Compiling National Accounts Matrices

cgemod

Abstract

National Accounts Matrices (NAM) can be used to present national accounts data in matrix format using the single-entry bookkeeping technique. An advantage of a NAM is that follows to structure of national accounts advocated by the System of National Accounts; a structure that is used by a large proportion of national statistical agencies. This means that a NAM presentation of national accounts data can be linked directly to published national accounts data, which increases the acceptability of a SAM developed from the NAM as a valid basis for policy analyses. Once a NAM is compiled the transition to a SAM format is straightforward as well as being grounded in SNA compliant national data. It is important to recognise two features of any NAM. 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 National Accounts Matrix (NAM) is a single-entry representation of (aggregate) national accounts data (see EC, 2003, Chapter 2). 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 NAM 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 NAM is a natural single-entry format. 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 opaque. 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. 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 NAM are considered; first, when a SUT is available for the chosen 'normal' year, and second, for when 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 NAM is one approach for reducing the omission of transactions.

Why develop a SAM by first compiling one, or more, NAMs? The main advantage of using a NAM 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 NAM should follow directly from the components of national accounts detailed in the SNA. Second, the institutional transactions are subdivided into a series of relatively discrete sub matrices, which can aid the search for data points. Third, a NAM can help achieve the important objective of completeness: if the national accounts are complete, i.e., all TVs are quantified, then the resultant NAM will be consistent, i.e., fully reconciled. If the NAM is not complete, then it is relatively easy to identify the cells of the NAM for which TVs are missing. And fourth, the resultant NAM(s) will provide important control totals used to guide the estimation of the full SAM.

'Control totals' can be defined as the target values for the sum 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 NAM is overwhelmingly a case of identifying the datapoints for each cell in the NAM. 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: first, the knowledge that some sub-matrices of a NAM should always be null, i.e., all entries will be zero, is important information; second, an understanding of the economic relationships in a country can identify cells in the NAM that should contain non-zero values, e.g., government social/welfare/unemployment schemes that transfer income to households are ubiquitous; and third, the row and column totals for the NAM 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.

This document is not a 'cookbook of recipes', if only because different national accounts agencies present their single-entry national accounts data in many different formats. These guidelines assume that the blocks of accounts for the 'Generation of Income', 'Allocation of Primary Income', 'Secondary Distribution of Income', 'Uses of Income', 'Capital', 'Financial' and 'Rest of the World' can be derived from the national accounts data. Even if the data are not available in the standard SNA format, it is suggested that a SNA consistent NAM 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; this is termed an 'aggregate NAM'. Hence the suggestion is to start with a NAM 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 the 'Use of Disposable Income', 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 NAM has been developed the process of adding factor and institutional detail can be undertaken to develop what is termed a 'full NAM': the process of compiling the 'aggregate NAM' 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 NAM'.

After compiling a 'full NAM', the process of moving to a SAM can be undertaken. It will need to be decided whether the 'full NAM' needs to be reconciled, e.g., to absorb any statistical adjustments into the NAM: 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 NAM is reconciled, it may be convenient to render the 'full NAM' in the format of a macro-SAM that reflects the structure of SAMs used to calibrate economic models[1]. In general, the 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 NAM templates as the basis for the suggestions. Both templates can/should be adjusted if the changes better fit the relationships in the economy being quantified. These are available in an Excel workbook (`NAM Templates.xlsx`) that can be downloaded from the course site.

[1] The SAM format most used for CGE models reflects the SNA revision for 1968.

2. What is a National Accounts Matrix?

National accounts data are typically presented using a double-entry method for formatting accounts. A NAM 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. 'Generation of Income' accounts,
3. 'Allocation of Primary Income' accounts
4. 'Secondary Distribution of Income' accounts
5. 'Uses of Disposable Income' accounts
6. 'Capital' accounts
    a. Savings
    b. Investment
7. 'Financial' accounts
8. 'Rest of the World' accounts.

A NAM follows this structure by grouping accounts in a NAM using the same blocks are those used in the SNA. This has the advantage of adopting a structure that is consistent with the layout adopted for many/most presentations of national accounts data, and in the process reducing the probability of omitting data points, i.e., producing an incomplete SAM/NAM.

Structure of a National Accounts Matrix

A NAM 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 the row and an expenditure by the account in the column. The associated workbook, 'NAM

`Template.xlsx`', contains two templates for NAMs. 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 NAM, 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 NAM 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 NAM 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 instrument, i.e., taxes. These considerations should be reflected in the NAM.

Record Keeping

Record keeping is critical. Recording where the estimates reported in the NAM 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 NAM 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*. This is the method implicit in the NAM templates.

3. Developing an Aggregate National Accounts Matrix

These guidelines have been developed using the NAM 'Agg NAM template' in the workbook 'NAM Template.xlsx'. The approach is generic based on the SNA but has been influenced by compiling a NAM for the UK (an arbitrary choice[2]); 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 NAM is constructed from 'aggregate' national accounts. If a SUTs were available for the chosen year some of the data points for the NAM could be taken directly from the SUT, **IF and ONLY IF** the SUT and other 'aggregate' national accounts data are fully reconciled[3]. If they are not fully reconciled, then 'adjustments' will be required. Using SUT data for estimating a NAM is considered in section 5 below.

The guidelines assume that the process begins with the commodity accounts,[4] 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[5] 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 arguably immaterial where the process begins. However, it is suggested that in practice the process should begin with the commodity, with the second set of accounts being the activity accounts. Thereafter, it may be convenient to work through the accounts in the order they appear in the SNA and the NAM template.

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

3 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'.

4 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.

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

NB: Some cells in the NAM 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 NAM Template

The suggested 23 accounts for an aggregate NAM are detailed in Table 3.1. The dimensions of this NAM could be reduced, or increased, but the suggested selection seeks a balance between detail and simplicity; the sub matrices of the NAM 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 *AE*) and column (in row *38*) are equal to the totals taken from the national accounts – 23:1 to 23:22 – see checks on column/row totals.
2. a check for equality of calculated row and column totals (row *45* of the spreadsheet), NB: if the number of accounts is changed then the formula in row *43* 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 *C:50*,
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 NAM.

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. And second, it is not certain that the national accounts data will be fully reconciled, even if there are no typographical errors.

Step-by-Step Guidelines

The step-by-step guidelines are one way to go about the process of compiling a NAM. 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 NAM, and then SAM, are progressively disaggregated.

'Known' ZEROs

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

Table 3.1 Accounts for an Aggregated NAM

Category	Accounts
Commodities	Commodities
Margins	Trade and transport services
Activities	Activities
Generation of Income	Value Added
	Net Taxes - Production
Allocation of Primary Income	Institutions
	Net Taxes - Commodities
Secondary Distribution	Institutions
	Direct Taxes
	Social Contributions
	Current Transfers
Uses of Disposable Income	Households
	NPISH
	Non Financial Corporations
	Financial Corporations
	Government
Capital	Savings (Gross)
	Consumption of Fixed Capital
	Stock Changes
	Gross Fixed Capital Formation
	Financial
Rest of World	RoW - Current
	RoW - Capital
Totals	

Commodity Accounts

One way to start with the commodity accounts is the identification of *C*(osumption), *G*(overnment), *I*(nvestment), and *X*(export) expenditures, i.e., incomes (rows) to the commodity account. *C* and *G* are recorded as the Use of Disposable Income by households (11:1) and NPISH (12:1) (*C*) and government (*G*) (15:1), while *I* is recorded as Gross Fixed Capital Formation (GFCF) (19:1) plus stock changes (18:1): all should be valued at purchaser prices (sometimes expressed as 'market' prices). In addition, it will be necessary to identify *X* (21:1) and ***M***(imports) (21:1) so that GDP can be calculated as $C + G + I + X - M$; this is a useful first check.

This leaves a gap in the definition of total income to the commodity account: intermediate inputs (1:2). Given an estimate of total demand at purchaser prices (1:23), it is possible to check the estimates entering in the row and derive an estimate of the value of total supply at purchaser prices (23:1). If the value of intermediate inputs is not reported, an estimate can be deduced if there is an estimate of total demand at purchaser prices; this is not ideal because it circumvents a check.

Turning to the supply side two estimates are required: domestic supply at basic prices (2:1) and net taxes on commodities/products, i.e., taxes on commodities (positive) plus subsidies on commodities (negative values). The estimates of commodity tax revenues will provide useful control totals. Again, a check that total supply at purchaser prices equals total demand at purchaser prices should be conducted.

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 (2:1); this will also be the account total for 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.

Completing the activity accounts requires estimates of payments to factors (3:2) and net taxes on production (4:2), i.e., taxes plus (negative) subsidies, which combined are value added.

The entries for the commodity and activity accounts can be obtained from SUT. 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 NAM.

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 generation of income accounts and to work down and across the categories. However, the estimates for the 'Uses of Disposable Income' can be more reliable and many of the required datapoints have been identified (row 1), and information about the primary allocation and secondary distribution of income may be less reliable.

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

Uses of Income Accounts

The Uses of income accounts include two core estimates for each institution – consumption expenditure at purchaser prices and savings – plus one optional set of estimates – consumption of fixed capital (often called depreciation).

The consumption expenditure estimates were completed for the commodity accounts, so the first step is to obtain estimates of gross savings by each institution (cells 16:11 to 16:15); be careful of the distinction between gross and net savings. If estimates of the consumption of

fixed capital are available by institution these estimates can be recorded in cells (17:11 to 17:15): this information can be used subsequently to enrich the tracking of the ownership of capital by different institutions in models.

If estimates of the consumption of fixed capital are NOT available by institution, it is likely that depreciation has been assigned to activities (17:2), so check.

The transfers between institutions in the Use of Disposable Income accounts (11:11 to 15:15) may be less easily identified on a bilateral basis, i.e., to:from and from:to. It is evident that the net transfers of an institution with itself will be zero, so the elements 11:11, 12:12, 13:13, 14:14 and 15:15 will be zero, so these entries can be made immediately. If the data are available on a bilateral basis, then the off-diagonal elements in the block 11:11 to 15:15 can be filled in, i.e., gross transfers. However, if data are not available on a bilateral basis, the next best solution is to enter the data as net transfers, i.e., in the triangle above or below the diagonal.

Capital Accounts

The income side of the capital accounts (rows 16 and 17) has five components. The first three consist of gross savings available in the economy that are defined as net savings by domestic institutions (households, NPISH, enterprises/corporations, government) plus capital transfers from the Rest of the World (16:22) plus consumption of fixed capital (17:23).

The next two are more difficult: capital transfers and the **Net** acquisition of financial assets and **Net** incurrence of liabilities. The later will be considered in more detail when considering the financial accounts (below). In the aggregate NAM, the effect of capital transfers between institutions will be zero since there is no impact on the relative account totals of omitting any element on the principal diagonal, i.e., the changes on the row and column total are identical.

It should be noted that it is a common practice to attach any ‘statistical adjustments’ to income side of the capital accounts, i.e., savings. This practice reflects the fact that savings are a component of national accounts that may be deemed less reliable and hence, **note** that estimates on the income and expenditures sides of the capital accounts may be subject to greater error bounds

It is now necessary to complete the entries in the cells for expenditure by the capital accounts to the investment accounts (18:16, 18:17, 19:16, 19:17). The recording of the consumption of fixed capital depends on whether savings by institutions, from the Use of Disposable Income accounts, are net or gross and whether the consumption of fixed capital is recorded in the activity accounts or the Use of Disposable Income accounts. The requirement is to pass income to the investment accounts from the capital accounts that funds GFCF and stock changes.

Investment Accounts

The estimate for Gross Fixed Capital Formation (GFCF) will have been made when recording demand for commodities (1:19); since this is (or may be) the only entry in the GFCF column the row (19:23) and column (23:19) totals will be known. Similarly, estimates of stock changes should have been found when recording demand for commodities (1:18); since this is the only entry in the stock change column the row (18:23) and column (23:18) totals will be known. Sometimes estimates of stock changes are less easily found; typically, they should be recorded in the SUT and the national accounts, but at other times they may be bundled in with GFCF. A substantial effort should be made to find estimates of stock changes.

Sorting out how to record the income to the Stock Change account can be a fiddle. It can be recorded as an expenditure by the GFCF account or as expenditure by the institution accounts. The choice makes little difference, so long as the choice made is remembered, since it will be needed for model equations.

A control totals for the consumption of fixed capital (17:23) and (23:17) should have been included as part of the account totals step.

Generation of Income Accounts

The first step for the generation of income accounts is to obtain estimates of compensation of employees to and from the Rest of the World (21:3) and (3:21). The income directly to institutions in the generation of income accounts come from factor payments for domestic factors use in domestic production (3:2) plus the compensation of employees from the Rest of the World (3:21), while net taxes on production (4:2) are separately identified. The reasons for separately accounting for taxes are that they will be important (policy) dimensions and

provide valuable control totals for subsequent stages in the development of a SAM. These values should be consistent with the row totals ((3:23) and (4:23)

The total income for factor payments (3:23) is distributed as income to institutions in the allocation of primary income (5:3) less compensation of employees to the Rest of the World (21:3). The total of net taxes on production (4:23) is also an income to institutions (the government) in the allocation of primary income (5:4). Note how the account totals for net taxes on productions (4:23) and (23:4) are defined by the tax revenues from net taxes on production, i.e., (4:2).

Allocation of Primary Income Accounts

The incomes to the allocation of primary income (5:3) and (5:4) are defined by the expenditures of the generation of income account. To these incomes must also be assigned the net taxes on commodities/products (6:1). The total of net taxes on commodities are defined by the tax revenues from net taxes on commodities (6:2); hence the expenditure for the net taxes on commodities must be paid to the institutions (government) (5:6) to identify the total income to, and expenditures by, institutions in the allocation of primary income account (5:23 and 23:5).

To these estimates must be added domestic property incomes (5:5) and property income on production (net of taxes and subsidies) from the rest of the world (5:21). The last may not be immediately available but note how pre identifying and checking the account income and expenditure totals will serve to identify if there is likely to be missing TV data and thereby prompt the compiler of the NAM to ensure completeness.

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.

The distribution of the total income of institutions from the allocation of primary income (5:23) must then be distributed as incomes to the accounts of the secondary distribution. First, identify the total revenues from direct taxes on income and wealth (8:5), then social contributions by institutions (9:5) and current transfers (10:5). The residual after

these expenditures (8:5, 9:5, 10:5 and 21:5) is the expenditure by the institutions from the allocation of primary income to institutions in the secondary distribution accounts (7:5).

Secondary Distribution (of Income Accounts)

The incomes to institutions in the secondary distribution accounts include direct payments from the allocation of primary income (7:5) plus the revenues from direct taxes on income and wealth (8:5), social contributions by institutions (9:5) and current transfers (10:5). As before note that the revenues from direct taxes on income and wealth, social contributions by institutions and current transfers are the total incomes to, and expenditures by, these accounts (8:23 and 23:8, 9:23 and 23:9, 10:23 and 23:10). Hence, the expenditures on these accounts by the allocation of primary income accounts are incomes to the institutions in the secondary distribution (7:8, 7:9 and 7:19), i.e., they are parts of current domestic transfers.

The distribution of the total income to institutions in the secondary distribution provides incomes for domestic institutions. In the template for these guidelines the objective is to distribute this income across the institutions recorded in the use of disposable income accounts, i.e., those institutions that may engage in final consumption and/or savings. There should be good estimates of the incomes (11:23, 12:23, 13:23, 14:23, 15:23) and expenditures (23:11, 23:12, 23:13, 23:14, 23:15). In addition, it is expected that 'adjustments for changes in net equity of households on pensions fund reserves to (21:11, 21:12, 21:13, 21:14, 21:15), and from (11:21, 12:21, 13:21, 14:21, 15:21), the 'rest of the world' will be sufficiently small to be second-order considerations. Attention can then focus on 'adjustments for changes in net equity of households on (domestic) pensions fund reserves'; these transfers will primarily appear in the row for households in the sub-matrix for transfers between institutions in the use of disposable income accounts. A first approximation can then be deduced from the differences in row and column totals.

Financial Accounts

The financial accounts are the accounts least familiar to economists used to working with SAMs. "The financial account records transactions that involve financial assets and liabilities and that take place between resident institutional units and between resident institutional units and the rest of the world" (SNA, paragraph 11.2). The key features relevant to the NAM are the meanings associated with assets and liabilities. "An asset is a store of value representing a

benefit or series of benefits accruing to the economic owner by holding or using the entity over a period. It is a means of carrying forward value from one accounting period to another" (SNA, para 11.3) and a "liability is established when one unit (the debtor) is obliged, under specific circumstances, to provide a payment or series of payments to another unit (the creditor)" (SNA, para 11.5).

The financial accounts are detailed in Chapter 11 – 'The Financial Account' – of the SNA. It is one of the less easily accessible sections of the SNA, but it should perhaps be consulted. For practical purposes with a NAM, and SAM, the key issue to appreciate is that it is concerned with "carrying forward value from one accounting period to another" (SNA, para 11.3). The entries in the NAM are the **Net** acquisitions of financial assets and the **Net** incurrence of liabilities, i.e., bilateral acquisitions and incurrences are not recorded. For now, it is valuable to obtain estimates of these net acquisitions and incurrences; later methods for incorporating this information in a SAM will be considered.

The other component of the financial accounts – Net Lending of the Rest of the World (20:22) is important. If this is a non-zero transaction, but it is assumed to be zero, estimates of the current external balance (22:21) will be biased. It is in effect a balancing item that represents the difference between the net acquisitions of financial assets and the net incurrence of liabilities, which it may be tempting to assume can be estimated by the difference between net acquisitions of financial assets and net incurrence of liabilities. However, it would be better to compare estimates of the Net Lending of the Rest of the World from the information in the financial accounts and the Rest of the world capital account.[6]

It is worth observing that it is common practice to attach any 'statistical adjustments' to the income side of the capital accounts, i.e., savings. This practice reflects the fact that savings are a component of national accounts that may be deemed less reliable. One consequence of this practice is that it is wise to recognise that estimates on the income and expenditures sides of the capital accounts may be subject to greater error bounds.

[6] If the estimates are close, it may be appropriate to use the crude average as a prior estimate. If the diverge appreciably then it may be appropriate to explore whether there are apparent errors in other estimates.

Rest of the World Accounts

The rest of the world accounts have largely been completed as elements of the other accounts. The exception is the current account balance (22:21). It is tempting to presume that the only datapoint required from the rest of the world accounts is therefore the current account balance, which may be strictly correct. 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 Aggregate National Accounts 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 transactions 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.

At this stage, if the differences between all row and column totals is less than 1%, it would be appropriate to move on the develop the full NAM. The one exception is the Capital account for which there may need to be a 'statistical' adjustment; but this requires extra attention to the reported transactions for this account.

It may not be ideal to reconcile a NAM, especially if there are gaps in the underlying data and crude estimates have been made. The information metric explored later in this course does NOT require a reconciled NAM or Macro-SAM.

4. Developing a Full Aggregate National Accounts Matrix

These guidelines have been developed using the full NAM 'Full NAM template' in the workbook 'NAM 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 NAM is being developed. When compiling the aggregate NAM much should have been learnt 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 NAM 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 NAM will carry over without change to the full NAM 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 NAM may be unreliable and/or incorrect, if incorrect they should be revised.

As with the aggregate NAM, 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 NAM template.

The key objective of the full NAM is the identification of control totals for institutions, tax instruments and factors

Full NAM Template

The suggested 46 accounts for an aggregate NAM are detailed in Table 4.1. The dimensions of this NAM may be reduced, but it is more likely that they will be increased. 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. While the aggregate NAM sought a balance between detail and simplicity; the full NAM 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 column BD) and column (in row 61) are equal to the totals taken from the national accounts – 46:1 to 46:45 – see checks on column/row totals,
2. a check for equality of calculated row and column totals (row 66 of the spreadsheet), NB: if the number of accounts is changed then the formula in row 66 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 C:73,
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 NAM.

It is unlikely that the checks will all be passed immediately. First, it will take time (and practice) to find data for the 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 NAMs

Category	Accounts	
	Commodities	
	Margins	
	Activities	
Generation of Income	Factors	Labour
		Gross Operating Surplus
		Mixed Income
	Taxes	Production
	Subsidies	Production
Allocation of Primary Income	Households	
	NPISH	
	Non Financial Corporations	
	Financial Corporations	
	Government	
	Taxes on Commodities	Imports
		Excise
		Other on products
		VAT
	Subsidies on Commodities	Imports
		Products
Secondary Distriubtion	Households	
	NPISH	
	Non Financial Corporations	
	Financial Corporations	
	Government	
	Direct Taxes	Income
		Wealth
		Current Taxes
		Social Contributions
		Current Transfers
Use of Disposable Income	Households	
	NPISH	
	Non Financial Corporations	
	Financial Corporations	
	Government	
Capital	Households	
	NPISH	
	Non Financial Corporations	
	Financial Corporations	
	Government	
	Consumption of Fixed Capital	
	Stock Changes	
	Gross Fixed Capital Formation	
	Financial	
Rest of World	RoW - Current	
	RoW - Capital	
	Total	

The step-by-step guidelines for the full NAM are broadly the same as those for the aggregate NAM: they are one way to go about the process of compiling a NAM 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 NAM, and then SAM, are progressively disaggregated.

Known' ZEROs

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

Commodity Accounts

The entries in the row of the commodity accounts are the same as for the aggregate NAM, i.e., *C*(osumption), *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 (44:1) 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 (14:1) and subsidies (18:1) on imports, Value Added Taxes (VAT) (17:1) and other taxes (16:1) and subsidies (19:1) 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 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 (14:1) and plus 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 NAM 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[7] (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 (7:3) from (negative) subsidies on production (8:3).

The entries for the commodity and activity accounts can be obtained from SUT. 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 NAM.

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 NAM.

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.

Since estimates for the 'Uses of Disposable Income' have already been collected (row 1), as have estimates savings by institution and, if available, consumption of fixed capital this is good starting point.

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

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

Uses of Income Accounts

The Uses of income accounts were largely derived when compiling the aggregate NAM. The immediately obvious difference is the additional of rows and columns for savings; in this instance the savings by each institution appears on the diagonal and then the contributions by institutions to GFCF will be defined as expenditures by the respective institution from the capital accounts (42:35 to 42:39), i.e., there is no apparent new information.

There are two reasons behind this decision. First, there are two sub matrices – Use of Disposable Income:Use of Disposable Income and Capital:Capital - that contain information about transfers between institutions that will benefit from more attention. And second, it is helpful to track the capital transfers to (35:45 to 39:45) and from (45:35 to 45:39) the rest of the world to better record the incomes and expenditures associated with institutions. As more information is added to the NAM, and later the SAM, the information contents of these sub matrices are likely to increase as the number of institutions increases, especially as the household account is disaggregated to increase the social dimensions of the database.

Capital Accounts

The disaggregation of the capital accounts by institutions involves getting detail on the capital transfers to (35:45 to 39:45) and from (45:35 to 45:39) the rest of the world. Estimates of these transfers should be included in the detailed national accounts for the key institutions and/or the accounts for transactions with the rest of the world; the interpretation of these transactions is relatively straightforward.

The transfers between institutions in the capital accounts (35:35 to 39:39) may be less easily identified on a bilateral basis, i.e., to:from and from:to. It is evident that the net transfers of an institution with itself will be zero, so the elements 35:35, 36:36, 37:37, 38:38 and 39:39 will be zero, so these entries can be made immediately.[8] If the data are available on a bilateral basis, then the off-diagonal elements in the block 35:35 to 39:39 can be filled in, i.e., gross transfers. However, if data are not available on a bilateral basis, the next best solution is to enter the data as net transfers, i.e., in the triangle above or below the diagonal.

[8] This may produce differences between the calculated and published row and column totals; if it does it implies that the published totals have been estimated gross of such transfers.

Estimates of transfers between institutions are among the more difficult data points to find. But, excluding them will produce an incomplete but consistent matrix, so if it is known that such transfers exist it is ultimately better to include non-zero estimates even if there are large error bounds on the estimates. This topic will be revisited regularly.

The estimates of **Net** acquisition of financial assets and **Net** incurrence of liabilities carry over from the aggregate NAM; but with each stage of disaggregation, it is important to review prior estimates considering any additional information.

It now necessary to complete the entries in the cells for expenditure by the capital accounts to the investment accounts (41:35 to 42:40). The recording of the consumption of fixed capital depends on whether savings by institutions, from the Use of Disposable Income accounts, are net or gross and whether the consumption of fixed capital is recorded in the activity accounts or the Use of Disposable Income accounts. The requirement is to pass income to the investment accounts from the capital accounts that fund investment and stock changes.

It is worth repeating that it is a common practice to attach any 'statistical adjustments' to the income side of the capital accounts, i.e., savings. This practice reflects the fact that savings are a component of national accounts that may be deemed less reliable. One consequence of this practice is that it is wise to recognise that estimates on the income and expenditures sides of the capital accounts may be subject to greater error bounds.

Investment Accounts

The estimate for Gross Fixed Capital Formation (GFCF) will have been made when recording demand for commodities (1:42); and carry over from the aggregate NAM, as do stock changes (1:41). GFCF is the often only entry in column although this may depend on where the funds (incomes) for the stock changes (column 41) are sourced. It can be treated as a negative income to the GFCF account or an expenditure by the GFCF account.

Control totals for the consumption of fixed capital (17:23) and (23:17) should have been included as part of the account totals step.

Generation of Income Accounts

The extension of the generation of income accounts focuses on factors and disaggregating the factor payments by activities into payments for labour (compensation of employees), gross operating surplus and mixed income. This should have been completed as part of the activity accounts, as, if practical, should differentiating between taxes and (negative) subsidies on production. The total incomes to labour will use the estimates of compensation of employees from the Rest of the World (3:44).

The incomes to institutions in the generation of income accounts come from factor payments for domestic factors use in domestic production (4:3 to 6:3) plus the compensation of employees from the Rest of the World (4:44), while taxes and subsidies on production (7:3 and 8:3) are separately identified. The reasons for separately accounting for taxes are that they will be important (policy) dimensions and provide valuable control totals for subsequent stages in the development of a SAM. These values should be consistent with the row totals (4:46 to 8:46).

The total income for factor payments (4:46 to 6:46) is distributed as income to institutions in the allocation of primary income (9:4 to 13:6) less compensation of employees to the Rest of the World (44:4). The totals of taxes and subsidies on production (4:46 and 8:46) is also an income to institutions (the government) in the allocation of primary income (13:7 and 13:8).

Allocation of Primary Income Accounts

The incomes to the allocation of primary income for institutions (9:6 to 13:8) are defined by the expenditures of the generation of income account. Only households provide labour, so the income to the compensation of employees (4:45) less compensation of employees to the Rest of the World (44:4) goes to households. Similarly, it is expected that all, or least most, of the mixed income goes to households; the more developed an economy the smaller the likely relative share of mixed income in factor payments. The distribution of gross operating surplus is more complex since some may go to all institutions; the more developed an economy the greater the likely share going to corporations and the less to other institutions.[9]

[9] If the government is a major owner of corporations, e.g., parastatals, then it can be important to distinguish between private and public corporations.

The revenues from taxes on production (7:3) is also an income to the government, while expenditure on subsidies on production (8:3) is also a negative income to the government.

To these incomes must also be assigned the net taxes on commodities/products (6:1). The totals of 'revenues' from taxes and subsidies on commodities defined as expenditures on the commodity account (14:1 to 19:1).

To these estimates are added domestic property incomes (9:9 to 13:13), which need to be defined on a bilateral basis, with transaction on the diagonal being zero if recorded net. Again, if the data are available on a bilateral basis, the off-diagonal elements in the block 9:9 to 13:13 can be filled in, i.e., gross transfers. However, if data are not available on a bilateral basis, the next best solution is to enter the data as net transfers, i.e., in the triangle above or below the diagonal. Finally, property income on production (net of taxes and subsidies) from the rest of the world (9:44 to 13:44) needs to be disaggregated. Note how in multiple instances the processes involve splitting various single estimates into vector/matrices of estimates, the sums of which should equal the prior (aggregate NAM) (control) total.

The distribution of the total income of institutions from the allocation of primary income (9:46 to 13:46) must then be distributed as incomes to the accounts of the secondary distribution. First, identify the total revenues from direct taxes on income (25:20 to 25:24) and wealth (26:20 to 26:24), then other current taxes (27:20 to 27:24), social contributions by institutions (28:20 to 28:24) and current transfers (29:20 to 29:24). The residual after these expenditures (20:20 to 24:24) is the expenditure by the institutions from the allocation of primary income to institutions in the secondary distribution accounts.

Secondary Distribution (of Income Accounts)

The distribution of the total income to institutions in the secondary distribution provides incomes for domestic institutions. In the template for these guidelines the objective is to distribute this income across the institutions recorded in the use of disposable income accounts, i.e., those institutions that may engage in final consumption and/or savings. There should be good estimates of the incomes (46:30 to 46:34) and expenditures (30:46 to 34:46). In addition, the 'adjustments for changes in net equity of households on pensions fund reserves can be taken from the aggregate NAM as can the transfers to and from the rest of the world.

Financial Accounts

The transactions with the financial accounts can be taken directly from the aggregate NAM.

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 NAM, 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 Aggregate National Accounts 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.

At this stage, if the differences between all row and column totals are 'small' it may be appropriate to move on.

5. Compiling a NAM with SUT Data

This section considers the two options for using a SUT when compiling a NAM. First, for when SUT is not available for the chosen year. And second, when a SUT is available for the chosen 'normal' year.

Using a SUT for a Different Year

The advice in the case is simple, do **NOT** use the SUT for a different year when compiling a NAM: the data will be wrong. The NAM 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 but 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 NAM 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. In the

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6. Reconciling a NAM

There are arguments for and against a compiler reconciling a NAM. 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.

7. Subsequent Developments

The subsequent developments entail reconciling the NAMs, if necessary, and converting the full NAM into a macro-SAM, which will require absorbing the financial accounts into the rest of the macro-SAM using the method of apportionment. 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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