: y_n = (column) vector of the corresponding row sums:

$$y_n = n + x. \quad (2)$$

Consequently, total uses of the endogenous accounts: y'_n = (row) vector of the corresponding column sums.

d-7) Total resources of the exogenous accounts: y_x = (column) vector of the corresponding row sums:

$$y_x = l + r. \quad (3)$$

Thus, total uses of the exogenous accounts: y'_x = (row) vector of the corresponding column sums.

d-8) Average use propensities of endogenous accounts:

-in endogenous accounts: $A_n = N.\hat{y}n^{-1}$; (4)

-in exogenous accounts: $Al = L.\hat{y}n^{-1}$; (5)

with $\hat{y}n^{-1}$ = inverse of the diagonal matrix of y_n. Thus, the structure of uses, or the initial direct effect of each additional monetary unit of the endogenous accounts' resources (with exogenous origin) is derived from the A_n and A_l matrices.

d-9) From d-1), d-4), and d-8) we can define:

$$N = A_n.\hat{y}n; \quad (6)$$

$$L = Al.\hat{y}n; \quad (7)$$

with $\hat{y}n$ = diagonal matrix of y_n.

d-10) From d-6), d-8), and d-9), it is possible the following development:

$$y_n = n + x = y_n = A_n.y_n + x = (I-A_n)^{-1}.x = M_a.\ x, \quad (8)$$

with $M_a = (I-A_n)^{-1}$ = accounting multiplier matrix. This matrix represents the global effects in the endogenous accounts' resources of each monetary unit of a change defined in d-3), with the assumptions described in a).

d-11) From d.4), d-9), and d-10), the following development is also possible:

$$l = A_l.y_n = A_l.\ (I-A_n)^{-1}.\ x = A_l.\ M_a.\ x. \quad (9)$$

Accounting multipliers can be decomposed in several different ways, as described and exemplified, for instance, in Santos (2004). On the other hand, instead of working with average propensities, it is possible to work with marginal propensities and obtain, rather than the accounting multipliers, the so-called fixed-price multipliers, as described and exemplified, for instance, in Santos (2007). The last reference is also illustrative of a work with transposed matrices, that is to say, exchanging uses by resources.

3.3 Results on the multiplier macro-effects of policy measures

From the empirical approach applied to the economic activity of our case study – Portugal in 2017, in Subsection 3.1 the "real estate activities" were identified as being the focus of interest. Accordingly, through the use of the methodology presented in Subsection 3.2, we now opt to assume fiscal policy measures that annul the value of other taxes on production paid by real estate activities, net of the other subsidies to production received by the same, which is brought about by changes in taxes and/or subsidies. In our illustrative case, the affected base values are 944 and 37 million euros, respectively. In the numerical version of the (disaggregated) SAM, these values (944 -37 ≈ 906 million euros) are recorded as resources of the general government's current account and as uses of real estate activities = 2,032 million euros; and as resources of the rest of world and uses of real estate activities = -1,126 million euros. In the case of the latter, as the amount is negative, it can be read as representing uses of the rest of the world – the European Union Institutions in our case, and the resources of real estate activities. By changing the above-mentioned values, in effect, not only are the uses of the "real estate activities" being directly affected, but also the resources of the general government and of the rest of the world.

For the algebraic version of the SAM, the account of the "real estate activities" is considered as exogenous, and all others as endogenous. Accordingly, by following the above-mentioned systematized procedures, the matrices of the average use propensities of endogenous accounts (An and Al, equations 4 and 5) were calculated, followed by the accounting multipliers matrix (Ma, equation 8). Next, in Matrix X, which, in this case, is also the vector x, the above-mentioned cells were annulled, and the new yn (total resources of the endogenous accounts) was calculated, as described in d-10) - Equation 8. New N and L matrices were calculated from this new vector and the previously calculated An and Al matrices, following d-9), enabling the completion of an "adjusted" SAM. From the latter, following the description in Section 2, the "adjusted" gross macroeconomic aggregates were then calculated, as well as the differences between them and the initial, namely: GDP, -3.7%; GNI, -4.3%; DI, -4.2%; S, -3.3%; NB, -2.9%.

Therefore, on the understanding that these percentage differences are the macro-effects or macroeconomic adjustments of possible fiscal policies measures which annulled the net taxes on the production of the real estate activities, it is thus possible to conclude that when the "real estate activities" uses are directly affected, together with the corresponding resources of the general government and of the rest of the world, the multiplier effects, which are spread throughout the matrix versions underlying our approach, resulted in a widespread negative impact.

On the other hand, the initial functional distribution of the generated income, mentioned in Subsection 3.1, revealed "adjusted" positions after this experiment, in which the income generated by the real estate activities increased by 0.41 percentage points. This increase is only relative, since the total has decreased and a part of the real estate activities suffered no change, as it is exogenous.

The above-mentioned results, together with any others that could come to light after running our model, are certainly conditioned by the corresponding assumptions that are presented in Subsection 3.2. In fact, the first defined assumption (a-1) – which supports that the structural features of the numerical version are the relevant and do not change – is limitative, and casts doubt on how it can bias the reading of the results. On the other hand, in an analysis similar to that above, in which the empirical approach was static, and the simulation made in the theoretical approach was comparatively static, the second (a-2) and third (a-3) assumptions seem reasonable. However, the fourth (a-4) may come into question when bearing in mind the remarks made at the end of Subsection 3.1. Potential doubts can also be reinforced regarding the way that the endogenous and exogenous accounts were organized, since uses and resources of the latter are not affected by the multiplier effects.

4 Concluding remarks

Supported by the national accounts and the underlying system, a SAM-based approach is proposed as a methodology to study a country's economic activity, as well as, the multiplier effects and the corresponding adjustments of changes associated, for instance, with policy measures.

For the application to the economic activity of Portugal in 2017, taxes and subsidies on the production of the real estate activities are identified as the source of both policy measures and the corresponding macroeconomic adjustments, quantified using an accounting multipliers model.

Since "(other) taxes on production" are recorded net of subsidies, the annulation of their value, such as in the case of our study, implies the admission of the existence of fiscal policy measures that can affect either taxes, or subsidies, or both. Furthermore, the uses of the real estate activities are affected, as well as the resources of the general government's current account and that of the rest of the world – which are the European Union Institutions in the case of our study. All these changes operate within the network of linkages underlying our SAM-based approach, with the corresponding multiplier effects being reflected in all the endogenous component of our matrix, which resulted in significant negative macroeconomic adjustments - which are summarized at the level of certain macroeconomic aggregates and balancing items. Other results could also be derived from replicated SAM, depending on the analysis that is required.

Both advantages and limitations can be identified regarding this approach. Accordingly, the adoption of the national accounts – both system and data – as the base source for the design and construction of SAMs provides access to a large range of users. These users could well benefit from not only the availability of (more or less) complete quantitative information, whose regularity of publication, flexibility, and consistency provides the possibility to compile time series of matrices, not only from national accounts, but also from other sources of information (e.g., business, financial, monetary, public, and international statistics). It is also possible to speak in terms of the past, present, and future; ex-ante and ex-post analysis; static, comparative static and dynamic analysis. The range of the possibilities of carrying out econometric and other types of modelling can therefore be extended. On the other hand, as shown in this study, the results obtained after running the adopted model, for any kind of simulation, through a simple worksheet, can be expressed in terms of the commonly used macroeconomic aggregates and items that are disseminated by information agencies and other more familiar means of communication.

Nevertheless, the limitations inherent in all these aspects cannot be ignored. Indeed, too much research has been carried out based on national accounts in terms of organization, methods of compilation, record, estimation/imputation, sources of data, and nomenclatures, etc. Accordingly, the national accounts have been improved and (from the author's point of view) represent the best source of information available to study the economic activity of countries. However, deficiencies continue to persist and should be present in studies supported by national accounts, even when complemented by other statistical sources. Thus, the sources and the methods underlying the data being used should not be neglected, in order to avoid biases in their reading and in the interpretation of the results obtained from the modelling phase. Finally, the limitations associated with the assumptions regarding the adopted model could also be considerable and should not be ignored.

It is also important to at least have an idea regarding which parts of our study are not measured by the adopted statistical sources, as these could potentially be of interest, and should be subject to future research – especially with regards potential "contributions" to the hidden economy.

Further developments are intended to be made, remaining within the central framework of the SNA, which would extend the same approach to the other flows and stocks, on the one hand, whilst reapplying the algebraic version presented in Santos (2009), on the other hand.

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