

VALUING UNPAID CHILD CARE IN THE U.S.: A PROTOTYPE SATELLITE ACCOUNT USING THE AMERICAN TIME USE SURVEY

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This paper builds on previous satellite accounts that treat households as production units, but challenges their measurement and valuation of time devoted to child care, making a case for the inclusion of supervisory child care time that does not overlap with other productive activities. We also suggest several other methodological refinements for estimates based on analysis of data from the American Time Use Survey: application of a vector of specialized replacement cost wage estimates for different child care activities rather than a single wage, and adjustments for the ratio of children to adults present and for the educational attainment of caregivers. Our estimates of the value of child care alone in 2004 and 2010 exceed previous estimates of the value of all non-market household production in the U.S. The end result is an upward adjustment of Gross Domestic Product by about 43 percent compared to previous adjustments of about 26 percent.

JEL Codes: D13, E1, J13

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1. INTRODUCTION

Increasing attention to the value of non-market work is motivating the construction of new satellite national income accounts in many countries (CMEPSP *et al.*, 2010). In order to add estimates of the value of non-market household work to Gross Domestic Product (GDP) in the United States, two recent studies employ time-use data to impute its market value (Landefeld *et al.*, 2009; Bridgman *et al.*, 2012). In this paper, we adopt a similar approach to the valuation of unpaid child care, an important component of all non-market household work. However, we argue that previous satellite accounting efforts have underestimated the amount and value of time devoted to child care for three reasons: omission of supervisory child care time, failure to consider the number of children cared for relative to adults present, and lack of adjustment for the care provider's educational attainment. The measurement and valuation of value of time devoted to child care

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deserves special attention because it holds important implications for current living standards and the well-being of future generations. Furthermore, child care time represents a significant portion of all time devoted to non-market household production.

Building on the method used in earlier estimates of the value of all non-market household work, we use pooled 2003–12 data from the American Time Use Survey (ATUS) to develop a prototype satellite account assigning a market value to unpaid child care in the U.S. We begin with a brief review of previous research on implications of valuing unpaid household work, methods of estimating the amount of time devoted to it, and imputation of its monetary value. Next, we make a case for including supervisory child care, for adjusting time spent in active child care for its intensity (measured by the ratio of children to adults present), and for applying education-adjusted specialist wages to different types of unpaid child care. In order to demonstrate the implications of this approach, we first replicate and then revise previous estimates of the total value of time spent in non-market household production in the U.S. We offer a separate stand-alone account of the value of unpaid time devoted to the care of children under 18 over the 2003–12 period, illustrating the effects of each adjustment we advocate. Finally, we demonstrate that these plausible adjustments increase GDP by about 43 percent, far more than suggested in previous estimates.

2. THE VALUATION OF NON-MARKET HOUSEHOLD WORK

The limitations of measures of GDP that omit consideration of the value of non-market work in the household have long been acknowledged (Hawrylyshyn, 1976; Murphy, 1978; Kendrick, 1979; Chadeau, 1985). For many years, the lack of adequate data for estimating the market value of this work has impeded efforts to develop expanded measures using satellite accounts. With the advent of nationally-representative time-use surveys, including the ATUS, researchers have begun to develop detailed imputations based on either a replacement or opportunity cost valuation of labor inputs. Still, the implications of these efforts remain underappreciated, and a number of issues regarding both measurement and valuation remain unresolved. The value of unpaid child care has received little explicit consideration, despite its relevance to both family living standards and human capital accounting.

2.1. *Implications*

In conventional measures of GDP, all non-market work activities (including production of goods and services in the household for own use, volunteer work, and time spent in education) are implicitly valued at zero. Yet this work contributes to current and future living standards and is, to some extent, substitutable with income from market production. Its quantitative dimensions are significant. Indeed, in every year the ATUS has been conducted and tallied to date (2003–12), the daily average of time that individuals 15 and older devoted to activities that can

be construed as non-market work averaged more than the daily average of time devoted to paid working and work-related activities.¹

Household production accounts for the bulk of all non-market work, and labor time devoted to it is augmented by investment in both household and government capital. Failure to include estimates of the value of household production in GDP leads to understatement of total output and probably to overstatement of the rate of economic growth.² As women have entered paid employment, they have reduced the amount of time devoted to housework and family care. While women's increased wages are reflected in conventional GDP measures, their decreased home production is not. Thus, the long-term trend in output as measured by conventional GDP fails to provide an accurate picture of true growth in national output (Landefeld and McCulla, 2000).

Previous research has powerfully demonstrated the implications of using time-use data to impute a value to non-market household work in a separate satellite account that can be added to conventional measures of GDP. Landefeld *et al.* (2009) show that the average annual growth rate for nominal GDP in the U.S. over the period 1985–2004 was 5.5 percent, but declined to 5.2 percent when the imputed value of household production was included. Examining a longer time period between 1965 and 2010, Bridgman *et al.* (2012) present adjustments that lower the average annual rate of nominal GDP growth from 6.9 to 6.7 percent.

Secular declines in the amount of time devoted to housework seem to counter-vail cyclical increases in household production that might be expected to increase with unemployment. Focusing on analysis of the effects of the Great Recession, Aguiar *et al.* (2011) exploit differences in the intensity of the downturn across states to control for secular trends, showing that household production is actually somewhat countercyclical.

Non-market household work also has important implications for household living standards, providing implicit income through in-kind consumption. Consider, for instance, two households of identical composition (two parents and two young children) with identical after-tax market income. In the first household one parent is employed full-time and another specializes in non-market household work; in the second, both parents are employed full-time. The first household enjoys the benefits of non-market household work that allow it to minimize purchases of expensive services such as child care.

By conventional measures, these households are equally well-off. By measures of “extended income” that include the value of non-market household work, the first household is considerably better off than the second (Folbre *et al.*, 2013). Accurate estimation of extended income is especially relevant to a comparison of the living standards of families with different levels of participation in market work and those with and without children.

Measurement and valuation of time devoted to child care also bears directly on cost-based estimates of the value of human capital. Many aspects of household

¹See Table A.1 for each year at <http://www.bls.gov/tus/tables.htm>. Our estimates of total non-market work include the following ATUS categories: housework; purchasing; caring for household and non-household members; engaging in organizational, civic, and religious activities; and education.

²If the rate of productivity growth in non-market work exceeds that in market work, the rate of growth of average productivity would be understated.

production (not just those directly devoted to child care) are inputs into the production of young adults capable of developing their cognitive skills through education and work experience. Ideally, estimates of the value of human capital would combine output valuation—such as the net present value of future income (Fraumeni, 2011)—with input valuation—such as the cost-based measures first proposed by John Kendrick (1976)—in real terms that would allow for productivity measurement. In the meantime, however, it is important to acknowledge that non-market work is an important component of the overall cost of children (Folbre, 2008).

While the overall amount of time that Americans devote to housework has declined substantially since 1965, the amount of time that parents devote to children has increased (Bianchi *et al.*, 2006). Child care is less susceptible to technological change (at least so far) than housework, and standards of childrearing seem to ratchet up along with income. Utilization of purchased child care does not reduce parental time as much as might be anticipated, as parents often compensate for reduced weekday time by spending more time with children in evenings and at weekends (Bittman *et al.*, 2004).

Parents clearly derive some intrinsic satisfaction from caring for children, as from other types of work. Difficulties conceptualizing child care time resemble, in some respects, the difficulties of conceptualizing leisure (Sevilla *et al.*, 2012). Still, the simple logic of replacement cost suggests that the value of unpaid child care reported by respondents to time-use surveys matters not only because it represents a growing component of all non-market household production, but also because it affects household living standards and influences the historical cost of investment in children's human capital.

2.2. Measurement of Time Devoted to Non-Market Household Work

Most time-use surveys ask respondents about their primary activities with questions such as “What were you doing?” Slight differences in wording and categorization of activities often create some incompatibilities in measurement across time. Both Landefeld *et al.* (2009) and Bridgman *et al.* (2012) present estimates of the amount of time devoted to child care that combine data from relatively small time-use surveys conducted before 2003 and included in the Multinational Time Use Survey (MTUS) archive with some results from the ATUS, which was implemented on a national basis beginning in 2003.

Both studies disaggregate household production into seven basic categories: cooking, housework, odd jobs, gardening, shopping, child care, and travel. The Bridgman *et al.* (2012) estimates show that child care represented about 11 percent of all household production time in 1965 and 13.5 percent in 2010. However, both studies defined child care only as care of household children, excluding care of non-household children (which includes care by non-custodial parents) and assigning it to the odd jobs category.³ This reduces their estimates of total child care time

³Personal communication, Steven Landefeld and Benjamin Bridgman (based on analysis of ATUS coding used in their analyses).

(the sum of care of household and non-household children) by about 5.5 percent in 2003 and 7.7 percent in 2010.⁴

Another coding issue concerns the treatment of travel. Many time-use scholars group travel time with the activity with which it is associated. For instance, travel time involved in taking a child to daycare, school, or to recreational activities is typically treated as a component of child care. The decision to treat travel as a separate category rather than assigning a portion of it to child care (again, likely the result of efforts to maximize compatibility with the earlier surveys) underestimates total time devoted to child care activities by about 18 percent.⁵

A more serious measurement issue arises from concerns about multitasking or joint production—vacuuming the living room while waiting for the washing machine to finish its cycle, or cooking meals while keeping an eye on the children. Because it is not uncommon for people to multi-task while working at home, some time-use surveys inquire about “secondary” activities by asking “Were you doing anything else at the same time?”

Joint production clearly complicates measurement of all household activities. Analysis of Australian time-use surveys, which include questions regarding secondary activities, shows that child care activities are the most likely to be combined with other tasks (Ironmonger, 2004). Therefore, it seems likely that surveys that do not tally secondary activities understate the amount of time devoted to child care activities.

The ATUS does not ask respondents to report secondary activities but does ask respondents to report any time that children under the age of 13 were “in your care.”

The Statistics Canada General Social Survey poses a similar question, asking if individuals were “looking after children” (Folbre and Yoon, 2007a). Responses to both the U.S. and Canadian questions are reported as “secondary” child care activity (Fedick *et al.*, 2005; ATUS published tables). This terminology is somewhat misleading. While some supervision of children is active—that is, requires the caregiver to pay close attention and scrutinize children’s behavior—much supervision takes the form of passive, or “on-call” availability. That is, it represents a responsibility that constrains time allocation to other tasks (Budig and Folbre, 2004). The ATUS survey question was initially designed to capture responsibility for children that did not necessarily take the form of an “activity” (Horrigan and Herz, 2004).

Responses to the “in your care” question clearly demonstrate that the temporal demands that young children impose far exceed explicit child care activities. In previous research, Suh (2013) shows that supervisory time in the ATUS is significantly affected by hours of paid employment, and the demographic, and racial/ethnic characteristics of parents. Other empirical studies of child care time confirm the temporal demands of supervisory care. For instance, a detailed analysis of the 1997 Panel Study of Income Dynamics Child Development Supplement (PSID-CDS) shows that children under 13 received about 59 hours per week of

⁴The coding decision is described in the technical background appendices. These estimates of their implications are based on estimates from the published ATUS tables A.1, <http://www.bls.gov/tus/#tables>, accessed June 26, 2013.

⁵Authors’ calculations.

active care (including care from non-household adults such as teachers) and about 22 hours per week in activities when adults were “available,” not counting sleep time (Folbre *et al.*, 2005). Time that children spent sleeping amounted to 79 hours per week, on average (about one-half of all hours in the week). The study notes that exclusion of time that children are sleeping from estimates of care time leads to the misleading inference that infants require less time than older children simply because they are less likely to be awake at any given time.

Another approach to assessing supervisory care for children utilizes survey questions regarding who respondents were with, or “who else was there” while they were engaged in activity. But the mere presence of a child is conceptually distinct from having a child “in your care.” A child can be in an adult’s care while watching television in another room or playing in the backyard. Indeed, such spatial separation is a common feature of supervisory care. On the other hand, the “with whom” variable could overstate child care responsibilities by extending their definition to include social activities in which many adults are present, sharing responsibility for a small child. Many activities reported as leisure fall into this category (Mattingly and Bianchi, 2003; Bittman and Wajcman, 2004).

Analysis of Canadian data that measured both physical proximity and “looking after” children shows that these are related but distinct measures of child care (Folbre and Yoon, 2007a). Similarly, Suh’s detailed analysis of the impact of economic, demographic, and cultural variables on different measures of child care in the ATUS reveals significant differences between “in your care” time and “time with children” (Suh, 2013). At least one published study has utilized the “in your care” question in the ATUS to expand estimates of the amount and market value of time devoted to children (Folbre and Yoon, 2007b).

Another aspect of time-use measurement is intensity of work. Some tasks are intrinsically more demanding than others in terms of physical and mental effort, level of stress, and responsibility. Multitasking generally requires additional effort, and analysis of Australian time use data from 1992 shows that women engage in multitasking significantly more than men (Floro, 1995; Floro and Miles, 2003).

Standard adult-centric measures of child care treat one hour of care provision the same whether one or more adults report caring for one child, or whether one adult is caring for one child or for more at the same time. But the ratio of children to adults deserves consideration. Detailed analysis of Australian time use data shows that the addition of a second or third child to a household is associated with only a small increase in time devoted to child care, a result consistent with increased intensity of effort within the same time frame (Craig and Bittman, 2008).

A higher ratio of children to adults is probably also associated with a decline in the quality of the care provided to an individual child. Children get more individualized attention from a parent, nanny, or a babysitter than from a child care provider or teacher. Research suggests that birth order, birth timing, and number of siblings have significant impacts on child outcomes—children benefit from more individual attention from parents (Conley, 2004; Price, 2008). However, it seems unlikely that the decline in quality per child is the only result; in general, child care is more demanding the greater the number of children per adult, even if children are able to play with one another and entertain themselves to some extent.

The aforementioned analysis of child-centric data from the 1997 PSID-CDS showed that about a third of the active care that children under the age of 13 receive, on average, involves overlaps of either additional adults or children (Folbre *et al.*, 2005). A recent analysis of time use data from the United Kingdom also utilized “who with” data to estimate the intensity of child care (Mullan, 2010).

2.3. *Imputing Market Value*

Estimation of the quantity of time devoted to household production allows input-based replacement-cost valuation based on the market value of labor and, where feasible, the market value of capital and other inputs. Ideally, input valuation should be combined with or at least compared to, valuation of outputs (Fitzgerald and Wicks, 1990; Abraham and Mackie, 2005). However, practical concerns often dictate reliance on valuation of labor time alone. Both Landefeld *et al.* (2009) and Bridgman *et al.* (2012) offer replacement cost estimates of the value of non-market household production as recommended by Abraham and Mackie (2005) for national income accounting purposes.

The replacement cost approach estimates what the market wages for labor of similar quality would be, multiplying these hourly wage rates by the number of hours. The simplest approach applies a generalist wage (such as a housekeeper’s wage). Alternatively a vector of specialist wage rates (such as wages for a cook, a gardener, or a preschool teacher) can be applied. Landefeld *et al.* (2009) apply both approaches. In their application of specialist wages, they assume that the “productivity of an average individual is less than the productivity of a specialist for the cooking, cleaning, odd jobs, and gardening categories, but equal to that of a specialist for the shopping, child care, and travel categories” (Landefeld *et al.*, 2009, p. 218). In some activities in which they consider it likely that productivity of an unpaid provider is lower, specialist wages are reduced to 75 percent of their market value (p. 218). Bridgman *et al.* (2012) use the wages of general-purpose housekeepers, arguing that this represents a reasonable lower-bound estimate.

We agree with Landefeld *et al.* (2009) that a specialist wage rate is appropriate for child care. Parents and other family members acquire child-specific information and skills that can increase their efficacy in child care. Further, the continuity of care that parents provide is crucial to the development of children’s emotional and social well-being. However, we believe that child care activities themselves should be disaggregated and assigned different specialist wage rates. Parents engage in a variety of tasks, including physical care, travel, and developmental care such as reading aloud or helping with homework.

The ATUS provides information that makes it possible to assign different specialist wage rates to different types of child care, a procedure that facilitates inclusion of supervisory care, which should clearly be valued at a lower rate than active care. One study used 2003 ATUS data to disaggregate child care into seven categories of supervisory, active care, and overlapped activities, applying a vector of wage rates ranging from the minimum wage of \$5.15 for supervisory care to \$25 an hour for developmental activities (Folbre and Yoon, 2007b). A report on the care sector of the state of Massachusetts also adopted this approach, applying different wage rates for interactive and supervisory care (Albelda *et al.*, 2009).

The value of supervisory time has been explicitly estimated in a number of studies using output-based approaches. Holloway *et al.* (2002) estimated the quantity of output of child care provided by households in the United Kingdom by subtracting from 24 hours time spent in school and in the formal market care sector, and asking what a market-based replacement for all parental time would cost. Mullan's subsequent analysis of U.K. data included estimates of supervisory time based on how much time children spent with parents including measures of child care intensity, yielding significantly higher estimates than would be expected based on simple measures of active child care alone (Mullan, 2010).

3. EXPANDING AND REFINING VALUATION OF CHILD CARE

In order to develop a separate satellite account for child care that exploits available data to the fullest extent, we advocate measures that take supervisory care, intensity of care activities, and education of care provider into account. We also advocate several specific replacement cost valuation strategies, including use of a relatively low wage rate for supervisory child care, attention to overlapping categories (such as the combination of supervisory child care with housework), and a specialist wage approach that applies different wage rates for different types of child care activity with attention to different levels of child care provider education.

Supervisory time clearly imposes constraints on parents that affect their ability to work outside the home, especially during night shifts or at weekends. Leaving a child younger than age 9 without adult supervision, even when that child is asleep, can be legally construed as neglect. Many paid jobs also involve on-call responsibilities, and these are clearly recognized by labor law.⁶ Discussions of the application of the Fair Labor Standards Act to household employment emphasize that covered employment includes all time that the employee is required to be at the employer's home and all time that the employee is required to be "on call" in the course of his/her duties. For instance, one website providing information regarding nanny taxes includes "all hours on duty, including meal time if the employee is required to remain at the premises during meals, nap time, and time when children are in school IF nanny is required to be 'on call' for any emergencies such as early dismissal, child sick at school, etc."⁷

⁶According to the U.S. Department of Labor, "An employee who is required to remain on his or her employer's premises or so close thereto that he or she cannot use the time effectively for his or her own purposes is working while on-call. Whether hours spent on-call is hours worked is a question of fact to be decided on a case-by-case basis. All on-call time is not hours worked. On-call situations vary. Some employees are required to remain on the employer's premises or at a location controlled by the employer. One example is a hospital employee who must stay at the hospital in an on-call room. While on-call, the employee is able to sleep, eat, watch television, read a book, etc. but is not allowed to leave the hospital. Other employees are able to leave their employer's premises, but are required to stay within so many minutes or so many miles of the facility and be accessible by telephone or by pager. An example of this type of employee is an apartment maintenance worker who has to carry a pager while on call and must remain within a specified number of miles of the apartment complex." See U.S. Department of Labor website at <http://www.dol.gov/elaws/esa/flsa/hoursworked/screenER80.asp>, accessed June 20, 2013.

⁷See the 4 Nanny Taxes site at <http://www.4nannytaxes.com/index.cfm/faq/nannyhousekeeper-faq-list/nanny-minimum-wage/>, accessed June 24, 2013.

Respondents in the ATUS are instructed not to report supervisory responsibilities while they are sleeping, and in its published tables the Bureau of Labor Statistics automatically excludes such care. This is a questionable exclusion. Babysitters and nannies are typically paid for staying overnight with children, including long periods of time when both caregivers and children are asleep. Rates of pay are typically less than for daytime hours, but still significant. For instance, parents in the San Francisco area recently reported paying between \$25 and \$100 per night for overnight nannies.⁸ In his analysis of U.K. time use data, Mullan (2010) estimates the value of overnight care, although he keeps it separate from the imputed value of other care. For all these reasons, it seems likely that the ATUS estimates of supervisory “in your care” time represent a conservative, lower-bound estimate of temporal constraints.

An alternative way to expand the definition of child care is to rely on questions regarding “who else was present” while adults were engaged in other activities, sometimes termed “social time” with children. Previous research on the ATUS shows that supervisory care and social time with children overlap considerably but are not exactly the same, since adults can report supervisory care of children who are in another room of the house, or playing outside (Suh, 2013). In our view, the ATUS data on “who else was present” provide important insights into supervisory care, but are not a substitute for the “in your care” measure.

More importantly, the “who else was present” question provides a means of measuring the intensity of both active and supervisory child care. The rationale for considering intensity is similar to the rationale for considering supervisory care—it influences the cost of comparable market services. Babysitters and nannies charge rates partly based on number, as well as age of children. For instance, one national company recruiting child care providers specifies a minimum recommended wage rate of \$11 an hour for one child, with an additional \$2 per additional child.⁹ Similarly, a national babysitting guide stipulates, “if you have more than one child, expect to pay \$2 to \$5 more an hour for each additional child.”¹⁰ Valued in terms of a substitute service provided outside the home, such as a child care center, the effect of number of children is even more pronounced: that is, it usually costs approximately twice as much to send two young children to a child care center as to send one.

The additional effort required to care for more than one child probably depends on their difference in ages. Older children can help supervise younger ones; children of similar ages may play together and entertain themselves. These complementarities probably help explain why the per-child increments described above are small. In the absence of much information about how these complementarities come into play, it seems plausible to simply assume that, on average, more children require more effort, but the increase in effort is far less than proportional.

The age of children tends to affect the type of child care activity directly—that is, babies require more physical care; young children who go to preschool or

⁸See, for instance, the website of the Golden Gate Mothers Group at <http://www.gmg.org/recommends/NannyPay.html>, accessed June 25, 2013.

⁹See the A+ Childcare site at <http://apchildcare.com/rates/>, accessed June 25, 2013.

¹⁰See <http://www.care.com/child-care-babysitting-cost-p1145-q22781.html>, accessed June 26, 2013.

kindergarten require more travel time. Young children also require more supervision. Using different wage rates for replacement cost estimates of different child care activities, therefore, captures much of the direct effect of child age.

Education of caregiver is especially likely to affect the value of time devoted to developmental care, such as reading aloud or helping with homework. However, education of caregiver may have more diffuse positive effects in other activities, as children are exposed to a larger vocabulary or to valuable problem-solving skills. Assigning a higher value to the child care time of more highly-educated individuals is consistent with the principle that replacement cost estimates should be adjusted for quality. In our view, even a reasonable guess at such an adjustment is better than no adjustment at all.

4. DATA AND ANALYSIS

We utilize data from the 2003–12 ATUSs conducted by the U.S. Bureau of Labor Statistics, a stratified random sample drawn from households that have completed their participation in the Current Population Survey (CPS), representative of the U.S. civilian non-institutional population aged 15 and over.¹¹ Since 2003, ATUS has collected time diaries from one individual from each participating household. ATUS respondents are asked to sequentially report their primary activities during the 24-hour period from 4 a.m. the day before the interview to 4 a.m. on the day of the interview. Respondents describe their activity episodes, including start and stop times and other information, such as who they were with and where they were. In addition, ATUS interviewers collect demographic data on household members and labor force information for the respondent and their spouse/cohabiting partner.

In developing a satellite account for child care, we follow the precedent set by previous research employing ATUS data for satellite accounting of household production in general (Landefeld *et al.*, 2009; Bridgman *et al.*, 2012). However, we divide nonmarket household labor activities captured in ATUS 2003–12 into slightly different categories, as well as adding a category of supervisory child care: (1) active child care, (2) supervisory child care, (3) adult care, (4) cooking and cleaning, (5) housework, (6) home repairs and maintenance, (7) gardening and pet care, (8) shopping, (9) organizing and managing, (10) travel related to housework and child and adult care, and (11) other household chores. A complete mapping between categories applied in previous research, our 11 household production categories, and the ATUS codes is presented in Appendix Table A.1.

We use these measures to construct an estimate of total time devoted to non-market household production using the methodology applied by previous studies and compare these to the estimate of total time including the value of supervisory or on-call time that is not overlapped with any other form of non-market household work. Unlike many other time-use surveys, the ATUS does not collect information on overlapping or simultaneous activities, other than supervisory or on-call time.

¹¹For more information about ATUS, see <http://www.bls.gov/tus>.

In order to refine estimates of the imputed value of child care time, we disaggregate child care activities, including both supervisory time overlapped with other forms of non-market household work (excluding primary child care) and non-overlapped supervisory time (see Table 2). We also include a vector of replacement cost wage rates for these different child care activities for each year, largely based on the Occupational Employment Survey. We opt for conservative lower-bound choices, because we adjust them (in the next column) both for number of children and for the education of the caregiver (for detailed information on replacement cost choices, see Appendix Table A.2).¹²

We define the intensity of child care as the ratio of adults (18 and over) to young children (aged 0–12) participating in a child care activity, per unit of time, measured by responses to the question “Who else was present?” while an activity was performed. Estimates of the weighted average of the density of all episodes of child care are provided in Appendix Table A.4. Following the example described earlier of wage rates for babysitters based on number of children, we increase the value of child care for episodes in which the intensity exceeded 1 but was lower than 2 by 18 percent. We increase the value of child care for episodes in which the intensity exceeded 2 by a total of 36 percent. When care is provided by an individual who has completed at least some college (but not attained a bachelor’s degree) we boost the replacement wage level by 10 percent; for college and beyond, we boost it 20 percent.

5. REPLICATED AND REVISED ESTIMATES

We estimate the total amount of time devoted to supervisory child care that was not overlapped with any other non-market production for every year between 2003 and 2012, and compare it with our measure of active child care (which includes care of non-household children) (see Table 1). Non-overlapping supervisory time is about four times greater than the amount of time devoted to child care activities. Inclusion of this category of time use increases the total number of hours devoted to non-market household production by more than 50 percent. This is by far the most important adjustment to previous estimates.

The effect of this addition on the imputed value of output is somewhat blunted by application of a relatively low wage—the legal minimum—to the valuation of non-overlapping child care time. This wage rate represents a plausible lower-bound, far lower than rates charged by market providers, as noted in the previous discussion. We assign the highest wage rates to developmental and managerial child care. When supervisory child care is combined with other household production activities we assign this combined activity a higher replacement wage than physical or developmental care (see Table 2).¹³

¹²We use occupation-based data rather than industry-based data for wages because this allows finer differentiation.

¹³Landefeld *et al.* (2009) and Bridgman *et al.* (2012) assigned the hourly wage rate of child day care services provided by the North American Industry Classification System in the Current Employment Statistics (CES-NAICS).

TABLE 1
 AVERAGE HOURS PER WEEK DEVOTED TO HOUSEHOLD PRODUCTION, INCLUDING SUPERVISORY CHILD CARE TIME (INDIVIDUALS 18 YEARS AND OLDER, ATUS
 2003–2012)

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2003–12
Cooking and cleaning	4.2	3.5	3.5	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2
Housework	4.9	4.9	4.9	4.9	5.6	4.9	4.9	4.9	4.9	4.9	4.9
Home repairs and maintenance	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4
Child care	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Adult care	1.4	1.4	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
Gardening and pet care	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1
Shopping	2.8	2.8	2.8	3.5	2.8	2.8	2.8	2.8	2.8	2.8	2.8
Organizing and managing	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4
Travel	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Other household chores	0.7	0.7	0.7	0.7	0.1	0.7	0.1	0.7	0.7	0.1	0.7
Replicated total	25.9	25.9	25.2	25.2	25.2	24.5	24.5	24.5	23.8	23.1	24.5
<i>Supervisory child care time</i>	14.7	14.0	14.7	14.0	14.0	14.7	13.3	13.3	13.3	12.6	14.0
<i>(“in-your-care”) not overlapped with any other non-market household production</i>											
Percentage impact of adding non-overlapping supervisory Child care	56.8%	54.1%	58.3%	55.6%	55.6%	60.0%	54.3%	54.3%	55.9%	54.5%	57.1%

TABLE 2
 IMPUTED ANNUAL VALUE OF DISAGGREGATED CHILD CARE ACTIVITIES, 2003 AND 2012 (INDIVIDUALS 18 AND OVER, ATUS)

	2003							2012										
	Hourly Wage Rate (\$)	Total (Unadjusted) Aggregate Value (thousands)	Intensity 1; Adjusted Wage (>1 but <4 children, +18%)	Intensity 2; Adjusted Wage (>4 children, +36%)	Intensity-Adjusted Average Wage	Intensity-Adjusted Aggregate Value (thousands)	Education 1; Adjusted Wage Rate (some college, +10%)	Education 2; Adjusted Wage Rate (college or above, +20%)	Total Intensity and Education Adjusted Aggregate Value (thousands)	Hourly Wage Rate (\$)	Total (Unadjusted) Aggregate Value (thousands)	Intensity 1; Adjusted Wage, >1 but <4 children (+18%)	Intensity 2; Adjusted Wage, 4 or more children (+15%)	Intensity-Adjusted Average Wage	Intensity-Adjusted Aggregate Value (thousands)	Education 1; Adjusted Wage, (some college, +10%)	Education 2; Adjusted Wage (college or above) +20%)	Total Intensity and Education Adjusted Aggregate Value (thousands)
Physical Developmental	9.0	148,803,176	10.62	12.21	10.38	174,000,925	11.42	12.46	197,364,145	11.00	163,871,335	12.98	14.93	12.67	191,149,356	13.94	15.21	212,489,215
Managerial	10.67	165,479,669	12.59	14.48	13.94	376,060,169	15.33	16.72	491,140,712	15.89	289,751,078	18.75	21.56	20.79	652,961,512	22.87	24.95	854,318,959
Travel	16.59	125,581,996	19.58	22.51	19.35	138,936,563	21.29	23.22	154,085,873	21.13	147,882,254	24.93	28.67	24.71	174,133,389	27.18	29.65	185,431,130
Supervisory (overlapped with any household production except primary child care)	9.14	75,789,324	10.79	12.40	11.14	100,543,450	12.26	13.37	276,969,865	10.97	90,920,158	12.94	14.89	13.37	124,132,075	14.71	16.04	339,178,446
Supervisory (not overlapped)	11.92	561,524,690	14.07	16.18	13.63	627,563,322	14.99	16.35	684,278,028	14.12	566,845,636	16.66	19.16	16.20	645,303,101	17.82	19.44	698,875,548
Total	5.15	556,851,270	6.08	6.99	5.84	589,012,910	6.42	7.00	673,726,407	7.25	771,905,355	8.56	9.84	8.26	839,431,125	9.09	9.92	926,865,670
Total		1,634,030,125				2,006,117,340			2,477,565,029		2,031,175,815				2,627,110,558			3,217,158,969

TABLE 3
 SIZE OF GDP ADJUSTMENTS RELATIVE TO STANDARD NATIONAL INCOME AND PRODUCT ACCOUNT (NIPA) MEASURES, 2003, 2004, 2010, AND 2012
 (BILLIONS OF NOMINAL DOLLARS)

	NIPA vs. Adjusted GDP, 2004 (Landefeld <i>et al.</i> , 2009)			NIPA vs. Adjusted GDP, 2010 (Bridgman <i>et al.</i> , 2012)			NIPA vs. Adjusted GDP, 2004 (Authors' estimates)			NIPA vs. Adjusted GDP, 2010 (Authors' estimates)		
	NIPA GDP	Adjusted GDP	% Difference	NIPA GDP	Adjusted GDP	% Difference	NIPA GDP	Adjusted GDP	% Difference	NIPA GDP	Adjusted GDP	% Difference
Gross Domestic Product	11,734.3	14,885.1	26.9%	14,660.4	18,247.7	24.5%	12,277.0	17,558.5	43.0%	14,958.3	21,522.0	43.9%
Non-market household services	0	2,219.5		0	2,591.80			4,266.2			5,333.0	
Net adjustments to consumer durables and government Spending		931.3			995.0			1,015.3			1,230.7	

In these calculations we use a measure of time devoted to child care that includes travel time and care of non-household children. Multiplying the average hours per person per week times the number of persons aged 18+ in the population and the number of weeks per year yields an estimate of the total value of time devoted to child care of about \$1.6 trillion in 2003 and about \$2 trillion in 2012.

Adjusting for two measures of intensity (caring for more than one but less than four children at a time, or for four or more) increases the 2003 estimate to about \$2 trillion, an increase of about 25 percent. Adjusting for the education of the primary caregiver increases it further, to about \$2.5 trillion, an increase of about 56 percent. The impact of these adjustments for 2012 is similar, increasing about 30 and 60 percent, respectively.¹⁴

Our choice of parameters here is plausible, but illustrative. As Table 2 makes clear, lower adjustment factors would lead to lower replacement wage rates, leading to a lower overall estimate.

These price-based adjustments come on top of the significant quantity adjustment entailed by inclusion of supervisory child care that does not overlap with other productive activities. The cumulative effect of both price- and quantity-based adjustments is to more than double estimates of the value of all non-market household work compared to previous estimates for the same years.¹⁵ Compared to the standard National Income and Product Account (NIPA) estimates, Landefeld *et al.* (2009) offer an estimate of adjusted GDP for 2004 (including some revisions to the treatment of consumer durables and investment to account for capital contributions to household production) that are 26.9 percent higher (see Table 3). Bridgman *et al.* (2012) offer similar estimates for 2010 that are about 24.5 percent higher. By contrast, our estimates, including similar revisions to non-labor categories, arrive at much higher estimates, 43 percent higher for 2004 and 43.9 percent higher for 2010.

6. CONCLUSION

Previous estimates of the value of non-market household production in the U.S. based on the ATUS have not taken full advantage of the detailed information it provides regarding supervisory time, the intensity of child care, and the educational attainment of child care providers. While opinions differ as to the appropriate definition of child care and the best methods of imputing market value, this paper clearly demonstrates the scope for more detailed and disaggregated empirical attention to this issue. In particular, it shows that supervisory child care, even when valued at a low replacement cost value, represents a major component of all non-market work and makes a significant contribution to the total value of goods and services produced in the U.S.

¹⁴Neither Landefeld *et al.* (2009) nor Bridgman *et al.* (2012) provide a disaggregated measure of the value of child care that would allow for comparison with our estimate.

¹⁵Estimates for intervening years and for 2011 and 2012 are available from the authors on request.

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SUPPORTING INFORMATION

Additional Supporting Information may be found in the online version of this article at the publisher's web-site:

Appendix Table A.1: Comparison of Household Production Categories Based on ATUS data

Appendix Table A.2: Median Hourly Wage for Specialist Child Care Activities, 2003–2012 (in dollars)

Appendix Table A.3: Median Hourly Wage for Specialist Nonmarket Activities (other than child care), 2003 and 2012

Appendix Table A.4: Average Intensity in Specific Types of Child Care (ratio of individuals under to those over 18, reported present, ATUS, 2003–2012)