

MEASURING INDIVIDUAL ECONOMIC WELL-BEING AND SOCIAL WELFARE WITHIN THE FRAMEWORK OF THE SYSTEM OF NATIONAL ACCOUNTS

BY DALE W. JORGENSON

Harvard University

AND

PAUL SCHREYER*¹

OECD

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. We bring together the relevant theoretical literature and the empirical tools needed for this purpose. We show how consumption-based measures of economic welfare can be integrated into the national accounts without changing their production or asset boundary. At the same time, explicit normative and methodological choices are required to select a social welfare function. The paper provides guidance how to make these choices transparent and how to present social welfare measures.

JEL Codes: E210, D31, D63

Keywords: distribution of consumption, national accounts, welfare measurement

1. INTRODUCTION

Renewed interest in the measurement of individual well-being and social welfare is evident in the recommendations by Stiglitz *et al.* (2010) 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* (European Commission *et al.* 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 and Eurostat established an Expert Group on Disparities in a

*Correspondence to: Paul Schreyer, OECD Statistics Directorate, 2, rue André Pascal, 75775 Paris Cedex, France (paul.schreyer@oecd.org).

¹Opinions and interpretations in this paper are those of the authors only and do not necessarily reflect the views of the Organisation for Economic Co-operation and Development or its Member countries.

National Accounts framework (EG DNA) to consider standards for the measurement of disparities within the framework of the national accounts. A second OECD-Eurostat Expert Group on Income, Consumption and Wealth (EG ICW) considered consistency between definitions of these concepts in macro-economic data from the national accounts and micro-economic data from household surveys and administrative records. Initial results have been reported by Fesseau *et al.* (2013) and Fesseau and Mattonetti (2013) and more recently by Zwijnenburg *et al.* (2016).

The expert group on disparities has 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 expert group has 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. Our work embeds these statistical advances in a broader theoretical framework based on Jorgenson and Slesnick (2014) and proposes measures of individual economic well-being as well as summary measures of social welfare.

The measurement of individual economic well-being is based on a long-established theory of consumer behavior.² 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 behavior deals with the individuals, rather than households, there is also a well-established, if less familiar, theory of household behavior that can serve as a valuable guide to the measurement of consumption.

We thus take the household, rather than the individual, as the 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 behavior to derive equivalence scales that depend on other characteristics of household composition as well. We compare the effect of using a uni-dimensional, size-related household scale with the Jorgenson-Slesnick multi-dimensional household scale and find important differences with likely effects on measured living standards.

In this paper we consider the measurement of individual welfare in Section 2. By way of example, we use information from the U.S. consumer expenditure

²The year 2015 is the centennial of Eugen (Evgeny) Slutsky (1915), “Sulla teoria del bilancio del consumatore,” *Giornale degli Economisti*, 51, 3, 1–26, often taken as the starting point for the theory of consumer behavior.

survey 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.

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.³ 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 (2014) have shown how to incorporate these normative assumptions into measures of social welfare within the framework of the national accounts. We discuss some of the properties of the Jorgenson-Slesnick social welfare measure and compare them with the welfare measure proposed by Atkinson (1970).

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 in particular real personal consumption expenditure per household equivalent member.

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 ICW and EG DNA.

2. MEASURES OF INDIVIDUAL ECONOMIC WELL-BEING

2.1. *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

³The term “equivalized consumption” is sometimes used for scaled household consumption, but “household-equivalent consumption” conveys the same meaning and is closer to standard English usage.

households and individuals. Although the traditional theory of consumer behavior is based on individuals, more in-depth analysis has recognized that the household is a more appealing way to think about decision-making units. The necessary framework was provided by the theory of household behavior of Samuelson (1956).⁴ 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 it is not obvious whether one household's economic well-being can be directly compared to another household's well-being unless they share the same characteristics.

The single most frequently used characteristic is 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)

“Equalized consumption or income is an indicator for welfare comparisons across standardized households or for a household comprising more than one person, equalized 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)

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, 2008; OECD, 2011a, 2011b) comparing income inequality and poverty across countries have used a scale which divides household income by the square root of household size.

The economic theory of equivalence scales (see Lewbel and Pendakur, 2008 for an overview) takes a more general starting point and defines equivalence scales as the proportional change in expenditure that is required to equalize utility between two households with different characteristics. In this vein, Barten (1964) proposed an approach where equivalence scales varied across types of commodities. As these equivalence scales depend on expenditure patterns, they vary not only with household size but also with prices and household characteristics that shape expenditure patterns. As a consequence, equivalence scales become multi-dimensional. Muellbauer (1977) estimated Barten scales for the U.K., Johnson (1994) and Slesnick (2001) and Jorgenson and Slesnick (1987) estimated Barten scales for the U.S. Table 1 reproduces Barten scales estimated by Jorgenson and Slesnick (1987).

⁴Samuelson's theory has been discussed by Becker (1981) and Pollak (1981).

TABLE 1
BARTEN EQUIVALENCE SCALES*

Size 1	Size 2	Size 3	Size 4	Size 5	Size 6	Size 7+
0.32	0.57	0.76	1	1.11	1.52	1.92
Age 16–24	Age 25–34	Age 35–44	Age 45–54	Age 55–64	Age 65+	
0.65	1	1.39	1.53	1.39	0.93	
Northeast	Midwest	South	West	Nonfarm	Farm	
1	1.03	1.13	0.74	1	1.63	
White	Nonwhite	Male	Female			
1	1.12	1	0.62			

*Reference household: size 4, age 25–34, Northeast, nonfarm, white, male.
Source: Slesnick (2001), based on Jorgenson and Slesnick (1987).

Establishing Barten scales requires, however, estimation of a system of consumer demand to evaluate how expenditure patterns change with household characteristics and with prices. This is a tall order and will often be impractical for statistical offices to implement. In practice, thus, equivalence scales will often be uni-dimensional (household size only) and independent of prices and expenditure patterns. Even so, the choice remains large and there is no obvious best way to adjust for household size. Table 2 compares different equivalence scales and their average elasticity with respect to household size. Differences are significant and can affect results of overall welfare measures. There is no single best equivalence scale and statistical offices have to balance the advantages of uni-dimensional scales (simplicity) against greater realism but also greater complexity of Barten-type scales.

Another, related measurement issue is the level of detail at which distributional measures are put in place. Ideally, the equivalence scales are directly applied to household-level information. In practice, another simplifying assumption is often used in empirical measurements. 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 in the simplified case. Each group is 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

TABLE 2
DIFFERENT EQUIVALENCE SCALES

Household size	Per capita measure	Barten scale (size dimension only)	OECD (old)	OECD (square root formula)
1	1.00	1.00	1.00	1.00
2	1.00	0.83	0.77	0.50
3	1.00	0.79	0.72	0.50
4	1.00	0.82	0.72	0.50
5	1.00	0.77	0.72	0.50
6	1.00	0.87	0.73	0.50
7	1.00	0.92	0.74	0.50

Source: Authors' calculations and Slesnick (2001).

treatment of households—grouping and the scaling of consumer expenditure take place for individual households with identical demographic characteristics.

2.2. *Whose price index? Recognizing differences in expenditure structures*

Much of the literature on the distribution of income or consumption has focused on how these attributes are distributed among agents at a point in time but has paid less attention on how to render group-specific income or consumption comparable both between households and over time. The conceptually correct measure of price changes is a cost-of-living index (Konüs, 1924). As households with different levels of consumption or income will feature different expenditure patterns, their cost-of-living indexes will in general be different and consequently, deflation of nominal consumption or income should proceed by means of a group-specific price index.

Separate cost of living indices for groups of households can be constructed as long as there is information on expenditure patterns for each type of household. If no such possibility exists, a rather strong assumption has to be invoked, namely that preferences of a household only depend on relative prices but are otherwise independent of the level of household welfare⁵ which may only affect the level of expenditures in a proportional way. The advantage of this simplification is that a single price index can be applied to deflate consumption or income for all households.

However, this trade-off appears to be of limited effects when examined empirically. Slesnick (2001) computes cost-of-living indices for household groups with different consumption levels for the time period 1948–95 and concludes that “...the inflation rates for the three groups are [...] very similar” (p. 84). In our own empirical example based on recent data from the U.S. Consumer Expenditure Survey we 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. For the period 2005–13 differences between price indices for the five groups of households are small, ranging between 1.9 percent and 2.1 percent per year. The use of an aggregate price index for different consumption groups would thus not appear to be a specifically constraining assumption⁶.

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 (CPI). Meyer and Sullivan (2011) and Broda and Weinstein (2008) show the important impact of alternative price indices. Fixler and Johnson (2014) opt for the Personal Consumption Expenditures (PCE) 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

⁵Independence 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).

⁶Note that this conclusion is based on a single characteristic, income, to group households and measure their cost-of-living index. Differentiation by other characteristics, in particular age, has been shown to yield more diverse results (Slesnick, 2001). Thus, with more complete information, for instance from econometric measurement that permits identifying expenditure patterns across multiple dimensions one may well find more pronounced differences between price indices for different groups of households.

calculations at hand where consumption expenditure for the various product groups will be deflated with price indices from the national accounts. We conclude that applying the deflator for private consumption expenditure from the national accounts constitutes a reasonable method to derive measures of real consumption.

2.3. *A measure of households' economic well-being*

Having dealt with equivalence scales, deflation and the scope of consumption, we can now explicitly state a measure W_k of individual welfare for household k ($k=1, \dots, K$):

$$(1) \quad W_k = W_k(V_k) \quad \text{with} \quad V_k = \frac{p \cdot x_k}{m_0(A_k)G_k(p)}$$

In (1), p is a vector of N prices of consumer products and x_k is a vector of N quantities of products consumed by household k . Real consumption per household equivalent member V_k is derived by deflating the nominal value of expenditure $p \cdot x_k \equiv \sum_i p_i x_{i,k}$ by a household-specific price index $G_k(p)$ or, in a simplified approach, by a general price index $G(p)$. Real consumption per household is then transformed into consumption per household equivalent member by applying an equivalence scale $m_0(A_k)$ corresponding to household k 's characteristics A_k . As discussed earlier, in the simplest case this is a function of household size only but in general captures multiple household characteristics.

The scope and valuation of the products entering a household's utility function are captured by private consumption expenditure here. The implication is that those goods and services that are provided for free by the government will not be captured by this expenditure measure despite the fact that they generate utility for the household. Or they will be valued at a price below cost in the case of subsidization. An alternative would thus be to select a measure of Actual Individual Consumption that includes Social Transfers in Kind, such as free health care, education or housing. However, prices and volumes of a measure of actual individual consumption do not reflect the consumer decisions in the face of a set of prices. Also, data availability is significantly more limited. The expenditure framework used is best understood as cost-minimizing behavior on the side of consumers, conditional on a set of publicly-provided services.

Jorgenson and Slesnick (1983, 2014) set W_k as the logarithmic transformation measure of the real expenditure measure V_k , ($W_k = \ln(V_k)$) implying that utility gains are decreasing with increasing consumption. In a more complete setting such as Jorgenson and Slesnick (1983, 2014) the individual measure of welfare is derived as a household's minimum expenditure to achieve a particular level of utility, W_k , given prices p . $V_k(W_k, A_k, p)$ then equals the household's expenditure function which provides an exact representation of the underlying level of the household's utility.⁷

⁷In the present framework, utility only depends on the level of consumption and household characteristics. Outside the framework of the national accounts, household utility could also depend on factors such as the health of household members, environmental quality or social relations. While the latter factors are clearly important, we leave these non-market variables aside here and focus on economic well-being. For an extension to non-market variables see Fleurbaey and Blanchet (2013).

2.4. 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 *et al.* (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).

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. 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 disproportionately used by low-income households, inequality measures based on actual individual consumption tend to turn out lower than inequality measures based on final consumption expenditure⁸.

⁸A 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.

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 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 database⁹ (Table 3). Clearly, this is a much rougher approximation than the match by Fesseau and Mattonetti (2013), Zwijnenburg *et al.* (2016) or Fixler and Johnson (2014) but it serves the purpose of demonstrating 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 2005–13.

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. An important step in national accounts-based computations of individual and social welfare consists thus of matching consumer expenditure data for each product category and quintile of households between survey and national accounts sources. For consumption categories that are not present in survey data such as FISIM or, in some cases, the value of owner-occupied housing, an imputation will be required drawing on additional sources.

3. FROM HOUSEHOLD TO SOCIAL WELFARE MEASUREMENT

3.1. *Efficiency and equity*

While the measurement of welfare for individual households or groups of households is of interest in itself, it is equally interesting 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 inter-household 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

⁹The consumer expenditure survey provides expenditures for each category cross-classified by household income group. Thus, for every income group, the survey-based expenditure measure is multiplied by the adjustment factor to arrive at the relevant variable V_k for household (income group) k . If there is added information about the distribution across income groups of those national accounts expenditure positions that are outside the survey measure, this information can of course be used and adjustment factors would vary across income groups. The consumer expenditure survey also provides information of the average household size for each income group. To this information is applied an equivalence scale so as to obtain the average number of household equivalent members per income quintile. Averaging across income groups (as these are quintiles with equal numbers of households each a simple average suffices) and multiplying by the economy-wide number of households yields the total household equivalent members.

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 furnishes 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	1.0
Transportation	P31CP070: Transport	
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.

to Slesnick (1998, 2001), Dutta (2002); Chakravarty (2009); Fleurbaey (2009), Cowell (2011) for extensive literature surveys.

We limit our considerations to issues that are important in the implementation of social welfare functions. A key ingredient to construct measures of social welfare is the measures of individual welfare, based on real consumption V_k (W_k, A_k, p) = $\frac{p \cdot x_k}{m_0(A_k)G(p)}$ as presented above. Consider the following average measure V obtained by dividing aggregate expenditure by the total number of household equivalent members and by applying a consumption price index:

$$V = \frac{\sum_{k=1}^K p \cdot x_k}{G(p) \sum_{k=1}^K m_0(A_k)} = \sum_{k=1}^K \frac{m_0(A_k)}{\sum_{k=1}^K m_0(A_k)} \frac{p \cdot x_k}{G(p)m_0(A_k)} = \sum_{k=1}^K s_k V_k,$$

where:

$$(2) \quad s_k \equiv \frac{m_0(A_k)}{\sum_{k=1}^K m_0(A_k)}.$$

We can interpret V "... as an indicator of efficiency since it is independent of the distribution of welfare across households. That is, a transfer of resources from a rich household to a poor household leaves V unchanged" (Slesnick, 2001, p. 27). Efficiency is a distribution-free measure of social welfare, attained at current prices p for a given aggregate expenditure and population of household equivalent members. This measure is directly available from the national accounts, after adjusting real expenditure for the total number of household equivalent persons.

Efficiency V is instrumental in de-composing a measure of social welfare that *does* take account of distributional considerations into efficiency and equity components. To this end, define a social welfare function as:

$$(3) \quad W = W(W_1, W_2, \dots, W_K),$$

where $W_k = W_k(V_k)$ ($k=1, \dots, K$) is individual economic well-being. Some key properties of social welfare functions along with two alternative specifications are given in the Annex. Here it suffices to recall that individual welfare has been measured as a function of real consumption expenditure. Similarly, we can define a welfare measure at the level of the total economy, call it $V^*(W)$.¹⁰

$$(4) \quad W(V^*, \dots, V^*) = W(W_1(V_1), W_2(V_2), \dots, W_K(V_K)),$$

where $V^* = V^*(W)$ is implicitly defined as the income (or consumption) that, if received by every individual, yields the same social welfare as the actual distribution.¹¹ We also refer to this measure of social welfare as the *standard of living*.

Given $V^*(W)$, and V , we can apply Jorgenson's (1990) de-composition of $V^*(W)$ into **equity** and **efficiency** components:

$$(5) \quad V^*(W) = \frac{V^*(W)}{V} V.$$

The efficiency component V was defined above. The other component of (5), $V^*(W)/V$, compares actual social welfare $V^*(W)$ with potential maximum¹² social welfare V and thus captures the relative loss in social welfare attributable to an inequitable distribution. This is the "equity" component of Jorgenson's

¹⁰Kolm (1969) used the label *equal equivalent*, Atkinson (1970) *equally distributed equivalent income*.

¹¹This is a simplified version of Jorgenson and Slesnick's (1983, 2014) social expenditure function.

¹²Note that the efficiency measure V can also be interpreted as the level of equally distributed consumption that would give rise to maximum social welfare: one property often assumed for the welfare function W is that it reflects the Dalton (1920) principle which states that a transfer from someone with higher consumption to someone with less is welfare-increasing, as long as the transfer does not lead to a change in ranks between individuals concerns and as long as the transfer is non-leaky (nothing gets lost in the course of re-distribution). If W is reflective of the Dalton principle (along with several other properties), W reaches its maximum under equal distribution of income. See Diewert (1985, Theorem 2) for a formal statement.

decomposition. Its derivation requires information about the distribution of consumption per household equivalent member among individuals (or groups of households) along with a specification of the social welfare function $W(W_1, \dots, W_K)$. A key characteristic of the welfare measure is its dependence on a particular price level – this arises because $V_k = V_k(W_k, A_k, p)$, the determinants of $W(W_1(V_1), \dots, W_K(V_K))$, are themselves dependent on a particular price level p .

A simple transformation of (5) helps introducing a family of indexes of relative inequality in the tradition of Kolm (1969) and Atkinson (1970):

$$(6) \quad V^*(W) = (1 - I(W, V))V \text{ with } I(W, V) \equiv 1 - \frac{V^*(W)}{V}$$

A social welfare function and the associated measure of inequality explicitly **introduce ethical judgments** about equity into measurement. The precise way this is done depends on the functional form of the social welfare function. In the two specifications discussed in the annex this happens by way of a parameter (*Degree of Aversion to Inequality*), to be set by analysts or policy-makers, that allows the statistician to produce measures of social welfare for a given judgement on distribution. Although the inequality parameter can take many different values, a pragmatic approach is to show two particular cases that limit the value of the inequality component from below and from above. Under the *utilitarian case* (in the sense of Jorgenson-Slesnick), the equity component in (5) and the inequality measure in (6) take the smallest admissible value within the specifications of the welfare function. Under the *egalitarian case*, the equity component and the inequality measure take the largest admissible value within Jorgenson-Slesnick's specifications of the welfare function.

It is shown in the Annex that the utilitarian case under the Jorgenson-Slesnick specification amounts to aggregating real consumption of different groups of households by means of a geometric average. This is equivalent to the Cobb-Douglas case under the Atkinson specification and is particularly simple to implement. It implies measuring inequality $I(W, V)$ as one minus the ratio of a geometric over an arithmetic average of equivalent consumption of different groups of households. We are now ready to move towards some illustrative empirical results for both specifications.

3.2. Results

A first set of results is presented in Table 4. It starts with the elements of the efficiency component of the social welfare measure. These are: (i) private household consumption expenditure as available from the U.S. National Income and Product Accounts expressed in constant 2005 dollars; (ii) the economy-wide number of household equivalent individuals computed on the basis of three different equivalent scales; and (iii) the ratio of (i) over (ii) which yields V , our measure of efficiency. The notable point here is the large differences in level and evolution of the number of household equivalent members between the multi-dimensional Jorgenson-Slesnick measure and the single-dimensional Barten scale and OECD scale. As the multi-dimensional adjustment has a stronger theoretical foundation

TABLE 4
PERSONAL CONSUMPTION EXPENDITURE

	Private Consumption expenditure billions of current \$	Private Consumption expenditure deflator (2005=1)	Private Consumption expenditure billions of 2005 \$	Household equivalent members, millions (single dimension Barten scale)	Household equivalent members, millions (OECD scale)	Household equivalent members, millions (multi-dimensional Barten scale - Jorgenson-Slesnick scale 2014)	Private Consumption expenditure per household equivalent member (OECD scale), 2005 \$	Private Consumption expenditure per household equivalent member (multi-dimensional Barten scale - Jorgenson-Slesnick scale 2014), 2005 \$
2005	8589	1.000	8589	238.7	185.6	472.0	46286	18260
2006	9066	1.027	8826	241.7	187.9	476.6	46971	18670
2007	9512	1.053	9035	244.4	190.0	481.4	47549	18970
2008	9750	1.085	8983	245.7	191.0	489.5	47045	18770
2009	9588	1.086	8829	245.8	191.1	496.1	46205	18260
2010	9954	1.105	9011	246.3	191.5	501.6	47056	18360
2011	10448	1.132	9226	248.7	193.4	n.a.	47716	n.a.
2012	10827	1.154	9381	253.1	196.7	n.a.	47689	n.a.
2013	11219	1.168	9608	255.6	198.7	n.a.	48353	n.a.
2005-2013	3.40%	1.96%	1.41%	0.86%	0.86%	1.22%	0.55%	0.11%
2005-2010	3.00%	2.01%	0.96%	0.63%	0.63%	1.22%	0.33%	0.11%

Source: OECD annual national accounts data base and authors' calculations. Note that the private consumption data underlying Jorgenson and Slesnick (2014 - last columns) are of a different vintage from the consumption data in the OECD national accounts. Data in the last column is consistent with the series shown in Table 5.

TABLE 5
CONTRIBUTIONS TO GROWTH OF THE STANDARD OF LIVING, U.S.

	Average annual growth rates					
	1948–2010	1948–1973	1973–1995	1995–2000	2000–2005	2005–2010
			Egalitarian*			
Standard of living (social welfare)	2.34	3.45	1.87	1.96	1.82	–0.27
Efficiency (Personal consumption expenditure per household equivalent member, 2005 \$)	2.16	2.67	1.97	2.65	2.03	0.11
Equity	0.17	0.78	–0.11	–0.68	–0.21	–0.37
			Utilitarian*			
Standard of living (social welfare)	2.24	3.09	1.90	2.20	1.93	–0.12
Efficiency (Personal consumption expenditure per household equivalent member, 2005 \$)	2.16	2.67	1.97	2.65	2.03	0.11
Equity	0.08	0.42	–0.07	–0.44	–0.10	–0.23

*see Annex for definitions.

Source: Jorgenson and Slesnick (2014), Table 3.7.

than the single-dimensional adjustment for household size only, we conclude that important information gets lost by moving to a size-only equivalence scale. Obviously, the advantage of the single-dimensional equivalence scale lies in its simplicity. But structural shifts in the composition of households other than their size will go unnoticed and may introduce a bias of unknown size. Indeed, the number of household equivalent members under the Jorgenson-Slesnick scale significantly exceeds the population size of the U.S. While a declining household size (as observed in the country) reduces the number of household equivalent members, an upward shift in the age structure or a shifting ethnical composition towards non-white persons will increase the number of household equivalent members. We also note that the differences in trend between the two single-dimensional measures are small so the choice between single-dimensional scales—the Barten scale and the OECD scale in the case at hand—will have little effect on the evolution of the overall measure of efficiency.

The next step consists of computing the welfare measure $V(W)$ along the specifications in the Annex and de-compose social welfare into its efficiency and equity components. We illustrate this step with results for (i) the utilitarian case where social welfare reduces to a geometric average of individual real consumption; (ii) the egalitarian case where maximum weight (within the other constraints of the welfare function—see annex) is given to inequality. The results presented are those by Jorgenson-Slesnick (2014) as they cover a time span of several decades, appropriate to gauge trends in the overall evolution of social welfare and its break-down into an efficiency and an inequality component.

Over the period considered, efficiency growth was strongest between 1948–73. This post-war period until the early seventies was also the time when equity rose, however measured. Subsequent slowing of the growth rate of average consumption per household equivalent member, combined with a rise in inequality led to a slower growth in social welfare. Living standards actually declined during the period 2005–10 where positive but weak efficiency growth is outweighed by a rise in relative inequality. The rise in inequality and the drop in the standard of living is perceptible under both the egalitarian and the utilitarian approach.¹³

4. CONCLUSIONS

Real household consumption per capita is a measure routinely employed as an indicator of economic well-being. We argue that 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. This may, however, not always be feasible, and the question is whether 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 analyzing 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.

Four key steps are required to implement social welfare measures. The first is a scaling of household consumption expenditure by the number of household equivalent members. We find that the choice of the equivalence scale matters, in particular when passing from the established one-dimensional, size-based scale to a multi-dimensional scale that incorporates demographic variables other than household size.

The second step is conversion of current price expenditure into constant price measures. We use data from the U.S. Consumer Expenditure Survey and the OECD national accounts to construct simplified national accounts compatible measures of individual welfare. In particular we test the effects of using group-specific deflators as opposed to aggregate consumption deflators from the national accounts. We conclude that for the case at hand, effects are small.

¹³By way of comparison, we carried out an alternative computation following Sen's (1973) social welfare measure by adjusting the average consumer expenditure per household equivalent member by the Gini coefficient. Over a comparable period (1979–2010), the two measures yield similar orders of magnitude for social welfare (around 1.6 percent per year for our own result and 1.4 percent for Sen-type measure). The correlation coefficient of yearly rates of change is around 0.7. However, differences can be important for shorter periods. For example, while the Jorgenson-Slesnick (2014) measure shows a decline in the overall standard of living in the years following 2005 this is not picked up by the simple Gini-adjusted metric.

The third step is aligning survey-based consumption categories to the consumption expenditure categories in the national accounts. As the work of the EG DNA shows, the effect on the resulting welfare measures for different household groups can be significant and underlines the need for a careful adjustment of survey sources.

The fourth step is introducing a social welfare measure to aggregate across individual welfare measures. Aggregate welfare, it is shown, can be presented as the sum of an efficiency effect (directly available from the national accounts after application of equivalence scales) and an equity effect that represents the welfare impact of inequality. The key issue here is to make ethical judgements explicit as the size of the equity effect will be directly related to society's aversion to inequality which is a normative choice. We discuss two specifications for a social welfare function and identify one particularly simple case where the two measures coincide.

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.

REFERENCES

- Abraham, K. G., "Expanded Measurement of Economic Activity: Progress and Prospects," in D. W. Jorgenson, S. Landefeld, and P. Schreyer (eds), *Measuring Economic Sustainability and Progress: NBER and CRIW Studies in Income and Wealth*, Vol 72; Chicago, IL, University of Chicago Press, 25-42, 2014.
- Atkinson, A. B., "On the Measurement of Inequality," *Journal of Economic Theory*, 2, 244-63, 1970.
- Barten A. P., "Family Composition, Prices and Expenditure Patterns," in P. Hart, G. Mills, and K. J. Whitaker (eds.), *Econometric Analysis for National Economic Planning*, 16th Symposium of the Colston Society, London, Butterworth, 277-92, 1964.
- Becker, G., *A Treatise on Family*, Cambridge, MA; Harvard University Press, 1981.
- Blackorby, C. and D. Donaldson, "Measures of Relative Equality and their Meaning in Terms of Social Welfare," *Journal of Economic Theory*, 18, 59-80, 1978.
- Broda C. and D. E. Weinstein, *Prices, Poverty and Inequality: Why Americans Are Better Off Than They Think*; Washington D.C., AEI Press, 2008.
- Budd, E. and D. Radner, "The Bureau of Economic Analysis and Current Population Survey Size Distributions: Some Comparisons for 1964," in James D. Smith (ed.) *The Personal Distribution of Income and Wealth*, NBER and CRIW Studies in Income and Wealth, New York: National Bureau of Economic Research, 39, 449-559, 1975.
- Chakravarty, S., *Inequality, Polarization and Poverty*; New York: Springer, 2009.
- Cowell, F., *Measuring Inequality*, 3rd ed., Oxford: Oxford University Press, 2011.
- Dalton, H., "The Measurement of the Inequality of Incomes," *Economics Journal*, 30, 348-61, 1920.
- Deaton, A., "Measuring Poverty in a Growing World or (Measuring Growth in a Poor World)," *Review of Economic Statistics*, 87, 1, 1-19, 2005.
- Diewert, W. E., "The Measurement of Waste and Welfare in Applied General Equilibrium Models," in J. Piggott and J. Whalley (eds), *New Developments in Applied General Equilibrium Analysis*, Cambridge: Cambridge University Press, 1985.
- Dutta, B., "Inequality, Poverty and Welfare" in K. J. Arrow, A. K. Sen, and K. Suzumura, *Handbook of Social Choice and Welfare*, 1; Amsterdam: Elsevier, 597-633, 2002.

- European Commission, International Monetary Fund, Organisation for Economic Co-operation and Development, United Nations, World Bank, *The System of National Accounts 2008*, United Nations, New York, 2009.
- Fesseau, M., V. Bellamy, and E. Raynaud, "Inequality Between Households in the National Accounts," National Institute of Statistics and Economics Studies, *INSEE Premier no 1265A*, 2009.
- Fesseau, M. and M. L. Matteonetti, "Distributional Measures Across Household Groups in a National Accounts Framework," *OECD Statistics Working Paper No. 53*; Paris: OECD, 2013.
- Fesseau, M., F. Wolff, and M. L. Matteonetti, "A Cross-country Comparison of Household Income, Consumption and Wealth between Micro Sources and National Accounts Aggregates," *OECD Statistics Working Paper*, No. 52; Paris: OECD, 2013.
- Fixler, D. and D. S. Johnson, "Accounting for the Distribution of Income in the U.S. National Accounts", in D. W. Jorgenson, S. Landefeld and P. Schreyer (eds), *Measuring Economic Sustainability and Progress: NBER and CRIW Studies in Income and Wealth*, 72; University of Chicago Press, Chicago, IL, 213-44, 2014.
- Fleurbaey, M., "Beyond the GDP: The Quest for Measures of Social Welfare," *Journal of Economic Literature*, 47, 4, 1029-75, 2009.
- Fleurbaey, M. and D. Blanchet, *Beyond GDP: Measuring Welfare and Assessing Sustainability*; Oxford: Oxford University Press, 2013.
- Hagenaars, A., K. de Vos, and M. A. Zaidi, *Poverty Statistics in the Late 1980s: Research Based on Micro-data*, Luxembourg: Office for Official Publications of the European Communities, 1994.
- Hardy, G. H., J. E. Littlewood, and G. Polya, *Inequalities*, Cambridge: Cambridge University Press, 1934.
- Jorgenson, D. W., "Aggregate Consumer Behavior and the Measurement of Social Welfare," *Econometrica*, 58, 5, 1007-40, 1990.
- Jorgenson, D. W. and D. T. Slesnick, "Individual and Social Cost of Living Indexes", in W. E. Diewert and C. Montmarquette (eds), *Price Level Measurement*, Ottawa: Statistics Canada, 241-323, 1983.
- , "Aggregate Consumer Behavior and Household Equivalence Scales," *Journal of Business and Economic Statistics*, 5, 32, 1987.
- , "Measuring Social Welfare in the U.S. National Accounts," in D. W. Jorgenson, S. Landefeld, and P. Schreyer (eds), *Measuring Economic Sustainability and Progress: CRIW and NBER Studies in Income and Wealth*, 72, 43-88, 2014.
- Kolm, S. C., "The Optimal Production of Social Justice," in J. Margolis and H. Guitton (eds) *Public Economics*, London: MacMillan, 145-200, 1969.
- Konius, A. A., "The Problem of the True Index of Cost of Living" in *The Economic Bulletin of the Institute of Economic Conjunction* (in Russian), 9-10, 64-71, published in English in 1939 in *Econometrica*, 7, 10-29, 1924.
- Lewbel, A., "Household Equivalence Scales and Welfare Comparisons," *Journal of Public Economics*, 39, 377-91, 1989.
- Lewbel, A. and K. Pendakur, "Equivalence Scales," in S. N. Durlauf and L. E. Blume (eds) *The New Palgrave Dictionary of Economics*, 2nd edition, New York: Palgrave Macmillan; 3, 26-29, 2008.
- May, K. O., "A Set of Independent Necessary and Sufficient Conditions for Simple Majority Decisions," *Econometrica*, 20, 680-4, 1952.
- Malmquist, S., "Index Numbers and Indifference Surfaces," *Trabajos de Estadística* 4, 209-42, 1953.
- Meyer, B. and J. Sullivan, "The Material Well-being of the Poor and Middle Class Since 1980," *AEI Working Paper* no 2011-04, 2011.
- Muellbauer, J., "Testing the Barten Model of Household Composition Effects and the Costs for Children," *Economic Journal*, 87, 347, 460-87, 1977.
- OECD, *The OECD List of Social Indicators*, Paris: OECD, 1982.
- , *Growing Unequal? Income Distribution and Poverty in OECD Countries*, Paris, OECD, 2008.
- , *Divided We Stand—Why Inequality Keeps Rising*, Paris: OECD, 2011a.
- , *How's Life?* Paris: OECD, 2011b.
- , *OECD Framework for Statistics on the Distribution of Household Income, Consumption and Wealth*. Paris: OECD, 2013a.
- , *OECD Guidelines for Micro Statistics on Household Wealth*. Paris: OECD, 2013b.
- Pollak, R. A., "The Social Cost of Living Index," *Journal of Public Economics*, 15, 311-36, 1981.
- Samuelson, P. A., "Social Indifference Curves," *Quarterly Journal of Economics*, 70, 1, 1-22, 1956.
- Sen, A. K., *On Economic Inequality*, Clarendon Press, Oxford, 1973.
- Slesnick, D. T., "Empirical Approaches to the Measurement of Welfare," *Journal of Economic Literature*, 36, 4, 2108-65, 1998.
- , *Consumption and Social Welfare*, Cambridge, Cambridge University Press, 2001.

- Slutsky, E., “Sulla theoria del bilancio del consumatore,” *Giornale degli Economisti (in Italian)*, 51, 1–26, 1915.
- Stiglitz, J. E., A. Sen, and J-P. Fitoussi, *Mismeasuring Our Lives*, Report by the Commission on Measurement of Economic Performance and Social Progress, New York: The New Press, 2010.
- United Nations Economic Commission for Europe, *Canberra Group Handbook on Household Income Statistics*; 2nd edition; Geneva: United Nations, 2011.
- Zwijnenburg, J., S. Bournot, and F. Giovannelli, “Expert Group on Disparities in a National Accounts Framework: Results from the 2015 Exercise”, Statistics Working Papers No 10, OECD 2016.

SUPPORTING INFORMATION

Additional supporting information may be found in the online version of this article at the publisher’s web-site:

Annex: Further Discussion of Social Welfare Functions

Annex Figure 1: Sensitivity of Inequality Measures to Widening Distribution