



Unpaid Work, Unpriced Services, and Equivalence Scales

Nancy Folbre (University of Massachusetts Amherst, USA)

Marta Murray Close (University of Massachusetts Amherst, USA)

Paper Prepared for the IARIW 33rd General Conference

Rotterdam, the Netherlands, August 24-30, 2014

Session 2B

Time: Monday, August 25, Afternoon

Unpaid Work, Unpriced Services, and Equivalence Scales

Nancy Folbre and Marta Murray Close
University of Massachusetts Amherst

Abstract

A growing literature calls attention to the contribution that non-market work, including child care, makes to total output. Valuation of this work has important implications for the comparative living standards of households of different sizes and compositions, highlighting the need to redefine household income, consider economies of scale in household production and measure the time costs of children relative to adults. This paper develops a simple model of alternative equivalence scales that takes these factors into account and demonstrates their empirical feasibility. The illustrative results suggest that conventional equivalence scales systematically overestimate the relative well-being of families with young children relative to those without, especially when resident parents are employed full-time and child care services are not publicly subsidized. On the other hand, families with three or more children may enjoy greater economies of scale than those with only one or two, because older children help entertain and supervise younger ones.

The national time-use surveys that have now been conducted in many countries document the quantitative significance of non-market household work. For instance, adults in the U.S. spend about the same amount of time in non-market work (services that someone else could, in principle, be paid to provide) as in market work. A number of satellite national accounts now include imputations of its market value (Giannelli et al. 2012; Bridgman et al. 2012, Hamunen et al. 2012, Landefeld et al. 2009). However, the implications of unpaid work and unpriced services for measures of well-being on the household level are only beginning to be explored. Adding the imputed value of non-market household work to household market income could provide a more accurate account of household well-being, but efforts in this direction must proceed carefully. Failing to account for the differential impact of non-market work across households of different size and composition could lead to misleading results.

This paper examines the implications of non-market work for standardized equivalence scales that are widely applied in policy analysis. Framing the problem in terms of relative income

and/or consumption, rather than household utility, it explores a number of ways in which non-market work is likely to affect relative living standards. It offers both theoretical and empirical support for the claim that conventional equivalence scales overstate the relative well-being of families with young children, particularly those in which co-resident parents are employed full-time, no other household members assist with child care and publicly subsidized child care is not easily available.

The first section of this paper briefly reviews the equivalence scale problem, making a case for the theoretical and political significance of non-market work in the measurement of household well-being. The second section develops a simple model illustrating a number of different ways in which non-market work can influence household living standards. The third section demonstrates the quantitative significance of household production and discusses potential ways to utilize time-use data to improve measures of equivalent income.

The Equivalence Problem

Economists have long appreciated many different dimensions of the equivalence problem. As a result, adding another dimension to the list risks a kind of conceptual fatigue. Yet the theoretical stakes are high, riding on a glaring inconsistency in our economic accounting system. In principle, work that is performed outside the market contributes both to economic output and social welfare. One recent study shows that inclusion of the estimated value of nonmarket household production in the U.S. raises the level of nominal Gross Domestic Product in the U.S. 39 percent in 1965 and 26 percent in 2010 (Bridgman et al. 2012). Yet despite direct evidence of change over time and considerable variation across households, its impact on relative living standards has received relatively little attention.

Equivalence Scales

The scaling issue can be approached from two very different theoretical directions. Neoclassical theory focuses on models of equivalent utility based on revealed preferences in consumption, recognizing conundrums regarding interpersonal utility comparisons and difficulty of distinguishing the effects of preferences and technology (Browning et al. 2013; Pollak and Wales, 1979).

Classical theory, implicit in national income accounting, sets utility comparisons aside, aiming simply to more accurately measure income, consumption, and relative material needs (Ebert and Moyes, 2003). But this process is not as simple as it might seem, because it is virtually impossible to directly observe either household economies of scale or the costs of children relative to adults, and these can be estimated in a variety of seemingly arbitrary ways (Nelson, 1993).

As a result, many different equivalence scales, based on a number of different assumptions, have been devised and applied, making consistent comparisons difficult. Policy-oriented researchers often resort to a simple scale in which a single parameter, an exponent applied to the number of household members, captures the effect of both economies of scale (or, more precisely, non-rivalry in consumption of household public goods) and the needs of children relative to adults.

Household income is often simply divided by the square root of household size because the exponent of .5 lies halfway between two implausible extremes: a straightforward per capita adjustment (implied by a parameter of 1), and complete lack of adjustment for number of household members (implied by a parameter of 0) (Johnson et al. 2005). A more disaggregated approach applies two parameters, one to represent economies of scale, another to represent the

needs of children relative to adults. A closely-related three parameter scale treats the first adult differently from additional adults (Betson, undated).

Empirical estimates clearly show that the selection of parameters has significant implications for comparisons of inequality and poverty across countries, and is especially relevant to comparisons between families with children and those without (Buhmann et al. 1988). Ironically, however, the difficulty of reaching a consensus regarding more detailed specifications militates in favor of simplicity. Definitions of need have an inevitably subjective component. While functional forms matter, as Constance Citro and Robert Michael put it, acknowledging “inevitable arbitrariness” seems a more graceful solution than “opaque econometric analysis” (Citro and Michael 1995: 178).

But the valuation of non-market work raises a bigger, more conceptual challenge to conventional definitions of income and consumption. The issue also has political and cultural ramifications. Women have traditionally performed a much larger share of non-market work than men, and continue to do so. In general, the time they allocate to such work lowers their market income. As feminist theorists and activists have long emphasized, the claim that such work is essentially unproductive is demeaning as well as implausible (Folbre 1991; Waring, 1990). Non-market work has particularly direct implications for the relative well-being of single mothers, a highly targeted subgroup for public assistance. Assessments of policy efforts to urge more of these mothers into paid employment in the U.S. seldom include any measure of the costs of purchasing substitutes for unpaid goods and services such as child care.¹

Measurement and Valuation of Non-Market Work

Valuation of non-market work offers a way to measure “extended income” or market income plus the value of goods and services for own consumption. This can be framed either in terms of utility maximization, relying on assumptions regarding individual and joint utility functions, or in terms of income available to meet material needs, setting aside issues such as leisure time and/or measures of subjective happiness. While utility-maximization approaches dominate the literature, material or needs-based approaches also have a long history, dating back to late nineteenth and early twentieth century debates. Simple estimates were typically based on multiplying the number of adult women not working for pay by the annual salary of a household servant (Wagman and Folbre, 1996).

Many recent estimates take a similar, though more refined approach, utilizing data from nationally-representative time use surveys and multiplying hours worked by a replacement cost (rather than opportunity cost) estimate. Though opportunity cost measures may be relevant to household decision-making, the replacement cost approach is considered more appropriate for national income accounting purposes because, like market prices, it is not affected by consumers’ surplus (Abraham and Mackie, 2005). For the same reason, it may also be more appropriate for comparative analysis of material living standards.

The most serious shortcoming of most approaches based on time-diary data is a tendency to seriously underestimate time devoted to child care, including only time in which the survey respondent reports a specific activity such as feeding, bathing, or reading to a child (Yoon and Folbre, 2007; Craig and Bittman, 2008). The supervisory demands, for young children in particular, far exceed the active care demands, and impose more serious constraints on parental employment. Unlike many other national surveys, the American Time Use Survey includes a

measure of supervisory time, and valuation of this time, even at the minimum wage, roughly doubles the value of non-market work (Suh and Folbre, 2014). That supervisory child care is more complementary with non-market household production, such as meal preparation and laundry, than with most forms of paid employment has important implications for understanding living standards.

Another important methodological issue relevant to living standards measurement concerns relative fungibility between market income and non-market work (Ruggles, 1990). Unemployment tends to have a modest effect on women's but not men's household work, and overall, its effect is surprisingly small, suggesting modest counter-cyclical impact. A recent study found that roughly 30% to 40% of the foregone market work hours are allocated to increased home production (Aguiar et al., 2011). Both urbanization and technical change have limited household production capacity—few families have either the infrastructure or the skills to produce their own food and clothing. The activities in which considerable substitutability between purchases and home-produced services is evident are meal-preparation, care of children, and care of adults in need of assistance, such as the frail elderly or individuals with disabilities.

Output-based valuation is methodologically superior to labor-input valuation, because it includes consideration of household technology, capital and the value of raw materials (Ironmonger and Soupermas, 2009). One can divide household production into final outputs such as accommodation, meals, clean clothes, child care, transport, volunteering, and education, and ask what it could cost to purchase similar outputs in the market. Subtracting the value of capital and raw materials yields an estimate of labor inputs. Unfortunately, this approach is difficult to operationalize, for two reasons. First, many household outputs are coproduced (such as supervisory time for children and other productive household activities). Second, the data

required for a plausible output valuation, especially including reasonable quality adjustments, are often difficult to find. Future research and data collection may well mitigate these problems. In the meantime, labor input valuation approaches represent the best feasible alternative.

The application of labor input valuation most directly relevant to considerations of equivalent income concerns measures of inequality in extended income. Several studies defining extended income as the sum of market income and the value of home-produced goods and services show that adding non-market work in the cross-section has an equalizing effect, though the size depends on the measure of inequality utilized (Folbre et al. 2013; Frick et al., 2012; Gottschalk and Mayer, 2002). The size of this equalizing effect declines as the value of household production declines as a percentage of total extended income. Thus, inequality in extended income may have increased even more over time in recent years than inequality in market income. Declining substitutability between market income and household production would exacerbate this trend. Likewise, a decline in the relative importance of household production may have important implications for overall economies of scale in the household and for the costs of children relative to adults.

Economies of Scale and the Relative Costs of Children

While less research has focused on what might be termed “equivalence” factors in household production than on estimates of its market value, some striking results stand out in analysis of food preparation and child care, in particular. Empirical assessment of consumer expenditures on these activities relative to hours per month devoted to them shows that they are relatively “time-intensive” commodities (Gronau and Hamermesh, 2006).

Exploiting a unique Russian data set that includes both time use and expenditure data for the period 1994-98, Victoria Vernon finds that scale economies in time devoted to food

preparation are much higher than those from expenditure on food. Doubling the number in a household from 2 to 4, (holding wages and non-labor income constant and controlling for differences in age composition) decreases per capita food expenditures by about 31 percent but decreases per capita time devoted to food by about 74 percent (Vernon, 2004). These results confound the usual assumption that food is a relatively “private” good in households (Deaton and Paxson, 1998). While food is excludable in consumption, meals are much less rivalrous in production. In other words, the relative price of a home-cooked meal declines significantly with household size. At the other extreme, meals purchased away from home, in restaurants, deliver no economies of consumption or production to the household as a unit (though household members clearly benefit from economies of scale in restaurant meal production, these are unrelated to household size).

Research on time devoted to child care in both Australia and the U.S. shows that this represents a larger component of the total cost of children than consumer expenditures. Applying neoclassical reasoning to a model of household utility equivalence, Bruce Bradbury utilizes data from the Australian Time Use Survey on adult leisure time to estimate that a couple with two children requires an income about 2.7 times as large as a couple with no children in order to enjoy the same consumption level, far exceeding conventional square-root-of-household-size equivalence scales and higher even than a per-capita measure (Bradbury 2008). Using child-centric data from the U.S. Child Development Supplement of the Panel Survey of Income Dynamics and comparing a replacement-cost valuation of child care time to U.S. Department of Agriculture estimates of expenditures on children under the age of 12, Folbre (2008) finds that time costs amount to between 62% and 65% of the total costs of children in two-child households.

Anecdotal accounts of large families have long suggested that children are cheaper by the dozen, partly because older children help care for younger ones (Carey and Galbraith, 1948). A detailed analysis of the incremental time costs of children in Australian households, including both active care and supervisory time, finds significant economies of scale in child care, total household production time, and total work time (Craig and Bittman, 2008). Addition of the first child represents by far the biggest time demand; the second child has a smaller impact, while addition of subsequent children has either a negative or small impact on child care time. These economies of scale for child care time are far higher than those implied by the conventional square-root equivalence scale. Another study using German data found that mothers' time devoted to developmentally-relevant child care activities for a specific child increased rather than decreased with number of siblings, suggesting complementarity rather than rivalry in consumption of this activity (Osmanowski and Cardona, 2012).

These studies have not yet had much influence on analysis of differences in equivalent income across countries and over time, though Ohler (2013) decisively illustrates their relevance to a comparison of the living standards of families with and without children.

Redefining Equivalence

A simple way of illustrating the relevance of time use valuation for relative living standards is to build on one-parameter and two-parameter models of equivalent income (and/or equivalent consumption). The model developed below applies reasoning similar to that employed in satellite national income accounts, and can be empirically fleshed out using similar sources of data—nationally representative time-use surveys.

Accounting for Household Production: A Revised One-Parameter Model

Start with the conventional one-parameter model of equivalent income where household market income is divided by the number of household members raised to some power θ reflecting economies of scale in consumption. Let Y denote household market income, let N denote the number of household members, and let θ be a scaling factor whose value is greater than or equal to zero and less than or equal to one. Then we can define equivalent income as

$$(1) \quad Y_e = \frac{Y}{N^\theta}.$$

If θ is zero, the denominator equals 1 and the number of household members has no effect on their individual living standards. At the other extreme, if θ equals 1, the denominator becomes the number of household members, essentially a per capita measure that implies no economies of scale. The term “economies of scale,” often used as shorthand, is not quite accurate here, because, as the previous discussion indicated, household production is essentially ignored. The primary factor driving θ is non-rivalry in consumption—in particular, household public goods such as housing, consumer durables, and utilities. Other, less important factors include lower costs from bulk purchasing and reduction of waste. The equivalence factor is the derivative of Y_e with respect to the number of household members:

$$(2) \quad \frac{dY_e}{dN} = -\frac{\theta}{N} Y_e.$$

The value of non-market household production can be construed as an addition to household income, yielding a larger sum that can be labeled “extended income.” (Alternatively, extended consumption, rather than extended income could be measured by adding the value of goods and services produced for home consumption to *market* expenditures). The simplest way to represent the value of non-market household production, consistent with the replacement-cost approach applied in many satellite national income accounts, is as a multiple of the number of productive

household members times the average imputed value of the non-market work performed by productive household members. For the time being, “productive” will be defined as making a non-zero contribution to non-market household production. Let H denote the average value of non-market household work per productive household member, and let N_p denote the number of productive household members. Then we can define equivalent extended income as

$$(3) \quad Y_{ee} = \frac{Y + N_p H}{N^\theta}.$$

The product of N_p and H represents an accounting model rather than a true production function. For symmetry, one could similarly disaggregate Y into the product of number of household adults and average market earnings per adult, but this complicates the model and is empirically unnecessary, since household income is collected by most household surveys.

An uncomfortable aspect of this approach is the assumption of perfect substitutability between the two sources of income, which is implausible. As with other sources of implicit income, such as medical insurance, lack of fungibility poses a problem (Ruggles, 1990). However, the problem seems more serious for the specification of poverty lines or thresholds than for descriptive analysis. If a household lacks sufficient market income to successfully engage in household production it is unlikely to devote time to non-market work (imagine a homeless person who eats only free food).

In equation (3), because adding another member to the household may affect N_p in the numerator as well as N in the denominator, it is immediately apparent that its negative effect on equivalent extended income is muted, and it could even have a positive effect (holding household market income constant). Adding a productive member to the household affects equivalent extended income less negatively than it affects equivalent income, and the precise

magnitude of the effect depends not just on the degree of non-rivalry in consumption but also on the new member's productivity in household work.

So far, we have followed the conventional model of equivalent income in summarizing non-rivalry in consumption with a single scaling parameter, θ . We have also ignored economies of scale in household production. As discussed above, however, economies of scale in household production probably render some essential household goods and services, including meals and child care, more “public” when produced at home rather than purchased in the market. One way to accommodate the possibility that household production is less rivalrous than market purchases is to specify separate scaling parameters for market income and household production. Let θ_m and θ_h denote the extent of non-rivalry in market-purchased and home-produced goods and services, respectively. Then, using a simple additive model, we can represent equivalent extended income as the sum of equivalent market income, denoted by Y_{me} , and equivalent household production, denoted by Y_{he} :

$$(4) \quad Y_{ee} = Y_{me} + Y_{he} = \frac{Y}{N^{\theta_m}} + \frac{N_p H}{N^{\theta_h}}.$$

It seems likely that the extent of non-rivalry in forms of income is affected by the age composition of the household. Further, the distinction between adults and children featured in two-parameter models clarifies some important implications of valuing household production.

Reassessing the Relative Costs of Children: A Revised Two-Parameter Model

The standard two-parameter equivalence scale essentially disaggregates the number of household members into the number of adults and the number of children and assigns a relative weight to children that is almost always less than one. Let N_a denote the number of adults in the household, and let N_k denote the number of children. Let λ denote the consumption needs of

children relative to adults. The standard two-parameter equivalence scale defines equivalent income as

$$(5) \quad Y_e = \frac{Y}{(N_a + \lambda N_k)^\theta}$$

It is desirable to specify a model of equivalent extended income that, like the standard two-parameter model of equivalent income, allows children to have different consumption needs than adults. We can easily specify such a model by replacing N in the denominator of equation (4) with $N_a + \lambda N_k$ from the denominator of equation (5). Before proceeding, however, we suggest one additional modification. It seems likely that the consumption needs of young children relative to adults in market consumption are less than those with respect to non-market work, since children require large quantities of direct care and supervision. In other words, λ is likely to differ across these two domains. The simplest way to accommodate this concern is to specify separate weights for children in the consumption of market-purchased and home-produced goods and services. Let λ_m denote the relative needs of children in market consumption, and let λ_h denote the relative needs of children in home production. Now we can define equivalent extended income as

$$(6) \quad Y_{ee} = \frac{Y}{(N_a + \lambda_m N_k)^{\theta_m}} + \frac{N_p H}{(N_a + \lambda_h N_k)^{\theta_h}}$$

Equation (6) provides simple, separable measure of the contribution of non-market work to living standards that is analogous, in this respect, to the satellite national account strategy. Basically, it suggests simple addition of the equivalized replacement-cost estimate of the value of home production to a standard measure of equivalized market income. It is empirically tractable, using essentially the same functional form for the estimate of household production that is used

in the satellite approach. The difficulties of estimating values for θ_h and λ_h , while formidable, are arguably no greater than those of estimating values for θ and λ , in the standard approach.

Refining the Model: Disaggregating Household Production

The model of equivalent extended income in equation (6) assumes that the average value of household production per productive household member is the same for all households. In practice, however, this value will depend on the demographic composition of the household. Consider, by way of example, two households, each composed of a married couple and a young child. In the first household, both parents are employed full-time outside the home and the household pays for child care while the parents are at work. In the second household, the husband is employed full-time outside the home and the wife cares for the child full-time at home. All else equal, the average value of household production will be higher in the second household than the first – and the difference will probably be substantial.

A similar concern arises with respect to the relative needs of children in market purchases and household production. Pursuing the example above, child care represents a large cost whether it is purchased in the market or provided at home. But the relative needs of children will be higher in market purchases and lower in household production in the household that purchases child care. In practice, differences across households in the average value of household production and in the relative cost of children in market purchases and household production can be accommodated by creating a taxonomy of households based on the age, gender, and employment status of their members and estimating a value of H , λ_m , and λ_h for each type of household. The age at which children become productive household members may also vary.

A second refinement to the model in equation (6) would be to disaggregate the second term on the right-hand side into different categories of household output or consumption, such as meal preparation, child care, accommodation, and transportation, as suggested by an output-valuation approach (Ironmonger and Soupermas, 2009). Each component could be weighted by its relative contribution to total household non-market product. That is, H , λ_m , and λ_h could vary in meal preparation, child care, accommodation and transportation and other aspects of household consumption. This disaggregation, illustrated in the empirical discussion below, is helpful because technical characteristics such as rivalry in consumption are often specific to particular outputs.

Empirical Illustrations and Possibilities

The quantitative significance of a consideration of non-market work can be demonstrated with simple illustrations based on aggregate estimates for the United States. Construction of household-specific measures is more complex, because the American Time Use Survey collects data on only one member per household, requiring approximation of total household non-market labor time based on synthetic households. While this empirical exercise lies beyond the scope of this paper, we outline an estimation strategy here and also make a case for improved survey design and data collection.

Illustrative Comparisons

As aforementioned, aggregate estimates from the American Time Use Survey for the civilian population ages 15 and over show that average time spent in non-market work (household activities such as housework and food preparation, purchasing goods and services, and caring for and helping household and non-household members) is roughly equivalent to time spent in market work.² In 2012, the respective averages were 3.15 hours per day relative to 3.19

hours per day. A conservative estimate of the replacement cost value of this time, applying the federal minimum wage of \$7.25 an hour, yields an average annual imputed income of \$8,336 per person. In the same year, consumer units consisting of 2.5 persons on average spent an average of \$51,442.³ Children under the age of 15 represented about 20 percent of the population in 2010.⁴ It seems reasonable to assume that consumer units contained, on average 2 persons over the age of 15, for a total contribution to household extended income of \$16,672, or 32 percent of average consumption expenditures (not including consideration of taxes, tax expenditures, public cash benefits, or in-kind subsidies)

The important issue for equivalence scales, however, is not the size of extended income relative to consumption but variation across households that is likely to be inversely correlated with market income and consumer expenditures. Among individuals living in households with no children under 18, those who were not employed contributed 1.15 hours more per day than those who were employed. Applying the same algorithm as above, this amounts to a difference of \$3,043 for each person not employed (about 6% of average household expenditures) or \$6,086 (about 12%) for two persons not employed.

In households in which the youngest child is under the age of 6, however, the difference in average non-market work between the employed and not-employed is much greater, amounting to about 2.6 hours per day. In such a household, the added value of a single non-employed adult to extended income estimated in these terms is \$6,880 or about 13% of average household expenditures. This number falls well within the range of estimates of the average annual cost of full-time child care for an infant (from about \$4,600 in Mississippi to nearly \$15,000 in Massachusetts), and for a four-year old (from about \$3,900 in Mississippi to nearly \$11,700 in Massachusetts) in 2011.⁵ The clear implication is that a household with a child under

age 6 in which both parents are employed is likely to require a significantly higher income than one in which only one parent is employed in order to achieve the same standard of living. A single parent who is employed (but does not enjoy significant child care subsidies) is likely to require higher income than one who is not employed for the same reason. .

Yet this rough comparison also challenges traditional assumptions regarding the relative consumption of adults and children. Parents who are not employed may generate higher household consumption than their market income indicates, but this does not mean that *adult* consumption is increased. Estimates of the cost of children, such as those published regularly by Mark Lino at the U.S. Department of Agriculture (2013), consider spending on child care a private good, one that is excludable from adult consumption. Surely similar reasoning should be applied to unpaid time devoted to child care. In a sense, the high market costs of child care render the hidden costs of unpaid time devoted to child care more visible.

Most two-parameter equivalence scales weight a child considerably less than an adult on the grounds that a child eats less and requires less expensive clothing and shelter. The Organization for Economic Cooperation and Development for instance, applies a .5 weight to children (Betson, undated:11). But as Bruce Bradbury's calculations based on Australian time use data, referred to earlier, indicate, young children in particular are more costly than adults once their time costs are taken into account. These time costs extend well beyond the replacement cost to include negative effects on the lifetime earnings of caregivers who reduce their labor market experience. In terms of equation (6) above, the relative costs of children are almost certainly higher than conventional measures both in households that purchase child care (which increases λ_m) and in those in which a household member provides unpaid child care (which increases λ_h).

Further, as aforementioned, time devoted to care activities with children is swamped by the demands of supervisory time, measured by the American Time Use time-diary question asking “during this time period were children in your care?” (but not counting time that children were asleep at night or time overlapping with primary child care activities). The published tables for the ATUS refer to this as “secondary” child care, and it is reported as averaging 4.78 hours per day for all persons 18 years and over living in households with children under 13 years in 2012. This temporal demand exceeds the average amount of time devoted to all other forms of non-market household work, though it often overlaps with such work, providing a clear example of joint production.

Yet supervisory time is probably even more conducive to economies of scale with children than care activity time. That is, supervising two or more young children at once is even more efficient than feeding or bathing or playing with two or more children at once. Furthermore, older children who are not very productive at other household tasks may be perfectly capable of supervising—essentially just keeping an eye on—younger ones. This suggests that, among families with young children, the economy of scale in consumption parameter for household production, θ_h is lower than θ_m (that is economies of scale in consumption are greater). One could also construe older children supervising younger ones as a case of economies of scale in child care production. For instance, a 14 year old child, added to a household, could easily raise the level of average household production if she or he devoted substantial time to supervising younger children.

In general, it seems likely that, with the exception of child care, non-market household production is less rivalrous in consumption than market purchases. The other most-time consuming activities captured by the American Time Use Survey, including meal preparation

and cleanup, housework, and shopping, yield household public goods. While market spending on most such services also yields household public goods, spending on food away from home, an increasingly significant component of total food costs, is clearly a private good.

A comparison of expenditure data and time-use data provides some interesting insights here as well. In 2012, average annual expenditures on food at home per consumer unit of 2.5 persons on average was \$3,921, representing 7.6% of total average annual expenditures. In the same year, average daily time in food prep and cleanup (not counting food shopping, which is not disaggregated in published tables) was .53 hours per person ages 15 years and older. Assuming 2 persons ages 15 or above, on average, in each consumer unit, and valuing time at federal minimum wage of \$7.25 per hour comes to \$2,805 per consumer unit, or 42% of total cost of food (average annual expenditures plus value of time).

Significant differences in time devoted to food preparation and cleanup are apparent between those employed and those not employed, even among those with no household children under 18. The former spend an average of .37 per day, the latter .64 hour per day. Over the course of a year, the difference between the two, for one person, valued at the federal minimum wage of \$7.25 per hour, comes to about 18 percent of average food expenditure. In other words, a two-adult household where one adult is not employed would enjoy substantially more home production time devoted to food than one in which both adults were employed, and probably enjoy greater economies of scale because, as indicated in earlier discussion of Vernon's (2005) research, home-produced food is more "public" in character than meals away from home. This result is also consistent with the literature suggesting that households with two earners spend a larger share of their food budget on food away from home (for more discussion see Ohler, 2013).

All else equal, then, one would expect a shift away from meals produced at home toward meals purchased at restaurants (or “ready-made” at the market or delicatessen) to reduce overall economies of scale in meal preparation. Such a shift has long been underway in the U.S., along with increased reliance on purchased child care (Ohler, 2013). As married women and single mothers have entered paid employment, the market income of their households has increased, but their time devoted to non-market work has declined. It seems unlikely that the productivity of their non-market work has increased sufficiently to compensate.

Further, households have almost certainly experienced declining economies of scale that have increased the negative impact of a reduction in time to non-market work on extended income and consumption. This does not, of course, imply that households are worse off. It does, however, strongly suggest that conventional measures of equivalent income and consumption have overstated their gains.

Implications for Survey Design and Administration

In principle, time-use data from nationally-representative surveys make it possible to empirically estimate measures of extended income equivalence. In practice, however, three serious limitations come into play (beyond the difficulties of measuring scale economies and costs of children relative to adults, which are hardly unique to this approach). Most time-use studies (the Australian national time-use survey is one notable exception) collect data from only one household member. This approach probably reflects a legacy of emphasis on individual decision-making and a tendency to disregard the contribution of households as units of production to Gross Domestic Product (Folbre 1991).

This limitation can be partially redressed by the construction of estimates based on synthetic households. For instance, the average amount of time devoted to non-market work by a

woman in a household with two young children and no other adult household members married to a full-time male employee can be added to the average for a full-time male employee in a household with two young children and no other adult household members married to a woman who is not employed to derive a measure of total household time devoted to non-market work. This approach has been applied in some empirical studies (Folbre et al., 2009; Folbre et al., 2013). However, much could be gained by the collection of household-level data, if only in a relatively small sample that could be used to help test and calibrate results from exercises like the one described above. A second limitation also concerns survey design. Few consumption surveys include any assessment of time use and vice versa; until recently, it has been hard to even find surveys in the same year that could be plausibly matched (see Gronau and Hamermesh 2006). As a result it is difficult to empirically assess substitutability between purchased and home-produced goods and services. Since a substantial portion of the costs of both types of surveys is consumed by sampling and survey administration, much could be gained by combining these two types of surveys, even at the cost of reducing the level of detail in both domains of money and time.

A third limitation lies in the approximate nature of estimates of the value of household production, which have primarily applied a labor input-valuation approach. Changes over time in the level of household capital and the nature of household production technology deserve far more attention than they have yet received. For instance, recent trends toward increased shopping via internet are shifting time costs away from households toward higher expenditures on shipping and transportation. Increased awareness of the importance of parental time as an input into child outcomes suggests that human capital formation should be considered an important household output.

Yet none of these limitations should discourage empirical efforts to improve equivalence scales by incorporating analysis of non-market work. Indeed, such efforts could increase awareness of important differences in material living standards and help motivate efforts to solve the larger problems that arise from failure to consider the value of unpaid work and unpriced services.

References

- Abraham, Katherine and Christopher Mackie, eds. *Beyond the Market: Designing Nonmarket Accounts for the United States*. Washington, D.C.: The National Academies Press, 2005.
- Aguiar, Mark A., Erik Hurst, and Loukas Karabarbounis, "Time Use During Recessions," NBER Working Paper No. 17259, July 2011.
- Betson, David M. undated. "Poverty Equivalence Scales: Adjustment for Demographic Differences Across Families. Manuscript, Department of Economics and Policy Studies, University of Notre Dame, available at <http://www3.nd.edu/~dbetson/research/documents/EquivalenceScales.pdf>
- Bradbury, Bruce, "Time and the Cost of Children," *Review of Income and Wealth* 54:3 (2008), 305–323.
- Bridgman, Benjamin, Andrew Dugan, Mikhael Lal, Matthew Osborn and Shaunda Villones, "Accounting for Household Production in the National Accounts, 1965-2010." *Survey of Current Business* May: 23-36, 2012.
- Browning, Martin, Pierre-Andre Chiappori, and Arthur Lewbel, "Estimating Consumption Economies of Scale, Adult equivalence scales, and Household Bargaining Power," *Review of Economic Studies* 80, 1267–1303, 2013.
- Buhmann, Brigitte, Lee Rainwater, and Guenther Schmaus, "Equivalence Scales, Well-being, Inequality, and Poverty: Sensitivity Estimates across Ten Countries Using the Luxembourg Income Study (LIS) Database," *Review of Income and Wealth* 34:2, 115-142, 1988.
- Carey, Ernestine Gilbreth, and Frank Gilbreth, Jr. *Cheaper by the Dozen*. New York: Thomas Y. Crowell Company, 1948.
- Citro, Constance and Robert Michael. *Measuring Poverty: A New Approach*. Washington, DC: National Academy Press, 1995.
- Craig, Lyn, and Michael Bittman, "The Incremental Time Costs of Children: An Analysis of Children's Impact on Adult Time," *Feminist Economics* 14:2 (2008), 59-88.
- Deaton, Angus and Christina Paxson, "Economies of Scale, Household Size and the Demand for Food," *Journal of Political Economy* 106 (1998) 897-930.
- Ebert, Udo, and Patrick Moyes, "Equivalence Scales Reconsidered," *Econometrica* 71:1, 319-343, 2003.
- Folbre, Nancy. "The Unproductive Housewife: Her Evolution in Nineteenth Century Economic Thought," *Signs: Journal of Women in Culture and Society* 16:3 (1991), 463-84.

- Folbre, Nancy, Janet Gornick, Helen Connelly, and Teresa Munzi, "Women's Employment, Unpaid Work, and Economic Inequality," in *Income Inequality: Economic Disparities and the Middle Class in Affluent Countries*, ed. Janet C. Gornick and Markus Jäntti. Stanford, CA: Stanford University Press, 2013.
- Folbre, Nancy, Cordelia Reimers, and Jayoung Yoon, "Making Do and Getting By: Non-Market Work and Elderly Women's Standards of Living in the U.S.," *Journal of Women, Politics, and Policy* 30:2-3 (2009), 198-221.
- Folbre, Nancy, "Inequality and Time Use in the Household," 342-363 in Wiemer Salverda, Brian Nolan, and Timothy M. Smeeding, eds., *The Oxford Handbook of Economic Inequality*. New York: Oxford University Press, 2009.
- Friedman, Milton, "A Method of Comparing Incomes of Families Differing in Composition," *Studies in Income and Wealth* 15. New York: National Bureau of Economics Research, 1952, 9-24.
- Frick, Joachim, Markus M. Grabka, and Olaf Groh-Samberg, "The Impact of Home Production on Economic Inequality in Germany," *Empirical Economics* 43:3 (2012), 1143-1169.
- Giannelli, Lucia Mangiavacchi, and Luca Piccoli, "GDP and the Value of Family Caretaking: How Much Does Europe Care?" *Applied Economics* 44 (16): 2111-2131, 2012.
- Gottschalk, Peter and Susan Mayer, "Changes in Home Production and Trends in Economic Inequality," in Daniel Cohen, Thomas Piketty, and Gilles Stain-Paul (eds.), *The New Economics of Rising Inequalities*. New York: Oxford University Press (2002), 265-284.
- Gronau, Reuben, and Daniel Hamermesh. "Time vs. Goods: The Value of Measuring Household Production Technologies," *Review of Income and Wealth* 52:1 (2006), 1-16.
- Hamunen, Eeva, Johanna Varjonen, and Katri Soenne, "Satellite Accounts on Household Production: Eurostat Methodology and Experiences," Paper Prepared for the 32nd General Conference of the International Association for Research in Income and Wealth, Boston, MA, 2012.
- Ironmonger, Duncan, and Faye Soupermas, "Using Time Use Episode Data to Estimate Household Production Outputs," Paper Presented at 32st Conference of the International Association for Time Use Research, 2009, available at http://ffb.uni-lueneburg.de/iatur2009/downloads/paper_presentation/Thursday/P_S_2/Ironmonger_Soupermas___Using%20Time%20Use%20Episode%20Data%20%20%28Paper%29.pdf
- Johnson, David S. Timothy M. Smeeding, and Barbara Boyle Torrey, "Economic Inequality Through the Prisms of Income and Consumption," *Monthly Labor Review* 128, 11-24, 2005.

- Landefeld, J. Steven and Stephanie H. McCulla, "Accounting for Nonmarket Household Production within a National Accounts Framework," *Review of Income and Wealth* 46:3, 289-307, 2000.
- Landefeld, J. Steven, Barbara M. Fraumeni and Cindy M. Vojtech, "Accounting for Household Production: A Prototype Satellite Account Using the American Time Use Survey." *Review of Income and Wealth* 55(2): 205-25, 2009.
- Lino, Mark, "Expenditures on Children by Families, 2012." U.S. Department of Agriculture. Washington, D.C., Center for Nutrition Policy and Promotion. Miscellaneous Publication Number 1528-2012, August 2013.
- Nelson, Julie, "Household Equivalence Scales: Theory versus Policy." *Journal of Labor Economics*, 11 (1993), 471-493.
- Ohler, Tami, *Essays on the Rising Demand for Convenience in Meal Provisioning in the United States*, Ph.D. Dissertation, Department of Economics, University of Massachusetts Amherst, 2013.
- Osmanowski, M. and Cardona, A. 2012. "Resource Dilution or Resource Augmentation? Number of Siblings, Birth Order, Sex of the Child and Frequency of Mother's Activities with Preschool Children," DFG Research Center, available at , accessed June 24, 2014
- Pollak, R.A., and M. L. Wachter. 1975. The Relevance of the Household's Production Function and Its Implications for the Allocation of Time," *Journal of Political Economy* 83 (1975), 255-277.
- Pollak, R.A. and T.J. Wales, "Welfare Comparisons and Equivalence Scales, *American Economic Review* 69 (1979), 216-221.
- Ruggles, Patricia. *Drawing the Line. Alternative Poverty Measures and Their Implications for Public Policy*. Washington, D.C. : Urban Institute Press, 1990.
- Seneca, Joseph T., and Michael K. Taussig, "Family Equivalence Scales and Personal Income Tax Exemptions for Children," *The Review of Economics and Statistics* 53:3 (1971), 253-262.
- Short, Kathleen. 2011. "The Research: Supplemental Poverty Measure: 2010." United States Census Bureau. Available at: http://www.census.gov/hhes/povmeas/methodology/supplemental/research/Short_ResearchSPM2010.pdf (accessed November 1, 2012).
- Suh, Jooyeoun, and Nancy Folbre, "Valuing Unpaid Child Care in the U.S.: A Prototype Satellite Account Using the American Time Use Survey," manuscript under review at *Review of Income and Wealth*, submitted May 2014.

Vernon, Victoria. 2005. *Food Expenditure, Preparation Time and Household Economies of Scale*. Available at: <http://ssrn.com/abstract=630862>.

Wagman, Barnet, and Nancy Folbre, "Household Services and Economic Growth in the U.S., 1870-1930," *Feminist Economics* 2:1 (1996) 43-66.

Waring, Marilyn. *If Women Counted. A New Feminist Economics*. New York: Harpercollins,

Yoon, Jayoung, and Nancy Folbre, "What is Child Care? Lessons from Time Use Surveys of Major English-Speaking Countries," *Review of Economics of the Household* 5: 3 (2007): 223-248.

Notes

¹ The Census Bureau's Experimental Poverty Measures do usefully address this issue (Short, 2010).

² See published tables at U.S. Bureau of Labor Statistics, American Time Use Survey, <http://www.bls.gov/tus/tables.htm>, accessed June 26, 2014. This definition of non-market household work is conservative, excluding time spent on telephone calls, mail and email, volunteering, and supervisory child care.

³ U.S. Bureau of Labor Statistics, Economic News Release, Consumer Expenditures, available at <http://www.bls.gov/news.release/cesan.htm>, accessed June 26, 2014.

⁴ See U.S. Census, Age and Sex Composition in the U.S., 2010, available at <https://www.census.gov/population/age/data/2010comp.html>, accessed June 26, 2014.

⁵ Child Care Aware of America, “Parents and the High Costs of Child Care,”
http://www.naccrra.org/sites/default/files/default_site_pages/2012/cost_report_2012_final_081012_0.pdf