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Better databases for economic modelling: constructing SAMs from the SNA.

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Abstract

Greater importance will be given to the SAM as a consistent and flexible database for economic modelling, underlining how it can support disaggregated economy-wide modelling. A proposal will be made for its construction from the SNA 93, in an ESA 95 framework.

Key words: Social Accounting Matrix; National Accounts; Economic Modelling

JEL classification: C68; C82; E01

1. Introduction

The results of economic modelling could be more efficient if developed with an underlying database.

In macroeconomic modelling, such a database needs to integrate the interrelated subsystems that exist within the economy as a whole and to be adapted to the methodology chosen by the modeller. When using a general equilibrium methodology in general and computable general equilibrium modelling in particular, the most suitable database is the Social Accounting Matrix (SAM), which describes the whole circular flow of a market economy and can be considered as a flexible accounting framework, making it possible to use either top-down or bottom-up methods to break down or aggregate each account into categories without losing the consistency of the whole system.

The SAM is a square matrix in which, by convention, the entries made in rows represent resources, incomes, receipts or changes in assets, whilst the entries made in columns represent uses, outlays, expenditures or changes in liabilities and net worth. Each transaction is recorded only once in a cell of its own. These figures include both production accounts and institutional accounts, which are further subdivided into yet other accounts, defined in accordance with the modelling purposes and the available information.

2. SAMs as databases for economic modelling

Each SAM can be expressed in two versions: numerical and algebraic. In the numerical version, each cell assumes a specific numerical value, with the sums of the rows being equal to the sums of the columns. In the algebraic version, each cell is represented by an algebraic expression that together with those of all the other cells

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represents a SAM-based model, the calibration of which involves a replication of the numerical version.

On the other hand, as Pyatt (1991) stressed, 'a SAM is a framework both for models of how the economy works as well as for data which monitor its workings. Recognition of this duality is of basic importance for quantitative analysis. It implies, *inter alia*, that the accounting identities which are captured by a SAM are not to be regarded simply as consistency requirements which must be imposed on a model, but rather they should be seen as a logical consequence of the paradigms which economists have adopted for analyzing society'.

When working at a macroeconomic level, national accounts are the most convenient source of basic information, although additional sources can also be used to support the disaggregation of the SAM values and several methodologies can be used to complement each other. Moreover, the base structure of the macro-SAM, which is constructed from the national accounts, provides all the consistency required for such a database, with it being possible to extract therefrom all the macroaggregates and other economic indicators that are essential for improving our knowledge of the quantifiable side of the economy. At the same time, it will also be possible to identify the national accounting transactions included in each cell in some detail, which can represent an important step forward in the use of the algebraic SAM version.

3. From the National Accounting Matrix (NAM) to the Social Accounting Matrix (SAM)

The construction from the national accounts of a macro-SAM designed specifically for general equilibrium modelling purposes will be easier if the latter is first converted into a matrix format.

In relation to the presentation of the national accounts within the framework of the 1993 version of the United Nations System of National Accounts – SNA 93, prepared by the Inter-Secretariat Working Group and published by the United Nations Statistical Office (ISWG, 1993), as well as the application of this system to the European Union through the European System of National and Regional Accounts in the European Community of 1995 – ESA 95 (Eurostat, 1996), the above-mentioned matrix format is presented by Chapter XX of the former system (SNA 93) and by Prgs. 8.100 – 8.155 of the latter system (ESA 95).

The matrix format of the national accounts, as shown in Table 1, will be associated with the National Accounting Matrix (NAM) in order to distinguish it from the SAM, as shown in Table 2, which was constructed for modelling purposes in accordance with the work of Graham Pyatt and his associates (Pyatt, 1988 and 1991; Pyatt & Roe, 1977; Pyatt & Round, 1985) and was itself inspired upon Sir Richard Stone's works, pioneered by his 1954 article 'Input-Output and the Social Accounts'.

In accordance with the 'SAM terminology', the three first accounts of both matrices are the production accounts, while the others, except in the case of the rest of the world, are the institutional accounts. There is direct correspondence for all the accounts, except for the secondary distribution of income account, the redistribution of income in kind account (II.2&3) and the use of income account (II.4), which are all included in the current account of the (domestic) institutions (dic). From this, as shown in Table 3, it will be easier to achieve the correspondence of the cells and the identification of the national accounting transactions (the codes are shown between brackets), which can in turn be complemented or justified through the observation of the corresponding T-

accounts, given by the traditional tables of national accounts – all of which are joined together here. Due to the modelling purposes for which the SAM is designed, the main difference between these two matrix approaches to the recording of macro-data is to be found in indirect taxes, which are recorded separately by the SAM in the cells $t_{dic\,p}$,t_{nwp}, $t_{dic\,a}$ and t_{nwa}, since the other cells of this matrix are recorded at factor cost in the factors account and at base price in the activities account, whereas all of the NAM's cells are recorded at market price. The remaining differences can be considered to be unimportant details that depend on the SAM structure chosen by modellers, depending on their way of interpreting the reality they are working with.

But what really matters is the possibility, on the one hand, of constructing a consistent macro-SAM from the national accounts with the necessary desegregation required for the specific modelling purposes and, on the other hand, of identifying the SNA transactions within each of its cells, which can be considered as a grand total (SNA 93, Prg. 20.13). Thereafter, the remaining disaggregation process (from other sources) will be made easier without any loss in the consistency of the whole system, since the transactions or cells of the matrices will be transformed into submatrices, with the sum of all their cells being equal to the former cell. Several methods can be used for making the necessary adjustments to these submatrices in the macro context, with the cross-entropy method, extensively used and developed by Sherman Robinson, probably being the most suitable.

With the possibility of constructing consistent SAMs from the SNA, we are now certainly experiencing the beginning of a new analytical phase in the development of this work instrument – perhaps the third such phase, since Richard Stone, who initiated the first one, identified the beginning of the second phase with the work of Pyatt and Roe in 1977, as he mentions in his foreword to their book 'Social Accounting for Development Planning with special reference to Sri Lanka' (Pyatt & Roe, 1977).

4. Concluding Remarks

The flexibility and consistency inherent in the SAM and the possibility of its construction from the national accounts systems, notably the ESA 95, may be considered to represent major contributions towards an improved form of economic modelling.

Since SAMs can be constructed from the national accounts, time series can also be compiled of national accounting transactions and, using the available computer technology, these can be exposed to the wide range of possibilities of econometric modelling, helping in the definition and breakdown of the SAM cell contents. Most notably, it is even possible to consider qualitative variables, separate quantities and prices (using current and constant or previous year prices series) or calculate elasticities. It will then be possible to speak, for instance, about dynamic econometric SAM-based Computable General Equilibrium (CGE) models that, either in isolation or joined together in sets, will provide better policy definition and analysis, based on the use of better data. In such a case, it will also be possible to speak in terms of the past, present and future and/or in terms of ex-ante and ex-post analysis.

On the other hand, if we consider modelling techniques as a support of (socio)economic theory, better and more stable empirical evidence can help us to (re)evaluate this theory or even to (re)orient the way in which reality has traditionally been defined and conceptualized. At the same time, the design of policy making can be based on a more positive and less normative analysis.

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Table 1. *The NAM*

	0	I	II.1	II.2&3	II.4	III.1	III.2	V
0 – goods and services	t_{00}	t_{0I}	0	0	$t_{0II.4}$	$t_{0III.1}$	0	t_{0V}
I – production	t_{I0}	0	0	0	0	0	0	0
II.1 – primary distribution of income	0	$t_{II.1I}$	$t_{II.1\ II.1}$	0	0	0	0	$t_{II.1\ V}$
II.2&3 – secondary distribution of income, redistribution of income in kind	0	0	$t_{II2\&3\ II.1}$	$t_{II2\&3\ II2\&3}$	0	0	0	$t_{II2\&3\ V}$
II.4 – use of income	0	0	0	$t_{II.4\ II2\&3}$	$t_{II.4\ II.4}$	0	0	0
III.1 – capital	0	0	0	0	$t_{III.1\ II.4}$	$t_{III.1\ III.1}$	0	$t_{III.1\ V}$
III.2 – financial	0	0	0	0	0	$t_{III2\ III.1}$	$t_{III2\ III2}$	$t_{III2\ V}$
V – rest of the world	t_{V0}	0	$t_{VII.1}$	$t_{VII2\&3}$	0	$t_{VIII.1}$	t_{VIII2}	

Sources: SNA93 (ISWG, 1993); ESA95 (Eurostat, 1996).

Table 2: *The SAM*

	p	*a*	f	dic	dik	dif	rw
p – products	t_{pp}	$t_{p\,a}$	0	$t_{p\,dic}$	$t_{p\,dik}$	0	$t_{p\,rw}$
a – activities	$t_{a\,p}$	0	0	0	0	0	0
f – factors of production	0	$t_{f\,a}$	0	0	0	0	$t_{f\,rw}$
dic – current account of the (domestic) institutions	$t_{dic\,p}$	$t_{dic\,a}$	$t_{dic\,f}$	$t_{dic\,dic}$	0	0	$t_{dic\,rw}$
dik – capital account of the (domestic) institutions	0	0	0	$t_{dik\,dic}$	$t_{dik\,dik}$	$t_{dik\,dif}$	$t_{dik\,rw}$
dif – financial account of the (domestic) institutions	0	0	0	0	0	$t_{dif\,dif}$	$t_{dif\,rw}$
rw – rest of the world	$t_{rw\,p}$	$t_{rw\,a}$	$t_{rw\,f}$	$t_{rw\,dic}$	$t_{rw\,dik}$	$t_{rw\,dif}$	

Sources: Pyatt (1988 and 1991); Santos (2006).

Table 3: *Correspondence between the cells of the SAM and the NAM*

Cell		Description (SNA-ESA code)
SAM	NAM	
t_{pp}	t_{00}	trade and transport margins
t_{ap}	t_{I0}	output of goods and services (P1)
t_{pa}	t_{0I}	intermediate consumption (P2)
$t_{p\,dic}$	t_{0II4}	final consumption (P3)
$t_{p\,dik}$	$t_{0III.1}$	gross capital formation (P5)
$t_{rw\,p}$ /$t_{p\,rw}$	T_{V0} /t_{0V}	imports / exports (P7/P6)
t_{fa}	$t_{II.1I}$	gross added value or gross domestic product (B1g; D1, D4)
$t_{dic\,f}$	$t_{II2\&3\ II.1}$ ($t_{II.1\,II.1}$)	gross national income (including net property income) (B5g; D1, D4)
$t_{rw\,f}$ /$t_{f\,rw}$	$t_{VII.1}$ /$t_{II.1\,V}$	compensation of factors or primary income (D1, D4) paid to/received from the rest of the world
$t_{dic\,dic}$	$t_{II2\&3\ II2\&3}$ ($t_{II4\ II4}$)	current transfers (including adjustments made for the change in the net equity of households in pension fund reserves) within domestic institutions (D5, D6, D7, D8)
$t_{rw\,dic}$ /$t_{dic\,rw}$	$t_{VII2\&3}$ /$t_{II2\&3\,V}$	current transfers to/from the rest of the world (D6, D7)
$t_{dik\,dic}$	$t_{III.1\ II4}$	gross saving (B8g)
$t_{dik\,dik}$	$t_{III.1\ III.1}$	capital transfers within domestic institutions (D9)
$t_{rw\,dik}$ /$t_{dik\,rw}$	$t_{VIII.1}$ /$t_{III.1\,V}$	capital transfers to/from the rest of the world (D9, K2)
$t_{dif\,dif}$	$t_{III2\ III2}$	financial transactions within domestic institutions (F1, …, F7)
$t_{rw\,dif}$/$t_{dif\,rw}$	t_{VIII2} /$t_{III2\,V}$	financial transactions to/from the rest of the rest of the world (F1, …, F7)
$t_{dik\,dif}$	$t_{III2\ III.1}$	net borrowing/lending (B9)
-	$t_{II4\ II2\&3}$	gross disposable income (B6/7g)
$t_{dic\,a}$ /$t_{rw\,a}$	-	net taxes on production paid to domestic institutions (general government)/(the rest of the world) (D29-D39)
$t_{dic\,p}$	-	net taxes on products paid to domestic institutions (general government)/(the rest of the world, included in t_{rwp}) (D21-D31)

Source: Santos (2006)