Measuring Individual Economic Well-Being and Social Welfare within the Framework of the System of National Accounts

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Abstract

While the agenda of "beyond GDP" encompasses measurements that lie outside boundaries of the *System of National Accounts*, key aspects of individual well-being and social welfare can be incorporated into an SNA framework. Jorgenson and Slesnick (1983, 2014) developed the theory and methodology for full implementation of these features. However, for regular statistical production, this may not always be feasible. We identify the simplifying assumptions required to put a less ambitious but empirically more tractable measurement of individual and social welfare in place. This concerns the theory and measurement of equivalence scales, group-specific price indices and explicit introduction of equity considerations.

We use data from the U.S. Consumer Expenditure Survey to construct simplified national accounts compatible measures of economic well-being and social welfare. We are also able to test the impact of benchmarking survey-based consumption categories to the consumption expenditure categories in the national accounts. This effect is significant and underlines the need for a careful adjustment of survey sources.

1. Introduction

Renewed interest in the measurement of individual well-being and social welfare is evident in the recommendations by Stiglitz, Sen, and Fitoussi (2009) on the measurement of economic performance and social progress and the G20 Data Gaps Initiative (2009) on enhancements in economic and financial statistics. While the agenda of "beyond GDP" encompasses measurements that lie outside the production and asset boundaries of *The System of National Accounts 2008* (2009), key aspects of individual well-being and social welfare can be incorporated into the framework of the *SNA 2008*. A leading example is the measures of individual and social welfare proposed by Jorgenson and Slesnick (2014).

The common features of the Stiglitz-Sen-Fitoussi and Data Gaps reports are a focus on income, consumption and wealth, rather than production, and an emphasis on disparities among members of the population rather than national aggregates. In response to the interest in income, consumption/saving, and wealth, the OECD has established an expert group (EG ICW) to consider international standards for measuring the distribution of household wealth and to develop

a framework for the integrated analysis of micro data on household income, consumption and wealth. The OECD and Eurostat have established a second expert group (EG DNA) to consider standards for the measurement of disparities within the framework of the national accounts. A first set of results has been reported by Fesseau, Wolff, and Mattonetti (2013) and Fesseau and Mattonetti (2013).

The two expert groups – EG ISW and EG DNA – have collected information from leading statistical agencies on the role of distributional information in the national accounts and existing capabilities for providing the necessary survey information. The reports have discussed the reconciliation of national accounting aggregates with survey statistics and have given detailed empirical examples of methods for incorporation of these statistics into the *2008 SNA*. To simplify the presentation in this paper, we limit our discussion to consumption by households and its distribution over the population, but similar information is available for income from the expert group reports.

The measurement of individual economic well-being is based on a long-established theory of consumer behaviour.[1] This is useful in choosing among the many possible approaches to the measurement of consumption considered in the literature and could be helpful in extending these approaches beyond the boundaries of the *2008 SNA*, which we do not consider in this paper. The first issue is the definition of the consumption unit. In economic surveys consumption is measured for households, consisting of individuals living together and sharing a budget. While the theory of consumer behaviour deals with the individuals, rather than households, there is also a well-

[1]The year 2015 is the centennial of Eugen (Evgeny) Slutsky (1915), "Sulla theoria del bilancio del consumatore," *Giornale degli Economisti,* 51(3): 1-26, often taken as the starting point for the theory of consumer behaviour.

established, if less familiar, theory of household behaviour that can serve as a valuable guide to the measurement of consumption.

We conclude that the household, rather than the individual, is the appropriate starting point for the measurement of consumption at the micro-economic level. This results in a second issue for economic statistics, namely, that a large household requires more measured consumption than a small household to achieve the same level of well-being. However, such differences are not necessarily proportional to household size. In measuring disparities among consuming units economic statisticians have introduced *household equivalence scales* to capture differences in the composition of households. At a minimum these scales depend on the number of individuals, but Jorgenson and Slesnick (1987) have shown how to use an econometric model of household behaviour to derive equivalence scales that depend on other characteristics of household composition.

The measurement of social welfare is based on the economic theory of social choice. This provides a framework useful in choosing among the many approaches for measuring social welfare considered in the literature. Measures of social welfare are based on the distribution of consumption scaled by a measure of household size. We refer to this as the distribution of household equivalent consumption.[2] While measures of individual welfare depend on optimization by households, no optimization is involved in deriving measures of social welfare from the theory of social choice. However, by contrast with measures of individual welfare, social welfare measures depend on normative assumptions or value judgements. Jorgenson and Slesnick

[2] The term "equivalised consumption" is sometimes used for scaled household consumption, but "household equivalent consumption" conveys the same meaning and is closer to standard English usage.

(2014) have shown how to incorporate these normative assumptions into measures of social welfare within the framework of the national accounts.

In this paper we consider the measurement of individual welfare in Section 2. We use information from surveys of consumer expenditures and control totals from the national accounts to construct measures of individual well-being. These measures incorporate differences in prices and total expenditure along with information about household composition. The distribution of individual welfare over a given population provides the information required to quantify differences among households. These are the "disparities" of EG DNA and can be integrated into the national accounts along with accounting aggregates like consumer expenditures. It is useful to emphasize that consumer expenditures could be augmented in various ways, recently summarized by Abraham (2014), but this would involve changing the boundaries of the national accounts.

In Section 3 we use the theory of social choice to construct measures of social welfare from the distribution of individual well-being. We also refer to a measure of social welfare as the *standard of living*. We consider only those measures of the standard of living that are feasible, given information about individual welfare available within the framework of the national accounts. Following Atkinson (1970), we decompose measures of social welfare between measures of efficiency and equity. Measures of equity can be transformed into measures of inequity or inequality. Our measures of efficiency can be expressed in terms of national accounting aggregates like personal consumption expenditures.

In Section 4 we conclude that economic statisticians should use measures of social welfare, including efficiency and equity to summarize information about the distribution of individual welfare. We emphasize that this can be done within the *2008 SNA*. Fortunately, the practical

issues that confront statistical agencies in measuring individual well-being and social welfare have been discussed exhaustively by EG ISW and EG DNA.

2. Measures of individual economic well-being

Whose well-being? Households, individuals and equivalence scales

Our investigation starts at the micro-economic level with a question about the nature of the consuming unit. The key lies in the distinction between households and individuals. Although the traditional theory of consumer behaviour is based on individuals, more in-depth analysis has recognised that the household is a more appealing way to think about decision-making units. The necessary framework was provided by the theory of household behaviour of Samuelson (1956).[3] Our starting point for welfare comparisons is thus the household. This coincides with the fact that empirical sources of information on consumption or income are typically collected for households, not individuals. At the same time, households may have quite different characteristics, for example in terms of the number of individuals living in a household so one household's economic well-being cannot be directly compared to another household's well-being unless they share the same characteristics.

Jorgenson and Slesnick (1987, 2014) and Lewbel (1989) have shown how to deal with the issue of scaling consumption expenditures to achieve comparability among households. We briefly review the theoretical framework and then turn to simplifying assumptions that are useful in practical implementations. In the theory of household behaviour economic well-being of a household k $(k=1,2,\ldots K)$ is presented by a utility function W_k that, in its simplest form, depends on the flow of consumption of consumer goods and services[4] available to the household. In

[3] Samuelson's theory has been discussed by Becker (1981) and Pollak (1981).

[4] Outside the framework of the national accounts, household utility could also depend on factors such as the health of

addition, the vector A_k represents the demographic characteristics of household *k.* Household size is an example of a relevant demographic characteristic. Others would include the age and gender of each household member and the household's place of residence. Whether or not to include a particular characteristic depends on whether it is deemed to be a relevant determinant of a household's expenditure pattern and therefore of its well-being.

Household welfare is represented by:

$$W_k = W_k(x_k, A_k) \qquad (1)$$

where W_k satisfies standard regularity conditions[5] and $x_k=(x_{1k}, x_{2k,}...x_{Nk})^T$ is the non-negative vector of N quantities of products consumed by unit k. Further, consumers face a vector of N prices $p=(p_1, p_{2,}...p_N)$. The expenditure by consumption unit k is then $M_k=p\cdot x_k$ where $p\cdot x_k \equiv \sum p_n \cdot x_{nk}$ stands for the inner product of p and x_k. Assuming that households minimise the costs of obtaining a level of utility that is at least as good as a particular level $W_k^{'}$, actual expenditure equals minimum expenditure and the latter is represented by an *expenditure function* $M_k(p, W_k^{'}, A_k)$:

$$M_k(p, W_k^{'}, A_k) = min_x \{ p\cdot x_k \mid W_k(x_k, A_k) \geq W_k^{'} \} \qquad (1)$$

Jorgenson and Slesnick (1987) simplify the expenditure function by assuming that it is the product of a scaling factor that depends only on prices and household characteristics $m_0(p,A_k)$ and a function $G(p,W_k')$ that depends on prices and household welfare but is independent of household characteristics[6], so that:

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household members, environmental quality or social relations. While the latter factors are clearly important, we leave these non-market variables aside for the considerations at hand and focus on economic well-being.

[5] W_k is defined over the non-negative orthant, continuous, and increasing in x_k.

[6] $G(p, W_k^{'})$ is itself an indirect utility function.

$$M_k(p, W_k', A_k)=m_0(p,A_k)\cdot G(p,W_k').$$

This formulation ensures that any scaling of households is independent of households' level of utility – an important condition to construct meaningful equivalence scales empirically. For example, if household *k* is compared with a reference household with attributes *A*, one obtains an equivalence scale $I_k(p, A_k)= M_k(p, W_k', A_k)/M_k(p, W_k', A)=m_0(p,A_k)/ m_0(p,A)$ that depends only on prices and household attributes (see Lewbel 1989 for a full discussion).

Jorgenson and Slesnick (1987, 2014) construct multi-dimensional equivalence scales from an econometric model of household consumption. They treat household size, the age of the head of household, region of residence, ethnicity, type of residence, and gender of the household head as relevant demographic characteristics. This allows for heterogeneity in consumption among different types of households. While setting up and maintaining such an econometric model would require significant resources beyond those needed for collection of survey data and compilation of the national accounts, the model would have to be updated only after benchmark revisions of the national accounts.

Economic statisticians have typically relied on even greater simplifications in the representation of household equivalence scales. The typical household equivalence scale is single-dimensional and only accounts for differences in household size. The *Canberra Group Handbook on Household Income Statistics* describes this as follows: " […] the needs of a household grow with each additional member but, due to economies of scale in consumption, not in a proportional way. For example, a household comprising three people would normally need more income than a lone person household if the two households are to enjoy the same standard of living. However, a

household with three members is unlikely to need three times the housing space, electricity, etc. that a lone person household requires." (UN-ECE 2011, p. 68)

"Equivalised consumption or income is an indicator for welfare comparisons across standardised households or for a household comprising more than one person, equivalised income is an indicator of the household income that would be needed by a lone person household to enjoy the same level of economic welfare as the household in question." (UN-ECE 2011, p. 68)

Thus, if econometric modelling of expenditure patters of households with multi-dimensional demographic attributes cannot be put in place, a frequent practice is adjusting for household size only. This entails the following

Simplifying assumption no 1: the scaling factor is independent of prices and there is only one relevant attribute, household size: $m_0 = m_0(A_k)$ where $A_k = size_k$. This implies that households' expenditure functions are of the form $M_k(p, W_k', A_k) = m_0(A_k)G(p, W_k')$ with $m_0(A) = 1$ (Lewbel 1989). The latter normalisation indicates that the reference size for equivalence scale is a single person household.

An example of such a simplified approach is the OECD modified equivalence scale (Hagenaars et al. 1994), commonly used in statistical work. Within each household, the first adult counts 1, all children under 14 get a weight of 0.3 and any additional person aged 14 and above gets a weight of 0.5. The original 'OECD equivalence scale' (OECD 1982, also called "Oxford scale") assigned a value of 1 to the first household member, of 0.7 to each additional adult and of 0.5 to each child. Recent OECD publications (e.g. OECD 2011, OECD 2008) comparing income inequality and poverty across countries have used a scale which divides household income by the

square root of household size. There is no generally accepted formula for setting equivalence scales when they are not derived from an econometric model of household behaviour.

The empirical example presented below uses the most recent OECD equivalence scale. The ready-to-use summary tables from the U.S. Consumer Expenditure Survey provide information on the average number of persons per household, broken down by income quintile of households[7]. Proceeding in this way points directly to a **second simplifying assumption** typically used in empirical measurements of social welfare. Rather than applying equivalence scales (and, as will be discussed below, price indices) at the level of *individual* households, *groups* of households are the object of measurement. Each group is then treated like a single, homogenous household. A natural way of grouping individual households is forming quintiles or deciles based on households' consumption or income. For instance, results of the U.S. consumer expenditure survey are published by quintiles defined over primary income of households. Jorgenson and Slesnick (1987, 2014) allow for a much more granular treatment of households – grouping and the scaling of consumer expenditure take place for households with identical demographic characteristics.

Whose price index? Recognising differences in expenditure structures

We can now turn to comparisons of the economic well-being of households, suitably normalised with a simplified equivalence scale. The starting point is the following theoretical definition for an **index of economic well-being** for household *k*, again based on the expenditure function (1). The index $S_k(p, W_k^{'1}, W_k^{'0}, A_k)$ measures the ratio of expenditure required to make household *k* indifferent between utility levels $W_k^{'1}$ and $W_k^{'0}$ given a set of prices and attributes:

[7] For more detail and explanation of the source data see http://www.bls.gov/cex/ .

$$S_k(p, W_k'^1, W_k'^0, A_k) = \frac{M_k(p,W_k'^1,A_k)}{M_k(p,W_k'^0,A_k)} = \frac{m_0(A_k)G(p,W_k'^1)}{m_0(A_k)G(p,W_k'^0)} = \frac{G(p,W_k'^1)}{G(p,W_k'^0)} \quad (2)$$

The corresponding Konüs (1924) **cost of living index** for household *k* shows the change in expenditures required to keep the household at the same level of utility W_k', when a change in prices occurs from p^0 to p^1:

$$P_k(p^0, p^1, W'_k, A_k) = \frac{M_k(p^1,\ W_k',A_k)}{M_k(p^0,\ W_k',A_k)} = \frac{m_0(A_k)G(p^1,W_k')}{m_0(A_k)G(p^0,W_k')} = \frac{G(p^1,W_k')}{G(p^0,W_k')} \quad (3)$$

The last term in (2) and (3) follows from simplifying assumption no 1. While the index of economic well-being and its dual cost-of-living index are now independent of household attributes, they still depend on the level of household *k*'s welfare. Hence, households with different levels of consumption or income will feature different expenditure patterns and consequently, different cost-of-living indexes. It is quite conceivable that separate cost of living indices be constructed for groups of households, and indeed this is one of the reasons for recommending the development of household satellite accounts (see below). However, if no such possibility exists, **simplifying assumption no 3** has to be invoked: preferences of a household only depend on relative prices (*G=G(p))* but are otherwise independent of the level of income or of household welfare more generally[8]. Income or welfare affects the level of expenditures in a proportional way but has no impact on the structure of consumption. The implication is that the expenditure function has to be of the following separable form:

$$M_k(p, W_k', A_k) = m_0(A_k) \cdot G(p) \cdot H(W_k') \quad (4)$$

[8] Independence from welfare levels implies homotheticity - a necessary and sufficient condition for the independence of the price index from the level utility, as shown by Malmquist (1953).

Under simplifying assumption no 3 the cost-of-living index is independent of the level of utility: $P_k(p^1,p^0) = G(p^1)/G(p^0)$. Simplifying assumption no 3 has the advantage that a single price index can be applied to deflate consumption or income for all households. Indeed, it is an assumption that applies for most consumption price indices that are constructed in practice. At the same time, the assumption is constraining from a theoretical perspective and can lead to sizeable differences in results as Slesnick (1993) shows in his analysis of U.S. poverty rates.

Even if a single price index is chosen for different households, there are several choices, for example the private consumption deflator from the national accounts, and various variants of the Consumer Price Index. Meyer and Sullivan (2011) and Broda and Weinstein (2009) show the important impact of alternative price indices. Fixler and Johnson (2014) opt for the private consumption deflator on the grounds that their work focuses on a national accounts-based measure of income and its distribution. The same reasoning applies to the calculations at hand where consumption expenditure for the various product groups will be deflated with price indices from the national accounts.

Our empirical example shows that simplifying assumption no 3 can at least partially be avoided provided there is information on expenditure patterns by groups of households. We use the information from the U.S. Consumer Expenditure Survey and construct a set of expenditure weights for each product group, household group and year under consideration. Weights from adjacent years are combined with the price changes for each product group to construct a Fisher price index of final household consumption expenditure by household income quintile. Results are presented in Table 1.

For the period 2005-2013 differences between price indices for the five groups of households considered in Table 1 are small. There is no reason to believe, however, that such small differences prevail over longer periods or in other countries. Also, even small annual differences, if maintained over longer periods add up to sizable numbers. Jorgenson (1990) reports that: "The cost of living index […] grows at 3.85 percent per year for the postwar period 1947-1985. By contrast the consumer price index, compiled by the Bureau of Labor Statistics, grows at 4.14 percent per year. The bias in the consumer price index grows at 0.29 percent per year and accounts for 34.1 percent of the overall bias in the growth of our welfare-based measure of the U.S. standard of living.".

Table 1. Price indices by household group, United States

			Quintiles				
		All households	Q1	Q2	Q3	Q4	Q5
2005		1.000	1.000	1.000	1.000	1.000	1.000
2006		1.027	1.029	1.028	1.028	1.027	1.026
2007		1.053	1.056	1.056	1.054	1.053	1.051
2008		1.085	1.093	1.090	1.088	1.085	1.081
2009		1.086	1.101	1.094	1.089	1.085	1.079
2010		1.105	1.119	1.114	1.109	1.104	1.097
2011		1.132	1.148	1.142	1.138	1.132	1.123
2012		1.154	1.170	1.163	1.159	1.154	1.145
2013		1.168	1.184	1.177	1.172	1.167	1.159
AARC 2005-2013		2.0%	2.1%	2.1%	2.0%	1.9%	1.9%
AARC 2007-2013		1.7%	1.9%	1.8%	1.8%	1.7%	1.7%

Source: authors' calculations.

A simple measure of households' economic well-being

Equation (4) provides the key for a money-metric measure of households' economic well-being. Letting $V_k \equiv H(W_k')$ be the level of a household's utility, it is easy to see that (4) can be re-written as

$$V_k \equiv H(W_k') = \frac{M_k(p,W_k',A_k)}{m_0(A_k)G(p)} = \frac{p \cdot x_k}{m_0(A_k)G(p)} \quad (5)$$

Thus, under simplifying assumptions 1, 2 and 3, individual economic well-being is measured as household equivalent expenditure, deflated by a general price index. Comparisons between households for a given point in time and comparisons of a particular household over time are based on household equivalent consumption expenditure.

Which consumption? Which income? From surveys to the national accounts

An underlying premise to this point has been that consumer expenditure or income, and prices and quantities of consumer products are readily observable for each household or group of households. This is not a matter of course when national accounts definitions of consumption and income are used as the benchmark or target definitions (Deaton 2005). Yet, taking national accounts benchmarks is a necessary step to derive national accounts-consistent welfare comparisons that can be compared with other national accounts variables such as GDP per capita. The national accounts framework is particularly useful as it provides a consistent link between primary and disposable income, consumption, savings and wealth.

In many instances national accounts estimates may be expected to be of higher quality than those from micro-sources due to the focus of national accounts on consistent and exhaustive estimates (Fesseau and Mattonetti 2013). The big disadvantage of national accounts data in the present context is that distributional information – essential for measures of economic well-being – is missing. Statistical groundwork is therefore required to use the informational contents from survey information about distributions of consumption or income across households and apply it to national accounts benchmarks. This cannot be done in an indiscriminate manner and requires

careful comparison of definitions and contents of income and consumption categories in surveys and in national accounts.

Fixler and Johnson (2014) report on early estimates by Budd and Radner (1975) who combine survey and tax data sources to construct a distributional measure for the national accounts. Fesseau, Bellamy and Raynaud (2009) use survey data combined with other statistical sources to develop a national accounts compatible distribution statistic for France. This work was brought to the international level by the OECD and Eurostat in 2013. In cooperation with 25 national statistical offices, survey-based information on the level and distribution of consumption and income categories were matched to the national accounts, following a common methodology. The various steps involved along with results for a recent year are described in Fesseau and Mattonetti (2013).

Table 2 below shows the size of their adjustments by expenditure category applied to survey data so as to benchmark them to the national accounts. Nearly universally, benchmarking to the national accounts leads to an upward adjustment of the source data from surveys. As the authors note, the introduction of national accounts concepts is not innocuous: inequality measures such as the ratio of income or consumption of the richest over the poorest quintile of households tend to be adjusted downwards when compared to survey-based measures. This observation will be confirmed by our own calculations below. At the same time, this effect depends on the specific choice of income or consumption variables. One such choice is between final consumption expenditure and actual individual consumption: the latter includes social transfers in kind, i.e., health, education and housing services provided for free or at a below-market price by the government. As these services tend to be disproportionally used by low-income households,

inequality measures based on actual individual consumption tend to turn out lower than inequality measures based on final consumption expenditure[9].

Table 2. Adjustment coefficient for consumption components
(Ratio between national accounts-based expenditure/survey-based expenditure)

	Number of countries	Value of the coefficient			
		Average	Median	Minimum	Maximum
Food and non-alcoholic beverages*	12	1.5	1.2	1.0	4.1
Alcoholic beverages*	12	4.1	2.0	1.2	25.3
Tobacco	12	3.3	2.6	2.1	10.9
Clothing and footwear	12	1.3	1.3	1.0	2.2
Actual rentals for housing	12	1.4	1.0	0.6	4.4
Imputed rentals for housing	8	1.0	1.0	0.6	1.6
Maintenance and repair of the dwelling, water supply and miscellaneous services	11	1.4	1.2	0.2	3.6
Electricity, gas and other fuels	12	1.2	1.1	0.9	2.5
Furnishings, household equipment and routine households maintenance	12	1.6	1.4	0.9	3.0
Medical products, appliances and equipment	10	1.9	1.3	0.8	7.6
Outpatient services	9	2.4	1.7	0.7	7.7
Hospital services	8	10.8	7.7	1.3	37.4
Purchases of vehicles	11	2.0	1.3	0.7	8.0
Operation of personal transport equipment	10	1.5	1.2	0.7	5.1
Transports services	10	2.0	1.9	1.0	4.5
Communications	11	1.4	1.3	0.9	3.4
Recreation and culture	11	1.7	1.7	0.8	3.4
Education	10	1.1	1.1	0.6	2.0
Restaurants and hotels	11	1.6	1.4	0.8	2.9
Miscellaneous goods and services**	10	1.9	1.9	1.2	2.7
Insurances expenditures	5	1.3	0.7	0.5	2.5

* Excluding own account production.

** Excluding FISIM, insurance expenditures and prostitution.

Note: Method A was applied to allocate the adjusted national accounts total for food and non-alcoholic beverages for twelve countries. Among these countries, the adjusted national total is, on average, 1.5 times higher than the corresponding micro total, ranging between 1.0 and 4.1 times across countries.

Source: Fesseau and Mattonetti (2013)

Similarly, Fixler and Johnson (2014) present a methodology that adjusts the U.S. Current Population Survey – a household survey – to more closely match the national accounts measure of personal income. The authors then complement the survey source with data from tax returns to

[9] A similar reasoning applies to income-based measures of inequality: those based on adjusted disposable income (which reflects social transfers in kind) tend to produce lower levels of inequality than those based on disposable income or those based on primary income.

obtain more granular information on income distribution and apply this to the national accounts benchmarks of disposable household income. Like Fesseau and Mattonetti (2013), a further step by the authors consists in imputing values for social transfers in kind.

Our simplified example uses results from the U.S. Consumer Expenditure Survey as conducted and published by the U.S. Bureau of Labor Statistics. We match 15 expenditure categories to the expenditure categories available in the OECD's Annual National Accounts database (Table 2). Clearly, this is a much rougher approximation than the match by Fesseau and Mattonetti (2013) or Fixler and Johnson (2014) but it serves the purpose of demonstrating usefulness and feasibility of proceeding in this direction. The advantage of our approach is that it can readily be applied to several years and we shall present results for the period 2005-2013. Table 3 shows only the mapping between expenditure categories and adjustment coefficients for 2013 but the figures are representative for other years as well. For the majority of categories, the national accounts figure exceeds the figure from the Consumer Expenditure Survey. The first step in our social welfare computation consists thus of adjusting the consumer expenditure data for each product category and quintile of households by the corresponding adjustment coefficient so as to benchmark total expenditure to the national accounts.

Table 3. Simplified mapping of product categories

BLS Consumer Expenditure Survey (CES)	OECD Annual National Accounts, finale consumption expenditure of households	Ratio ANA/CES (all households, 2013)
Food	P31CP010: Food and non-alcoholic beverages	0.9
Alcoholic beverages	P31CP021: Alcoholic beverages	2.2
Owned dwellings incl mortgage interest	P31CP042: Imputed rentals for housing	1.7
Rented dwellings+other lodgings	P31CP041: Actual rentals for housing	0.9
Utilities, fuel and public services	P31CP044: Water supply and miscellaneous services relating to the dwelling	0.7
	P31CP045: Electricity, gas and other fuels	
Household operations (incl communication), housekeeping supplies, household furnishces and equipment	P31CP050: Furnishings, households equipment and routine maintenance of the house	1.8
	P31CP080: Communications	
Apparel and services	P31CP030: Clothing and footwear	5.4
	P31CP110: Restaurants and hotels	
Transportation	P31CP070: Transport	1.0
Healthcare	P31CP060: Health	5.2
Entertainment	P31CP090: Recreation and culture	3.3
Personal care products and services, miscallenous, cash contributions	P31CP121: Personal care	1.3
	P31CP123: Personal effects n. e. c.	
	P31CP127: Other services n. e. c.	
Reading and education	P31CP100: Education	1.7
Tobacco	P31CP022: Tobacco	2.6
Insurance and pensions	P31CP124: Social protection	0.7
	P31CP125: Insurance	
N.A.	P31CP126: Financial services n. e. c.	N.A.
Total		1.7

Source: authors' calculations.

3. From household to social welfare measurement

Which aggregation? Specifying the social welfare function

While the measurement of welfare for individual households or groups of households is of interest in itself, it is also of significant interest to aggregate across households and so obtain a measure of social welfare that can be followed over time or compared across countries. There is a large body of literature on social welfare measurement and the conditions under which it is possible to carry out cardinal comparisons to form aggregates of welfare measures. Coverage of the topic is far beyond the scope of the present paper and the reader is referred to Slesnick (1998, 2001) and Fleurbaey (2009) for extensive literature surveys.

We limit consideration to issues that are important in the implementation of social welfare functions. We have already emphasized that the measurement of individual welfare is carried out at the level of households, not at the level of individuals, since household members pool their resources and consumption patterns are household specific. Also, many data sources such as

information on income or consumption are based on households not individuals. Measures of social welfare are based on the measures of individual welfare we have discussed, scaled for differences in household size and composition. The first criterion in measuring social welfare, is that measures of individual welfare enter social welfare functions symmetrically. It was stated in (5) that under simplifying assumptions 1 and 3, individual welfare is measured by household equivalent consumption expenditure, deflated by the price level *G(p)*. For convenience, we shall re-write $H(W_k^{'}) \equiv V_k$ so that the values of $V_k = \frac{p \cdot x_k}{m_0(A_k)G(p)}$ provide the basic ingredients to construct a social welfare function:

$$W = W(V_1, V_2, \ldots V_K) \qquad (6)$$

We have already pointed out that observations on household consumption or income are reported in terms of household groups such as consumption deciles. Each group *k* has to be weighted by the number of household equivalent persons so that 'individuals' enter the social welfare measures with equal weight. Consider the empirical example with groups of households set up in quintiles based on average household income. Average welfare per quintile has to be weighted with the quintile's share in total household equivalent individuals. Note that if the average number of persons per household is equal across income quintiles, or if quintiles have been formed on the basis of households, each group of households enters with the same weight.

A second issue concerns axiomatic and economic requirements that are typically imposed on a social welfare measure. They constitute value judgements - albeit relatively weak ones – and deserve being spelled out. The requirements also help narrowing down the choice of possible specifications of the social welfare function. Requirements include[10] in particular: (i) **symmetry**,

[10] For a formal discussion of these properties see Roberts (1980), Jorgenson and Slesnick (1983) and Diewert (1985).

that is the requirement that any permutation of the order by which individuals appear in the welfare function has no impact on the aggregate welfare measure; (ii) **linear homogeneity** of the social welfare function in its elements: a proportional change of every individual's welfare raises social welfare by the same proportion; (iii) the social welfare function should be **non-decreasing** in its elements: a rise in any individual's welfare should always translate into a rise in social welfare, everything else constant. This is a formulation of the Pareto principle and not entirely innocuous. It implies, for instance that even in a situation where distribution of household welfare is very skewed, an additional dollar of income or consumption available to households at the top of the distribution (and unchanged income or consumption for everyone else) would entail a rise in social welfare; (iv) **cardinal interpersonal comparability**. Cardinal comparability is necessary to construct a meaningful social welfare function. This requires that social welfare orderings are invariant with respect to positive affine transformations that are the same for all individuals[11].

The third matter is of a stronger normative nature. We require that the social welfare function explicitly provides for the possibility to **integrate ethical judgements about equity**. This happens by way of a parameter (ρ or τ in what follows), to be set by analysts or policy-makers, that allows the statistician to produce measures of social welfare for a given judgement on distribution. The two specifications for the social welfare function shown below feature this parameter to which we refer as *Degree of Aversion to Inequality*.

The symmetry property was proposed by May (1952).

[11] Roberts (1980) demonstrates that different types of cardinal inter-personal comparability are compatible with different functional forms of the social welfare function. Cardinal full comparability generates the Jorgenson-Slesnick social welfare functions, while cardinal unit comparability generates the Atkinson social welfare functions (see below). This requires that social welfare orderings are invariant with respect to positive proportional transformations that are the same for all individuals, except for a constant term.

Two functional forms

We suggest two functional forms. Our first proposal is Jorgenson and Slesnick's (1983, 1984) class of social welfare functions that combines the average level of household welfare with deviations of (logarithmic (*ln*)) individual welfare levels from average. Their class of welfare functions can be written as:

$$W_{JS}(V_1, V_2, .. V_K) = ln\overline{V_{JS}} - I_{JS} \qquad (7)$$

$$with\ I_{JS} \equiv \gamma\left[\sum_{k=1}^{K} s_k \left| lnV_k - ln\overline{V_{JS}} \right|^{-\rho}\right]^{-1/\rho}$$

In (7), $ln\overline{V_{JS}} = \frac{1}{K}\sum_1^K s_k ln\, V_k$ is a weighted *geometric* average of equivalised consumption per household. Weights $s_k \equiv \frac{m_0(A_k)}{\sum_k m_0(A_k)}$ represent the share of each household or group of households in the total number of household equivalent members[12]. Two particular values of ρ are of specific interest:

- $\rho \rightarrow$-∞: in this ***utilitarian case***, in which the second term on the right hand side of (7) disappears and the social welfare function reduces to an average of welfare levels over all consuming units. No weight is given to the deviation of individuals' consumption from average and consequently to inequality.

- ρ =-1: in this ***egalitarian case***, maximum weight is given to the part of (7) that reflects inequality. Thus, social welfare will be affected most by inequality under this set-up. Note, however, that the inequality effect is capped by the Pareto requirement spelled

[12] Jorgenson and Slesnick (1983) show that such weighting is necessary if a social welfare function is 'equity-regarding' in the sense that it increases as the distribution of total expenditure becomes more equitable.

out earlier (a rise in real consumption of *any* household – everything else being equal - should always lead to a rise in total welfare, even if this implies greater inequality). This requirement is ensured by the parameter $\gamma = ([1 - \min(s_k)]\left[1 + (1 - \min(s_k))^{-(\rho+1)}\right])^{-1/\rho}$.

It is straightforward to see that over time, the logarithmic rate of change of social welfare is made up of the rate of change of average welfare and the rate of change of the inequality adjustment[13]:

$$\Delta W_{JS}(V_1, V_2, .. V_K) = \Delta ln\overline{V_{JS}} - \Delta I_{JS} \, . \qquad (8)$$

Our second suggestion for a specification of the social welfare function is Atkinson's (1970) generalised mean over individual economic well-being:

$$W_A(V_1, V_2, .. V_K) = \overline{V_A}(1 - I_A) \qquad (9)$$

$$with \; I_A \equiv \left[\sum_{k=1}^{K} s_k \left(\frac{V_k}{\bar{V}_A}\right)^{-\tau}\right]^{-1/\tau}$$

Akin to the Jorgenson-Slesnick case, Atkinson's specification of the social welfare function presents itself as average individual economic well-being $\bar{V}_A \equiv \sum_k s_k \bar{V}_k$, corrected for Atkinson's inequality measure I_A.[14] As before, the parameter τ captures aversion to inequality. In the present case, it ranges from minus 1 (the ***utilitarian case***) to infinity (the ***egalitarian case***). In the utilitarian case, social welfare reduces to the (arithmetic) average of economic well-being across individuals; in the egalitarian case, maximum emphasis is put on equivalised consumption at the

[13] $\Delta X = X^t - X^{t-1}$ is the difference operator for a variable X between periods t and $t-1$.

[14] For a discussion of Atkinson's measure see Diewert (1985), Deaton and Muelbauer (1980) and Blackorby and Donaldson (1978).

low end of the distribution. The Atkinson set-up also allows easy tracking of an intermediate position, the '***middle class case'***: here, τ is set to equal -0.1 so that W_A approximates the median of the consumption distribution.

The middle class case is introduced here because the policy debate regularly focuses on this part of the population. It also goes to show that the social welfare measurement framework is flexible and can provide evidence for a large number of ethical choices. We shall also demonstrate that the middle-class case under the Atkinson specification closely matches the utilitarian case under the Jorgenson-Slesnick specification. The Atkinson specification can also be conveniently de-composed[15] into an effect that captures the contribution of the average growth of social welfare and an effect that captures the contribution of the inequality adjustment (equation 10). When there is no inequality adjustment ($I_A=0$), the growth rate of social welfare reduces to the utilitarian case.

$$\frac{\Delta W_A}{\Delta W_A^{t-1}} = \frac{1}{2}(I_A^t + I_A^{t-1})\frac{\Delta \bar{V}_A}{\bar{V}_A^{t-1}} + \frac{1}{2}(\bar{V}_A^t + \bar{V}_A^{t-1})\frac{\Delta I_A}{1-I_A^{t-1}}. \qquad (10)$$

We are now ready to move towards empirical results for both specifications. A first set of results is presented in Table 4. It shows consumption-based measures of social welfare, expressed in constant 2005 dollars. The utilitarian case shows trends in average equivalised consumption under the two specifications of the social welfare function for the years 2005-13. Both levels and growth rates are quite different under the two specifications. This, however, is a simple reflection of the differences between arithmetic (the Atkinson specification) and geometric averages (the Jorgenson-Slesnick specification). It is interesting to observe that the middle-class case under the Atkinson specification closely matches the utilitarian case under the Jorgenson-Slesnick

[15] This symmetric de-composition is due to Bennet (1920).

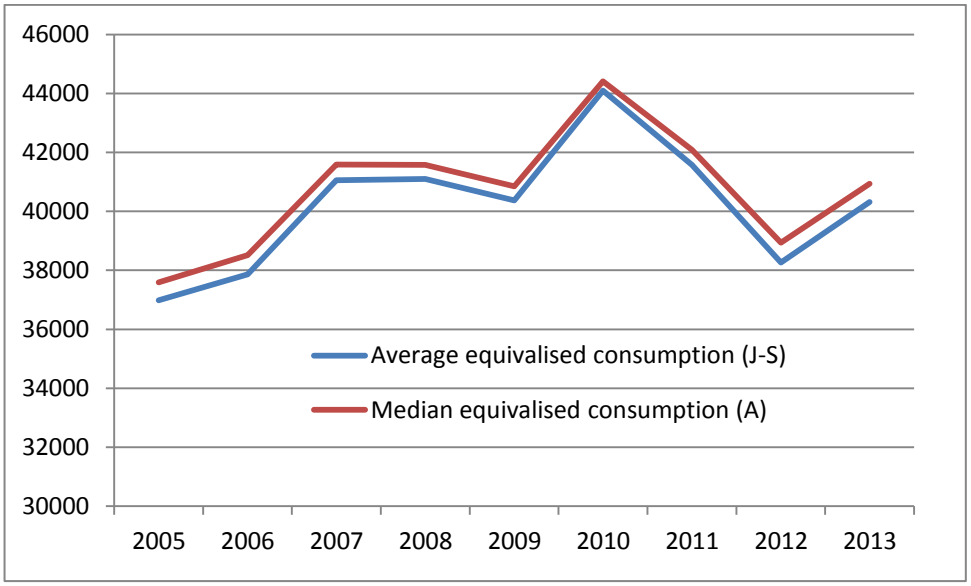
specification – a reflection of the fact that for a given distribution, geometric averages are closer to the median than to the arithmetic mean (Figure 1).

Table 4. Consumption-based social welfare
United States, constant 2005 $ per equivalised household member

	Utilitarian' case		***Egalitarian' case***		***Middle class' case***
	Average equivalised consumption		≈Equivalised consumption of first quintile		≈Equivalised consumption of third quintile
	Jorgenson-Slesnick	Atkinson	Jorgenson-Slesnick	Atkinson	Atkinson
	rho-->∞	tau=-1	rho=-1	tau=50	tau=-0.1
	Weighted geometric mean	Weighted arithmetic mean			
2005	36982	45812	20495	24014	37596
2006	37867	46971	20859	24570	38512
2007	41058	47550	23049	24057	41590
2008	41096	47045	23292	25931	41580
2009	40375	46203	22862	25017	40849
2010	44091	47065	24329	24762	44404
2011	41580	47725	23486	25117	42086
2012	38266	47702	21015	24562	38941
2013	40318	48365	22586	25616	40933
2005-13	1.1%	0.7%	1.2%	0.8%	1.1%
2008-13	-0.4%	0.6%	-0.6%	-0.2%	-0.3%

Source: authors' calculations.

Figure 1. Middle-class and utilitarian case under two specifications
United States, constant 2005 $



Source: authors' calculations.

Next, consider the evolution of social welfare over time and its break-down into an average welfare effect and an inequality adjustment following equations (8) and (10). They are shown in Table 5. Overall rates of change replicate the results from Table 4 for the egalitarian case. It is of note that while overall trends in social welfare show the same direction under the two specifications (positive for the period 2005-13, negative for the recession years 2008-13), the respective contributions of average growth and inequality adjustments are somewhat different. The Atkinson specification of the social welfare function produces a larger contribution of the inequality adjustment than the Jorgenson-Slesnick specification.

As a final step we investigate the impact on the resulting welfare measures of benchmarking consumption expenditure to the SNA. From Tables 5 and 6 it is immediately apparent that benchmarking consumption categories to the national accounts has a significant impact on welfare results. Overall, consumption based welfare decreases whereas it increases under SNA

benchmarking, mainly driven by differences in the evolution of average household equivalent consumption. Under the Atkinson specification, the sign of the inequality adjustment contribution changes from +0.49% per year to -0.18% per year for the period 2005-13. It is not clear whether our rough-and-ready procedure used to map consumer expenditure survey categories to the final consumption expenditure categories in the national accounts magnifies or reduces this effect.

The visible impact of the SNA benchmarking confirms results by Fesseau and Matonetti (2013) and Fixler and Johnson (2014). We conclude that benchmarking to the SNA is a key step in welfare computations that requires careful mapping, and typically additional source data to ensure quality of the benchmarking procedure. This point applies even more forcefully when consumption categories that do not exist in survey sources are allocated across households, in particular health, education and housing services provided by government for free or at below-market prices.

Table 5. Components of consumption-based social welfare change
United States, **SNA-benchmarked**, annual average rates of change

Jorgenson-Slesnick	2005-13	2008-13
Social welfare (egalitarian case)	1.21%	-0.62%
Contribution of average equivalised consumption	1.08%	-0.38%
Contribution of adjustment for inequality	0.13%	-0.23%
Atkinson		
Social welfare (egalitarian case)	0.81%	-0.24%
Contribution of average equivalised consumption	0.32%	0.25%
Contribution of adjustment for inequality	0.49%	-0.50%

Source: authors' calculations.

Table 6. Components of consumption-based social welfare change
United States, **no SNA benchmark**, annual average rates of change

Jorgenson-Slesnick	2005-13	2008-13
Social welfare (egalitarian case)	-0.02%	-1.90%
Contribution of average equivalised consumption	-0.43%	-2.10%
Contribution of adjustment for inequality	0.41%	0.20%
Atkinson		
Social welfare (egalitarian case)	-0.38%	-1.52%
Contribution of average equivalised consumption	-0.21%	-0.94%
Contribution of adjustment for inequality	-0.18%	-0.58%

Source: authors' calculations.

4. Conclusions

Real household consumption per capita is a measure routinely employed as an indicator of economic well-being. This paper makes the assumptions inherent in using this measure explicit. We argue that at a minimum head-count measures of the population should be replaced by measures of equivalent household members, price indices should be group-specific, and equity considerations should be introduced and made explicit.

Jorgenson and Slesnick (1983, 1987, 2014) have developed the theory and methodology for full empirical implementation of these features. While this may not always be feasible at the outset, we show how less ambitious but empirically more tractable measures of individual and social welfare can be derived that preserve some key features of well-founded welfare measures. Statistical offices could use these simplified approaches to gain experience in developing and analysing distributional information within the setting of the national accounts. They could then experiment with less restrictive assumptions about measures of individual and social welfare in order to respond more fully to user interest in distributional issues. International organizations like

OECD and Eurostat could extend the work of the existing expert groups by developing full-fledged international standards for measuring individual and social welfare.

We use data from the U.S. Consumer Expenditure Survey and the OECD national accounts to construct simplified national accounts compatible measures of economic well-being and social welfare. Two specifications are chosen for the social welfare measure and our computations show that this choice matters. We are also able to test the impact of benchmarking survey-based consumption categories to the consumption expenditure categories in the national accounts. This effect is significant and underlines the need for a careful adjustment of survey sources. It also goes to show that survey based results on inequality and social welfare cannot readily be taken as a good approximation to results under more comprehensive notions of consumption and income.

We conclude by recommending that distributional information should be incorporated into national accounts. This process could begin with a household satellite system for measuring consumption expenditure and income broken down by relevant demographic and economic attributes such as household size, region, age of household members and consumption and income levels, very much in the spirit of Social Accounting Matrices that have long been present in the national accounts literature. Such information provides the necessary ingredients to compile group-specific cost of living indices, to express and to compare individual economic well-being per household equivalent member and to construct a social welfare measure with explicit normative choices.

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