



DEPARTMENT OF ECONOMIC AND SOCIAL AFFAIRS  
STATISTICS DIVISION  
UNITED NATIONS

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System of  
Environmental  
Economic  
Accounting

## **SEEA EEA Revision**

### **Working group 5: Valuation and accounting treatments**

#### **Background paper:**

#### ***Exchange values and welfare values in the SEEA EEA***

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# Background paper: Exchange values and welfare values in the SEEA EEA

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This note addresses the relationships between the valuation principles guiding SNA and SEEA-EEA, basically exchange values and eventually simulated exchange values, and between those principles and measures of welfare in economic terms. The note draws heavily on Barton et al. (2019), the comments received to that working paper and on Hein et al. (2020).

## Exchange values in the SNA

The general rules on valuation in the 2008 version of the SNA state that “the power of the SNA as an analytical tool stems largely from its ability to link numerous, very varied economic phenomena by expressing them in a single accounting unit. The SNA does not attempt to determine the utility of the flows and stocks that come within its scope. Rather, it measures the current *exchange value* [italics added] of the entries in the accounts in money terms, that is, the values at which goods, services, labour or assets are in fact exchanged or else could be exchanged for cash (currency or transferable deposits).” (UN 2008, paragraph 3.118). Note that the SNA concept of ‘exchange value’ refers to the price at which goods and services are or could be exchanged.

The section “The SNA and measures of welfare” (UN 2008, paragraph 1.75) states that “GDP is often taken as a measure of welfare, but the SNA makes no claim that this is so and indeed there are several conventions in the SNA that argue against the welfare interpretation.” An example of such a convention is the exclusion of unpaid services from the production boundary (the limits of goods, services, and assets included and valued in accounts) used to define GDP. Note, however, that although excluded by convention these values can, in principle, be part of the national accounts.

In any case, it is important to highlight that valuation within the SNA context is different from valuation in a cost-benefit analysis framework. The goal of the former is to find exchange values, while the goal of the latter is to analyze welfare changes. However, both concepts are related, as discussed in the next section.

## Theoretical relationships between exchange values and welfare measures

The focus on exchange values in SEEA EEA implies that the monetary values shown in the national accounts are not equivalent to a correct measure of welfare from an economic point

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of view<sup>4</sup>. In particular, the exchange values recorded in the transaction-based nature of the system<sup>5</sup> exclude consumer surplus while including producer surplus and production costs. Thus, focusing on exchange values implies that resulting estimation of the level of the value of economic flows will be lower than those obtained in cost-benefit analyses.

However, the literature has pointed out that, by using index number theory, it is possible to approximate a correct measure of welfare change from national accounts data using the prices and quantities pertaining to two periods of time. An index number is the measure of change in a variable, or group of variables, over time. The literature has proposed different indexes to measure welfare changes based on the data produced by national accounts, essentially by applying appropriate deflation methods (Diewert, 1992; Fenichel and Obst, 2019). The literature has also shown that, as long as changes are marginal and a set of additional conditions are met; changes in societal welfare are approximated sufficiently well by changes in Net Domestic Product (NDP), which is calculated by subtracting depreciation from Gross Domestic Product (GDP). More precisely, in a dynamic model Weitzman (1976) showed that marginal variations in NDP equal variations in welfare under a set of restrictive assumptions, which have been partially relaxed in subsequent studies (see Harberger 1971 for a previous and similar result and Löfgern 2010 for a survey of this literature and a discussion about the assumptions needed). More recent quantitative analysis show that the equivalencies / proximities of both concepts do not only exist with regard to variations of the respective aggregates (such as NDP, GDP or overall welfare) but also with regard to *variations* of specific quantity-price-pairs, in the sense that the welfare loss or gain calculated for them as consumer surplus change is a good proxy for the amount of the NDP change that is caused by the alteration of a price quantity pair<sup>6</sup> (Schweppe-Kraft and Ekinici, 2019).

Beyond their theoretical importance, these findings open up quite practical opportunities for the use of accounting data. If, for instance, urban green supply advances the saturation point, an additional expansion of urban green may result in a decrease of its (simulated) price as a consumer good. If the relative decline of (simulated) prices is higher than the relative increase in quantity the value of the quantity price pair in the accounts will drop. In order to show if this change is positive or negative the same accounting data can be used to calculate the consumer surplus change. If this is higher than the additional provisioning cost (including land prices) the net effect on welfare and, as a proxy, also the net effect on NDP will still be positive. The proximity between exchange values and welfare values, in terms of variations, thus allow a welfare based interpretation and use of accounting data that can directly inform policy on ways to enhance resource allocation.

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<sup>4</sup> In a partial equilibrium context and ignoring wealth effects, economists measure changes in welfare estimating changes in the consumer and the producer surplus (the consumer surplus is the maximum amount that consumers would have been willing to pay in excess to what they actually paid for a good, and the producer surplus is the amount that producers obtained from selling a good, in addition to their costs). Hicksian variations are considered to be more precise measures of welfare, as they take into account general equilibrium and wealth effects. For details, see (Harberger, 1971).

<sup>5</sup> The SNA uses a quadruple entry bookkeeping system that ensures consistency in recording transactions between multiple entities.

<sup>6</sup> Using a with-and-without approach in analogy to Cost Benefit Analysis, it can be shown that the contribution of the change of a quantity-price-pair to real NDP, this means: after deflation, is a good proxy for the change of consumer surplus and vice versa. Even if the change of a certain ecosystem service flow from one year to another exceeds the level that lets (simulated) prices fall to “0”, the resulting change of real GDP is still a good proxy for the additional consumer surplus associated with the variation of the respective quantity-price-pair (Schweppe-Kraft and Ekinici, 2019).

An important point for the SEEA debate is that for this [i.e. marginal variations in NDP equal variations in welfare] result to hold at the aggregate level, one need to assume that all consumption services and capital stocks (assets) that are relevant to human wellbeing are correctly priced and included in the accounts, and those that are irrelevant to human wellbeing are excluded. This is particularly relevant because it is unclear to what extent the SNA boundaries (production and consumption) are related to welfare concerns in practice. Relating to our topic, for this to hold all relevant natural capital and ecosystem services need to be included in the accounts to obtain an indicator that approximates welfare changes. By the same token, the (accounting) prices discussed in this literature are not focused exclusively on those observed in current market transactions. Indeed, this is also true in principle for the national accounts since the SNA states that “when non-financial resources are provided without a quid pro quo, such resources should be valued at the market prices that would have been received if the resources had been sold in the market” (UN 2008, paragraph 3.130). Nonetheless, while measurement of these services and asset prices may be appropriate in principle, their inclusion is not standard SNA practice.

### **Extending the exchange value concept to SEEA-EEA**

The objective of the SEEA-EEA (UN, 2014) is to incorporate natural capital and ecosystem services into economic decision making by describing how the economy depends on the environment, as well as its impacts on it. The SEEA-EEA approaches its objective by extending the general principles of the SNA to environmental goods and services that are not included or not separately identified in the SNA. This allows compilation of integrated monetary accounts that capture the flow of ecosystem services and stocks of ecosystem assets, including measures of income and wealth adjusted for ecosystem degradation. To achieve this integration, when doing valuation, it is necessary to maintain consistency with the SNA valuation principles. While there is broad agreement of the need for consistency there are various interpretations of what this implies:

- A) some argue that application of SNA valuation principles gives flexibility to choose valuation methods, as long as they exclude consumer surplus. The interpretation is that “could be exchanged” allows to impute transactions that have not actually taking place. The argument being that this is also part of the regular practices of the SNA (well-known examples are owner occupied dwellings, or FISIM, or kitchen gardens);
- B) some argue that consistency implies that as we are considering non-market production, valuation in principle should be based ‘at cost’, similar to the way the SNA values education and health output;
- C) some argue that the SNA allows for flexibility to define a different type of production (in addition to market production, non-market production, and production for own consumption traditionally recognized) when it comes to ecosystems;
- D) some argue that the SNA is not prescriptive as to mechanism prescribed (any value function between 0 and the demand curve would suffice), and hence assuming perfect price discrimination (which would make the consumer surplus go away) may be a practical way to reconciliation.

The majority viewpoint is that A is the starting point, however recognizing that for certain services B is also a feasible approach, allowing to depict resulting values as a range. Options C and D have little support.

Concern has been voiced that use of relatively low exchange values may lead to perverse outcomes. Nevertheless, others argue that the next version of the SEEA EEA should be seen as a first step, incorporating only the less controversial values, and that low values are only a consequence of this cautious approach.

The nature of this extension is consistent with the motivation, as discussed in Stiglitz et al. (2018), that future developments of the national accounts should be guided by the principles underlying national accounts rather than by current conventions. At the same time, as noted by Stiglitz et al (2018) and Jorgenson (2018), while the national accounts should tackle the difficult task of measuring welfare and well-being, this work should be undertaken without forgetting the importance of current measures of economic activity, such as GDP, which also need ongoing refinement to adapt to new economic phenomenon. As discussed above, for variations, there are close relationships between the exchange and welfare values, which allows for a welfare related interpretation of the accounts. However, it is also important to note that the creation of macroeconomic statistics to provide measures of economic performance in the sense of production is also relevant, and it does not rely on welfare economics for their interpretation. One can be interested in analyzing variations in the production of goods and services without addressing whether there has been a consequent change in welfare.

To ensure a consistent extension to the SNA, ecosystem services and assets should thus be valued in the SEEA EEA using prices<sup>7</sup> based on the SNA exchange value concept, i.e., the prices at which goods, services or assets are, or could be, exchanged for cash. When traded in regular markets, exchange values are observable. However, following the SNA, “when market prices for transactions are not observable, valuation according to market-price-equivalents provides an approximation to market prices. In such cases, market prices of the same or similar items when such prices exist will provide a good basis for applying the principle of market prices. ... If there is no appropriate market in which a particular good or service is currently traded, the valuation of a transaction involving that good or service may be derived from the market prices of similar goods and services by making adjustments for quality and other differences.” (UN 2008, paragraph 3.123).

While this approach can be applied in a range of instances, for some ecosystem services, such as open-access, nature-based recreation or air filtration, there are often no markets where the same or similar items are currently traded in sufficient numbers and in similar circumstances. The Technical Recommendations document of the SEEA EEA (UN 2017, p. 97) therefore proposes to apply the concept of exchange values to include “those values that reflect the price at which ecosystem services and ecosystem assets would be exchanged between buyer and seller if a market existed.” In this framing, valuation approaches that are compatible with the principles of the SEEA EEA include, for instance, avoided damage costs methods and

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<sup>7</sup> Note that the SNA exchange price concept is, in principle, identical to the price as a marginal value concept used in economics.

hedonic pricing. These methods do not generally provide a measure of welfare, i.e., including producer and consumer surplus (NRC, 2005). The Simulated Exchange Value (SEV) method is an alternative that addresses more directly the goal of estimating “the price at which ecosystem services and ecosystem assets would be exchanged between buyer and seller if a market existed” (Caparrós et al., 2003 and 2017). The method has been applied mainly to free access nature based recreation, as discussed below, but the same principles can be applied beyond this particular case. The method was discussed extensively in Barton et al. (2019), and the key messages are summarized below.

### **Exchange values and simulated exchange values**

As already noted, when traded in regular markets, prices and quantities are observable. When goods are not traded in one particular local market, but they are traded elsewhere, the approach proposed by the SNA is to use prices of similar markets. The problem arises because for some goods, such as free access nature based recreation, there are no markets where the same or similar items are traded currently in sufficient numbers and in similar circumstances. In these cases, the SEV proposes to simulate the price and the quantity that would have been observed if a similar good would have been traded in a market (Caparrós et al., 2003). As discussed in Barton et al. (2019), the goal is to simulate the whole market: demand, supply and competitive environment. The demand is estimated using standard non-market valuation methods (see Caparrós et al. (2017) for a discussion focused on the use of the contingent valuation method and Oviedo et al. (2016) for a focus on the use of choice experiments). The SEEA EEA TR (UN et al. 2017: p. 97) also proposes to extend the concept of exchange values, to include “those values that reflect the price at which ecosystem services and ecosystem assets would be exchanged between buyer and seller if a market existed”.

If the market is simulated there are several prices that could emerge, depending on the assumed institutional context. There is a broad consensus that the goal should be to focus on a realistic institutional context when simulating a market. The most realistic scenario will in general be the current one, which almost by definition implies no payment, as there would otherwise be no reason for applying the method.

Thus, the challenge is to design the most realistic alternative that would actually imply a payment for the ecosystem service, and would therefore provide an estimation of the income generated if it would be traded in a market. It has been proposed to develop a typology of mechanisms (perfect competition, monopoly, monopolistic competition, oligopoly, monopsony, far-from market, near market ...). It was also remarked that cost-recovery would be a very logical situation, in which average maintenance costs would be recouped (note that this concept is closely related to perfect competition).

It has also been proposed that the most realistic context may be defined based on 1) whether there is a legal basis for excluding users and 2) whether technology and transaction costs make it possible to charge users. The criteria developed in Barton et al. (2019) should be understood in this context.

It is also worthwhile to note that one institutional context, a monopoly with full price discrimination, implies that all the consumer surplus is appropriate by the producer. This

implies that there is no consumer surplus left, and hence the problem discussed above that the consumer surplus is left out has no practical consequences. However, as discussed in Barton et al. (2019) this institutional context is in general not particularly realistic as it implies, focusing for example on free access nature based recreation to a forest, that the owner is able to identify the maximum willingness to pay of each visitor and then charge to each of them a different price.

A relevant issue is that when simulating a market, there will in general result a discrepancy between the simulated price and the actual quantity (the significance of this discrepancy depends on assumptions about the way the service is “sold” in the simulated market<sup>8</sup>). Discussion paper 5.1 supports the idea that the simulated quantity should be multiplied by the simulated price, while a price of zero should be used for the part of the actual quantity that would not be traded in a simulated market (Barton et al., 2019). Some commentators have argued that an another alternative would be to option would be taking the trapezium i.e. simulated price times simulated quantity, plus the area under the demand curve for additional units up to the observed quantity, so combining simulated exchange with notional full price discrimination to capture the observed visits.

From the subsequent discussions a third alternative has emerged as being more consistent with SNA practices. The idea would be to distribute the total value that could be internalized in a simulated market, i.e. simulated price times simulated quantity, and distribute this value over the actual quantity (hence, implicitly defining a sort of “average” price between the simulated price and the zero price mentioned above). This would have the advantage that one would apply a single uniform price to all physical quantities which can then easily be used to depict spatially (in the form of a map).

### **Open issues and need for conventions**

What the appropriate institutional context is to estimate “the price at which ecosystem services and ecosystem assets would be exchanged between buyer and seller if a market existed” is debatable, and estimations are going to be sensitive to the particular institutional context used. In the case of open-access recreation, Barton et al. (2019) argued that for iconic recreational sites probably the most appropriate institutional context is defined by monopolistic competition, with price discrimination among iconic nature-based recreational sites but without price discrimination among consumers. For non-iconic and relatively homogeneous greenspaces, the appropriate institutional context may be that of perfect competition. However, even this general recommendation is highly sensitive to the particular area and country. Furthermore, in the case of Payments for Ecosystem Services the adequate institutional context is even harder to define. That said, as one of the goals of the SEEA is to allow for international comparability, this difficulty calls for a set of conventions providing

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<sup>8</sup> For example, a payment for a one-year permission for free access to urban parks can reduce the number of visits far less than fees for every individual visit that sum up to the same revenues. For each buyer, the purchase of an annual ticket is based on an average calculation between the first visits with high and further visits with increasingly lower benefits. Once the annual ticket has been paid, the number of visits can then be extended to the point of saturation. A single-entrance ticket, in contrast, inhibits all visits with benefits that are above the saturation point but below the ticket-price. Institutional settings with moderate annual payments for free access can therefore be more or less compliant with the observed quantity. If the price for the annual ticket is less the area below the demand curve of the person with the lowest preference, there will be no effect on quantity at all.

clear guidance on which institutional context is considered more adequate for different ecosystem services.

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