The Architecture of the System of National Accounts: A three-way international Comparison Canada, Australia and the United Kingdom

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Since the publication of "System of National Accounts 1993" or SNA93 more than a decade ago there has been considerable convergence internationally in the use of the structure, scope of accounts and measurement methods suggested in those standards. The paper begins with a brief overview of the architecture of the SNA93 standard by relating the elements of the system to their analytic roots. Based on this description of the system, three countries' application of that standard is compared. The comparison is done from two perspectives – Scope: – what elements of the flow of accounts are covered and how are they structured, and Integration: - how are the various accounts tied together when there are discrepancies and the identities do not hold.

A. The Development of a "System of Accounts"

The SNA is an economic accounting structure derived from macroeconomic analysis. Its architecture is drawn from many areas of macroeconomic study. Work as early as Adam Smith's Wealth of Nations and later work by Richard Stone led to the development of the concept of National Income which was the earliest aggregate measure at the root of the System of accounts. Early economics was also concerned with production of commodities and the productivity concept of turning inputs into outputs and the contributions of the factors of production to changes in output. This area of analysis eventually led to development of Input-Output Tables by Leontief which has heavily influenced the adoption of Gross Domestic Product as a central variable of macro-economic analysis. And finally, Keynes work in developing an analytic framework to explain the dynamics of the macro economy following the Great Depression of the 1930's added more dimensionality to the measurement of the macro economy. Other key variables like consumption, investment, savings and wealth explain the behavior of the economy and are now focal variables in today's system of accounts. This analysis studied the major decision centers and therefore transactors of the economy – households, businesses, governments and foreign economies and their dynamic effects on the economy through their propensities to consume, save or invest out of income which flows from the productive activity already articulated in the production account. Sometime in the late 1940's and early 1950's the idea of an integrated set of accounts pulling together all of these analytic underpinnings into a system of accounts became a focus of work at the international level. By 1968, the idea came together with the publication of "The System of Accounts" was published by the United Nations with major contributions by Stone, Jaszi, among many others.

This first "system of accounts" was designed and described for its analytic content and potential uses. The need for consistent accounts was described as follows: "by providing a consistent picture of the development of an economic system, a series of national accounts are useful, indeed indispensable, in describing and analyzing economic change and so contribute to many forms of economic decision making."[1] In addition to its analytic use, the system was also described as a "scheme for collection of economic statistics".

The system articulated the major transactions of the macro economy by examining activity in the economy through to the production and use of incomes, the accumulation of fixed and financial assets to arrive at a closing balance for net national wealth. The fully integrated system was designed around the key macroeconomic variables, production, consumption, investment and wealth accumulation. The various accounts were related to specific types of analysis related to research or policy management as illustrated in table 1 below.

1. Table 1: Analytic underpinnings of the System of Accounts

USE → SUPPLY ↓	Opening assets	Production	Consumption	Accumulation	The rest of the world	Revaluations	Closing assets
	1 / 2	3 / 4	5 / 6	7 / 8 / 9 / 10	11 / 12	13 / 14	15 / 16
1 Financial claims 2 Net assets				Studies of national wealth; analysis of productivity			
3 Commercial Production 4 Non Commercial Production		Input-output analysis; analysis of productivity; business cycle studies	Consumers' demand analysis; studies of govt. spending	Models of stock building and fixed capital formation; investment policy	Export demand analysis, studies of the "globalization" phenomenon		
5 Final consumption 6 Income and outlay		Production functions; analysis of productivity; analysis of factor shares	Distribution and redistribution of income; fiscal policy	Depreciation analysis; investment allowances	Studies of the return on foreign investment; double taxation policy		Studies of the "wealth effect" on consumption
7 Change in stocks 8 Fixed investment 9 Financial claims 10 Capital finance	Studies of net worth		Analysis of saving behaviour	Monetary policy and liquidity preference	International finance and liquidity; long-term foreign aid policy	Studies of capital gains and losses; capital gains tax policy	Studies of net worth
11 Current transactions 12 Capital transactions		Import demand analysis	Short-term foreign aid policy	International finance and liquidity; long-term foreign aid policy	Analysis of balance of trade payments		
13 Financial claims 14 Net assets				Capital revaluations			
15 Financial claims 16 Net assets				Studies of national wealth; analysis of productivity			

While the 1968 system was rich in its analytic underpinnings, the statistical infrastructure was not well developed. Since it was the early basis for a system of accounts it did not articulate the true "architecture" of the statistical system. The production boundary (the delineation between market and non-market production), the classification systems (industries, products, functional breakdowns), the statistical units (establishments,

[1] A System of National Accounts, United Nations, 1968, page 12.

enterprises, institutions), the definition of the asset boundary (produced, natural, tangible, intangible etc) were not fully developed.

This early system served as the foundation for the current architecture. As countries developed National Accounts and as users fed back on their experiences in analytic use of the systems, the statistical community began to refine and articulate the statistical underpinnings of the system. An international effort in the mid to late 1980's profited from the many experiences of countries in building economic accounts, and resulted in the set of accounts known today as SNA93.

B. The Architecture of SNA93 - A Basis for comparison

In this section of the paper the SNA93 architecture is described by first explaining the framework as is relates to its analytic underpinnings outlined above. The architecture of SNA93 can be described in three parts:

- The *Central Framework* which translates the analytic view of a "system of accounts" into the basic accounting structure
- The *Infrastructure* which defines the building blocks needed to construct a fully consistent set of economic accounts, and,
- The *Integrated Data System* which is the set of accounts and tables which are central to describing the economic process.

1. The Central Framework of SNA93 consists of:

1. ***Integrated economic accounts*** by institutional sector tracing production of income through to wealth accumulation for each institutional sector
2. ***Supply and Use of goods and services*** which traces production of commodities by industries through their use as intermediate inputs or final demand by institutional sectors
3. ***Three dimensional analysis of transactions***, which articulates all the transactions of the system from both the "real" side of the accounts (Production, consumption and investment) and the "financial" side of the same transactions (creation and deletion of financial claims and fixed assets), all by institutional sector (from whom, to whom). This feature forces consistency on the system,
4. ***Functional analysis*** of the purposes of spending by institutional sector : for example: spending by governments (health, education, defense etc), consumers(accommodation, food, transportation, health etc) and business (intermediate use and investment),
5. ***Population and employment data*** consistent with SNA concepts for analysis of the labour variables of the system and per capita analysis.

These five elements of the framework reflect the analytic requirements of a macroeconomic data system as outlined in the earlier version of the SNA as reflected in table 1 above.

2. The Infrastructure of SNA93

In order to build this consistent data set for analysis, the architectural building blocks of the data system need to be well defined as do the structure of the "accounts" or datasets included in the system. The important architectural elements which are the infrastructure of the system for each of the five elements of the central framework are:

1. The institutional sectors and the institutional units which are aggregated to measure them are the building blocks of the integrated sequence of accounts. There are two basic institutional units; households and legal entities. Legal entities are units which are created to perform some economic function like production in the case of enterprises and governance and provision of public goods and services in the case of government units. Each unit is capable of engaging in transactions with other units, of owning assets and of incurring liabilities. The units reflect the decision centers in the economy for financing, saving and investment. The units are grouped together into mutually exclusive sectors based on their economic objectives, functions and behaviors. Carrying through on the examples of the units mentioned above, corporations' economic function is the production of goods and services for sale on the market with an objective of gaining profit for its owners. Government institutional units are quite distinct in their function and objective. They engage in non-market production and also have as an economic objective the redistribution of income and wealth among institutional sectors through taxation and transfers. The main institutional sectors of the system are:
    a. Non-financial corporations
    b. Financial corporations
    c. General governments
    d. Households
    e. Non-profit institutions serving households
    f. Rest of the World

    Sectors a through e cover the domestic economy and f covers the transactions of the rest of the world with the domestic economy. The main sectors can be broken down into sub-sectors such as general government into the relevant levels of government or financial corporations into banking, insurance and other financial institutions.
2. The Supply and Use analysis articulates the production of goods and services by production units. Two important elements of the system play an important role in this part of the system: the production and asset boundaries and the valuation principles.
    a. The production boundary includes the production of all individual or collective goods and services that are supplied to institutional units other than their producer. It also includes own account production of goods that are retained by the individual unit for consumption or fixed capital formation. In the case of household units this own account production includes production of housing services as well as own account construction of dwellings. Any other goods produced by households for

own consumption are only counted when significant. This usually means agricultural products produced and used on the farm.

b. The assets boundary is defines real wealth in the system. An asset is something that is owned by a unit or units in the system from which economic benefits are derived over a period of time greater than one year. The benefit is often derived from use in the production process but also as a store of value. Assets which lead to capital formation in the system are produced by a unit and used repeatedly in future period. Valuables are included as assets, but not as capital formation.
c. Valuation of production in the Supply/Use framework is at basic prices, which are the prices receivable by the producer unit before taxes on those products are added, including any subsidies received. Non-market production is valued at cost when there is no market price valuation equivalent available. When production is carried forward to the sequence of accounts, the taxes on products are added in and subsidies netted out to arrive at GDP at market prices.
d. Two classification systems are at the base of this measurement: an industrial classification system - the one suggested in SNA93 is ISIC rev 3 the International Standard Industrial Classification at the two digit level of aggregation or approximately 120 industries, and a classification of commodities- the CPC or the Central Product Classification is recommended at the 3-digiet level, about 300 products. The relevant statistical unit in the case of measuring output is the producer unit. This is the unit of the economy which can report on the output of products and the inputs used. The selection of the unit of measure is based on homogenous production technology. There are many producer units in an economy. The majority are small units producing one type of commodity. Others are part of large complex enterprises which produce many different types of products and services and participate in many industries. These enterprises are broken down into sub units, called establishments, for the statistical purpose of articulating supply and use of homogeneous production technology.

3. The three dimensional aspect of the infrastructure is also referred to as quadruple entry book keeping. Transactions across sectors are recorded in four counterpart transactions. This ensures consistency in measuring variables across sectors, and across accounts. For example, when a corporation pays income tax to the central government, the transaction is recorded simultaneously as a transfer of income from the payer, the corporate sector, and as a receipt of income by the receiver sector, the government. It is also recorded as a decrease in cash on the financial account of the corporate sector and an increase in cash by the government sector. This ensures that the closing balance on the balance sheet of each sector also reflects the transfer of income from one sector to another, thereby imposing stock-flow consistency on the system as well. This is very important for analysing and understanding the economic process. This feature is key to ensuring that many of the types of analyses outlined in table one provide consistent results such as

multifactor productivity analysis which relates the production activity to the service flow from the stock of fixed assets.

4. Functional analyses are designed to articulate the purpose of expenditures by sector. They are designed to aid in the analysis of the objectives and functions of the institutional sectors. There are four key classifications suggested by SNA93.
    a. The Classification of the Functions of Government (COFOG) articulates 14 key purposes of government expenditure like health, education and social security.
    b. The classification of Individual Consumption by Purpose (COICOP) which breaks household expenditures down into 10 main purposes (with sub categories) such as housing, transportation, health, education, leisure etc..
    c. The classification of Outlays of Non-Profit Institutions by Purpose (COPNI) articulates 8 categories of NPI outlays such as health, education, religious services, welfare services etc...
    d. Classification of Outlays of Producers by Purpose (COPP) breaks down the outlays of production units into classes such as research and development, repair and maintenance, employee training and welfare, etc..
5. Employment and population data aligned with SNA concepts means having population data aligned with the "national" boundaries of the accounting system and definitions of the households sector. It also means aligning employment measures with the production boundary and labor input definition of the product account – key for the purposes of calculating and analyzing productivity trends. The definitions and classifications are outlined in chapter 17 of SNA93.

3. The Integrated Data System of SNA93

3.a The Sequence Economic Accounts

The accounting model of the 1993 standard traces the transmission of income to wealth using a "sequence of accounts". The building blocks of the sequence of accounts are six major institutional sectors: Households and unincorporated businesses[2], Non-profit institutions serving households, financial corporations, non-financial corporations, governments and non-residents. The whole economic process from production of income, through redistribution of income, consumption and saving, through to accumulation of fixed assets and financial assets, to the position of net worth is recorded for each institutional sector. The major macro economic variables are recorded or calculated as balancing items in the following "sequence of accounts":

[2] Unincorporated businesses are grouped with households due to the difficulty of splitting some transactions between the household and business portion. For some accounts, like the production account, it is preferable to separate the sector in two to arrive at a pure "business" sector. But for income generation and distribution accounts it is hard to delineate between the two institutional units.

3.b Table 2: The Sequence of Economic Accounts of SNA93

Production Accounts: For each institutional sector (except the non-resident sector) the value of output is recorded, intermediate consumption (goods and services used up in the transformation of inputs to outputs) are subtracted to arrive at the balancing entry for this account – *Value Added.* The sum of value added across institutional sectors is equal to the *Gross Domestic Product* for the economy.
Production of Income: In the course of production, the primary inputs, labour and capital, produce income. Wages, salaries and supplementary income and gross operating surplus are recorded for each sector. The *sum of the primary incomes* equals *value added* for each sector and the *sum of all primary incomes across sectors* equals *Gross Domestic Product*
Primary Distribution of Income: Property income is income from lending real and financial capital. Primary income is redistributed from one sector to another in this account resulting from payment of interest through financial claims or rents and royalties on use of real property. *Total sector income* is the sum of *primary income plus net property income received*. Summation across sectors (including the non-resident sector) of total primary income equals *Gross National Income* after subtraction of capital consumption allowances equals *Net National Income*
Secondary Distribution of Income: In this account pure transfer of incomes across sectors are recorded. . *Total sector income* is the sum of *primary income plus net property income received.* After deduction of direct taxes paid and social contributions the balancing item on primary distribution account is *Disposable Income*. Current expenditures are also recorded on this account as uses of income. The balancing item on this account is savings; the sum of savings across sectors is *National Savings* and after accounting for capital consumption allowances equals *Net National Savings.*
Capital Accumulation Accounts: Net savings from the secondary distribution of income accounts are the starting point of this account as a source of funds for capital accumulation. Depreciation and net capital transfers are added to arrive at total funds available for investment. Fixed capital formation on tangible and intangible assets is recorded as the use of funds to arrive at the *Net Lending/Borrowing* position of the sector. The sum of net lending/borrowing across sectors balances to zero. Also, the sum of current expenditures from the secondary distribution of income account and capital expenditures on the capital accumulation accounts less imports equals *Gross Domestic Product* calculated as the sum of final expenditures.
Financial Accumulation Accounts: Transactions in financial assets and liabilities are recorded for each of the institutional sectors. The balance of net changes in financial assets less changes in net financial liabilities is *net changes in financial assets* and is equal to *net lending/borrowing* of the capital accumulation accounts.
Other Changes in Volume of Assets Account: This account records holding gains and losses on Financial and non-financial assets by Institutional Sectors. It also records destruction of assets due to extraordinary events. Depletion and new discoveries of non-produced assets are also part of this account. It basically records any change in asset which is not due to a "transaction".
Balance Sheet Accounts: Closing stocks are recorded here for Financial assets and liabilities as well as tangible and intangible non-financial assets. *Net Worth* is calculated as the balancing entry for the balance sheet of each institutional sector summing to National Net Worth across the sectors. *National Net Worth* is equal to *National Net Wealth* – the sum of the stock of all tangible and intangible fixed assets at market price.

The economic process, of production of income, consumption, investment and creation of wealth are reflected by the structure and the order of the sequence of accounts. In describing the economic process through a sequence of accounts consistency is imposed on the data through the series of identities inherent in the system The following table presents the main identities of the sequence of accounts.

3.c Table 3: The Identities of the Sequence of Accounts

The Production Identities

GDP = Output – taxes less subsidies on products – intermediate consumption

GDP = Final consumption expenditures + changes in inventories + Gross fixed capital formation + acquisitions less disposals of valuables + exports of goods and services – imports of goods and services

GDP = Compensation of Employees + Gross operating Surplus of corporations + Gross mixed Income + taxes less subsidies on products

Income and Saving Identities

Gross National Income (GNI) = GDP + taxes less subsidies on production and imports (net receivable from abroad) + compensation of employees (net receivable from abroad) + property income (net receivable from abroad).

Net National Income (NNI) = GNI less consumption of fixed capital

Net National Disposable income (NNDI) = NNI + net taxes on income and wealth receivable from abroad + net social contributions and benefits receivable form abroad.

Net Saving = NNDI – final consumption expenditure + net equity of households on pension funds receivable from abroad + net capital transfers receivable.

Net saving + net capital transfers = changes in net worth due to savings and capital transfers

The income and savings identities apply to each institutional sector as well as to national estimates by changing the identities to net amounts receivable from other sectors.

Savings and Investment Identities

Net saving + net capital transfers receivable = Gross fixed capital formation + changes in inventories + acquisitions less disposals of valuables and non-produced non-financial assets + net lending/borrowing

Net lending (+)/borrowing (-) = net acquisitions of financial assets les net incurrence of financial liabilities

Wealth Identities

Opening net worth = Opening Assets – opening liabilities

Changes in net worth = changes in net worth due to savings and capital transfers + changes in net worth due to other volume change in assets + changes in net worth due to holding gains or losses

Closing Net Worth = closing assets - closing liabilities.

There are three different views of the GDP aggregate, sum of value added, sum of factor incomes and sum of final expenditures. There are two views of measuring net lending by sector, the difference of total incomes and total outlays and the difference in transactions on assets and liabilities. The imposed consistency on the system also allows some variables to be calculated residually rather than directly, for example, savings is the residual of current incomes less consumption or current expenditure, government deficit is the difference of total incomes and outlays of the government sector, or even detailed variables which are difficult to measure directly from administrative records or by the use of surveys can be derived. For example, inventory investment as measured by national accounting conventions is difficult to measure directly, but in a consistent set of accounts, can be arrived at residually as the difference of supply and use of a commodity. Many aspects of household wealth are also difficult to measure directly as households do not generally keep balance sheet records, but for example, by exploiting the fundamental balance sheet identity, mortgage lending by financial institutions can be used to measure mortgage borrowing of households.

Macroeconomic analysis is greatly enhanced by the consistency of the integrated system. For example, the labor input variables can be compared to value-added to analyze labor-productivity trends. Debt burden of households, governments or business can be measured by their debt levels from the balance sheet accounts as a ratio of their total sector income as measured in the distribution of income accounts and at the same time interest burden ratios can be calculated as the ratio of interest paid to total income recorded in the distribution of income. The return to capital can be measuring as a ratio of net operating surplus to the stock real assets. The imposition of common infrastructure (classifications and measurement principles) across all of the sequence of accounts adds explanatory power to the derived aggregates. These ratios are important in the understanding the sustainability of the economic functioning of the various sectors.

The integrated system is also an audit and planning tool for the statistical system at its roots. Since the system is put together from a variety of data, both survey and administrative record based, all with varying levels of quality, aggregates derived from more than one approach will never be equal. But a high quality statistical system will produce results that are within an acceptable range and the inconsistency can be resolved through a balancing method. SNA93 recommends for example that the level of GDP be derived using the value added method or the so called “production approach” and the other measures be reconciled by allocating any statistical discrepancy to the lower quality sub aggregates of the income and expenditure methods. The allocation method used will depend on the relative quality of the elements of the statistical base. If the statistical discrepancies are not random but indicate bias, they are often used to identify gaps or emerging measurement issues in the statistical process. Later in the paper examples of different balancing approaches and how the system has helped identify gaps and measurement problems will be given in the cross country comparison.

The Other Changes in the Volume of assets account plays a big role in the stock flow consistency of the system. It can be broken down into revaluation accounts and other volume changes in assets. The revaluation account records the holding gains and losses on real and financial assets. Separating the change in wealth into components due to savings and due to holding gains and losses is central to the study of the wealth effect on the behavior of the sectors. In addition, articulating other volume changes in assets like the discovery of unknown mineral reserves or the destruction of an asset due to some catastrophic event are extremely important in the measurement of net worth and its driving factors. As will be seen later in the paper, this account is under valued in many National Accounts systems and represents an important data gap.

3.d The Supply and Use Tables and Input Output

In addition to the sequence if accounts outlined above, the system includes goods and services accounts, supply and use tables and symmetric input output tables providing detailed analysis of industries and products. The tables are in fact, a breakdown of the production and generation of income accounts. This is the part of the system that reflects 'the production function' at the core of structural and productivity analysis. Table 3 below is a simplified Supply and Use table which demonstrates the use of identities to balance the production and the use of products in the system.

The three way identity of arriving at GDP is tested in the table:

Sum of value added by industry (5-1) equal to sum of incomes of primary factors of production (6) equals sum of final expenditures on domestic production (2+3+4-7).

As is the Supply and Use identity:

Outputs + Imports (Supply 5 + 7) = Intermediate consumption (by industries) + final consumption + gross fixed capital formation +exports (Demand 1+2+3+4)

3.e Table 4. Simplified Supply and Use Tables

	Products	Industries	Rest of World	Final Consumption	Gross Capital Formation	Total
Products		1. Intermediate Consumption	2. Exports	3.Final Consumption Expenditure	4.Gross Capital Formation	Total Use by Product
Industries	5.Output					Total Output by Industry
Components of Value Added		6.Value Added				
Rest of World	7.Imports					
Total	Total Supply	Total Inputs by Industry				

The dimensionality of the supply and use table is usually rectangular with many more products than industries. The SNA93 recommends the use of the CPC classification which has 1,800 commodities at its 5 digit level, but for countries where less detail is collected, the three digit level could be used (about 300 product groups). ISIC rev 3 is recommended for the industry classification. Again the level of detail will depend on the countries' statistical system but a reasonable breakdown is considered to be the 2 digit level or more (about 20 industries).

The supply and Use tables are important statistical tools in the SNA. They are used to test and monitor the quality of the data system used to feed the sequence of accounts. For example they can be used to:

1. Identify gaps, inconsistencies and valuation problems in the data system.
2. Calculate weights for the calculation of price and volume index numbers, and
3. Estimate variables residually which are not captured in the statistical system for reasons of response burden or expense
4. Benchmark infra annual data and projection systems to add consistency to short term indicators

The supply and use tables are also used to calculate symmetric input output tables, either product by product of industry by industry. These tables convert the supply and use tables from a statistical tool to an analytic tool. Input Output tables are used to do all sorts of structural analysis and when combined with the rest of the SNA Framework are used to do many types of the analyses outlined in the table which showed the analytic underpinnings of the System of Accounts. These include:

1. Analysis of production, input structures and multifactor productivity
2. Analysis of the structural change of components of final demand like consumer spending and investment in fixed capital
3. Analysis of impact of changes in tax rates or tax regimes on products and production
4. Analysis of impacts of changes in regulation in the economy
5. Analysis of impact of changes in technology and/or relative price change
6. And the list goes on....

The other major advantage of a set of supply and use tables and input output tables integrated with the rest of the system is that it provides a basis for many analytic data by-products such as satellite accounts. These are usually aggregations or classifications not readily available in either a standard product or industry classification system but are of great analytic importance. These by products often relate to activities which cross industry and product boundaries such as tourism, transportation, communication or health. They also form a basis for super imposing other related data on the system such as environmental flows to measure the impact of economy on the environment.

While supply and use data systems are the most data intensive part of the system, they are the thread that ties the system together and have a big impact on the quality of the system both in terms of statistical integrity and analytic usefulness.

4. Functional Breakdown of Expenditures and Employment and Population Data

The last two elements of the central framework will not be described in detail here. Their purpose is described in the infrastructure section above. Functional Breakdowns add analytic depth to the purpose of expenditures in the system. For example the purpose classification of household expenditures allows for analysis of the consumption function in the context of joint consumption (expenditures on cars and repairs grouped together) and of substitution (different modes of transportation grouped together). The alignment of population and employment data with SNA concepts facilitates many types of analysis. The employment data are essential for productivity analysis. While these data elements seem straightforward, in many statistical systems there are more than one estimate of employment – from a household survey and a business survey. Most often neither is aligned with the SNA view of hours worked or the production boundary and work is required to create one consistent measure.

C. A Three Country Comparison: Australia, Canada and the United Kingdom

Australia, Canada and the United Kingdom are examples of countries where the fully-integrated SNA93 system has been implemented. In this section, each country's system is described to show how the system has been applied, showing to some extent, how the supporting statistical system has influenced the dimensions and detail of each system.

1. Australia

The Australian System of National Accounts (ASNA) is a prime example of a system that has be designed and implemented on an integrated basis in line with SNA93 – but with some differences based on what is most important to user needs, and on data availability. The data system is available from 1994/95 forward on a fully integrated SNA93 basis. Many parts of the system exist for longer time series.

1.a The Production and Asset Boundaries

For the ASNA these boundaries are closely aligned with SNA93. The production boundary includes estimates of financial services for which no explicit charge is made, the value of service of owner occupied housing and the service provided by homeowners in building or renovating the housing stock. No explicit estimates are made for illegal activity. This is the only exception to the SNA production boundary. The asset boundary is also largely SNA93 compliant with the exception of the treatment of valuables which are not as yet included as fixed assets.

1.b Valuation Methods

The valuation methods in the ASNA are those suggested in SNA93. The sequence of accounts transactions are measured at market prices including the balance sheets. The input output and supply and use tables use the basic price valuation as suggested in SNA93.

1.c The ASNA Sequence of Accounts

The ASNA publishes a full sequence of accounts annually, which is a slightly modified version of the international standard. The accounts of the ASNA are as follows:

- ***The gross domestic product account***, which records the value of production (GDP), the income from production and the final expenditures on goods and services produced. This is a combination of the Production account and Production of Income accounts of SNA93. These accounts are published by industry for GDP, by factor income type and by final expenditure category but not by institutional sector. This is based on the users' key demands for the three breakdowns of GDP but less of an interest in sectoral analysis of the production account data. Volume and Price measures are published based on the Final Expenditure approach of GDP using Annual Chain-Laspeyres index formula method.
- ***The Income Accounts***, which show primary and secondary income transactions, final consumption expenditures and consumption of fixed capital. Net saving is the balancing item on this account. The ASNA income account joins the primary and secondary distribution of income accounts of SNA93 into one. These accounts are produced for four major domestic sectors, Households (including non-profit institutions serving households), financial corporations, non-financial corporations and governments.
- ***The capital accounts***, which record the net accumulation of non-financial assets and the financing by way of saving and capital transfers. Net lending/borrowing is the balancing item of this account. It is produced for the four domestic sectors outlined above.
- ***The financial accounts***, which show the net acquisition of financial assets and net incurrence of financial liabilities. The balancing item is net financial position which is equivalent to net lending/borrowing measured in the capital accounts. This account is also recorded for the four domestic sectors of the economy.
- ***The balance sheets***, which record the stock of assets (financial and non-financial) and liabilities at a point in time and Net worth is the balancing item. This account is recorded for the four domestic sectors.
- ***The external account***, which is important enough to record separately from the sequence of accounts and is published according to the Balance of Payments manual published by the IMF. It is fully integrated with the SNA in that common variables such as imports, exports or interest and other income flows are equivalent in both accounts.

This sequence of accounts (missing only the Other Changes in Volume of Assets Accounts) is published on a *fiscal* year basis annually with about a 150 day lag on the reference period. These are preliminary estimates until the data system matures with all final data sources available about 36 months after the reference period. There are approximately 24 tables published which refer to the sequence of accounts, but at the same time about 80 additional tables are published which include detailed dis-aggregations of the many variables of the system. These include for example, gross fixed capital formation and capital stocks by type of asset, capital consumption allowances by industry and institutional sector, household expenditure detail, breakout of government accounts by level of government, just to name a few.

A summary version of the sequence of accounts is also published on a quarterly basis with a 60 day lag. The quarterly sequence of accounts includes national GDP by expenditure component, projections of value added by industry and GDP by income type. The constant price estimate of GDP is the expenditure based GDP using an annually linked chain-Laspeyres measure. The sector accounts include a national account for current and capital accounts and income accounts for the household sector and summary income/capital accounts for the external and government sectors. The quarterly data base also includes many detailed breakdowns of expenditures. The data are published on a seasonally adjusted and trend basis in addition to the original unadjusted estimates.

1.d Supply and Use tables and Input Output tables

The ASNA compiles both rectangular Supply and Use Tables used for balancing the system and symmetrical or square industry by industry Input Output tables. The industrial classification used is ANZIC (Australian and New Zealand Industrial Classification system) which can be concorded to ISIC rev 3. The commodity classification used is one designed solely for the purpose of compiling Input Output and Supply/Use Tables. The Input Output and Supply Use tables are closely linked. They are produced as follows:

1. The first Supply and Use Tables for any given year are compiled about 12 months after the reference period. The dimensions are some 100 industries by 150 commodity groups. This projected annual supply and use table is used to balance the production accounts of the “sequence of accounts” and no statistical discrepancy is ever shown between the three measures of GDP.
2. The “Preliminary” Supply/Use Table is compiled within 24 months of the reference period and is based on partial benchmark data. The rest of the system is benchmarked to these preliminary data and therefore the quarterly system is never projected for more than seven quarters.
3. The “Final” Supply/Use Tables are produced within 36 months of the reference period. This is based on “final” survey and administrative data, as complete as the statistical system can provide. The dimensions are some 109 industries by 1100 commodity groups. The “final” version of the sequence of accounts is benchmarked to this.
4. When and only when the Supply/Use tables are “final”, the industry by industry Input Output Tables are compiled and published. These are

symmetrical tables with 109 industries. These are available about 4 months after the final Supply and Use tables or about 40 months after the reference period. The particular form, industry by industry, and the dimensions have been chosen as the best compromise between response burden and analytic use to the tables. These include effects of changes in factor costs, productivity, and incidence of taxes on production and imports and primary input content of demand.

This particular production cycle of Supply and Use Tables for balancing the ASNA with IO tables available when the data becomes “final” takes advantage of the fully integrated design of the SNA architecture. It provides users with a consistent set of accounts, balanced with no statistical discrepancies, from the production accounts through to the capital accumulation accounts. Preliminary versions based on projected or incomplete data take advantage of input-output ratios to fill in data gaps.

The final Supply/Use tables are the most data intensive part of the system, requiring respondents to fill in outputs and inputs by commodity. The input structure is collected by “establishment” which is the statistical unit based on homogeneous production technology but where full data can still be collected. This means there is primary, secondary and ancillary production in some units, but data cannot be collected to split inputs by all types of production within an establishment. To minimize response burden and to optimize the usefulness of the data, the Australian Bureau of Statistics has designed a collection strategy which rotates industries in and out of collection on a three or five year basis depending on the stability of the input structure. The more rapidly evolving sectors are on the three year cycle. For each year, about 25 per cent of inputs are based on collected data as opposed to imputed or allocated input data. Since the Australian statistical system is centralized, the economic data collection is organized and oriented around the compilation of the accounts both in structure and detail and in timeliness.

1.e Other features of the ASNA

The integration of Supply/Use tables with the sequence of accounts provides a balancing tool for the sequence of accounts down to the balancing *item Net lending/borrowing* of the *capital accumulation account*. Thus, the net lending/borrowing sums to zero across sectors when the external account is added in. But net lending/borrowing (net financial requirements) is also calculated from the financial accounts. Here a statistical discrepancy is shown in the financial account to equate the two balancing items. For the Balance sheet, the Household sector is used to balance across sectors for most instrument types due to the fact that direct balance sheet data is not generally available for households but is for the corporate and government sectors and is collected for the external account.

In addition to the sequence of accounts, the functional breakdowns of the SNA93 architecture are available in the detailed expenditure tables of both the annual and quarterly sequence of accounts. Also, ***Productivity Accounts*** are compiled as part of the ASNA database – including the labour input as specified in SNA93.

Finally, regional or state level production accounts are also a feature of the ASNA with some other key variables, like household and some government sector income accounts available at the state level.

2. United Kingdom

The accounts of the UK are another example of a complete and fully integrated set of accounts. The design and form of the UK accounts conform to the ESA95, which is a version of SNA93 written specifically for the member countries of the European Union. The ESA95 is fully consistent with SNA93. It does however, add more precision to some aspects of SNA93 which take the form of recommendations with alternative solutions. ESA95 attempts to standardize the measurement of the SNA aggregates because they are used for the calculation of contributions to the Union and for the monitoring of the complete European Union economy. In 1997 the UK completed a set of accounts based on the ESA95. This included completion of a longer project whereby the distributed statistical system was centralized over a 10 year period. This has meant that some parts of the SNA were previously published by other institutions are now all the responsibility of the Office of National Statistics (ONS). For example financial accounts and balance sheets and balance of payment statistics were previously published by the Bank of England.

2.a The Production and Asset Boundaries

These boundaries are closely aligned with SNA93/ESA95 for the UK. The production boundary includes estimates of financial services for which no explicit charge is made, the value of service of owner occupied housing. No explicit estimates are made for illegal activity but there is extensive work done on "exhaustiveness" to account for under-reporting and data gaps. Valuation of illegal activities is being worked on at the European level by Eurostat. In employing the production boundary for households producing goods for own use – by convention, only own-account construction of housing and production of agricultural goods is included. Anything else is deemed to be insignificant.

The asset boundary is also largely SNA93 compliant including treatment of valuables as fixed assets. The ESA95 rule for "small tools" is employed excluding any transactions on purchases less than 500 Euros even though it may be used in production process for more than one year.

2.b Valuation Methods

The valuation methods in the UK SNA are those suggested in SNA93 and ESA95. The sequence of accounts transactions are measured at market prices including the balance sheets. The input output and supply and use tables use the basic price valuation.

2.c The UK Sequence of Accounts

The UK publishes a full sequence of accounts annually, which is a slightly modified version of the international standard but compliant with ESA95. The sequence of accounts as follows is produced for the four domestic sectors, non-financial corporations, financial corporations, governments and households and non-profit institutions and the external sector wherever relevant:

- ***The goods and services account***, which is an aggregate supply and demand table but by institutional sector. It records the value of output at basic prices by sector plus imports as resources intermediate use and net exports as uses to arrive at GDP at basic prices by sector and by adding net taxes on products and imports to arrive at total GDP at market prices. Volume and Price measures are published based on the Final Expenditure approach of GDP using Annual Chain-Laspeyres index formula method
- ***The Generation of Income Accounts*** record the uses of GDP at market prices by type of factor income.
- ***The Allocation of Primary Income Accounts***, which show primary by type as resources for each sector.
- ***The Secondary Distribution of Income Account*** shows the redistribution of income through transfers across sectors as sources and payments of taxes and social contributions as uses to arrive at disposable income by sector.
- ***The Redistribution of Income in Kind Account*** shows the income in kind produced by each sector and who it is used by sector added to the disposable income of each sector
- ***The Use of Income Account*** shows consumption spending by sector out of disposable income and the adjustment for net equity of pension funds. Net saving is the balancing item on this account.
- ***The Acquisition of Non-financial Capital Accounts***, which record the net accumulation of non-financial assets and the financing by way of saving and capital transfers. Net lending/borrowing is the balancing item of this account. It is produced for the four domestic sectors outlined above and net lending for the external sector.
- ***The Financial Accounts***, which show the net acquisition of financial assets and net incurrence of financial liabilities. The balancing item is net financial position which is equivalent to net lending/borrowing measured in the capital accounts. This account is also recorded for the four domestic sectors of the economy.
- ***The Balance Sheets***, which record the stock of assets (financial and non-financial) and liabilities at a point in time and Net worth, is the balancing item. This account is recorded for the four domestic sectors.

This particular view of the sequence of accounts – shown for both *resources* and *uses* view of each account, is the ESA95 suggested presentation. Although ESA95 suggests splitting the Non-profit institutions serving households out as a sector unto itself, this is not currently done for the UK accounts. The sequence of accounts is first published about 6 months after the reference period based on preliminary data. The accounts are revised every year for the subsequent three years.

A summary version of the sequence of accounts, with the main macro variables and sector balances with sector detail for households, governments and the external account is published quarterly with about a 55 day lag after the reference quarter. In addition, a flash estimate of GDP is published about 40 days after the reference quarter.

Detailed expenditures of households by purpose (COICOP based) and government expenditure by function (COFOG) are also available as well as expenditure by asset type.

2.d The Input Output and Supply/Use Tables

For the United Kingdom the Supply and Use tables and the Input Output tables are square with the same dimensionality. The Supply/Use tables balance the production account for 123 industries based on the NACE rev 1 classification system (European industry classification system equivalent to about ISIC level 2 industries) and 123 products based on the CPA the European product classification system. The Symmetrical Input Output Tables are published on a product by product basis for the 123 products.
This dimensionality and format (product by product Input Output tables) is based on the ESA95 recommendation of using NACE at the 2 digit level and CPA at the 3 digit level. Most of the published Supply/Use and Input Output Tables for European countries have roughly the same dimensionality slightly over 100 industries and commodities – following the ESA95 recommendation.

The supply and use tables are used to balance the production account. They are produced at the time of the first full annual, about 18 months after the reference year. This means that there are no statistical discrepancies in the sequence of accounts for all of the years for which Supply/Use and Input Output are available. The data for the supply and Use tables are based on the Annual Business Enquiry which builds estimates for all industries while using a sub sample of each industry to collect data on inputs. The data collected is summary (not full commodity detail therefore double deflation technique is not used to calculate deflated value added by industry), but the summary detail is available for all industries.

2.e Other Features of the UK SNA

The full sequence of accounts is published annually in a publication called “The Blue Book” covering about 10 years of data (available on the internet and in a printed version). The fully integrated database exists back to 1994 but many important variables such as constant price GDP are available for longer time series.

In the Blue Book, the sequence of accounts is published for sub sector detail as well for the financial corporate sector and for the government sector. Transparency is a key factor in the UK approach to balancing and publishing of data. For the Supply/Use tables a series of Coherence Adjustments are published to show how the equality of supply and demand was achieved. When the sequence of accounts is published, these adjustments are split out by sector and published as statistical adjustments necessary to offset the balancing adjustments of the production account. This process means that no statistical discrepancies exist up to the balancing item of *Net Lending/Borrowing* in the sequence of accounts – but statistical discrepancies still exist between *Net Lending/Borrowing* and *Net financial requirements* on the financial account. The whole balancing approach for the UK accounts is described in detail in the Concepts, Sources and Methods also published on the NSO web site.

As part of the publication of the Supply and Use tables, employment and capital stocks consistent with the UK accounts are also published on a by industry basis used for productivity analysis.

3. Canada

The Canadian System of National Accounts (CSNA) is another example of a highly integrated system of accounts based on the SNA93 standard. The Canadian approach has a quarterly emphasis – the sequence of accounts being published on a quarterly basis. The Supply/Use and Input Output tables have an important regional dimension which is motivated in part by administrative use of the Supply Use system to allocate a value added tax system which is administered at the Canada level but harmonized with regional indirect taxes. This administrative use means that the Supply Use tables are produced on a regional basis to arrive at National Supply Use tables. This imposes a cost in the form of a loss of timeliness and cost of data collection. The Canadian System is also based on a highly centralized statistical system. The economic data survey and administrative data collection systems have been designed and modified over the years to feed the CSNA. This process began over 30 years ago as the aspects of the SNA in Canada were developed in the 60s and 70s closely aligned to the 1968 United Nations System of Accounts and continues today.

3.a The Production and Asset Boundaries

These boundaries are closely aligned with SNA93 for Canada. The production boundary includes estimates of financial services for which there is no explicit charge and the value of service of owner occupied housing. No imputation is made for the labor portion of own account fixed investment by households (renovation and self home construction). Only the material portion is capitalized at present. No explicit estimates are made for illegal activity. Work on valuation of illegal activities is currently under review. In employing the production boundary for households producing goods for own use – by convention, only own-account construction of housing and production of agricultural goods is included. Anything else is deemed to be insignificant.

The asset boundary is also largely SNA93 compliant except for treatment of valuables as fixed assets. No thresholds are applied in the capitalization of fixed assets. Anything used in the production process over one year is included.

3.b Valuation Methods

The valuation methods in the CSNA are slightly different from those suggested in SNA93. The sequence of accounts transactions are measured at market prices including GDP but the balance sheets are presently a mixture of market and book value. The balance sheets will be converted to full market value by the end of 2004. The input output and supply and use tables use a modified basic price valuation for balancing purposes which is a purchase price valuation by industry and product. When value added by industry is published, it is converted to the basic price concept recommended in SNA93.

3.c The CSNA Sequence of Accounts

The CSNA publishes a full sequence of accounts quarterly, which is a slightly modified version of the international standard. The accounts of the CSNA are as follows:

- ***The gross domestic product account***, which records the value of production (GDP), the income from production and the final expenditures on goods and services produced. This is a combination of the Production account and Production of Income accounts of SNA93. These accounts are also published monthly for value added by Industry but only in the form of chain linked value added, adjusted for inflation. No sector detail is available for the GDP account. This is based on the users' key demands for the three breakdowns of GDP but less of an interest in analysis of the production account data by sector. Volume and Price measures are published based on the Final Expenditure approach of GDP using quarterly Chain-linked Fisher index formula method
- ***The Income & Outlay Accounts***, which show primary and secondary income transactions, final consumption expenditures and consumption of fixed capital. Net saving is the balancing item on this account. The CSNA income account joins the primary and secondary distribution of income accounts of SNA93 into one. These accounts are produced for four major sectors, Households (including non-profit institutions serving households), corporations, governments and the external sector.
- ***The capital accounts***, which record the net accumulation of non-financial assets and the financing by way of saving and capital transfers. Net lending/borrowing is the balancing item of this account. It is produced for the five sectors. In addition to the sectors outlined above, the corporate sector is split into financial and non-financial corporations.
- ***The financial accounts***, which show the net acquisition of financial assets and net incurrence of financial liabilities. The balancing item is net financial position which is equivalent to net lending/borrowing measured in the capital accounts. This account is also recorded for the five sectors of the economy. In addition financial accounts are published for 35 detailed sub sectors.

- ***The balance sheets***, which record the stock of assets (financial and non-financial) and liabilities at a point in time and Net worth, is the balancing item. This account is recorded for the five major sectors on a quarterly. In addition financial accounts are published for 35 detailed sub sectors but only on an annual basis.

This sequence of accounts (missing only the Other Changes in Volume of Assets Accounts) is published up to the financial accounts with the GDP release with about a 60 day lag on the reference quarter. The balance sheets are published quarterly with a 90 day lag. While the GDP account is fully reconciled with the Supply/Use and Input Output system, the Canadian approach to balancing the sequence of accounts is different from that of other countries. As many as 12 preliminary quarters could be available before a supply/use balance is available. None of the three measures of GDP is deemed to be the most accurate in the preliminary system. The final expenditure approach and the income approach are calculated independently (at market prices) and an average is published showing a statistical discrepancy of equal and opposite sign on each account. The final expenditure approach is then deflated and the monthly GDP deflated value added by industry at basic prices is adjusted to use the more complete information of the quarterly final expenditure approach but not entirely "reconciled". The discrepancies of the income and expenditure approach are not allocated among sectors meaning that the Net Lending/Borrowing of the economy across domestic sectors and the external account does not sum to zero. A separate discrepancy is also shown between the net Lending/Borrowing balances for the Income & Outlay accounts and the Financial Accounts. The Canadian approach is to correct data gaps and discrepancies which are specifically identifiable but to leave the basic data unadjusted to the extent that the discrepancies are not resolvable. Even after the GDP accounts have been reconciled to the Supply/Use tables a small discrepancy remains as the GDP account published survey based inventory change and operating surplus which are derived residually in the Supply/Use system. The system then is reconciled and released on a fully consistent basis but the system is not fully resolved in an economic sense.

There is one major inconsistency in the Canadian sequence of accounts. The consumption of fixed capital recorded for corporations in the sequence of accounts is taken directly from business accounting records, measured based on a mixture of historical cost and book value. The capital stocks recorded on the balance sheet for the corporate sector are derived from a Perpetuary Inventory Model where the stocks are valued at current replacement cost and the consumption of fixed capital inherent in the net stock value is a current value measure. In addition, a third capital stock measure is calculated for the purposes of measuring multi-factor productivity. This is an are where the Canadian system needs further work to clean up the inconsistency.

3.d Supply/Use and Input Output Tables

As mentioned earlier, the Supply/Use tables are the statistical tool used to balance the production account but are also an important administrative tool used to allocate Value-added tax collections between the federal and provincial governments. This determines the level of detail both in terms of geography and commodity dimensions. The Supply/Use tables for Canada are rectangular and balanced for 300 industries using the NAICS (North American Industrial Classification System) and 726 commodities using a product classification system unique to the Canadian Input Output tables. Symmetrical Input Output tables (coefficients) are published on an industry by industry basis for the 300 industries form the Supply/Use tables. The industry by industry configuration was chosen for the same reason as for the Australian accounts such that no simplifying assumptions are made in going from the industry technology known from collecting data at the establishment level as would be the case for separating secondary activities from industries to arrive at commodity by commodity tables.

This supply/use balancing is compiled annually for 13 regions of Canada (provinces and territories) and forms the benchmark for GDP for the sequence of national accounts mentioned above. (The sequence of accounts is also published by province for the GDP, household and government sectors up to net lending/borrowing.) This process, from data collection to the production of the tables, takes about 3 years for the preliminary version and 4 years for the final version. The additional detail of the Canadian system imposes an additional year in the finalizing of the sequence of the accounts relative to most other countries. Work is being done to upgrade the timeliness of this part of the system and experimental work is also being done to produce preliminary versions of Supply/Use as is the case for both Australia and the UK.

3.e Other Features of the CSNA

Detailed breakdowns of household expenditure (COICOP) and capital expenditure are published as part of the sequence of accounts. No breakdown of government expenditure by function consistent with the CSNA is available but will be when Statistics Canada completes the production of Government financial statistics based on the GFS2001 manual published by the International Monetary Fund within the next few years.

As part of the CSNA, quarterly labor productivity data are published for the "business" sector (corporations plus unincorporated business) about 10 days after the quarterly GDP release. Multifactor Productivity measures are also published annually for the business sector as are the labor and capital services data used to calculate them (consistent with the CSNA). Productivity analysis is only published for the business sector because the output of the non-business sector is still only measured by deflating inputs used for non-business GDP, assuming no change in productivity.

Annual data on Purchasing Power Parities are also published as part of the CSNA based on the OECD benchmarks available every three years (volume indexes for GDP and prices comparisons at the GDP level and for final expenditure components). A more detailed bilateral PPP database is done for the Canada-United States comparison as demanded by the key users of the CSNA.

D. Summary and Conclusions

The System of accounts was designed to facilitate the analysis of the macro economic process from the creation of income via production through to changes in wealth and to provide detailed information on the evolution of the economy in terms of the structure of production and spending and the uses of primary factors of production. The SNA93 has achieved the buy-in of the international community as the tool for building the statistical database.

The three countries compared in this paper all produce a highly integrated set of accounts which greatly facilitates consistent analysis of the economy by their domestic users and across international comparisons. Two important elements of commonality is that all three countries' systems are based on highly centralized statistical systems. In addition, all three countries include the Balance of Payments Statistics as part of the SNA accounting system.

While each country largely follows SNA93, the application does differ across the three countries. The sequence of accounts is presented quite differently in each case – while the major analytic aggregates such as GDP, savings, investment, consumption, net lending/borrowing and wealth are all presented and measured on a reasonably consistent basis. The slight differences in application of production boundary (and in likely methodology for some aspects of the accounting system) and valuation reflect what is significant for that particular economy. These do not likely impede international comparisons leading to reasonable conclusions. The adherence to ESA95 across the European Union adds discipline to the application of the standard in that ESA95 attempts to put clarity to all of the "borderline" issues related to compiling a set of accounts.

Where the countries differ the most is how the identities are used to balance the system. In both the UK and Australia, the Supply and Use identities are used to eliminate all discrepancies up to and including the measure of Net Lending/borrowing in the sequence of accounts. In Canada the system is left "over identified" even after the Supply and Use tables have been balanced. All countries record statistical discrepancies between the net lending/borrowing and financial requirements.

In all cases the users are well served by a system of national accounts that is consistent and complete. The statistical systems take full advantage of using the SNA as a tool for validating and augmenting the survey and administrative data systems. This helps keep the data relevant and maintains the quality of the system.

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