Compiling Macro Social Accounting Matrix

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Abstract

Macro Social Accounting Matrices (macro-SAM) can be used to present national accounts data in matrix format using the single-entry bookkeeping technique. An advantage of a macro-SAM is that it can be consistent with the structure of Social Accounting Matrices (SAMs) used by many Computable General Equilibrium (CGE) models, which is basically a SAM structure consistent with the 1968 SNA. If a macro-SAM exists, the transition to a macro-SAM format that is grounded in SNA compliant national data. It is important to recognise two features of any macro-SAM. First, the datapoints – transaction values (TV) – are point estimates, i.e., measured with error. And second, the TVs must be complete ***and*** *consistent, i.e., consistency (equality of incomes and expenditure for all accounts) is not adequate.*

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1. Introduction

A macro–Social Accounting Matrix (macro-SAM) is a single-entry representation of (aggregate) national accounts data. The guidelines outlined in this paper are intended to provide individuals, who are endeavouring to develop a Social Accounting Matrix (SAM), with hints and suggestions when converting single-entry national accounts data into macro-SAM format. The guidelines outlined in this document assume that the available national accounts data for a country have been compiled by following the System of National Accounts (SNA) conventions. If the SNA conventions have been followed, the 'aggregate' national accounts data are likely to be organised such that a macro-SAM is a straightforward single-entry format, although they may not immediately contain all the information in a macro-SAM. The implicit presumption when undertaking this approach is that a top-down method is being followed.

It is a truism when developing a SAM that "[I]f we put all these initial estimates together [for a SAM] we reach the familiar situation: an **incomplete** and **inconsistent** social accounting matrix" (Stone, 1977, p xxiv, emphasis added). This should alert compilers of SAMs to two important requirements: the SAM must be complete, i.e., all transactions must be included, and the SAM must be consistent, i.e., all transactions must be reconciled. As will become evident, a SAM can be consistent but incomplete and that the transactions in such a SAM must be distorted. Similarly, a SAM may be complete, in the sense that there are estimates for all transactions, but inconsistent because the estimates are recorded with error.

If a SAM is used for economic analysis, it should, ideally, be compiled for a 'normal' year. One definition of 'normal' might be 'a year that is relatively free from exogenous shocks', which is evidently an opaque definition. A more practical definition might be a year that does not include major shocks, e.g., a year without a drought, a year with adequate food supplies, a year without a pandemic (covid?). Ultimately the choice of the year for a SAM is somewhat subjective. The choice should not be determined by the availability of data, if only because the dates for surveys and census are decided in advance.

A particular issue is the availability of Supply and Use Tables (SUT). For some countries, annual SUT are produced, BUT only periodically (usually) every 5 or 10 years, are these produced as exercises for fully benchmarking the national accounts whereas for other

years they estimated with varying degrees of accuracy. Hence the reliability of the individual transactions value (TV) data in SUT will vary, the most reliable will be for benchmarking years and the further from those years the less reliable may be the estimated TVs. However, some of the aggregated TVs in the SUT may be more reliable, e.g., total private (*C*), government (*G*) and Investment (*I*) consumption, gross outputs by activities, labour remuneration, etc. Hence, the initial approach taken for these guidelines is to assume that an SUT is **not** available for the chosen 'normal' year. Then, in section 5, the two options for using a SUT when compiling a macro-SAM are considered; first, when a SUT is available for the chosen 'normal' year, and second, when a SUT is not available for the chosen year.

Consistency is seemingly easily assessed: the row and column totals will equate. Completeness is more difficult; in all probability it will be impossible to be certain, empirically, that no transactions have been omitted. In such circumstances, a strategy is required to guide the determination of an acceptable approximation to completeness: in part the strategy will need to rely on theory and in part on an understanding of the economy. The development of a macro-SAM is one approach for reducing the omission of transactions.

Why develop a SAM by first compiling one, or more, macro-SAMs? The main advantage of using a macro-SAM is a close link to SNA compliant published 'aggregate' data; this makes it easier to identify the transaction values (TVs) for individual cells. In fact, a macro-SAM should follow directly from the components of national accounts detailed in the SNA. In the macro-SAM in these guidelines, it is necessary to 'reassign' data in the Allocation of Primary Income, the Secondary Distribution and the Use of Disposable Income accounts when compiling the macro-SAM. Second, a macro-SAM can help achieve the important objective of completeness: if the national accounts are complete, i.e., all TVs are quantified, then the resultant macro-SAM will be consistent, i.e., fully reconciled. If the macro-SAM is not complete, then it is relatively easy to identify the cells of the macro-SAM for which TVs are missing. And fourth, the resultant macro-SAM(s) will provide important control totals used when estimating a full SAM.

'Control totals' can be defined as the target values for the sums of the values of selected TVs in the SAM. Simple examples include row and column totals, GDP, absorption, etc.

Ideally, a comprehensive set of 'aggregate' national accounts data will be available, and therefore compiling a macro-SAM is overwhelmingly a case of identifying the datapoints for each cell in the macro-SAM. However, this may not be the case: so, the guidelines include suggestions about how gaps in the 'aggregate' national accounts data may be identified. There are three fundamental methods for identifying gaps:

1. the knowledge that some sub-matrices of a macro-SAM should always be null, i.e., all entries will be zero, is important information,
2. an understanding of the economic relationships in a country can identify cells in the macro-SAM that should contain non-zero values, e.g., government social/welfare/unemployment schemes that transfer income to households are ubiquitous, and
3. the row and column totals for the macro-SAM should equate if the national accounts have been fully reconciled, so differences can be used to locate the likely sub-matrices where transactions are missing.

The first two methods focus the search for information about transactions on the non-zero sub-matrices, while the first method has entered a substantial amount of information. The third method focuses attention on where missing information needs to be found. A common error is to assume that the default value for cells is zero: a lack of readily available data does not mean there have been no transactions, so this is a critical error.

This document is not a 'cookbook of recipes' if only because different national accounts agencies present their national accounts data in different formats with different levels of detail. The coverage should be comprehensive, hence a presumption that data points should be reported in the national accounts; this is too often not the case, and some data points will have been estimated as residuals, e.g., savings by domestic institutions.[1] This is disappointing since*, inter alia*, it runs counter to the principle that national accounts were developed to give empirical content to economic models. **Where this is the case, it will be necessary seek workarounds; it is not uncommon to find that estimates of datapoints can be derived other parts of the national accounts or inferred. A macro-SAM can help with this because it provides a structure that aids identifying workarounds**.

[1] It is notable that many economies now suppress data in SUT, ostensibly for reasons of confidentiality with respect to highly concentrated industries/activities.

These guidelines assume that blocks of accounts for the TVs for factor payments, incomes and expenditures by institutions (households, enterprises and government), taxation and savings and investment are available. These may be in a format that is SNA compliant, i.e., 'Generation of Income', 'Allocation of Primary Income', 'Secondary Distribution of Income', 'Uses of Income', 'Capital', 'Financial' and 'Rest of the World'.[2] Even if the data are not available in the standard SNA format, it is suggested that a SNA consistent macro-SAM has benefits in making the process more systematic.

The approach advocated is that of successive disaggregation. Start with highly aggregated data and progressively disaggregate the data. Hence the suggestion is to start with a macro-SAM that approximates the presumption of one entry for each sub-matrix; this is relaxed in three ways: first, separately identify selected control totals for taxes on products, production, and direct taxes; second, separately identify key domestic institutions for current expenditure and incomes, and third, allow for the consumption of fixed capital to be recorded by activity OR institution and record stock changes. The reasons are that taxes are critical to the price formation in a SAM and key policy instruments, so careful estimates of tax transactions are essential. Keeping final demand and savings by institutions explicit is important because savings are typically deduced as residuals, *aka* unknowns, so need to be understood early in the process. Once a highly aggregated macro-SAM has been developed the process of adding factor and institutional detail can be undertaken to develop what is termed a 'full macro-SAM': the process of compiling the 'aggregate macro-SAM' will have helped find where data are recorded in the national accounts and provide control totals to help identify if transactions are missing in the 'full macro-SAM'.

After compiling a 'full macro-SAM', the process of moving to a SAM can be undertaken. It will need to be decided whether the 'full macro-SAM' needs to be reconciled, e.g., to absorb any statistical adjustments into the macro-SAM: there are information theory arguments for delaying this process of reconciliation. Reconciliation can be achieved by some estimation algorithm or by apportionment (see Pyatt, 1989). Whether or not the macro-SAM is reconciled, it may be convenient to render the 'full macro-SAM' in the format of a macro-SAM that reflects the structure of SAMs used to calibrate economic models[3]. In general, the

[2] Some national accounts agencies operate using earlier versions of the SNA.
[3] The SAM format most used for CGE models reflects the SNA revision for 1968.

information content is unchanged, but the presentation can be more compact. However, it can, in some instances, be useful to apply the apportionment technique to remove accounts without undermining the information content. The transition from a macro-SAM to a micro-SAM is explored in a separate document.

The guidelines below use two, adaptable. macro-SAM templates. These are available in an Excel workbook (`macro-SAM Templates M2.xlsx`) that can be downloaded from the course site.

2. What is a Macro Social Accounting Matrix?

National accounts data are typically presented using a double-entry method for formatting accounts. A macro-SAM is a single-entry (matrix) representation of the same data. In the schema associated with the SNA the 'blocks' of accounts identified are

1. 'Production' accounts
    a. Commodities
    b. Margins
    c. activities)
2. Factor accounts,
3. Institutional accounts
    a. Representative Household Groups (RHG)
    b. Non-profit Institutions serving households (NPISH)
    c. Incorporated Business Enterprises
    d. Government
4. 'Capital' accounts
    a. savings
    b. Investments
5. 'Rest of the World' accounts.

A macro-SAM follows this structure by grouping accounts in a macro-SAM using the blocks derived from SNA 1968 and adopted by most CGE models. This has the advantage of adopting a structure that is consistent with the information content of most presentations of national accounts data, and reducing the probability of omitting data points, i.e., producing an incomplete SAM/macro-SAM.

Structure of a macro-Social Accounting Matrix

A macro-SAM is a square matrix representation of national accounts data, i.e., the standard double-entry bookkeeping presentation is transformed into single-entry system, i.e., an accounting system whereby each transaction is both an income to the account in a row and an expenditure by the account in the column. The associated workbook, `macro-SAM Template M2.xlsx`, contains two templates for macro-SAMs. A useful feature of double-entry bookkeeping is that each income to an account is also an expenditure by another

account; hence the entries in a macro-SAM, and SAM, can be derived from two sets of accounts; one for the income specification and one for the expenditure specification. These may not be the same and thus require the compiler to make decisions about the relative reliability of the two estimates, e.g., tobacco and alcohol consumption are often under reported in household expenditure data and hence the supply side data may be deemed more reliable.

In essence a macro-SAM is a matrix that summarises the national accounts at a high level of aggregation, in the same way that a macro-SAM summarises detailed transactions data. In that sense it can be seen as a reporting device it is own right or as a steppingstone to a disaggregated SAM. As such it is arguably important that when compiling a macro-SAM the account structure is ultimately conditioned by the purposes behind the resultant SAM.

If, as is the implicit presumption in this document, the objective is a SAM that will be used to calibrate price-driven whole economy (CGE) models a key concern is the identification of the components that define prices and are important policy instruments, e.g., taxes. These considerations should be reflected in the macro-SAM.

Record Keeping

Record keeping is critical. Recording where the estimates reported in the macro-SAM were derived from is very important. After a short period of time the precise location in the national accounts that provided datapoints will be forgotten. Without records replicability can be very difficult. In addition, when compiling a macro-SAM errors will occur or be found in the base data: it is important to track back.

A common method is to use a system for identifying cell entries, e.g., row (*r*) and then column (*c*) number, i.e., *r*#:*c*#, where # is a number. This is the method can then be used to compile a document that identifies the sources, and any 'adjustments' for each cell in the SAM. Sections in the documents can be based on the aggregate macro-SAM template, with subsections used to detail the information used to disaggregate the SAM.

When working with the macro-SAMs the comments facility in Excel is a useful complement to document the macro-SAM.

3. Developing an Aggregate Macro-SAM

These guidelines have been developed using the macro-SAM 'Agg macro-SAM template' in the workbook '`macro-SAM Template M2.xlsx`'. The approach is generic based on the SNA but has been influenced by compiling a macro-SAM for the UK (an arbitrary choice[4]); national accounts data for any country that follows the SNA in the compilation and presentation of national accounts could have been chosen.

The guidelines assume that Supply and Use Tables are **NOT** available for the year chosen for the SAM, i.e., the macro-SAM is constructed from 'aggregate' national accounts. If a SUT was available for the chosen year some of the data points for the macro-SAM could be taken directly from the SUT, **IF and ONLY IF** the SUT and other 'aggregate' national accounts data are fully reconciled[5]. If they are not fully reconciled, then 'adjustments' will be required. Using SUT data for estimating a macro-SAM is considered in section 5 below.

The guidelines assume that the process begins with the commodity accounts[6], because the expenditure side of the commodity accounts can be used to quantify the relationships between BASIC and PURCHASER prices and verify consistency between the commodity accounts and GDP[7] measured by the expenditure method. The additional (column) data for the activity accounts provides the basis for BASIC prices. This is a matter of preference: since the system is circular then it is immaterial where the process begins. However, it is suggested that in practice the process should begin with the commodity accounts, with the second set of accounts addressed being the activity accounts. Thereafter, it may be convenient to work through the accounts in the order they appear in the SNA and the macro-SAM template.

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4 Except in respect to the matter (handicap) of language, which limits the author to countries using English.

5 In the SNA it is presumed that SUT are used to benchmark national accounts. But this is not always straightforward. First, while SUT may be produced annually the benchmarking may only take place periodically, e.g., every 5 or 10 years, with the intermediate tables being inferred on less complete information. Second, national account aggregate may have been revised since the benchmarking exercise. And third, the choice of benchmarking year is often made some time in advance, and the chosen year may not be 'normal'.

6 This choice reflects a British tradition that is arguably consistent with the concept of 'consumer sovereignty'. It is common to find USA tables present the activity/industry accounts in the first row(s) and column(s): the (theoretical) reasons for this are a mystery to me.

7 GDP from the income side requires recording indirect taxes which is less straightforward.

NB: Some cells in the macro-SAM will be known to have **ZERO** TVs. The knowledge of **ZERO** TVs is valuable. **BUT**, TVs between an institution and itself may be **ZERO** in the aggregate but **NON-ZERO** when the institution is disaggregated, e.g., inter RHG transfers.

Aggregate macro-SAM Template

The suggested 12 accounts for an aggregate macro-SAM are detailed in Table 3.1. The presumption that you start with highly aggregated data points, which (a) makes it simpler to find data points, and (b) makes it easier to identify areas of the SAM where data points are more limited. The dimensions of this macro-SAM could be reduced, or increased, but the suggested selection seeks a balance between detail and simplicity; the sub matrices of the macro-SAM will be referenced by the account numbers in row *7* and column *A* in the template. In the template several subsidiary calculations have been included, these include:

1. checks that the calculated row (in column *V*) and column (in row *28*) are equal to the totals taken from the national accounts – see checks on column/row totals.
2. a check for equality of calculated row and column totals (row *30* of the spreadsheet), NB: if the number of accounts is changed then the formula in row *30* and column *V* of the spreadsheet will need to be deleted and then reset,
3. a check on the published GDP total and the calculated GDP, from the expenditure side – see cell *E:45*,
4. checks to ensure that the sums of the totals entered for the components of each category are equal to published aggregates.

You may need to adjust the formulae depending on any restructuring of the aggregate macro-SAM.

It is unlikely that the checks will all be passed immediately. First, it will take time (and practice and patience) to find data for all the cells; the checks should help to guide the search for data points. Spending time now with a highly aggregated macro-SAM is usually time efficient. And second, it is not certain that the national accounts data will be fully reconciled, even if there are no typographical errors. A fact best found early.

NB: with this macro-SAM all the entries will be scalars.

The step-by-step guidelines are one way to go about the process of compiling a macro-SAM. Multiple options are available. However, these step-by-step guidelines emphasise an important principle; the aim of the process is to collect 'control' totals that will be useful as the macro-SAM, and then SAM, are progressively disaggregated.

'Known' ZEROs

The first step is to enter 'known' ZEROs into the aggregate macro-SAM. If in doubt assume entries are non-ZERO. **NB**: ZERO in the aggregate macro-SAM may be non-ZERO in the disaggregated macro-SAM.

Table 3.1 Accounts for an Aggregated macro-SAM

Category	Accounts
Commodities	Commodities
Margins	Trade and transport services
Activities	Activities
Factor accounts	Factor payments
Institutions	Households,NPISH,Enterprises,Govt
Taxes & Subsidies	Net taxes on products
	Net taxes on production
	Income taxes
Capital	Savings (Gross)
	Stock Changes
	Gross Fixed Capital Formation
Rest of World	RoW - Current
Totals	

Commodity Accounts

One way to start with the commodity accounts is the identification of *C*(onsumption), *G*(overnment), *I*(nvestment), and *X* (export *fob*) expenditures, i.e., incomes (rows) to the commodity account. *C* and *G* are recorded as expenditures by institutions on commodities (1:5), there may also be data for NPISH but commodity expenditure by enterprise should be zero. Gross Fixed Capital Formation (GFCF) (1:11) may or may not include stock changes (1:10). Exports (fob), *X*, will be in (1:12). All should be valued at purchaser prices

(sometimes expressed as 'market' prices). In addition, imports (*cif*), *M*, will be in (imports) (12:1) so that GDP can be calculated as $C + G + I + X - M$; (E42) this is a useful first check.

This leaves two gaps in the definition of total income to the commodity account: margins (1:2) and intermediate inputs (1:3). If total demand at purchaser prices (1:13) is reported an estimate of the sum of the two gaps is known, so it is the split that remains to be known.

Turning to the supply side, four estimates are required: domestic supply at basic prices (3:1), net taxes on commodities/products, i.e., taxes on commodities (positive) plus subsidies on commodities (negative values) (6:1), margins (2:1) and total supply or demand at purchaser prices (13:1). All these estimates should be reported in the national accounts data.[8] Estimates of the value of domestic trade and transport margins may be the least accessible, but if estimates of the other three are available an estimate of margins (2:1) can be calculated. Given an estimate of expenditure on margins (2:1) an estimate of demand for margins (1:2) is known, since they are equal, and the split between demand for margins and intermediate inputs is known.

There are two common issues that can arise. Trade and transport margins may have been included in the value of total demand at purchaser prices, even though the entry in the cell 1:1 should be zero, i.e., demand and supply of margin services are identical. Second, the value of imports should be recorded carriage, insurance and freight (*cif*) paid, but may have been recorded inclusive of import duties, i.e., valued at basic prices, in which case double counting can have taken place by including import duties in the net taxes on commodities.

Activity Accounts

For the activity accounts it is helpful to start with the value of domestic production at basic prices (3:13); this will also be the total income to the activity account and therefore the total value of expenditure by the activity account.

An important design feature of a SAM is that factors are ONLY employed by activities, which determines how activities must be defined.

[8] Some times national accounts only report net indirect (and direct) tax revenues, so it may be necessary to delve deeper.

Completing the activity accounts requires estimates of payments to factors (4:3) and net taxes on production (7:3), i.e., taxes plus (negative) subsidies, which combined are value added.

Account Totals

The next step is to collect estimates of the row and column totals for the rest of the accounts. It is good practice to collect estimates of total resources/incomes and estimates of total uses/expenditures for each account and ensure that they equate; this will help confirm that the correct data have been collected from the national accounts, and that the available data are consistent. Typically, national account data are presented in tables (as T-accounts) for each of the categories, so this process will aid familiarization with the data tables.

It is tempting to start collecting account totals for the factor accounts and to work down and across the categories. However, it may be easier to start with the institutional accounts; the choice will depend on the accessibility of the data.

Once the totals are identified, the process of filling in the other TVs can begin; **this can be frustrating**.

Factor Accounts

At this level of aggregation, the focus is on the total expenditure by domestic activities on factors: the sum of remuneration to labour, mixed incomes[9] and gross operating surplus (GOS) (4:3), and net taxes on production (7:3) (later this should be broken out to separately identify taxes and subsidies). Thes data should complete the activity accounts.

The expenditure by the factor accounts is usually less straightforward. A SAM presumes that **domestic** factors are owned by resident **domestic** institutions. The definition of domestic is determined by residence not by nationality But, domestic factors can be used in other economies and that foreign factors can be used by domestic activities. Hence estimates are required for 'imports' of foreign factor **services** (12:4) and exports for domestic factor **services** (4:12); these are often dominated by capital services, but labour services are also

[9] 'Mixed income' is where national account agencies have not distinguished between remuneration to labour and gross operating surplus.

important, because how different factor incomes are distributed to institutions. Such estimates should be available from the balance of payments data for the current account.

The final component is an allowance for depreciation, which is part of domestic savings (9:4). A desirable source of estimates is the difference between GOS and net operating surplus (NOS), but this source may be unreliable. Importantly the definition of depreciation is economic depreciation, the proportionate reduction in the value of capital services, **NOT** accounting depreciation. Hence total payment for domestic factors services (5:4) is defined as expenditure by domestic activities on factors (4:3) plus exports of factors services (4:12) less imports of factor services (12:4)

Institution Accounts

For the aggregate macro-SAM institutional accounts are not disaggregated to avoid, for now, the problems presented by 'mixed incomes'.

Total income to all institutions is defined as payment for domestic factor services (5:4), which has been derived from the factor accounts, plus net indirect (5:6 and 5:7) and direct tax revenues (5:8) and total transfers from the rest of the world (5:12).

Net indirect tax revenues on products (6:1) and production (7:3) are already quantified and therefore can be assigned to (5:6) and (5:7). Income taxes are slightly more complicated since the direct taxes paid by households, aka income taxes, and enterprises, aka corporation taxes, must be quantified to assign direct tax payments by institutions (8:5), which can then be assigned to (5:8).

Initially transfers to and from the rest of the world appear trickier because there are so many potential components, e.g., remittances, aid, grants, etc. In an ideal world, the balance of payments data for the current account will distinguish between the various international transactions on the current account and then all the components can be quantified; in this case (5:12) and (12:5) will be residuals, when net foreign savings (9:12) are quantified as the difference between the trade balance and the current account balance after net transactions between the factor and institution accounts with the rest of the world. However, if the data are not detailed enough, a first estimate of the net transfers can be derived from the balance of payments data. Net foreign savings (9:12) can be quantified as the difference between the

trade balance and the current account balance, which means that net foreign transfers by institutions are a residual.

Given an estimate of total institutional income, an estimate of gross savings by domestic institutions (9:5) can be derived as a residual. This is often how estimates of gross domestic savings by institutions are derived, but it is important to carry out a 'reality' check, e.g., if domestic savings are negative after deducting estimates of government savings/borrowings this is unlikely to be a sustainable situation, which implies either an error in the data or that the chosen year is not normal.

Tax Accounts

The tax accounts are important because they provide the first set of control totals for tax instruments that are critical policy instruments.

Net taxes on commodities/products, i.e., taxes on commodities (positive) plus subsidies on commodities (negative values) (6:1), are a major component of the differences between basic and purchaser prices. The tax instruments included in net taxes on products are import duties, export taxes, general sales taxes (GST), value added taxes (VAT), excise taxes, e.g., on alcohol, tobacco, fuels, etc., any economy specific commodity taxes, and various subsidies on commodities. Some subsidies may be recorded as net taxes, but care needs to be taken to separate out taxes and subsidies when some commodities experience one or the other. Net taxes on production (7:3), i.e., taxes plus (negative) subsidies, are taxes/subsidies levied on production. These may be levied on factors used in production and/or gross output. Production subsidies are particularly important policy instruments.

Income taxes are slightly more complicated since the direct taxes paid by households, aka income taxes, and enterprises, aka corporation taxes, must be quantified to assign direct tax payments by institutions (8:5). Again, these totals should be reported in the national and/or government accounts. It is important not to confuse taxes on income with taxes on 'wealth', e.g., Capital gains taxes (CGT), inheritance tax (IHT), etc., which may be important to government income but need to be modeled differently.

Capital Accounts

The capital accounts are important from the point of view of current consumption and future capital stocks. The savings/income side of capital accounts is always tricky and often involves imputation of selected TVs as residuals.

The macro-SAM templates treat purchases of commodities by Gross Fixed Capital Formation (GFCF) account (1:11) as the only purchases by that account. In the same way, purchasers (positive and negative) of commodities are the only transactions by the Stock Changes account (1:10). This means that the expenditure estimates for these accounts define the incomes the accounts receive (9:10 and 9:11) from the savings account.

The third expenditure item for the savings account is domestic savings to the rest of the world (12:9). In an ideal world, the balance of payments data for the current account will distinguish between the various international transactions on the current account, e.g., remittances, aid, grants, etc., such that net foreign 'savings, (9:12 or 12:9) are quantified as the difference between the trade balance and the balance of other transactions on the current account. This is often reported as the external balance, i.e., the net difference between all imports and exports with the rest of the world.

My preference is to treat net foreign 'savings' as positive or negative income transactions to the savings account (9:12), but the opposite choice is equally valid.

Given total expenditures by the savings account, the total income to the savings account will be made up of depreciation (9:4), savings by domestic institutions (households, enterprises and government) (9:5) and foreign savings (9:12). Some estimates of components of domestic savings may be reliable, e.g., government savings/borrowings, but others will not be reliable. Hence the practice, following Stone, of using a residual to balance the savings account.

International Accounts

The values of exports (*fob*) (1:12) and imports (*cif*) (12:1) will be in the national accounts, with the difference being the trade balance. The next value needed is the current account balance, which should also be in the national accounts, with the difference between the two equaling net value of other transactions on the current account. This net value needs to be

allocated between the factor, institution and savings account transaction with the rest of the world.

Hence estimates are required for 'imports' of foreign factor **services** (12:4) and exports for domestic factor **services** (4:12). If these values are not available from the balance of payments data for the current account, either gross or net, an estimate of net transfers can be calculated so that the factor accounts clear.

Institution transfers to and from the rest of the world are trickier because there are so many potential components, e.g., remittances, aid, grants, etc. Ideally, the balance of payments data for the current account will distinguish between the various international transactions on the current account and then all components can be quantified; in this case (5:12) and (12:5) will be residuals.

The final item is savings from the rest of the world (9:12). The balance of payments data for the current account should distinguish between the various international transactions on the current account, e.g., remittances, aid, grants, etc., such that net foreign 'savings, (9:12 or 12:9) are quantified as the difference between the trade balance and the balance of other transactions on the current account. This is often reported as the external balance, i.e., the net difference between all imports and exports with the rest of the world.

All too often the propensity is to assume that apparently missing transactions data mean that the estimated values of the cell's TV is zero. In those circumstances compilers are induced to use estimation software to reconcile, i.e., render consistent, the matrix. The outcome will be an incomplete but consistent matrix in which the recorded TVs are biased.

4. Developing a Full Aggregate Macro Social Accounts Matrix

These guidelines have been developed using the full macro-SAM 'Full macro-SAM template' in the workbook '`macro-SAM Template.xlsx`'. The approach remains generic, based on the SNA, but the selection of institutions, tax and factor accounts may need adjusting to be consistent with the country for which the macro-SAM is being developed; the template includes several tax instruments so that some adjustments can be made without needing to change any calculations. When compiling the aggregate macro-SAM you should have learnt much about the accounts relevant to the country being analysed and the available data in the national accounts. Thus, the lessons learnt while compiling the aggregate macro-SAM will be important in guiding the choice of accounts and indicating where in the national accounts the sought-after estimates can be obtained.

As will rapidly become apparent some of the entries in the aggregate macro-SAM will carry over without change to the full macro-SAM while others can be used as controls totals to verify that the additional data points are complete and consistent with the aggregates. However, it needs to be borne in mind that as information is added it may become apparent that the datapoints in the aggregate macro-SAM may be unreliable and/or incorrect, if incorrect they should be revised.

As with the aggregate macro-SAM, the guidelines assume that the process begins with the commodity accounts, because the expenditure side of the commodity accounts can be used to quantify the relationships between BASIC and PURCHASER prices and verify consistency between the commodity accounts and GDP measured by the expenditure method. The additional data for the activity accounts provide the basis for BASIC prices. This is a matter of preference: since the system is circular then it is immaterial where the process begins. However, it is suggested that in practice the process is arguably best begun from either the commodity or the activity accounts, with the second set of accounts addressed being the ones not chosen as the start point. Thereafter, it may be convenient to work through the accounts in the order they appear in the SNA and the macro-SAM template.

The key objective of the full macro-SAM is the identification of control totals for institutions, tax instruments and factors. The logic is based on info-metrics; all information is

important and all available information should be used without making uninformed assumptions.

Full macro-SAM Template

The suggested 35 accounts for an aggregate macro-SAM are detailed in Table 4.1. The dimensions of this macro-SAM may be changed, but you should only need to change the dimensions if you want to add extra accounts (you can of course relabel accounts to match the labels to your economy). The main reasons for this are likely to be the availability of data for additional tax instruments and/or differences in the institutional structure, e.g., an identification of public sector (government) owned corporations, aka parastatals. While the aggregate macro-SAM sought a balance between detail and simplicity; the full macro-SAM seeks information about potential control totals even if this makes the process more difficult.

In the template several subsidiary calculations have been included, these include:

1. checks that the calculated row (in columns AP and AR) and column (in row 48 and 50) are equal to the totals taken from the national accounts,
2. a check for equality of calculated row and column totals (row 54 of the spreadsheet), NB: if the number of accounts is changed then the (transpose) formula in row 52 of the spreadsheet will need to be deleted and then reset,
3. a check on the published GDP total and the calculated GDP, from the expenditure side – see cell E:65,
4. checks that to ensure that the sums of the totals entered for the components of each category are equal to published aggregates.

You may need to adjust the formulae depending on any restructuring of the full macro-SAM.

It is unlikely that the checks will all be passed immediately. First, it will take time (and practice) to find data for all the cells; the checks should help to guide the search for data points. And second, it is not certain that the national accounts data are fully reconciled, even if there are no typographical errors.

Table 4.1 Accounts for a Full macro-SAMs

Category	Accounts
Commodities	Commodities
Margins	Trade and transport services
Activities	Activities
Factor accounts	Labour
	Gross operating surplus
	Mixed income
Taxes & Subsidies	Import duties
	Export taxes
	VAT
	Excise
	Gneral sales tax
	Other taxes on products
	Production 1
	Production 2
	Income - Households
	Income - Corportions
	Current Taxes
Subsidies	Imports
	Products 1
	Products 2
	Producation
Institutions	Households
	NonProfit Institutions Servong Households
	Financial Enterprises
	Non-Financial Enterprises
Government	Social Contributions
	Current transfers
	Income
	Expenditure
Capital	Savings (Gross)
	Consumption of Fixed Capital
	Stock Changes
	Gross Fixed Capital Formation
Rest of World	RoW - Current
	RoW Capital
Totals	

Mixed Incomes

The use of the catch-all 'mixed incomes' in the SNA and national accounts is a major issue for those wanting to compile a SAM for use in economic analysis. The problem arises for two reasons. In economic activities varying proportions of gross output are accounted for by small and self-employed businesses where the distinction between 'payment' for the owner's labour services and Gross Operating Surplus (GOS) is opaque. Such businesses exist in most activities/industries but are most common in agriculture, retail and services. A such, the problem is simple; the 'mixed income' category is used where the compilers of national accounts do not have enough information to distinguish between returns to the broadly defined categories of remuneration to labour and GOS.

But economic models typically need to distinguish between labour, capital and land as factors. The solution is less straightforward. When compiling a SAM as some point in the process assumptions need to be made to split mixed incomes between labour and GOS.

The problem is made more difficult because of the need to split GOS between returns to capital and returns to land/natural resources.

At this stage in the process retaining the mixed income category is appropriate, but it is important to recognise that it will need to be addressed.

Tax Instruments

Tax instruments are critical components of economic models that all too often are inadequately addressed and therefore differences in how tax instruments operate are ignored. This may be understandable in accounting terms because the data are often hard to access, but in terms of an economic model it is problematic.

The accounting and economic model requirements for tax transactions are identical: the SAM needs to record TVs and the government revenues from different tax instruments. The focus of attention then is on the applied tax rates NOT the published/headline rates. The accounting problem is therefore to identify the TVs but there is an information gap with respect to the differences between the applied and headline tax rates.

At this stage in the process the objective is to collect data about the revenues raised from each major tax instrument to provide control totals when estimating the micro-SAM.

Note: there will be residual categories for taxes on products, production, factors and institutions.

Step-by-Step Guidelines

The step-by-step guidelines for the full macro-SAM are broadly the same as those for the aggregate macro-SAM: they are one way to go about the process of compiling a macro-SAM and to a greater or lesser extent reflect personal preferences. Multiple options are available. However, these step-by-step guidelines emphasise an important principle; the aim of the process is to collect control totals that will be useful as the macro-SAM, and then SAM, are progressively disaggregated and estimated.

Known' ZEROs

The first step is to enter 'known' ZEROs into the aggregate macro-SAM. If in doubt assume entries are non-ZERO. **NB**: ZERO in the aggregate macro-SAM may be non-ZERO in the disaggregated macro-SAM, e.g., inter household transfers are net zero for a single aggregate household.

Commodity Accounts

The entries in the row of the commodity accounts are the same as for the aggregate macro-SAM, i.e., *C*(onsumption), *G*(overnment), *I*(nvestment) and *X*(export) expenditures, but with one addition: an estimate of the demand for trade and transport margins recorded in 1:2. This value will be same as the entry for the supply of trade and transport margins recorded in 2:1. As before, with the addition of *M*(imports (34:1) GDP, from the expenditure side can be calculated as $C + G + I + X - M$; this is a useful first check.

The main additional information comes from disaggregating the net taxes on commodities/products. The choice of tax instruments will be country specific. As a minimum it would be expected to include estimates of taxes (7:1) and subsidies (18:1) on imports, Value Added Taxes (VAT) (9:1) and other taxes (12:1) and subsidies (19:1 and 20:1)[10] on products. NB: subsidies are recorded as negative values and taxes as positive values. In the template an account is added for excise taxes (15:1); the reason for this is that it is helpful to

[10] Where different subsidies operate in different ways, e.g., lump sums, output/input quantities, they should be separated.

distinguish between taxes that levied *ad valorem*, e.g., VAT, and those levied on quantities, e.g., excise taxes.

NB: imports (*M*) in GDP from the expenditure side are valued at basic prices, i.e., imports valued *cif* (44:1) plus import duties (7:1) and subsidies (18:1). This should be double checked against the estimate for GDP.

So together with domestic supply at basic prices (3:1) plus imports at basic prices plus taxes and subsidies on products and trade and transport margins the components that define purchaser prices, i.e., the basis for prices in the commodity row, have been defined.

Activity Accounts

The value of domestic production at basic prices (3:1) is the same as in the aggregate macro-SAM and will also be the account total for income to the activity account and therefore the total value of expenditure by the activity account.

Completing the activity accounts requires estimates of payments to three 'factors': labour (compensation of employees) (4:3), gross operating surplus[11] (5:3) and mixed income (6:3). Mixed income is recorded where the separation of factor payments between labour and gross operating surplus is not 'transparent'; it is overwhelmingly made up of returns to self-employment.

It is also useful to separate out net taxes on production (13:3 and 14:3) from (negative) subsidies on production (21:3). Any taxes/subsidies associated with the use of factors by activities should also be recorded (17:1).

The entries for the commodity and activity accounts can be obtained from Supply and Use Tables (SUT), if the SUT are for the same year. But, building them up from the national account totals will subsequently facilitate the incorporation of SUT estimates from a period different to that used for the macro-SAM.

Account Totals

The next step is to collect estimates of the row and column totals for the rest of the accounts; some of these will be identical to those in the aggregate macro-SAM.

[11] Gross operating surplus is not solely the return to capital; it is the return to all other factors not separately identified.

It is good practice to collect estimates total resources/incomes and estimates of total uses/expenditures for each account and ensure that they equate; this will help confirm that the correct data have been collected from the national accounts and that the available data are consistent. Typically, national account data are presented in tables for each of the categories.

Once the totals are identified the process of filling in the other TVs can begin.

Factor Accounts

The split between factor TVs here is matched to the split found in published national accounts and most SUT. The estimates should come from the national.

It is also necessary to collect data for any factor subsidies. These can be difficult to find but should have been included in estimates of net production taxes; a difficulty is encountered when trying to determine whether the subsidies are paid in respect of factor use or output.

Tax and Subsidy Accounts

This is a crucial component since taxes and subsidies are key policy instruments: it is much neglected and all too often the distinction between different taxes is ignored and consequently behavioural tax relationships in models is simplistic.

The first step is to identify the key tax instruments in the economy by the accounts to which they apply. The most detailed will usually be those for commodities, while those for activities and factors may be opaque, and those on institutions the most straightforward. The 'Full Macro SAM template' contains a set of suggested tax instruments and subsidies that should be adequate for the first pass on the estimates of tax REVENUES and subsidy EXPENDITURES by different instruments to breakdown the summary revenues developed for the aggregate macro-SAM.

NB: There almost invariably needs to be a residual category for each of the aggregates in the aggregate macro-SAM.

Finding data on the revenues/expenditures can be tedious. In theory they should be reported for each instrument in the government accounts, but all too often this information is not published (withheld??). Nevertheless, the effort needs to be made now since revisiting this topic when the final SAM is criticised for lack of detail means that all the SAM estimation procedures should be redone.

Some notes on different tax instruments may be useful.

1. Import duties: import duties can be levied in various ways, e.g., *ad valorem*, quantities, quotas, etc., so depending on the trade regime the total revenue for each component is important. Also note that many countries have preferential trade agreements (PTA) and this may mean that the rest of the world account needs segmenting.
2. Export taxes: these are less common in developed economies, but border taxes can be very important in some developing countries. Care needs to be taken to differentiate between export taxes, i.e., taxes on exported commodities, and royalties etc., charged on mineral resources, i.e., taxes charged on production by activities or linked enterprises.
3. Value Added Tax: VAT are taxes on commodities that are paid by households and NPISH.[12] VAT is usually applied *ad valorem*. It is **NOT** a tax on value added paid by activities, which are taxes paid on factor use. VAT systems are being widely adopted because they are less distortionary than GST despite the higher operating costs.
4. Excise taxes: these are taxes paid on commodities where the tax is usually applied on the quantities of commodities purchased, e.g., tobacco, alcohol, fuels.
5. General Sales Tax (GST): These are taxes paid on commodities by all agents. They are mostly applied *ad valorem*. These are being phased out because they can distort production incentives. But they are cheaper to operate than VAT.
6. Factor taxes: These are complicated, especially since they can be paid for by activities or factors and are often lumped together with other taxes on production.
    a. Factor use taxes: these are paid for by activities and can vary by factor. A complication is that some production subsidies are paid based on factor use.
    b. Factor 'income' taxes: these paid for by factors, especially labour through taxes such as national insurance.
7. Income taxes: The distinction between household income taxes and corporation/enterprise taxes is important.

[12] Complications can arise due to the operating of VAT thresholds below which, for firms below the threshold, VAT is not collected on sales and not rebated on input expenditures.

There are taxes on wealth, e.g., inheritance taxes (IHT) and capital gains taxes (CGT), and property, e.g., local government taxes/rates, that need to be borne in mind. These are taxes levied on wealth and property (part of the capital accounts) not on income (part of the current accounts) but provide income to the government's current account, i.e., are part of total income to the government. These can be treated as transfers between households and the government, but because wealth is not explicitly tracked it is difficult to define a behavioural basis for such transfers.

Ideally estimates are available from the government accounts, but when missing work arounds are necessary. These options are reviewed below.

Some related issues are addressed by the financial accounts chapter in the SNA.

Household Accounts

With households the expenditure details may be the most accessible. Consumption (1:22) is known so the next target estimates are income taxes (15:22) and savings (30:22) followed by remittances (expenditures abroad) (22:34). The most difficult to access will be transfer between non-government domestic institutions transfers/expenditures (22:22 to 25:25) and transfers between non-government institutions and the government (26:22 to 29:25).

Savings by households (30:22) are always difficult to estimate because there are interactions between savings and inter-institution transfers, especially with regard to taxes on wealth and poverty. Estimates of these expenditure transfers can be difficult to acquire because of limited data. But if the account totals are known then estimates of these, in total, will be known, and as more estimates are entered into the macro-SAM the more likely are estimates of these transfers to be found.

On the income side the largest source will be incomes from factors (22:4 to 25:6), but this element is complicated by several considerations. Remunerations to labour will go to domestic households (part of 22:4) and the rest of the world (22:34). Mixed incomes will overwhelmingly go to domestic households, so this is a good starting away assumption. The issue of mixed incomes will need to be addressed when moving to a full SAM.

A substantial proportion of 'mixed income' will go directly to households: the whole of the labour service component, most, if not all, of the capital component, and that part of payments for land and natural resource services from land not owned by enterprises.

Some of net operating surplus (NOS) will go to households, but this share typically decreases as economies become more developed, i.e., the role of enterprises increases, and the proportion going to enterprises increases; these may be private or parastatal enterprises.[13]

Non-Profit Institutions Serving Households (NPISH) Accounts

Most incomes to NPISH will come from transfer by domestic and foreign institutions, which are difficult to estimate, and most expenditures will be on commodities. One approach is net out transfer expenditure between NPISHs and other institutions and assume NPISHs do not pay income taxes or save, i.e., limit NPISH's expenditure to current consumption. This defines income as being equal to current consumption and reduces the estimation problem to determining the shares of NPISH incomes from different sources.

Enterprise Accounts

Expenditures by the enterprise accounts will dominated by savings (30:24 and 30:25), income/corporation taxes (16:24 and 16:25) and payments to the beneficial owners of the enterprises (households (22:24 and 22:25), government (28:24 and 28:25) and the rest of the world (34:24 and 34:25), i.e., foreign owners. Consumption expenditure should be zero; note that GDP does not include enterprise expenditure on commodities.

A large proportion of NOS will be paid to enterprises (private and government owned), and this proportion will increase as an economy becomes more developed and self-employment less important. But some of NOS will go directly to households through unincorporated business enterprises. Some of mixed incomes may accrue to enterprises through ownership of land and natural resources, but this will be difficult to identify.

Government Accounts

The template distinguishes between income and expenditure by the government account; this a deliberate as part of a strategy to develop estimates of inter-institutional transfers. The government T-accounts should provide estimates of total income and expenditure (row and column totals).

[13] In some SAMs ALL of NOS is allocated to the enterprise accounts. This assumption is always wrong and especially so in lesser developed economies.

Starting on the expenditure side: estimates of *G* (1:29) – government current expenditure on commodities, government borrowings/savings (30:29) and foreign expenditures (34:29) should be available. The unaccounted expenditures – residual - should be accounted for by transfers TO other domestic institutions.

For the income side government: income will accrue from tax instruments (28:7 to 28:21) – noting that subsidies are treated as negative taxes, government owned institutions (28:22 to 28:25) and transfers from RoW (28:34). The unaccounted incomes – residual - should be accounted for by transfers FROM other domestic institutions.

This provides two estimates for transfers between other domestic institutions and the government. The published data may go some way towards breaking these aggregates down, but most likely disaggregation will require additional data, e.g., from household income and expenditure data.

Importantly estimates of government revenues from wealth and property taxes have not been recorded, but they should have been collected ready for use when moving to a full SAM. In the meantime, using estimates of the net values of transfers can serve as an important placeholder.

Capital Accounts

A reason for only recording GFCF (all positive) (1:33) and Stock Changes (1:32) (a mix of positive and negative) expenditures on commodities is that it provides simple estimates of two of the three expenditures from the savings account (30:33 and 30:32). The third is savings used to purchase foreign assets (30:34) for which estimates should be reported in the national accounts. Hence an estimate of total savings can be verified (30:36).

Savings will be made up of consumption of fixed capital/depreciation (30:31). This should be economic, not accounting, depreciation and may be recorded in several ways. It can be assigned to activities (31:3), i.e., activity specific, or to capital factors (GOS and mixed income) (31:5 and 31:6). It may, rarely, be recorded by the institutions that own the assets (31:22 to 31:25). Control totals for the consumption of fixed capital (31:36) should have been included as part of the account totals since they will be implicit in the national accounts. Some estimates are essential.

Savings/borrowings by the government (30:29) should be explicit in the national accounts as should estimates of foreign savins used to purchase domestic assets (30:34). This leaves savings by domestic institutions (30:22 to 30:25). The simplicity of expenditures by enterprise accounts (income taxes, transfers to institutions (domestic and foreign that own enterprises) and savings (30:24 and 30:25) make deriving estimates easier, although estimates of transfers are always tricky. This leaves savings by households (30:22) and NPISH (30:23) that are always tricky and hence the common habit of estimation as residuals.

Rest of the World Accounts

The rest of the world accounts will have largely been completed as elements of the other accounts, and/or be available from the aggregate macro-SAM, as should the current account balance. However, it is important to recognise that other estimates may not be 'correct' and therefore it is good practice to verify that the estimates in the rest of world accounts in the national accounts are consistent with the estimates reported in other national accounts.

Evaluating the macro Social Accounting Matrix

If the national accounts are complete and have been fully reconciled the row and column totals should equate. If they do equate, then at this level of aggregation it may be reasonable to expect that the accounts are complete, but even so it will be valuable to carefully examine the accounts to ensure that there is no reason to believe that substantive transactions are missing. The most likely candidates are transaction of an account with itself, e.g., inter-household transfers; these may have been netted out at this level of aggregation but may be important as the database is disaggregated.

Differences between row and column totals provide useful information. They indicate that transactions may be missing, mislocated or incorrect, with the intersection of rows and columns for which difference in totals exist indicating the likely cells causing the problem. It is suggested that for each case a good approach is to assume first that a transaction is missing, second that a transaction has been assigned to the wrong cell and third that the recorded transaction is incorrect.

Reconciling a macro-SAM

At this stage, if the differences between all row and column totals are 'small' – a few percentage points - it may be appropriate to move on. Where the differences are large and/or residuals are 'odd'/economically peculiar, e.g., negative savings by households in a 'normal' year, serious attention needs to be given to the possibility/likelihood that the SAM is not complete. If it is complete, a lack of consistency implies, strongly, that certain datapoints are highly unreliable.

In such instances it may be necessary to reconcile the macro-SAM before proceeding to develop a micro-SAM. In these cases, RAS is not a good method (see in the later modules). While there are arguments for and against a compiler reconciling a macro-SAM. To a greater or lesser extent, the choice will depend upon the compiler's choice of estimation metric and how the metric uses control totals.

5. Compiling a macro-SAM with SUT Data

This section considers the two options for using a SUT when compiling a macro-SAM. First, for when SUT is not available for the chosen year. And second, when a SUT is available for the chosen 'normal' year. It may be tempting to use SUT data at this stage but this will more often than not be unwise.

Using a SUT for a Different Year

The advice in this case is simple, do **NOT** use the SUT for a different year when compiling a macro-SAM: the data will be wrong. The macro-SAM should be compiled from aggregate national accounts, which hopefully will have been fully reconciled.

If a SUT is not available for the chosen year, but for a different year the SUT closest in time to the chosen year may be needed as part of the estimation of a micro-SAM but **NOT** in TV format, rather in (column and/or row) coefficient format to generate prior estimates for a micro-SAM.

Using a SUT for the Chosen Year

If a SUT is available for the chosen year then many data points in the macro-SAM can be taken from the SUT, e.g., total private (C), government (G) and Investment (I) consumption, gross outputs by activities, labour remuneration, GOS, imports (*cif*), exports (*fob*) etc.

It would normally be expected that the aggregates in the SUT are identical to those in the summary national accounts, but that may not be the case because (a) the national account aggregates may have been revised since the SUT was compiled, or (b) the national accounts have not been fully reconciled.

6. Subsequent Developments

The subsequent developments entail reconciling the macro-SAMs, if necessary, and converting the full macro-SAM into a micro-SAM. Then the information from SUT will be added to create the first micro-SAM; this may require reconciliation. After that the developments can focus on progressively disaggregating accounts to increase the information content in both economic and social dimensions.

Hence, in addition to further data gathering exercises, certain technical skills will need developing apportionment and mathematical methods for estimation.

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