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Clarification C10
Measurement of non-market output

MEASUREMENT OF NON-MARKET VOLUME OUTPUT

by François Lequiller, OECD

E-consultation for SNA Review
Clarification Item C10
Measurement of non market volume output

François Lequiller, OECD, 9 November 2005

The ISWGNA agreed to open a “clarification item” (number C10) on the measurement of the volume of non market output in the context of the preparation of the SNA 1993 Rev 1. Responsibility was given to François Lequiller, OECD, to prepare a first proposal which has been circulated, for information, to the July 2005 AEG meeting. The present text is a second version taking into account comments from the AEG.

The present text is proposed for E-consultation of the AEG. It is therefore structured alongside four questions with responses YES and NO, plus possible comments.

This text is a pure clarification of the SNA: no change is proposed in the overall message of the SNA 93 of paragraphs 16.133 to 16.145. The objective remains to recommend the compilation of output indicators based on “output methods” for individual services and some collective services, and to offer, as a second best, indicators based on “input methods”. There is no change proposed in the calculation of current price non market output¹. The objective is simply to build on the experience of the recent UK Atkinson report and the Eurostat Handbook on Price and Volume Measures to discuss somewhat more the theory of non market prices and, at the same time, propose more practical guidelines.

Executive summary: four questions

For the market sector, the SNA makes a reference to economic theory (paragraph 16.10). But the SNA does not discuss the theoretical adequacy of cost estimates to measure the contribution of non market sector to economic well-being.

Question 1: *does the AEG support the inclusion of new sentences in Chapter 16 of the SNA discussing the importance in theory of taking into account marginal benefits to households in the estimation of the volume change of non market services?*

The current SNA does not use the terms that have been used in other manuals, such as input/output/outcome and does not fully discuss the differences between these concepts. There is room in the new SNA for a more precise definition of these terms, in order to give better guidelines.

Question 2: *does the AEG support the inclusion in the new SNA of more precise definitions of “input”/“output”/“outcome”?*

¹ Except for the reference to capital services, which depends on a separate decision of the ISWGNA/AEG.

The current SNA does not give practical guidelines for best practice regarding the measure of volume indicators of health and education.

Question 3: *does the AEG agree to include in the new SNA positive and practical descriptions of acceptable output indicators, in particular for education and health?*

The current SNA does not mention the recent experimental output indicators for certain collective services in its paragraph 16.139.

Question 4: *does the AEG agree to revise paragraph 16.139 to give it a more positive tone and reflect current thinking?*

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1: Theory of non market “prices”

In the market sector, as explained in SNA paragraph 16.10, the relative prices of different goods and services should reflect both their relative costs of production and their relative utilities to purchasers. There is no revealed price for the production of non-market goods and services and the current price value is estimated on the basis of the total costs of production (including capital services if this is confirmed by the AEG). But there is no reason to suppose that non market output is always supplied up to the point where the marginal cost of supplying it is equal to the benefit obtained by the consumer from a marginal unit produced. In these circumstances, the conditions listed in paragraph 16.10 do not necessarily hold for services which government or other non market producers provide to consumers either free of charge or at a nominal price, and costs of production may therefore not be a good proxy for valuing the benefits to the consumer.

In economic theory, the calculation of the contribution of non market services to welfare should reflect the marginal benefit accruing to consumers and not the marginal cost. For example, the value of government spending on education can be measured in terms of the improvement in outcomes which are attributable to that spending alone. Hence, in measuring the output resulting from government spending on education – in other words, its marginal contribution to welfare – it would be appropriate to take into account the impact of that spending on students’ expected future earnings. The output of fire services should be measured not in terms of the costs of putting out fires but should reflect how much people (including their property) benefit from being covered by the fire service. This could grow more rapidly than the costs of the fire service, given the growth of productivity in fire fighting and the growth in the volume of property covered and in the value of a human life saved. Following on from this last point consider healthcare. The wealthier our society becomes the higher the negative value placed on a day’s sickness: in these circumstances, being cured of illness has taken on a higher value. Thus the volume output of health increases through the avoidance of higher valued days of sickness. It is apparent from these examples that the change in the volume of many non

market services reflects the general growth in prosperity in a country's economy. If the change in the marginal benefit for the consumer is the result of a change in the quality of the service, this should be reflected in the change in the volume growth of the service, as happens with any other quality element linked to the service.

Question 1: *does the AEG support the inclusion of new sentences in Chapter 16 of the SNA discussing the importance in theory of taking into account marginal benefits to households in the estimation of the volume change of non market services?*

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2: Better describe the definitions of input/output/outcome

The current SNA does not use some terms that are widely used in the Atkinson report and the Eurostat manual on volume and prices (such as “input method”, “output method”) nor tries to fully describe the difference between input/output/outcome.

In practice, there are two possible methods of compiling volume estimates of the output of non market goods and services. The first, subsequently called the “output method” is based on the calculation of a volume indicator of output using appropriately weighted measures of output of the various categories of non-market goods and services produced. These measures of output should reflect fully changes in both quantity and quality and any output change attributable to change in the marginal benefit of the services. The second, called the “input method” is used for services for which the “output method” is hardly applicable because there are no adequate quality-adjusted quantity measures of output. The “input method” consists of measuring changes in “output” by changes in the weighted sum of volume measures of all the inputs. The latter should fully reflect both changes in quantity and quality. They are generally best derived by deflating the various input costs by corresponding constant-quality price indexes, or when such price indexes are unavailable using volume indicators that reflect input volume change (for example, number of hours of employees).

It is useful at this stage to define the terms input, activity, output, and outcome. Taking the health service as an example, input is defined as the time of medical and non medical staff, the drugs, the electricity and other inputs purchased, and the capital services from the equipment and buildings used. These resources are used in primary care and in hospital activities, such as a general practitioner making an examination or the carrying out of a heart operation. These activities are designed to benefit the individual patient. To the extent that they do, the health care provided constitutes the output associated with these input activities. Finally, there is the health outcome, which may depend on a number of factors apart from the output of health care, such as whether or not the patient gives up smoking.

The measurement of the volume output of non-market individual services should avoid two pitfalls. First, it should not be restricted to reflect the input or the activity of the unit

producing the services. Inputs are not an appropriate measure and while activities may be the only available indicator, and hence have to be used, they too are an intermediate variable. What should be measured is the service rendered to the customer. Second, if outcome is defined as the welfare objectives of the non market service (for example, level of health for the health service, or level of education for the education service) the change in the volume of the output of the non market unit cannot be reflected by the change in the indicators of outcome. This is because indicators of outcome can be affected by other aspects that are not directly related to the activity of the non market services. For example, in the case of health, it is well-known that there are many other factors than the output of the non-market health units such as sanitation, housing, nutrition, education, consumption of tobacco, alcohol, and drugs, pollution, etc; whose collective impact on the health of the community may be far greater than that of the provision of health services. Similarly, the output of education services is quite different from the level of knowledge or skills possessed by members of the community. Education services consist principally of teaching provided by producers of education services - schools, colleges, universities - to the pupils and students who consume such services. The level of knowledge or skills in the community depends in addition on other factors, such as the amount of study or effort made by consumers of education services and their attitudes and motivation. What we are looking for is to identify only that part of the overall change in outcomes directly attributable to the non-market service concerned.

Question 2: *does the AEG support the inclusion in the new SNA of more precise definitions of “input”/“output”/“outcome”?*

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3: Description of acceptable volume output indicators

While the current SNA correctly describes (paragraphs 16.136 and 16.137) what not to do, which is to confuse output and outcome (though not using these terms), it does not really give any positive guidelines on what to do in practice, in particular regarding health and education which are the two major non market services. Paragraph 16.138 simply says that “there is no mystique about non-market health or education which makes changes in their volume more difficult to measure than volume changes for other types of output such as financial and business services or fixed tangible assets”. There is perhaps no “mystique” as the SNA says, but in practice most statisticians are puzzled on how to construct an acceptable volume indicator for these services².

The “output method” is the recommended method for compiling indicators of volume change of non market services. The method is based on indicators compiled as appropriately price-weighted averages of adequately quality-adjusted quantity indicators. Economic theory would suggest using marginal benefits as price weights for the

² At the same time one can note that, regarding financial or insurance services, the SNA does not give any idea of how to measure their volume. Thus the poor statistician is left without any non-mystical information!

calculation of indicators of non market services rather than average costs. However, first, data on marginal benefits are difficult to obtain, and, second, their use as internal weights would contradict the amounts shown as weights for the base year and would not allow users to replicate the compilation of volume and prices. Therefore, in practice, national accounts compilers will preferably rely on average cost weights. The quantity indicators should reflect as much as possible the output of the non market unit. If only activity indicators are available, they should be quality adjusted to take into account the contribution of the unit to the change in outcome. Two criteria should be respected to compile adequate indicators of volume change. First, the quantities and costs used should reflect the activity of the full range of services for the functional area under review and cost weights should be updated regularly. If part of the costs of the functional area is not covered by the quantity indicator, it should not be assumed that the uncovered part follows the changes of the part which is covered. If no direct output method is applicable for this part, an input method should be used for it. Secondly, it should make allowance for quality change. There are different aspects to quality change. Services should be sufficiently differentiated with the aim of arriving at categories that can be regarded as homogeneous. An aspect of quality change is then captured by changes in the proportions of different categories. Also, the volume measure of each category can be based on a quantity indicator of activity but be augmented by a quality adjustment obtained from the contribution to outcomes. In effect, the quantity indicator is marked up or down by a percentage reflecting indicators of success and the contribution of the service to that success.

It is recommended that, prior to the implementation of these volume indicators in the national accounts, they should have been tested for a substantial time by the statisticians, in conjunction with experts of the domain, in particular, considering their importance, in the domains of health and education. Also, the context in which they will be published should be fully assessed, in particular the implied productivity measures. In the absence of passing satisfactorily these tests, it might be advisable to use the second best method, the “input method”.

Health services are defined as the quantity of health care received by the patients, adjusted to allow for the quality of the service provided, for each type of health care. As an example, the “output method” indicator of non market hospital services can be based on the index aggregation of detailed cost-weighted numbers of treatments provided to patients, taking into account adequate quality adjustments. Ideally, a treatment would incorporate all activities provided to patients as part of the health care pathway associated with their diagnosis irrespective of setting (inpatient, outpatient, primary care, etc.). Typically, however, information is only available on the individual activities making up the health care pathway, with no linkage made between each. There tends to be relatively more and more suitable information on hospital inpatient activities compared with, say, primary care. For example, in many countries, efforts to improve the management of public hospitals have led to the creation of detailed classifications of inpatient hospital activities with several hundred groups that are medically meaningful and as homogeneous as possible with regard to resource use. In most cases, cost information is also collected at the same level of detail as activity. For services to inpatients the use of

cost-weighted quality adjusted quantity indicators of numbers of treatments by each group of this classification is a good method to estimate the volume of non market hospital services. While this method captures changes in the treatment mix well, changes in the quality of individual treatments are difficult to measure. They may be due to better performing equipment, better performing doctors and nurses or changes in the hospital environment such as the occurrence of infectious diseases in the hospital, medical errors, and additional facilities for patients, etc. In principle, the change in the number of treatments of each entry should be quality adjusted to take into account these effects.

Education services are defined as the quantity of teaching received by the students, adjusted to allow for the quality of the service provided, for each type of education. As in the case of health, an output indicator can be compiled for the output of non market education services using cost-weighted detailed quantity indicators taking into account adequate quality adjustments. It is important to distinguish as many different kinds of education service as possible as their relative costs, or qualities, may vary considerably. Stratification should at least distinguish pre-school, primary, lower secondary, upper secondary, higher education, and other education. In the case of higher education courses, there should be stratification by subject. Available quantity indicators are in general imperfect. The number of teachers is a pure input indicator. The number of hours taught is a better indicator, but remains an activity indicator as, for example, it does not seem reasonable to treat time wasted in class as an output. The number of pupils is an indicator closer to output, but an even better indicator would be a quantity showing pupil attendance at school (number of pupils multiplied by hours of effective attendance). Pupils cannot learn from the output of the service if they are not at school. However, all these indicators do not reflect the contribution to the change of the outcome, which is the level of education of the pupils. Thus quality adjustments should be added to the measure, wherever possible. A proposed quality indicator could be the annual results in pupil attainment or exam success, providing controls are in place to adequately ensure that changes in outcome are solely, or at least largely, attributable to changes in the output of education services for the period under review. Another possible source of indicators of quality change is reports of school inspections. Sometimes pupil/teacher ratios are proposed as an indicator of quality. However, it is recommended that, if this approach is taken, it is based on a sound analysis of the relationship between the ratio and the quality of classroom teaching.

Question 3: *does the AEG agree to include in the new SNA positive and practical descriptions of acceptable output indicators, in particular for education and health?*

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Paragraph 16.139 of the SNA explains that “measuring the change in the volume of collective services is distinctly more difficult, however, as it is not possible to observe and record the delivery of such services”, and a few sentences later, adds “in practice, it may not be feasible to avoid using changes in the volume of inputs into such services as proxies for changes in volumes of output”. The same paragraph notes that many

collective services are preventative in nature and states that output measures for these services are “an area in which further research is needed”.

It is now considered possible to measure the output of quite a few collective services, and over the last ten years there has been a considerable amount of research undertaken into developing such measures. They include preventative services such as police, corrective services and fire services, as well as some administrative services. While it is clear that more research and development needs to be done, the prospects of compiling satisfactory output measures for collective services are thought to be somewhat brighter than suggested in paragraph 16.139. It is therefore proposed that this paragraph be amended to reflect the current state of knowledge. .

Question 4: *does the AEG agree to revise paragraph 16.139 to give it a more positive tone and reflect current thinking?*