

DRAFT

Estimating GDP in small economies

A note by Tim Jones, April 2015

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1 Summary

According to the 2011 ICP, over a hundred UN member states have small economies, with a GDP of less than US\$50bn per year; in many cases, much less. The resources that can (and should) be devoted to national accounting are also small, including not more than a handful of people. Many of these economies also have a large informal sector (including agricultural production) which is notoriously hard to measure with the accuracy commonly expected.

The SNA is however a highly complex system, designed by and for experts in highly developed economies. It is predicated for the most part on the existence of formal accounting data. And it goes well beyond this in the breadth and detail of its concepts. While no doubt appropriate for the EU and other OECD member states, full implementation of the SNA is well beyond the capacities (and indeed the needs) of most small developing economies. For the latter, GDP is, like it or not, the key indicator (something that "...has long ceased to be the primary purpose of compiling the accounts." according to the SNA (2008) §1.3).

The gap between theory and practice is huge. Many national accounts statisticians return from training in the SNA with a good knowledge of the theory. But in practice there are enormous problems just in establishing the level of GDP to within ten per cent or so. (This is demonstrated by the size of revisions that have been made in some African countries in recent years.) The World Bank publication *The 2008 SNA – compilation in brief* goes some way to bridging the gap, but not far enough. It places much emphasis on business surveys, which in small economies are rarely adequate for estimating GDP reliably.

In this note it is argued that the United Nations should provide only the most basic framework necessary for estimating an approximation to GDP and its growth in real terms. Such a cut-down version should be capable of implementation in small economies and considered sufficient for GDDS purposes. (OECD and Eurostat can be left to elaborate their more extensive and sophisticated requirements for larger economies.) Secondly, priority should be given to obtaining and exploiting high quality data on final consumption from household

budget surveys, which have a number of other uses and advantages, at least every five years. Then it is argued that the best cost-effective procedure in small economies is (1) to establish a benchmark level of GDP using the supply-use framework and (2) to extrapolate the benchmark every quarter using administrative data from the tax system.

2 Simplifying SNA requirements

Insofar as the international initiative to “implement the SNA” has encouraged more funding for national accounts in developing countries, it is to be welcomed. However there is a danger that these funds will be misdirected towards goals that in practice are neither cost-effective nor sustainable.

There are two ways in which the phrase “implementing the SNA” is unhelpful. The first is the idea that establishing the full sequence of sector accounts and balance sheets is a goal every country, however small, should be aiming for. The other is the implication that the quality of GDP estimates depends on compliance with the more sophisticated concepts and definitions of the SNA.

2.1 Sector accounts

Small economies are typically very open and dependent on external sources for finance (rather than the resident household sector). Thus the balance of payments (BoP) statistics are crucial for economic analysis. Unfortunately BoP is perhaps even more demanding to compile accurately than GDP. SNA sector and financial accounts are thus not likely to have much value when transactions with the rest of the world are so uncertain.

Of course, top to bottom BoP and GFS accounts should be compiled, and these can be supplemented with readily available data from the financial sector. But, given other priorities, putting these into (and completing) the full SNA sequence of accounts is likely to be well beyond the capacity of the national accountants in most small economies. As suggested above, household saving is unlikely to be a key variable. Typically derived as a residual in the accounts, it is in any case likely to be small compared with the errors associated with its measurement. Despite pressure from first world econometricians, it should be possible to manage a small economy without knowledge of it.

2.2 Measuring GDP

As mentioned above, GDP is considered by the SNA as a by-product of the national accounts. Despite its ubiquity as a key economic indicator, there is no official manual devoted to GDP (its components and related aggregates) rather than to the national accounts as a whole. Even when it comes to quarterly estimates, the focus remains on “QNA” rather than “QGDP”.

Furthermore, some of the more sophisticated concepts and definitions are of secondary importance. This can make the requirements for data and analysis too complicated and demanding for small economies. The perceived need to meet such requirements can lead NSIs away from optimal, cost-effective solutions and indeed reduce rather than enhance the quality of the estimates. Such complications include:

- Double deflation
- FISIM as currently defined
- Work-in-progress in crop production
- Stocks of finished goods
- Other refinements

These topics are discussed in more detail below. The use of simpler methods by economically small countries should be acceptable when it comes to assessing both the quality of the estimates and compliance with the SNA. Such simplification is unlikely to make a significant difference to the level or growth of GDP.

Double deflation

Taken literally, "double deflation" implies that, for each activity, (a) output and (b) inputs, both measured at current prices, are to be deflated separately by price indices of the various commodities involved. Gross value added (GVA) at constant prices is in theory the difference between the two.

The deflation of output – (a) – is recommended and usually feasible for most activities, at least for sales (rather than output – see below). But the availability of corresponding data on intermediate consumption (IC) – necessary for (b) – is quite another matter. Attempts to deflate IC independently are likely to lead to nonsense, especially when the value added is small relative to output, as any inaccuracies will be magnified and obscure the true figures.

A simpler approach for most activities is to assume that at constant prices the input-output ratio remains constant. In other words, if output increases by ten per cent in real terms, then both IC and GVA at constant prices also increase by ten per cent. This formulation is precisely equivalent to an index of production weighted according to GVA. The assumption is not so appropriate for crop production, where output depends more on the weather than on the quantity of key inputs, for which it may be possible to make estimates from other sources.

If the input-output ratio is also assumed to remain unchanged at current prices (in the absence of actual data) this amounts to "single deflation". But if there is an independent estimate of total intermediate consumption at current prices, the implied IC and GVA deflators under the simpler constant price method described above will in general differ from the output deflator. This is neither single nor strictly double deflation, but a middle way.

FISIM

Using reference rates to determine the level and allocation of FISIM is theoretically attractive and there is now a strong expectation (for example in the IMF's *Data Quality Assessment Framework*) that this procedure should be followed. But in practice measurement is not straightforward. It is unlikely that the coherent data required to obtain sensible results will be readily available. Unless the financial services industry is dominant, as in a small "off-shore" tax haven, it is a complication that makes little difference to the level of GDP. The allocation is highly sensitive to the choice of reference rate, with unpredictable results when rates are varying. Another issue is the commercial banks' holdings of government debt (Treasury bills and bonds), which can be significant in some countries. Marketable in principle and so to be

excluded from the calculation, in practice the banks are clearly investing depositors' money in these securities, in the absence of an effective market. Reality will be distorted by the extent to which the average interest rate received by the banks from these securities differs from the reference rate.

Simpler is the former method of estimating total FISIM, as the difference between total interest received (from all sources) and total interest paid. These data are readily available from the banks' profit and loss accounts. Then total FISIM can be divided by two, with half allocated to depositors and the other half to borrowers irrespective of interest rates. Further allocation (to sectors and activities) may require some additional data, such as on the distribution of lending across activities. This is of secondary importance in most cases. By convention, government could be exempt from such allocation.

Work-in-progress in crop production

Estimates of the value of agricultural output are typically very rough. Allocating annual crop production across the growing season(s), rather than simply to the period of the harvest (or of the consumption of the product), is a complication that serves little purpose.

Stocks of finished goods

In commercial accounts, turnover (sales) is the primary variable, in general readily available. For manufacturing, the effect of adjusting sales to output by including changes in stocks of finished goods (and work-in-progress, unless the process is very lengthy) is secondary. Obtaining the necessary data and making the calculation is a significant extra burden. Thus the cost of making this adjustment in most cases far outweighs the benefits, especially if the sales estimates themselves are weak. It is simpler to omit the changes in these stocks from both sides (output and expenditure) of the GDP account.

Other refinements

There are several other refinements in the SNA that either make little material difference or are beyond the capacity of many NSIs to evaluate. These include such items as

- Illegal activities (unless so widespread they cannot be ignored)
- Own-account production of capitalised services
- Intra-enterprise and other transactions excluded from commercial accounts
- Acquisition of valuables
- Valuing own-account collection of fuel wood and water

Gross value added by government (and NGOs) should include capital consumption. In theory this requires long series of estimates of government fixed capital formation classified by type of asset and the corresponding deflators. Omission of this imputed value is unlikely to cause a big problem for policy makers at national level, but estimates based on the short-cut method for estimating capital stocks proposed by Derek Blades (RIW, 2015) could be an acceptable alternative.

3 Key data sources

3.1 Business surveys

The SNA and existing guidance both assume that establishment surveys are the primary data source and more reliable than household surveys. The SNA asserts that "household income and expenditure surveys ... are based on smaller samples and may be less frequent than establishment surveys..." SNA (2008) §24.10. They may be less frequent, but in small economies the samples may not be smaller, and establishment surveys have a number of other significant difficulties and disadvantages.

Of course, where production of specific goods and services are concentrated in a few key enterprises, these can and should be covered by regular returns, although reluctance to comply can be a problem in some cases. Data on financial institutions can be obtained from regulatory reporting. In countries that have a working system of *Déclarations Statistiques et Fiscales*, the formal sector at least should be well covered without the need for a survey. Elsewhere, however, there is little prospect, even for many formal sector activities, that business surveys can provide the comprehensive, reliable data needed for estimating the level of GDP at all, let alone on a regular, timely basis.

There are several reasons for this. Perhaps the biggest problem is the population of establishments. Only if there has been a recent census of establishments will the total population be known with any certainty. These censuses are expensive, rare and quickly become out of date. Even in a census, some significant activities without obvious premises will not be well covered. The activity of landlords is a good example.

The size of the contribution of businesses to the economy is extremely variable (if not zero, from less than a thousand to several million dollars per year). It is therefore essential for sampling purposes that establishments can be stratified by the likely size of their contribution. This implies the existence of a comprehensive, reliable, up-to-date business register, including a size indicator. Which small economies have such a dynamic register?

Next, the sampling fraction required to obtain a given level of precision is very much larger in a small economy than in a large one. The relative cost is therefore far higher, especially as it is usual to use enumerators to contact the businesses and to collect the completed forms. The burden of providing the information falls heavily on relatively small businesses. Some businesses can be very reluctant to respond in a timely way and there is little effective sanction available if they don't. Non-response from a key business in a specific activity can make estimating the output or value added problematic, especially when the change from year to year is being measured. The achieved sample may not be adequate for this.

Then, though true of any survey, establishment surveys are particularly susceptible to reporting, recording and data capture errors. The latter can usually be detected with suitable validity checks, but can cause serious bias if these checks are not applied.

High quality surveys of informal activity are rare. The approach has to be quite different from the one used for businesses with annual accounts, and essentially similar to (if not part of) a household survey. The value of agricultural production (in many cases undertaken by

millions of small-scale farmers and a large proportion of GDP) is also extremely difficult to measure with the accuracy expected in GDP estimates.

Enterprise surveys are thus unlikely to be good enough to establish the level of GDP. On the other hand, they are needed to obtain information on input-output ratios and on wholesale and retail trade margins. These ratios vary, but much less so than the level of turnover does, so a smaller achieved sample is acceptable and the results do not depend on knowing population totals.

3.2 Household surveys

Will estimates of consumption based on household budget surveys be any better? It is assumed here that such a survey is high-quality, covering 12 months, with a reasonably large sample size of several thousand. Such a survey has several advantages for establishing the level of GDP, as well as some limitations. Household consumption surveys have other important uses, notably for poverty analysis and the derivation of weights for consumer price indices. They are likely to lead indirectly to better estimates of the production of many products, from that of meat and fish to hairdressing and domestic services.

The population of households is known from the population census and can be updated using demographic statistics. They vary in size much less than businesses. Household consumption of a particular product will include informal as well as formal production. It is usually more widespread than is output, and therefore the subject of a much larger number of observations. These points suggest that the precision of the estimates based on samples of similar size will generally be better in household surveys, except where specific goods or services are produced by a very small number of key enterprises that can be completely enumerated.

Of course, household consumption surveys have their limitations. Spending on some important products (such as alcohol) is understated. While in low-income countries most households are usually willing to cooperate, well-off people may be reluctant to take part, causing a downward bias in the estimates..

Nonetheless, there are ways to compensate for these limitations when balancing commodity flows. For many products, the data represents the only scientific assessment of household final consumption expenditure (HFCE) and hence of production. Arguably, sub-national estimates of HFCE (rather than of GDP) are more relevant to assessing the outcome of economic policies at local level.

4 What to do

So what are national accounts statisticians in such countries to do? Experience over the last decade or so can point the way. The strategy has been twofold:

1. Establish a benchmark using the supply-use framework (initially limited to simple but comprehensive commodity flow accounts). The primary data sources are a high quality household budget survey, data from the revenue authorities, government accounts, and a few key enterprises.

2. Extrapolate the benchmark with quarterly indicators, primarily based on data from the VAT system, and repeat the benchmarking process, within five years if possible.

This approach is explained in more detail below.

4.1 Compiling a benchmark

In Europe and elsewhere, supply-use tables are at the heart of the national accounting system. The advantages of the supply-use framework for estimating the level of GDP are as follows.

- It integrates all three traditional measures into one comprehensive framework.
- The best use is made of all the available data.
- It enables gaps to be filled and data compared through an appropriate common classification of products.
- Discrepancies between supply and demand (use) are the subject of arbitration at a detailed level.
- The results are free from statistical discrepancies. (The latter are, in any case, unreliable as a genuine quality measure and a nuisance for users.)

A full supply use table (SUT) is illustrated below.

The SUPPLY USE TABLE and its parts

PRODUCTS	DOMESTIC OUTPUT								Total output	Imports of gds & servs	Margins	Taxes on products	Total supply	Total demand	INTERMEDIATE CONSUMPTION								Total IC	Final consump ⁿ House-holds	Govern-ment	Capital forma-tion	Exports of gds & servs
	A	B	C	D	E	F	G	H							etc	A	B	C	D	E	F	G					
TOTAL	PART A														PART A												
A1	PART D														PART C												
A2																											
A3																											
A4																											
A5																											
B0																											
C1																											
C2																											
C3										PART B																	
C4																											
C5																											
C6																											
C7																											
C8																											
etc																											

GROSS VALUE ADDED	
TOTAL	PART A
Compens of employees	
Other productn taxes	PART E
Gross operating surplus	
Mixed income	

▨	PART A: Production accounts
▨	PART B: Commodity flow balances
▨	PART C: Intermediate consumption matrix
▨	PART D: Make matrix
▨	PART E: Generation of income

The major categories of supply (on the left) and demand (on the right) are

Supply	Use
Output	Intermediate consumption
Imports of goods services	Final consumption
Margins	Capital formation
Taxes on products (less subsidies)	Exports of goods services

In addition to these, the other variables are:

- Products (down the side) in rows
- Activities (along the top) in columns

A simplified version

However, countries intending to compile an SUT for the first time would be well advised to proceed step by step, and to start by compiling a simplified version, described below. The main purpose is to establish a benchmark level of GDP for a given year.

It is useful to split the framework into its component parts. In particular

- Part A (in three places in the table) comprises summary production accounts, showing total output, intermediate consumption and value added by activity.
- Part B (in two places in the table) comprises summary commodity flow balances showing the supply and use of each product:

As a first step in compiling an SUT, Part B is the one to focus on. Even without the other parts, achieving a complete set of these commodity flow balances is likely to provide much improved estimates of GDP. The steps in the process are set out below.

Data requirements

The minimum data requirements for a soundly based SUT are as follows:

- External trade in goods (Customs data)
- Trade in services (BoP details). In countries where tourism is important, estimates of visitor expenditure by product are needed.
- A comprehensive household expenditure survey
- Government expenditure details
- Total output (this may come from the existing national accounts sources, or a new set of administrative and/or business survey data)
- Estimates of trade mark-ups and input-output ratios
- Details of taxes (and subsidies) on products

Classification of products and activities

SNA recommends the Central Product Classification (CPC) to classify products. While the CPC is comprehensive and detailed, it is not practical as it stands for compiling an SUT. Similarly ISIC Rev.4 is recommended for activities. While the top-level (alpha) level may be appropriate, it needs to be tailored to suit local conditions.

For high quality results, the first step is to establish a structured classification of products and activities (CPA). This can be based on ISIC letters A-U, with up to about 50 sub-activities. These can be further split into around 150 products. The detail should reflect what is important in the local economy. It should also distinguish intermediate products from consumer and capital items (end-use) wherever possible.

Correspondence tables

The next step is to establish “many to one” correspondence tables needed to convert source codes to the CPA. If the trade statistics based on Customs entries are classified by the Harmonised System (HS), then for each HS code a corresponding CPA code is needed. Similarly, codes (possibly based on COICOP) will have been used to classify household expenditure in the household budget survey. These also need to be converted to the CPA. The same applies to all the datasets. Standard correspondence tables (available from the UNSD or EUROSTAT websites) may be helpful in this process. However the task is not trivial and requires great care if the results are to be of high quality.

Assembling the source data

Once the correspondence tables are established, the first five items of source data listed above can be aggregated and entered into the appropriate column of the simplified SUT. In some cases a figure (such as output) may need to be split approximately between two or more CPA items.

Then, estimates for margins have to be made for example by applying marginal rates to the value of imported and home produced goods. Total margins and wholesale and retail trade output should be constrained to agree.

Good quality estimates of the intermediate consumption of each product by all activities will not be available at this stage, but it is possible to make rough estimates of the value of certain raw materials used by specific industries.

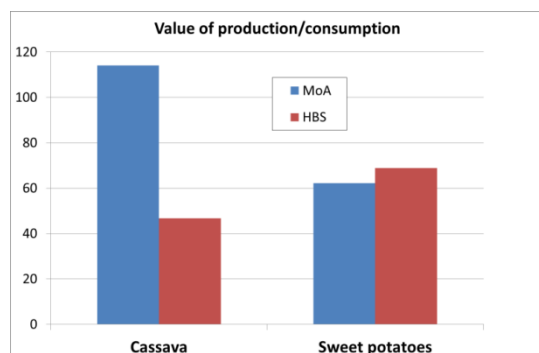
Balancing the rows

Finally, it is necessary to examine each row to fill in gaps (especially intermediate consumption) or to resolve discrepancies by making adjustments to one category or another. Normally, by default, where supply exceeds demand, one of the demand categories would be increased, and vice versa. But sometimes a problem with one of the sources may be revealed.

One example comes from a country in which there were two sources of data for food crops:

- Regular crop forecasts twice a year by the Ministry of Agriculture (MoA) mainly for food security purposes
- Detailed consumption data from a Household Budget Survey (HBS)

When it came to major root crops there was a huge balancing problem with cassava, illustrated in the chart below.



For cassava, MoA figures showed production about two and a half times that implied by the HBS. For sweet potatoes, on the other hand, the statistics agreed quite well, with consumption a bit higher than production. HBS showed households consuming much less cassava than sweet potatoes, while MoA crop forecasts implied the reverse was true.

These crops are similar, except that cassava takes well over a year to mature, but there can be three crops of sweet potatoes in a year. The HBS data was checked for outliers – but there was no obvious error. The external trade (including informal cross-border trade) was negligible). The MoA methodology was to multiply the area planted by the expected yield. It took a long time to discover the reason for the discrepancy. Eventually it became clear that the semi-annual MoA yield estimates took no account of the frequency of the harvest.

Balancing is an iterative process. It is important to keep an eye on the obvious supply chain links; for example, the intermediate consumption of paddy should not be worth more than the total output of milled rice. At the end of the process, intermediate consumption calculated by multiplying estimated total output by the corresponding input-output ratio activity by activity (Part A of the SUT) has to agree with the total intermediate consumption by product (Part B).

Software

For this initial step, commodity flow balances, there is no real need for specialist software. It is relatively easy to construct a set of well designed, structured MS Excel worksheets using links and formulae, with one sheet for assembling the data for each major variable (including a column in which to insert explicit adjustments). The overall balances can be shown in a summary sheet, with columns linked to the (adjusted) total for each variable. The SUMIF formula is especially powerful for aggregation and for summarising data according to the correspondence tables. Using links ensures transparency. The source of a figure can easily be traced. Then, if errors are found in the source data, the SUT can be updated automatically.

Such a system can be extended to include the balancing of a full intermediate demand matrix (a more complex set-up). Alternatively a specialist software package such as ERETES could be used, but this does require substantial technical assistance, training and a highly motivated team to operate it successfully.

4.2 Extrapolating the benchmark

The second part of the strategy is to extrapolate the benchmark to produce annual and quarterly estimates of GDP and its components in a timely fashion. As explained below, this system does not depend primarily on regular business surveys. Most of the data is available monthly or quarterly. In theory, annual business accounts should enhance the quality of the estimates, but these are not available quickly and, as explained above, there is no guarantee that the quality will, in practice, be good enough.

Exploiting VAT data

The system of Customs duties on external trade has long been the source of foreign trade statistics. Value added tax (VAT) is a relatively new (but ubiquitous) system of taxation on (formal) local production (and imports). On the assumption that the tax authorities are

reasonably competent, this system has the potential to be exploited for statistical purposes in a similar way.

Businesses with turnovers above a given threshold are required to register as VAT traders. They are then required to submit regular monthly or quarterly returns. The returns typically contain not only the “output” “input” and “net” tax due, but also the value of non-taxable as well as taxable “supplies” (essentially, turnover). If these data are entered into a database, and provided each trader is classified by activity, the data can be used to provide high quality indicators of formal sector activity. Provided the difference between changes in turnover and changes in output is accepted as immaterial, this source is far more reliable and cost-effective than a business survey that includes information on work-in-progress and inventories of finished goods. Of course, the data need to be validated and edited to eliminate data capture or other errors. Such errors may not be important for tax administration purposes, but they can cause significant bias in the statistics.

There may be issues around access to the data, but these are well worth tackling, at the highest level, if necessary. (It could require an enabling change to the tax legislation.) Tax authorities are typically much better resourced than statistical offices to ensure compliance, and the sanctions for failure to comply with tax legislation is typically much more serious than for failure to respond to a survey. With no need for sampling and high levels of compliance, this source provides very much more accurate results than any statistical survey of the same population, especially in small economies. Of course, traders may understate taxable transactions, but tax authorities do carry out audits from which the extent of understatement may be assessed. In any case, it is likely that hidden transactions will also be omitted from any statistical returns.

If the necessary arrangements can be made, this source is virtually costless to the statistical office (apart from the initial investment). The role of the enterprise survey becomes more one of obtaining supplementary information, such as input-output ratios, commercial trade margins and more details of the type and prices of goods and services produced.

There is even greater potential for a “data revolution” in the VAT system. The very latest technology involves the use of electronic devices at the traders’ points-of-sale to transmit the details of individual transactions directly to the tax authorities in real time. If the purchaser is also a VAT trader, his taxpayer identification number may be recorded as well as that of the seller. Potentially, this development could provide the kind of statistics needed for the intermediate consumption matrix at no extra cost either to the statistical office or to the enterprises involved!

Business income tax

Annual business income tax returns are generally much more complex than VAT returns, and not all the information of interest for national accounting may be available in a database. But this system may cover a wider range of producers and has potential to provide more information at little cost. Francophone countries may exploit it by means of *Déclarations Statistiques et Fiscales* based on a common *plan comptable*, a significant advantage not

available in countries based on Anglo-Saxon accounting. But there is still the informal sector to consider, and a time delay compared with VAT returns.

Other indicators

The administrative data described above has a wide coverage (particularly of revenue-generating activity). But it does not cover informal businesses (usefully defined in this context as not registered for tax purposes). In the absence of any separate estimate, the benchmark will provide a rough indication of the extent of informal activity through the difference between the estimated total output of an activity and turnover from the tax system.

Attempting to collect data on informal activity for measuring change quarterly (or even annually) is not likely to be worthwhile. Change depends on business births and deaths, in addition to the average turnover and value added per business. An experiment conducted in Uganda about ten years ago demonstrated how large the sampling error of the latter can be, while change in the total population cannot easily be measured at all. The only way is to seek another indicator for overall output (for construction the quantity of inputs is commonly used) or to use the formal sector figures from the revenue authority (possibly adjusted for increases in coverage) as the overall indicator.

5 Conclusion

There is no doubt that estimates compiled in this way will be subject to error. While systematic procedures can be followed in balancing an SUT, the benchmark is bound to include a large measure of judgment. The extrapolation will go off track. A new benchmark should be compiled within five years. If a similar household budget survey is conducted and similar procedures are followed or improved, the new benchmark is an opportunity to correct the level of GDP before it goes too far adrift.

However, the GDP estimates are likely to be of much better overall quality than if they are based on poor performing annual business surveys for which there may be no guaranteed budget. If results from the business surveys seem implausible (as they may do if the achieved sample is not good enough), hard pressed national accountants may disregard them anyway, in favour of guestimates that satisfy expectations. Such black arts are all too common, and simply reflect the near impossibility of the job.

For small economies (a majority of UN Member States), the full System of National Accounts is well beyond the capacity of their statistical offices to compile on a regular, timely basis. For these countries, it is suggested that a much simpler, cut-down, achievable system with associated practical guidance be made available. It should focus on preparing estimates of GDP and its growth, in a cost-effective manner. It should highlight the key cost-effective data sources. It should endorse simpler, more straightforward concepts and methods in place of the more sophisticated requirements of the full SNA.

Setting up and maintaining such a system based on tax data, with regular benchmarks every five years, is a demanding but achievable goal for most countries.