Accounting for Household Production in the National Accounts, 1965–2010

By Benjamin Bridgman, Andrew Dugan, Mikhael Lal, Matthew Osborne, and Shaunda Villones

NONMARKET production has long been a subject of interest to national accountants and economists, dating back at least to the seminal work of Simon Kuznets (1934). Since the inception of the national income and product accounts (NIPAs) in the 1930s, issues have been raised about the scope and structure of the accounts. Kuznets, one of the early architects of the accounts, recognized the limitations of focusing solely on the measurement of market activities and excluding a broad range of other nonmarket activities that have productive value such as household production. And although the national accounts are now recognized as one of the most successful analytical measures in the United States, various supplemental series and accounts have been developed to account for a broader set of activities outside of the market economy that may offer further sources of economic growth.

For example, William Nordhaus and James Tobin in the early 1970s developed a major set of extended accounts that tackled the broader measurement of welfare; those accounts added imputations for government and household capital services, nonmarket work, and a major imputation for the value of leisure. The effect was significant, as the imputations nearly doubled gross national product (GNP) in 1965 (Nordhaus and Tobin 1973).[1] Throughout the 1970s and 1980s, Dale Jorgenson with Laurits Christensen, Barbara Fraumeni, and Alvaro Pachon developed a system of national accounts that vastly expanded measures of consumption and investment (Jorgenson and Christensen 1969, 1973; Jorgenson and Fraumeni 1980, 1989; Jorgenson and Pachon 1983). Jorgenson and colleagues not only accounted for household physical capital services, household production, and leisure, but they also quantified the impact of investment in human capital on GDP. In a particularly important series of papers, Jorgenson and Fraumeni (1989, 1992a, and 1992b) developed the lifetime incomes approach to valuing investments in human capital, which in combination with other imputations, added roughly

$14 billion to GDP for 1984, almost 4.5 times as large as the unadjusted value of GDP for 1984.

Work by John Kendrick and Robert Eisner also suggested expanding the boundaries of investment to include investments in capital of all kinds, including investment in tangible human capital and in intangible investments such as research and development. Kendrick's set of expanded income and product accounts

Summary of Findings

This paper develops a satellite account that adjusts gross domestic product (GDP) for household production between 1965 and 2010. The primary findings are as follows:

- Incorporating the value of nonmarket household production raises the level of nominal GDP 39 percent in 1965 and 26 percent in 2010. The decline reflects the steadily decreasing number of hours households spent on home production.
- In 1965, men and women spent an average of 27 hours in home production, and by 2010, they spent 22 hours. This overall decline reflects a drop in women's home production from 40 hours to 26 hours, which more than offset an increase in men's hours from 14 hours to 17 hours.
- The downward trend in the hours spent on nonmarket household production appears to be unaffected by the 2007–2009 recession, despite the increasing number of unemployed household members.
- Including the value of household production lowers measured GDP growth by accounting for the losses in home production associated with increases in women's labor force participation and in market wages between 1965 and 2010. Over this period, adjusting nominal GDP for home production lowers growth from 6.9 percent to 6.7 percent.
- Home production reduces measured income inequality. Although households engage in a similar number of hours in home production regardless of income, adding a relatively constant value of home production to all households proportionately raises the income of low-income households more than that of high-income households.

---

1. Before 1991, GNP was the primary measure of U.S. production and is measured as the market value of goods and services produced by labor and property supplied by U.S. residents regardless of where they are located.

resulted in a 34 percent increase in GNP in 1969 (Kendrick 1976). Eisner (1989), in his attempt at folding in the work of many of his predecessors, published a set of "Total Incomes System of Accounts," resulting in an adjusted GDP for 1981 that was 1.5 times larger than the unadjusted value.

We contribute to this body of literature by constructing a "satellite account" estimate of GDP that incorporates the value of production by households. We measure three different types of home production activities: the production of nonmarket services, the return to consumer durable goods, and a return to government capital attributable to home production. The most significant, in terms of its impact on GDP, is the production of nonmarket services, such as cooking, gardening, or housework. To measure the value of nonmarket services, we make use of two unique surveys that track household labor activities and apply a wage to the total number of hours spent in home production.[2] One of these surveys is the Multinational Time Use Survey (MTUS), which combined a number of time use surveys conducted by academic institutions into a single data set. These surveys were taken sporadically between 1965 and 1999. The other is the American Time Use Survey (ATUS) produced by the Bureau of Labor Statistics (BLS). This survey was taken annually between 2003 and 2010. The second type of home production activity we measure is the return to consumer durable goods, which we treat as investment rather than as consumption, as is currently the case in the NIPAs. The third type of home production involves computing a return to government capital that can be attributed to home production.

We note that exercises similar to ours have been conducted by Steve Landefeld, Fraumeni, and Cindy Vojtech (2009) and Landefeld and Stephanie McCulla, (2000). Our paper contains two extensions of this previous work.

First, we can examine the impact of home production over a business cycle. This was not possible for Landefeld, Fraumeni, and Vojtech (2009) to do as a result of the way in which the ATUS and MTUS data were collected. Landefeld, Fraumeni, and Vojtech (2009) computed the impact of home production using methodology that we subsequently used for 1965 to 2004. They combine the MTUS data and the ATUS data into a single time series that tracks household labor activities over this period. However, the MTUS survey was only conducted five times between 1965 and 1999; household labor values are interpolated between surveys, meaning that it is impossible to observe the impact of the business cycle on home production for this period. They also only used 2 years of ATUS data, 2003 and 2004, that do not cover a business cycle.

Second, we merge the 7 years of ATUS data with the Current Population Survey (CPS) data on household income and examine the relationship between home production and inequality.

We find that incorporating home production in GDP raises the level of GDP 39 percent in 1965 and 25.7 percent in 2010. The impact of home production has dropped over time because women have been entering the workforce. This trend is driven by an increasing trend in the wage disparity between household workers and employees (that is, the opportunity cost of household labor). This disparity has led to a decrease in the number of nonmarket labor hours spent by both employed and not employed women. The fact that women have been entering the workforce over time also means that the growth rate of the traditional measure of GDP will be higher than our adjusted measure. Because standard GDP does not account for home production, some of the increase over time in GDP will be due to women switching from home production to market-based production. Our adjusted GDP measure includes the unmeasured home production, so the increase in GDP that occurs due to substitution from home production to market-based production will be smaller. During 1965 to 2010, the annual growth rate of nominal GDP was 6.9 percent. When household production is included, this growth rate drops to 6.7 percent.

While inclusion of the value of nonmarket services accounts for most of the impact of the adjustment of GDP for home production, returns on consumer durable goods also matter.

We treat consumer purchases of durable goods, measured in the Bureau of Economic Analysis (BEA) personal consumption expenditures, as investment and compute a measure of capital services attributable to them. Overall, however, the returns to consumer durable goods are about half the size of the value of nonmarket services. The smallest adjustment by far is the inclusion of an extra return to government capital. However, we note that the only government service we feel that we can reliably assign to home production is road use (see section 2.3). Drawing on information from a Census Bureau survey, we assign 50 percent of the value of road capital to personal transportation and add a measure capital services to this value.

Turning to the impact of the 2007–2009 recession, we find the impact on home production was small. From 2007 to 2010, home production drops by a little less than 3 hours per person per week, with a slight

---

2. Measuring household production has been challenging in part because of a heavy dependence on time input. Ultimately, many economists have adopted Arthur Pigou's (1932) view that production should be measured "directly or indirectly…with the measuring-rod of money."

increase in 2009 only. From 2007 to 2010, the unemployment rate rose from around 6 percent to around 9 percent. This finding seems counterintuitive, as one might expect that home production would increase when unemployment rises. One possible explanation is that the downward trend in home production, which we note has been steady from 1965 to 2010, drowns out any business cycle impact.

We also find that home production decreases inequality. The impact of home production on the trend in inequality is different from the impact on the level of income: researchers have found that income inequality has increased over the last few decades.[3] Including home production in income estimates accentuates this trend because the impact of home production has decreased over time; therefore, the reduction in income inequality that arises from home production will also shrink over time. We find that home production hours do not vary with family income: for women, who contribute to the bulk of home production hours, the correlation between family income and home production is about 0.01. Therefore, adding home production income to family income is essentially the same as adding a constant number to family income, which will raise the income of low income families proportionately more than high income families, leading to a decrease in inequality. This finding is consistent with earlier work in this literature (Frazis and Stewart 2006).

The rest of this paper is organized as follows:

- Section 1 describes the ATUS and MTUS data, note trends in home production, and examine the relationship between home production and family income.
- Section 2 describes the three adjustments made to GDP to include home production.
- Section 3 puts the results of sections 2 and 3 together, and presents the home production satellite account estimates.
- Section 4 provides concluding remarks.
- An appendix provides methodological details on data sources and the construction of some variables used in our analysis.

1. The MTUS and ATUS Data

1.1 Overview
The MTUS and ATUS are crucial components of our satellite account. The ATUS series begins in 2003, and tracks the number of hours per day that American households spend on tasks such as cooking, house-

work, or gardening.[4] The ATUS surveys are large scale, having response sizes of 15,000 to 20,000 diary days, and are conducted annually. Before 2003, the University of Michigan and the University of Maryland conducted several smaller scale surveys of household activities.[5] These surveys were taken more sporadically than the ATUS survey and covered the years 1965–66, 1975–76, 1985, 1992–93 and 1998–99. These surveys were later incorporated into the MTUS data set, which includes data on American households as well as households in 14 other countries.

1.2 Household production hours
In our study of household production, we combine the ATUS and MTUS data sets into a single data set that tracks household production between 1965 and 2010. The MTUS survey split household time use into 41 different categories. We exclude categories that track activities such as paid work, leisure, sleeping, volunteer activities, and personal care from home production, following the recommendations laid out in the study *Beyond the Market: Designing Nonmarket Accounts for the United States* (Abraham and Mackie 2005).[6] This leaves us with seven categories of time use that are included in household production: housework, cooking, odd jobs, gardening, shopping, child care, and domestic travel. We note the MTUS data does not include hours for these seven categories outside the survey years. To deal with this issue, we interpolate hours between survey years for each category, following Landefeld, Fraumeni, and Vojtech (2009).

In contrast to the MTUS, the ATUS survey contains a much more detailed accounting of household activities. To maintain comparability between the two data sets, we reclassified each ATUS category into one of the seven aforementioned MTUS categories. Table 1 shows the total home production hours in each category for men and women over the 45-year period we examine. Overall, total household production hours have decreased, as have the number of hours spent in each category. Home production hours for women are significantly higher than for men. Interestingly, while women's hours have dropped over time, men's hours have risen somewhat. The overall drop in women's hours is significantly larger (about 14 hours) than the increase in men's hours (about 3 hours).

---

3. Saez and Piketty (2003).

4. There are seven categories of household work included in our adjustment: cooking, housework, odd jobs, gardening, shopping, child care, and travel.

5. The sample sizes of these surveys were between 1,200 and 10,000 diary days.

6. For a list of recommendations from *Beyond the Market* specific to household production, see Landefeld, Fraumeni, and Vojtech (2009, 207).

Because time use data are available on a yearly basis between 2003 and 2010, we are afforded a clearer picture of the trends in more recent years. In chart 1, total home production hours are averaged across women and men and against the unemployment rate. Home production decreases over time, showing a sharp drop in 2010. Interestingly, as the unemployment rate rises, home production falls. In 2007, before the financial crisis, home production averaged 24.2 hours per week. It drops to 23.5 hours in 2008, rises slightly to 23.8 hours in 2009, and then drops to 21.5 hours in 2010. During this period, the unemployment rate rises from around 6 percent to around 9 percent. This suggests that the relationship between home production and the business cycle is not strong. One explanation for this finding is that the downward trend in home production swamps any increase that might arise from an increase in unemployment. We note that concurrent work by Mark Aguiar, Erik Hurst, and loukas Karabarbounis (2011) also finds that when aggregate home production hours are analyzed, the last recession appears to have had no impact on home production. However, Aguiar, Hurst, and Karabarbounis (2011) find that if they disaggregate the ATUS data at the state level, home production increases in states where the recession was more severe. Their conclusion is that the time series variation in the ATUS data series is not sufficient to identify the impact of the business cycle on home production; one must turn to cross-sectional variation in order to tease out the impact of the business cycle from the overall downward trend in home production.

In chart 2, the home production series from chart 1 is decomposed into its constituent categories. The only

Table 1. Total ATUS and MTUS Household Production Hours

[Weighted average hours per week]

	Women					Men					Women and men				
	MTUS			ATUS		MTUS			ATUS		MTUS			ATUS	
	1965	1975	1985	2003	2010	1965	1975	1985	2003	2010	1965	1975	1985	2003	2010
Cooking	12.8	10.8	9.2	5.9	5.9	1.8	1.5	2.5	1.9	2.4	7.5	6.4	6.0	4.0	4.2
House work	11.5	9.6	9.3	7.5	6.7	1.8	2.3	5.1	2.7	2.7	6.8	6.1	7.3	5.2	4.8
Odd jobs	3.2	3.0	1.1	4.5	2.9	2.9	4.0	2.5	4.7	3.5	3.1	3.5	1.8	4.6	3.2
Gardening	0.4	0.4	0.8	1.0	0.9	0.3	0.3	1.0	2.0	2.3	0.3	0.3	0.9	1.5	1.6
Shopping	2.8	3.6	4.1	3.6	3.3	1.8	2.0	2.5	2.5	2.3	2.4	2.9	3.3	3.1	2.8
Child care	4.8	3.9	3.7	4.4	3.9	1.2	1.1	1.1	1.8	1.8	3.0	2.6	2.4	3.2	2.9
Travel	4.3	4.6	4.3	4.0	2.3	3.9	4.0	3.9	3.3	1.7	4.1	4.3	4.1	3.6	2.0
Total	**39.7**	**36.0**	**32.4**	**30.9**	**25.9**	**13.6**	**15.3**	**18.5**	**19.0**	**16.8**	**27.2**	**26.1**	**25.8**	**25.2**	**21.5**

ATUS American Time Use Survey
MTUS Multinational Time Use Survey

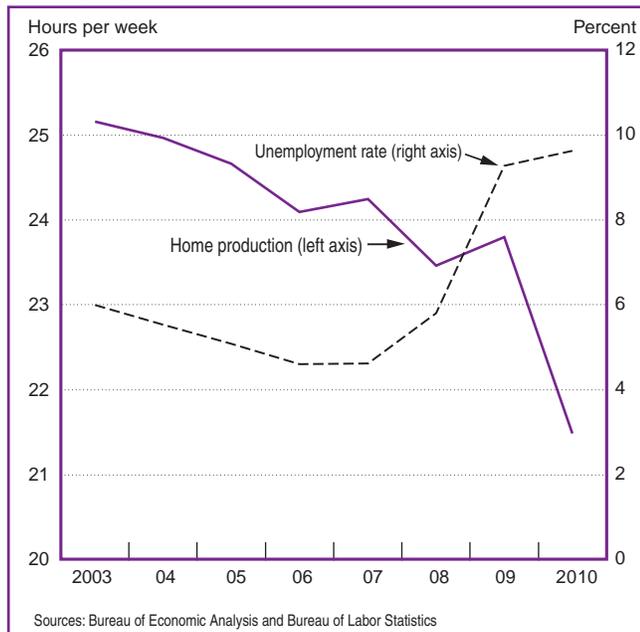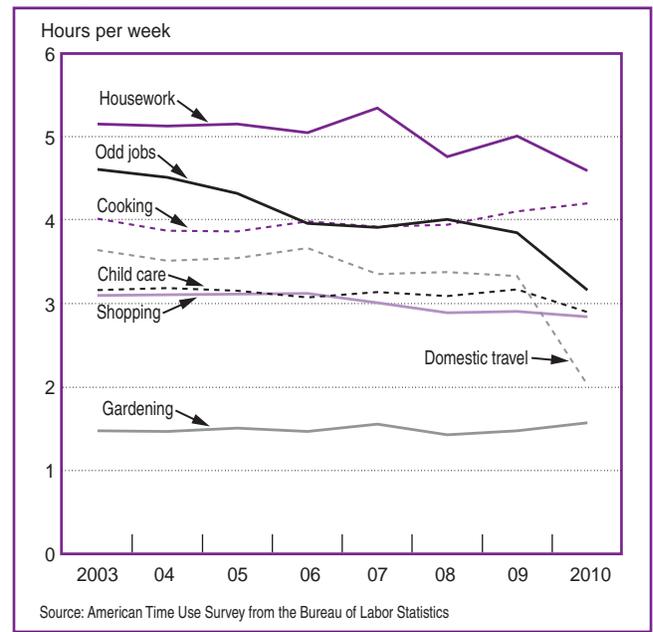### Chart 1. Home Production Hours and Annual Unemployment Rate, 2003–2010

Sources: Bureau of Economic Analysis and Bureau of Labor Statistics

Chart 2. Hours of Household Production Categories, 2003–2010

Source: American Time Use Survey from the Bureau of Labor Statistics

significant change is in travel and odd jobs. Travel dropped sharply in 2010, consistent with the sharp drop in overall home production in that year. Some of this drop may be due to the high unemployment rate, which would reduce commuting time. However, the unemployment rate in 2009 was almost as high as in 2010, yet travel time remained at almost the same level as in 2008. Odd jobs has steadily dropped from a little over 4.5 hours in 2003 to just above 3 hours in 2010.

To summarize, from 1965 to 2010, we observe an overall drop in home production hours. Because of this, the impact of home production on the level of GDP would decrease over time, and the measure of GDP adjusted for household production would grow at a slower rate than unadjusted GDP.

1.3 Home production and inequality

Many economists have been interested in the impact of nonmarket activity on the distribution of income. Using data from 2003, Harley Frazis and Jay Stewart (2006) find that including household production decreases income inequality. Individuals have a similar amount of household production regardless of household income. Household production adds a constant amount of income that increases income for low-income families proportionally more than for high-income families. Since the importance of household production has been decreasing over time, its impact on inequality has likely been declining as well: the amount of extra income added to each household's income will decline from one year to the next.
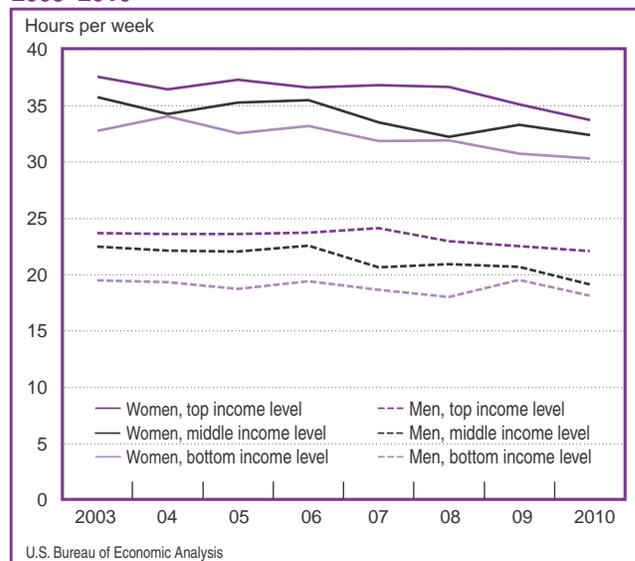
We document evidence consistent with the findings of Frazis and Stewart (2006), using ATUS and Current Population Survey (CPS) data. The ATUS survey asks a single individual in a household to account for his or her time use. Because the ATUS survey sample is a subsample of the CPS survey, it is possible to merge family income information from the CPS survey into the ATUS survey.[7] We merged the data sets and categorized households by whether they were in the top, middle, or bottom third of income in the merged data.[8] In chart 3, we plot home production hours by income level for women and men. Home production hours are very similar for each income level, although it appears that individuals in higher income households have somewhat more home production than those in lower income households. For men, the correlation between home production hours and income was 0.096, while for women, it was 0.014, both significant at the 95 per-

cent confidence level. Averaged over the years 2003 to 2010, the home production for women (men) in the lowest income category was 32.2 (19.0) hours per week, while in the highest income category it was 36.3 (23.3) hours per week.

The most noticeable change is a drop in female home production hours for the middle income category between 2006 and 2008, which moves from 35.5 hours to about 32.5 hours. This drop is primarily driven by a drop in hours devoted to housework, possibly reflecting the high economic growth during this period, which would raise the opportunity cost of doing housework. Although the financial crisis occurred in 2008, we do not observe an effect until 2009, when home production hours increased. This is unsurprising because the financial crisis peaked in fall of 2008, and ATUS survey respondents are chosen with the same frequency from month to month. Therefore the impact of the crisis would not show up in the data until the following year. Additionally, we note that the decline in the 2006–2007 interval before the financial crisis was about 2 hours, larger than the 2007–2008 decline of about an hour.

To summarize, we find that the correlation between home production hours and income is small, especially for women, who contribute to the bulk of home production hours. The fact that the correlation is close to zero implies that the effect of home production on inequality will be essentially to add a constant to the income of all households, thereby decreasing inequality. Since home production hours have trended downwards over time, however, this effect should decrease over time.

Chart 3. Home Production Hours by Income Level, 2003–2010

Hours per week

Legend:
- Women, top income level
- Women, middle income level
- Women, bottom income level
- Men, top income level
- Men, middle income level
- Men, bottom income level

U.S. Bureau of Economic Analysis

---

7. The family income variable was missing or unreported for 53 percent of ATUS respondents. We conduct our analysis of inequality using only families who had nonmissing values for family income.

8. In the merged ATUS-CPS data, the cutoff for the top third of income was $60,000, and the cutoff for the middle third was $30,000–$59,999.

2. Estimates of Household Production

2.1 Nonmarket Household Services

The nonmarket household services component is the largest adjustment to GDP necessary to create our household production accounts. Household services measure the value of time spent on the home production tasks we described in section 1. To compute household services, we first aggregate household production hours across the seven categories described in section 1. The value of household services is then computed to be the product of housekeeper wages for each gender and the number of hours of work. This method assumes a market-cost approach of valuing nonmarket household services. As discussed in Landefeld and McCulla (2000), in the market-cost approach, two methods of computing prices are used for valuing nonmarket household services. In our approach, we chose the housekeeper-cost method that uses the wage rate of general-purpose domestic workers. The alternative method, called the specialist-cost method, uses the wages of a variety of market equivalent specialists of the categories used in valuing home production (that is, chefs, plumbers, and carpenters).

Each method of imputing cost has drawbacks. Using the wages of specialized workers does not take into account the dependence of the quality of the product on the skills of the individual that performs the work. Someone who is performing nonmarket household work may be especially proficient in preparing meals but have little understanding of plumbing problems. In addition, average household workers likely do not have the same specialized tools and skills as professional specialists who devote all of their time to the specialized task. Therefore, there are likely to be economies of scale and specialization that would not be realized in many of the average tasks of home production. As a result, the use of the specialist-cost method may lead to an overstatement of the value of household labor services.

In contrast, the use of a general-purpose housekeeper wage may lead to an understatement of the value of household labor services because the household member may enjoy many nonproductive benefits from general tasks performed at home, such as caring for a child or tasks that may be more of a hobby, such as gardening, woodworking and car repair. However, to avoid measurement difficulties in valuing welfare gains associated with household labor services, we have elected to use the wages of general-purpose housekeepers to provide a reasonable lower bound estimate of labor services as previously used in Landefeld and McCulla (2000), Landefeld Fraumeni, and Vojtech

(2009) and by many other national accountants in their work of constructing nonmarket accounts.

Between 1965 and 2010, the overall value of nonmarket household services grew at a 5.6 percent annual rate (chart 4), 1.1 percentage points slower than published GDP, which grew at an annual rate of 6.7 percent.[9] Nonmarket household services made up 30.1 percent of GDP in 1965 and 17.7 percent in 2009. The decrease over time in nonmarket services as a fraction of published GDP underlies the decrease over time in the impact of the household production adjustment on GDP.

The slow growth rate of nonmarket services is at least partly driven by the decline in home production hours we documented in section 1. Why do we observe a shift in production from nonmarket household services to market services? The answer to this question is twofold. First, the employment of women outside of the household has generally increased over time, from 38 percent in 1965 to 55 percent in 2010. This shift has caused a decrease in the total number of hours spent by women on household production. On average, women spent 39.7 hours on household production in 1965 and 26 hours in 2010. We note that the participation of men in the civilian workforce has decreased over time, from 80.7 percent in 1965 to 71.2 percent in 2010. This decrease has not been sufficient to outweigh the impact of the entry of women: the fraction of men exiting formal work has declined less during this period and the number of hours of household production performed by men (13.6 hours in 1965 and 16.8

---

9. As described earlier, nonmarket hours are interpolated between the MTUS survey years (1965–66, 1975–76, 1985, and 2003), while data for each ATUS year from 2003–2010 has been reported.

Chart 4. Total Value of Nonmarket Services, 1965–2010

Billions of dollars

U.S. Bureau of Economic Analysis
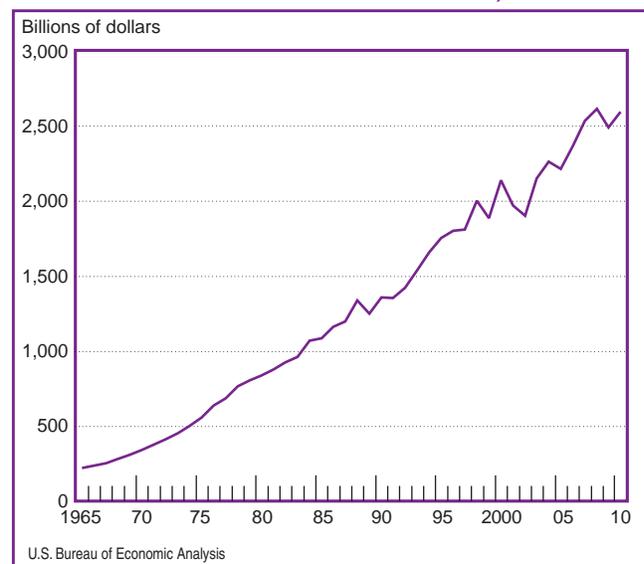
hours in 2010) is lower than those performed by women.

A second reason for the production shift likely stems from the trend in the opportunity costs between market and nonmarket work. As shown in chart 5, compensation for household workers relative to all employed workers has declined over time. This trend has driven a decrease in the number of household production hours spent by women who do not enter the labor force. As shown in table 2, the number of nonmarket labor hours per week of employed women has dropped roughly 5 hours between 1965 and 2010,

Chart 5. Average Wages of Household Workers as a Percentage of the Wages of All Employed Workers, 1946–2009
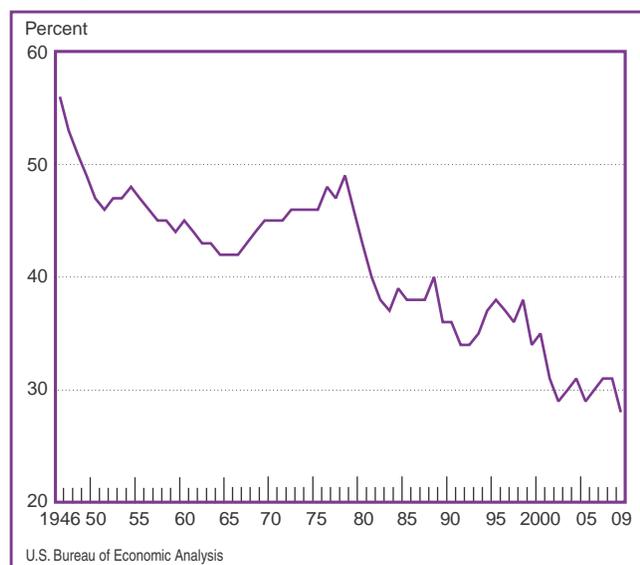

U.S. Bureau of Economic Analysis

while the number of nonmarket labor hours of not employed women has dropped significantly more, by more than 16 hours. As it gets less expensive to hire workers for home production, women who were engaged in home production will substitute away to other activities, choosing instead to pay others to perform home production tasks. This suggests that in addition to women leaving the labor force, a significant amount of the drop in home production can be explained by the drop in home production hours of not employed women. To see this, we note that if the female employment rate was held fixed over time at the 1965 level, the average household production hours would have dropped from 29.5 hours in 1965 to 19.4 hours in 2010, a change of 10.1 hours.[10]

Landefeld, Fraumeni, and Vojtech (2009) noted that average cooking hours decreased from 1985 to 2004, while the personal consumption expenditures price index for purchased meals increased faster (3.1 percent annual rate) than that of food purchased for consumption at home (2.6 percent annual rate). They note that this finding is at odds with the finding that nonmarket hours have dropped over time—why would nonmarket hours decrease when the cost of food preparation has appeared to have gotten relatively cheaper? To resolve this, using the time use data, they compute a price index for food cooked at home that incorporates the opportunity cost of time. Their new price index rises at a 3.4 percent rate annually.

As a final note, household production hours of employed men rose between 1965 and 2010 (table 1), but this rise was offset by the declines in men's labor force participation rates and household production hours for men not in the labor force. Average household production hours for employed men rose from 11.6 hours in 1965 to 14.5 in 2010, while average hours for men who were not employed dropped slightly from 22 to 21.2 hours.

2.2 Consumer durable goods

BEA's GDP measure treats consumer purchases of durable goods as consumption. Our adjustment of GDP treats consumer purchases of durable goods as investment. We reclassify BEA's measure of personal consumption expenditures on consumer durable goods as investment. We also create a new personal consumption expenditures category containing services of consumer durable goods. It is measured by applying the return on personal interest income and personal dividend income, minus depreciation of consumer durable goods, to personal consumption expenditures on

Table 2. Women's Household Production, 1965–2010

	1965	2004	2010
Percent of women			
Employed	37.9	57.1	55.0
Not employed	62.1	42.9	45.0
Nonmarket labor hours per week			
Employed women	27.0	26.5	21.6
Not employed women	47.5	36.6	31.3
Weighted average of nonmarket labor hours per week			
Employed women	10.2	15.2	11.9
Not employed women	29.5	15.7	14.1
Total	39.7	30.8	25.9
Alternatives			
Using 1965 employment status weights			
Employed women	10.2	10.0	8.2
Not employed women..............................	29.5	22.7	19.4
Total	39.7	32.8	27.6
Using 1965 nonmarket labor hours			
Employed women	10.2	15.4	14.8
Not employed women..............................	29.5	20.4	21.4
Total	39.7	35.8	36.2

NOTE. Numbers may not be additive because of rounding.

---

10. We note that a similar exercise for 1985 to 2004 was performed in Landefeld, Fraumeni, and Vojtech (2009). Our findings for the longer period are similar to theirs.

consumer durable goods.[11] We believe that personal interest and dividend income is a good measure of the return to consumer durable goods because on the margin, one would expect consumers to invest in durables until the rate of return to durables was equal to the return on financial instruments that would be the alternative investment. Chart 6 shows total investment in consumer durable goods over time. Like nonmarket services, services of consumer durable goods increase over time; however, the level of services of consumer durable goods is less than half that of nonmarket services. The household capital–labor ratio, as measured by the chained-dollar net stock of consumer durable goods per person, increased at an annual rate of 3.8 percent between 1965 and 2010.[12] The capital-labor ratio for private nonresidential capital increased at an annual rate of only 1.6 percent over the same period. This substitution of capital for labor in household production also reflects the lower relative price change. Between 1965 and 2010, the price of consumer durable goods rose at a 1.3 percent annual rate, while private nonresidential capital grew at a 2.5 percent annual rate.
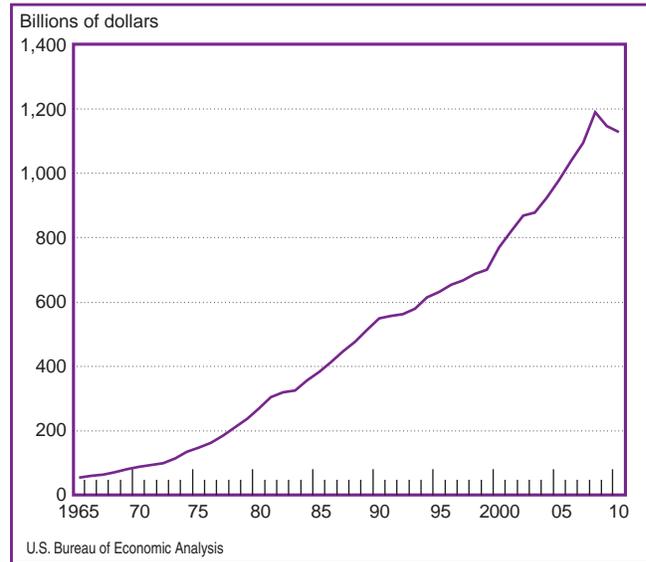
2.3 Government

We include a portion of government capital in the form of road infrastructure in the capital stock of the household sector. We construct our measure of the return to government capital by taking BEA's measure of the net stock of government capital that is attributed to roads, dividing by 2, and applying the interest rate on government securities with a maturity of 10 years. We divide the measured stock of road capital by 2 because, according to survey data from the Census Bureau for 2000, approximately half of all road use is by personal vehicles rather than business-owned vehicles such as trucks.[13] This capital is used by the household workers in concert with private automobiles (included in consumer durable goods) to produce household output. Most other government capital is used by government workers to produce government output (for example, public hospital buildings are used to produce public health services) or provided to the business sector (for example, the portion of roads used by commercial trucking), so their services should be placed in those sectors. While there may be additional government capital that is used by households in production (for example, public parks used by parents in the produc-

---

11. BEA measures of personal interest income and personal dividends income are used to construct the return to consumer durable goods. Depreciation is also BEA's measure of current-cost depreciation of fixed assets and consumer durable goods.

12. The denominator in this calculation is the total population of persons older than 18, from the CPS.

13. For more information, see the appendix.

Chart 6. Services of Consumer Durable Goods, 1965–2010

Billions of dollars

U.S. Bureau of Economic Analysis

tion of child care), these are likely to be quantitatively tiny. Even the inclusion of road infrastructure, a very large category of government capital, has very little impact on the estimates of the return to government capital. We also have no data to impute these values as we do with the survey on road use.

We note that a double counting problem does not arise from apportioning public capital to the household sector. Currently, GDP does not include a return to government capital, only depreciation. Therefore, we do not need to subtract the return to roads from government output.

Chart 7 shows the services of government capital in household production. The investment returns to roads grew at a 6.6 percent annual rate but consisted of

Chart 7. Services of Government Capital, 1965–2010

Billions of dollars

U.S. Bureau of Economic Analysis
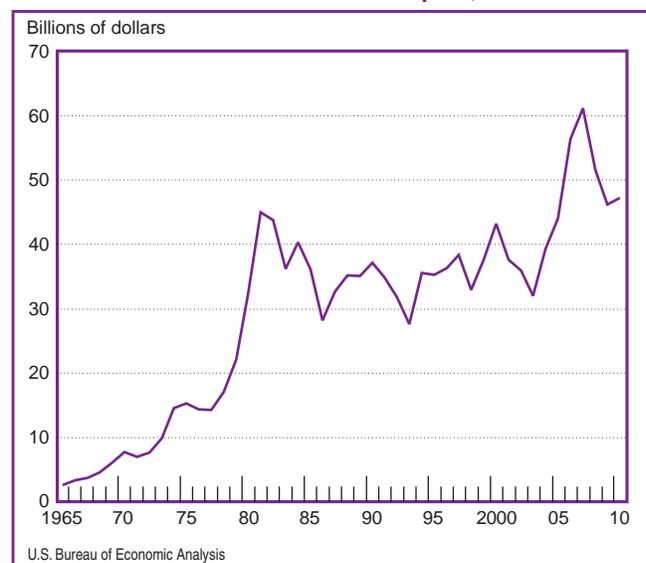
only 0.3 percent of NIPA GDP in 2010. Compared with nonmarket services and the services of household durable goods, the return to government capital is very small, which suggests that including an additional return to government capital from household production will not noticeably impact our satellite account's estimate of GDP.

3. Satellite Account Estimates

Chart 8 plots our adjusted measure of GDP against NIPA GDP, showing how much each of the three adjustments described in the previous section adds to NIPA GDP.[14] By far the largest adjustment is the addition of nonmarket services, which raises NIPA GDP 31 percent in 1965 and 17.7 percent in 2010. The next largest adjustment is the inclusion of the services of consumer durable goods, which raises NIPA GDP 7.6 percent in 1965 and 7.7 percent in 2010. This increase reflects the increased reliance on technology and household appliances for household production as more labor hours shifted to the workplace, a trend that was also noted by Landefeld, Fraumeni, and Vojtech (2009). By far the smallest adjustment is the inclusion of the return to roads, which is barely visible on the chart. Overall, although including home production in

GDP results in an absolute increase that grows over time, in percentage terms the effect of the adjustment has decreased relatively smoothly over time. Adjusting for home production increases nominal GDP 39 percent in 1965, and 25.7 percent in 2010.[15]

Tables 3 and 4 break out the adjustments into categories for 1965 and 2010. The columns under the heading NIPA measures show the standard GDP numbers as produced by the BEA.[16] The categories under services of consumer durable goods and nonmarket services are zero because they are not included in NIPA GDP. The estimates of these categories, which are part of our satellite account, are shown under adjusted GDP. These lead to an increase in personal consumption expenditures. Personal investment is a new category that is created from investment in consumer durable goods in personal consumption expenditures and residential investment, which is categorized under gross business investment in the NIPAs. Reclassifying these as investment raises GDP because of the inclusion of a return on consumer investment. The final new category is the services from government capital, which is not included in the NIPAs.

Chart 9 shows the adjusted GDP growth rate against the growth rate of NIPA GDP.[17] During 1965 to 2010, we estimate an average annual growth rate of nominal GDP of 6.9 percent. When household production is

---

14. Similar adjustments have been made in earlier studies, such as Landefeld and McCulla (2000). Landefeld, Fraumeni, and Vojtech (2009) built on this previous work by incorporating ATUS data and narrowing the contribution of government capital to those types which are most closely related to household production.

15. Our NIPA GDP estimates and the estimates of the adjustments for 1965 to 2004 differ from the estimates of Landefeld, Fraumeni, and Vojtech (2009) by a slight amount because of revisions in the underlying data series.

16. A similar table to this appears in Landefeld, Fraumeni, and Vojtech (2009). Our NIPA GDP estimates and the estimates of the adjustments for 1965 differ from those estimates by a slight amount because of revisions in the underlying data series.

17. We use the NIPA GDP published in July 2010.

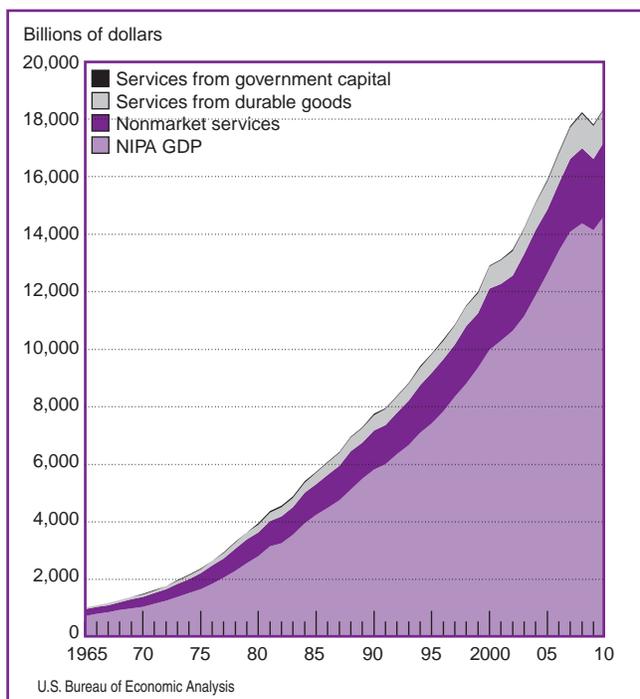### Chart 8. NIPA GDP and the Three Major Adjustments, 1965–2010

Billions of dollars

Chart 9. Growth Rates of NIPA GDP and Adjusted GDP, 1965–2010
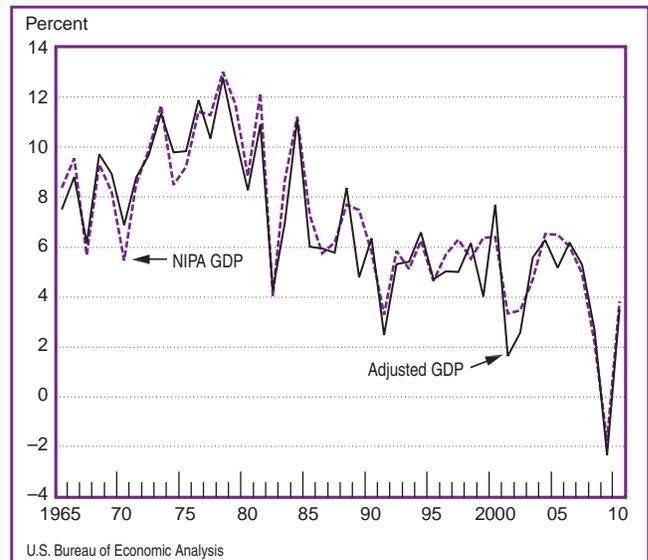

Percent

U.S. Bureau of Economic Analysis

Table 3. NIPA GDP and Adjusted GDP Growth Rates and Contributions to Growth, 1965 and 2010

	NIPA GDP measures				Adjusted GDP			
	1965	2010	Average annual growth rates (percent)	Contribution to GDP growth (percent)	1965	2010	Average annual growth rates (percent)	Contribution to GDP growth (percent)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Gross domestic product	719.1	14,660.4	6.9	100.0	998.9	18,427.7	6.7	100.0
Personal consumption expenditures and investment	443.8	10,349.1	7.2	71.1	755.3	14,409.7	6.8	78.3
Personal consumption expenditures	443.8	10,349.1	7.2	71.1	659.4	13,053.0	6.9	71.1
Nondurable goods	163.3	2,336.3	6.1	15.6	163.3	2,336.3	6.1	12.5
Services	214.1	6,923.4	8.0	48.1	491.4	10,643.5	7.1	58.2
Housing	76.6	1,900.7	7.4	13.1	76.6	1,900.7	7.4	10.5
Services of consumer durable goods	0.0	0.0	n.a.	n.a.	54.9	1,128.3	6.9	6.2
Depreciation of consumer durable goods	0.0	0.0	n.a.	n.a.	45.8	915.3	6.9	5.0
Return to consumer durable goods	0.0	0.0	n.a.	n.a.	9.1	213.0	7.2	1.2
Nonmarket services	0.0	0.0	n.a.	n.a.	222.4	2,591.8	5.6	13.6
Other	137.5	5,022.7	8.3	35.0	137.5	5,022.7	8.3	28.0
Consumer durable goods [1]	66.4	1,089.4	6.4	7.3	4.7	73.2	6.3	0.4
Investment	0.0	0.0	n.a.	n.a.	95.9	1,356.7	6.1	7.2
Residential	0.0	0.0	n.a.	n.a.	34.2	340.5	5.2	1.8
Consumer durable goods [1]	0.0	0.0	n.a.	n.a.	61.7	1,016.2	6.4	5.5
Gross business investment	118.2	1,827.5	6.3	12.3	84.0	1,487.0	6.6	8.0
Nonresidential fixed investment	74.8	1,415.3	6.8	9.6	74.8	1,415.3	6.8	7.7
Change in business inventories	9.2	71.7	4.7	0.4	9.2	71.7	4.7	0.4
Residential	34.2	340.5	5.2	2.2	n.a.	n.a.	n.a.	n.a.
Net exports	5.6	–516.4	–210.6	–3.7	5.6	–516.4	–210.6	–3.0
Government consumption expenditures and gross investment with capital services	151.4	3,000.2	6.9	20.4	154.0	3,047.4	6.9	16.6
Government consumption expenditures and gross investment	151.4	3,000.2	6.9	20.4	151.4	3,000.2	6.9	16.3
Services of government capital	n.a.	n.a.	n.a.	n.a.	2.6	47.2	6.6	0.3
Addenda:								
Labor income	399.5	7,984.5	6.9	54.4	621.9	10,576.3	6.5	57.1
Personal income	555.5	12,541.0	7.2	86.0	832.8	16,261.1	6.8	88.5
Personal saving	42.7	653.9	6.3	4.4	58.6	754.8	5.8	4.0
Private investment	118.2	1,827.5	6.3	12.3	179.9	2,843.7	6.3	15.3
Gross saving	158.5	1,697.8	5.4	11.0	220.2	2,714.0	5.7	14.3

1. In the NIPA methodology, a portion of expenditures on "other motor vehicles and parts" are allocated as maintenance expenditures and are not capitalized in the fixed assets accounts.
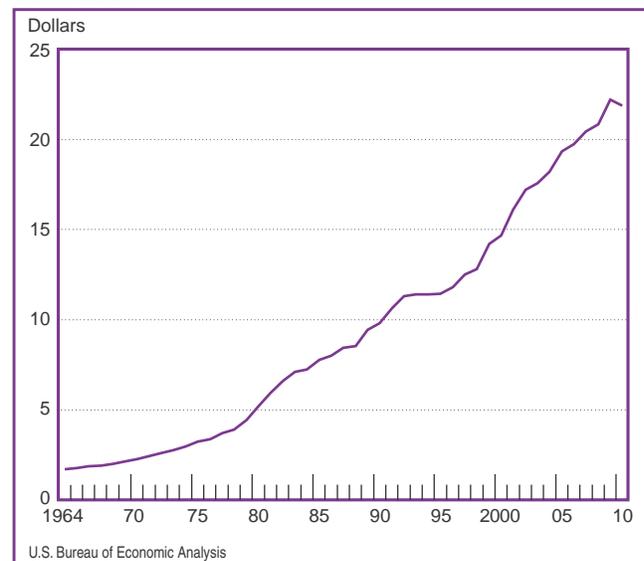
GDP Gross domestic product
NIPAs National income and product accounts

included, this average annual growth rate drops to 6.7 percent. Including household production also increases the volatility in GDP growth. From 1965 to 2010, the variance for nominal NIPA GDP annual growth is 8.7 percentage points versus 9.2 percentage points for adjusted GDP growth. Overall, however, the two growth rates track each other closely. Some divergence occurs in 1995 to 2005, when the growth rate is more volatile than the NIPA growth rate. In the last 5 years, the adjusted GDP growth rate returns to the pattern observed in the earlier data, tracking the NIPA GDP growth rate more closely. This change in volatility seems to be driven by volatility in the housekeeper compensation series, which also becomes more volatile during the mid-1990s to the mid-2000s.

As we remarked above, the largest impact of the household production adjustments comes from the inclusion of nonmarket services. The importance of this sector has decreased over time. This decrease is driven by the decrease in women's nonmarket labor hours, and is related to the drop in wages for nonmarket work relative to market work. Chart 10 shows the difference between the wages of all workers minus the wages of household workers. Over the last 20 years, the wage differential between employed and not employed

Chart 10. Differential Between the Average Hourly Wages of All Workers and of Household Workers, 1964–2010

U.S. Bureau of Economic Analysis

Table 4. Impact of the Adjustments on the Components of Gross Domestic Product, 1965 and 2010

[Percent]

	Changes due to the adjustment		Impact of adjustment on total NIPA GDP		Shares of NIPA GDP		Shares of adjusted GDP	
	1965	2010	1965	2010	1965	2010	1965	2010
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Gross domestic product	39	26	39	26	100	100	100	100
Personal consumption expenditures and investment	70	39	43	28	n.a.	n.a.	76	78
Personal consumption expenditures	49	26	30	18	62	71	66	71
Nondurable goods	0	0	0	0	23	16	16	13
Services	130	54	39	25	30	47	49	58
Housing	0	0	0	0	11	13	8	10
Services of consumer durable goods	n.a.	n.a.	8	8	n.a.	n.a.	5	6
Depreciation of consumer durable goods	0	0	6	6	n.a.	n.a.	5	5
Return to consumer durable goods	n.a.	n.a.	1	1	n.a.	n.a.	1	1
Nonmarket services	n.a.	n.a.	31	18	n.a.	n.a.	22	14
Other	0	0	0	0	19	34	14	27
Consumer durable goods [1]	–7	–7	–9	–7	9	7	n.a.	n.a.
Investment	n.a.	n.a.	13	9	n.a.	n.a.	10	7
Residential	0	0	5	2	n.a.	n.a.	3	2
Consumer durable goods [1]	0	0	9	7	n.a.	n.a.	6	6
Gross business investment [1]	–29	–19	–5	–2	16	12	8	8
Nonresidential fixed investment	0	0	0	0	10	10	7	8
Change in business inventories	0	0	0	0	1	0	1	0
Residential [1]	0	0	–5	–2	5	2	n.a.	n.a.
Net exports	0	0	0	0	1	–4	1	–3
Government consumption expenditures and gross investment with capital services	2	2	0	0	21	20	15	17
Government consumption expenditures and gross investment	0	0	0	0	21	20	15	16
Services of government capital	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	0	0
Addenda:								
Shares								
Household PCE and investment share of GDP	n.a.	n.a.	n.a.	n.a.	62	71	76	78
Private investment share of GDP	n.a.	n.a.	n.a.	n.a.	16	12	18	15
Household investment share of private investment	n.a.	n.a.	n.a.	n.a.	0	0	53	48
Nonmarket services and services of consumer durables share of PCE	n.a.	n.a.	n.a.	n.a.	0	0	42	28
Labor income share of national income (GDP)	n.a.	n.a.	n.a.	n.a.	56	54	62	57
Personal saving rate as a percentage of personal income	n.a.	n.a.	n.a.	n.a.	8	5	7	5
Personal saving rate as a percentage of disposable personal income.....	n.a.	n.a.	n.a.	n.a.	10	3	13	6
Personal saving as percentage of GDP	n.a.	n.a.	n.a.	n.a.	6	4	6	4
National saving rate (gross saving as a percentage of GDP)..................	n.a.	n.a.	n.a.	n.a.	22	12	22	15

1. The apparent negative effects of the adjustments are solely a result of the reclassification of residential investment and consumer durable goods.
GDP Gross domestic product

NIPAs National income and product accounts
PCE Personal consumption expenditures

workers has increased quite steadily. As shown in chart 1 and table 2, home production hours have decreased over time for both employed and not employed women.

3.1 Income

Turning to the income side, we find that the household production adjustment has a similar effect: the impact on levels is largest in 1965 and decreases over time. Incorporating household production increases labor income 55.7 percent in 1965 and 32 percent in 2010. Personal income (a broader measure of income to include income from consumer durable services) follows a similar trend to labor income, increasing 50 percent in 1965 and 30 percent in 2010. In terms of growth rates, the adjustment decreases the growth rate for personal income from 7.2 to 6.8 percent from 1965 to 2010.

3.2 Saving and Investment

Adjusting GDP for household production increases the levels of personal investment and personal saving, because consumer durable goods are categorized as investment rather than as consumption. As with the previous metrics (income and GDP growth), adjusting for household production decreases the growth rate. From 1965 to 2010, the growth rate of private investment increases at an annual rate of 6.27 percent using NIPA GDP versus 6.33 percent using the adjusted GDP. In terms of levels, including consumer durable goods increased private investment 52.2 percent in 1965 and 55.6 percent in 2010. Interestingly, the increase in private investment due to the adjustment is largest in 2010, in contrast to the other metrics where the increase was smallest in 2010. However, this finding is likely due to volatility in the underlying series

used to construct private investment, rather than a re-flection of an underlying trend (as we remarked above, the effect of including household production on the growth rate in private investment is to decrease it, sim-ilar to the other series).

The percentage increase in private investment due to reclassifying consumer durable goods as investment is, on average, roughly 55 percent (chart 11). Our ad-justed measure of private investment consists of pur-chases of consumer durable goods, residential spending, and business investment. Of these three data series, there is a significant volatility in business invest-ment.

As for saving rates, the adjustment for household production has the effect of decreasing the growth rate, similar to the previous metrics. In the NIPAs, personal saving as a percentage of disposable income decreases from 1965 to 2004, from 8.58 percent to 3.42 percent, and increases in 2009 to 5.94 percent. Our adjustment steepens the decline from 1965 to 2004, when the ad-justed saving rate drops from 11.65 percent to 6.03 percent, and flattens the increase from 2004 to 2009, when the saving rate is 6.37 percent.

Chart 11. Increase in Private Investment From Consumer Durable Goods, 1946–2010

U.S. Bureau of Economic Analysis
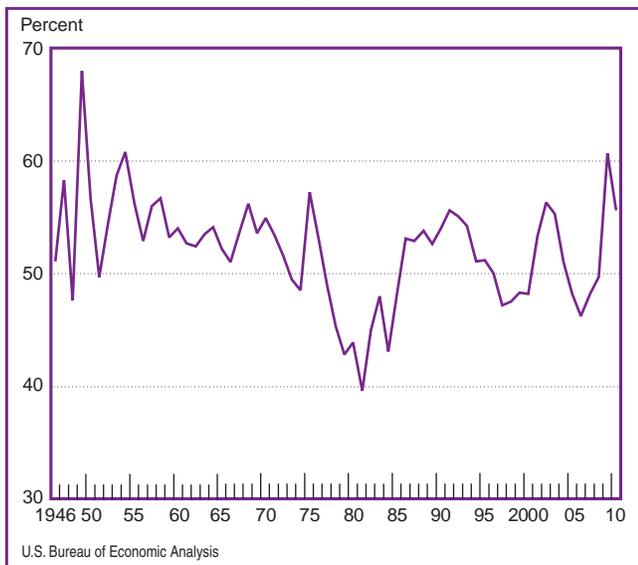
4. Conclusions

This paper constructs a satellite account that adjusts the traditional NIPA measure of GDP to account for home production. We find that including household production as output increases GDP but that the im-pact of home production on GDP has decreased over time, as women have entered the workforce. Further-more, although one might have expected home pro-duction to increase in the last recession, we find that home production continued to decrease. We also com-bine ATUS data with CPS income data to analyze the impact of home production on income inequality. Consistent with prior research on this issue, we find that home production is almost uncorrelated with in-come and tends to decrease income inequality.

Our work on measuring household production is representative of the work BEA is doing in an effort to expand conventional measures of GDP to address con-cerns that have been raised in light of the recent hous-ing and financial crisis on the adequacy of GDP in capturing the impacts of such crises. While numerous proposals, most notably the *Report on the Measure-ment of Economic Performance and Social Progress* (Sti-glitz, Sen, and Fitoussi 2009) have called for the development of a broader measure of social welfare, there are well-documented problems of subjectivity and uncertainty inherent in measuring health, happi-ness and the environment that would seriously threaten the vital role that GDP plays in managing the market economy if they were to be included.

However, there is much that can be explored by fo-cusing on the economic aspects of nonmarket and near-market activities that represents BEA's broader re-search agenda for the future. In accordance with one of the overarching recommendations from *Beyond the Market* (Abraham and Mackie 2005), BEA is making strides in trying to better measure near-market pro-duction activities in a series of satellite accounts that will help provide a more complete picture of the na-tion's productive activities. BEA's work to better mea-sure medical care inflation, investments in human capital, the economy's use of natural resources, and the distribution of personal income in a national accounts framework, in combination with evolving household production research, will provide a more comprehen-sive picture of the determinants of demand for goods and services. Such a suite of satellite accounts will also help to highlight the shift from market production to nonmarket production over business cycles.

BEA is also exploring ways in which "new" statistics could be produced from the information already pre-sented in the current GDP accounts to better address recent concerns over the adequacy of the national ac-counts in capturing the differential impact of the most recent recession across households, industries, and re-gions of the country (Landefeld, Fraumeni, and Vo-jtech 2010). Within the scope of existing accounts and through the use of supplement satellite accounts like the one presented in this paper, BEA is focused on extending the usefulness of the national accounts in meeting the growing needs of analytical users, business leaders and policymakers alike.

Appendix

Estimates of the value of household nonmarket services are based on time series estimates of population by gender and labor force participation from the Bureau of Labor Statistics (BLS), estimates of compensation of household employees from BEA, and point estimates of time-use activities (Landefeld and McCulla, (2000)). In addition, because the activity codes for the American Time Use Survey often change, in order to maintain comparability across years with different coding schemes, BLS provides a coding lexicon that indicates how activities have been combined or separated. The updates in this paper were done using the 2003–2010 multiyear files (as opposed to the individual year files).

Services of consumer durable goods is the sum of (1) the BEA estimate of depreciation of consumer durable goods and (2) the BEA estimate of consumer durable goods multiplied by a rate of return on consumer durable goods (obtained by dividing personal dividend and interest income by total financial assets less equity in noncorporate business).

Investment is the sum of the BEA estimates of residential investment and consumer durable goods.

Finally, services of government capital is the sum of the (1) depreciation of government capital and (2) return to government capital. However, because depreciation is already included in the existing measures of government consumption, depreciation of government capital here is zero. Return to government capital is 50 percent of the BEA estimate of highways and roads multiplied by the rate of return on government capital, estimated using the 10-year constant maturity rate. According to Landefeld, Fraumeni, and Vojtech (2009), government capital is limited to roads because capital services from security (for example, police and fire fighters) and public buildings (for example, public day care centers) were impossible to obtain. Furthermore, the 50 percent chosen to be applied to roads for household production is based on car passenger miles adjusted for work commutes, buses and trucks from the 2000 census. Application of 50 percent to this value for the entire period of the study is arbitrary.

References

Abraham, Katherine G., and Christopher Mackie. 2005. *Beyond the Market: Designing Nonmarket Accounts for the United States.* Washington, DC: National Academies Press.

Aguiar, Mark, Erik Hurst, and Loukas Karabarbounis. 2011. "Time Use During Recessions." NBER Working Paper 17259. Washington, DC: National Bureau of Economic Research (NBER).

Eisner, Robert. 1989. *The Total Incomes System of Accounts.* Chicago: University of Chicago Press.

Frazis, Harley, and Jay Stewart. 2006. "How Does Household Production Affect Earnings Inequality? Evidence From the American Time Use Survey." BLS Working Paper 393. Washington, DC: Bureau of Labor Statistics (BLS).

Jorgenson, Dale W., and Laurits R. Christensen. 1969. "The Measurement of U.S. Real Capital Input, 1929–1967." *Review of Income and Wealth* 15, No. 4 (December): 293–320.

Jorgenson, Dale W., and Laurits R. Christensen. 1973. "U.S. Income, Saving and Wealth, 1929–1969." *Review of Income and Wealth* 19, No. 4 (December): 329–362.

Jorgenson, Dale W., and Barbara M. Fraumeni. 1989. "The Accumulation of Human and Nonhuman Capital, 1948–84." In *The Measurement of Saving, Investment, and Wealth*, edited by Robert E. Lipsey and Helen Stone Tice, 227–286. Chicago: University of Chicago Press, for the National Bureau of Economic Research.

Jorgenson, Dale W., and Barbara M. Fraumeni. 1992a. "Investment in Education and U.S. Economic Growth." *Scandinavian Journal of Economics* 94. Supplement: S51–S70.

Jorgenson, Dale W., and Barbara M. Fraumeni. 1992b. "The Output of the Education Sector." In *Output Measurement in the Service Sectors*, edited by Zvi Griliches, 303–338. Chicago: University of Chicago Press, for the National Bureau of Economic Research.

Jorgenson, Dale W., and Barbra M. Fraumeni. 1980 "The Role of Capital in U.S. Economic Growth, 1948–1976." *Capital, Efficiency, and Growth*, edited by George M. Von Furstenberg, 9–250. Cambridge, MA: Ballinger Publishing.

Jorgenson, Dale W., and Alvaro Pachon. 1983. "The Accumulation of Human and Non-Human Wealth." In *The Determinates of National Saving and Wealth,* edited by Richard Hemming and Franco Modigliani, 302–352. London: Macmillan Publishers.

Kendrick, John W. 1976. *The Formation and Stocks of Total Capital.* New York: Columbia University Press, for the National Bureau of Economic Research.

Kuznets, Simon. 1934. *National Income 1929–1932.* Senate Document No. 124, 73rd Congress, 2nd Session. Washington, DC: U.S. Government Printing Office.

Landefeld, J. Steven, and Stephanie H. McCulla. 2000. "Accounting for Nonmarket Household Production within a National Accounts Framework," *Review of Income and Wealth* 46, No. 3 (September): 289–307.

Landefeld, J. Steven, Barbara M. Fraumeni, and

Cindy M. Vojtech. 2009. "Accounting for Household Production: A Prototype Satellite Account Using the American Time Use Survey." *Review of Income and Wealth* 55, No. 2 (June): 205–225.

Landefeld, J. Steven, Brent R. Moulton, Joel D. Platt, and Shaunda M. Villones. 2010. "GDP and Beyond: Measuring Economic Progress and Sustainability." Survey of Current Business 90 (April): 12–25.

Multinational Time Use Study. 2005. Version 5.5.2. Created by Jonathan Gershuny, Kimberly Fisher and Anne H. Gauthier, with Alyssa Borkosky, Anita Bort-nik, Donna Dosman, Cara Fedick, Tyler Frederick, Sally Jones, Tingting Lu, Fiona Lui, Leslie MacRae, Berenice Monna, Monica Pauls, Cori Pawlak, Nuno Torres and Charlemaigne Victorino. Colchester, United Kingdom: University of Essex, Institute for Social & Economic Research; accessed February 2006; www.iser.essex.ac.uk.

Nordhaus, William D., and James Tobin. 1973. "Is Growth Obsolete." In *The Measurement of Economic and Social Performance*, edited by Milton Moss, 509–534. New York: Columbia University Press.

Pigou, Arthur C. 1932. *The Economics of Welfare.* 4th edition. London: Macmillan Publishers.

Saez, Emmanuel, and Thomas Piketty. 2003. "Income Inequality in the United States, 1913–1998." *Quarterly Journal of Economics* 118, No. 1 (February): 1–39.

Stiglitz, Joseph E., Amartya Sen, and Jean-Paul Fitoussi. 2009. *Report of the Commission on the Measurement of Economic Performance and Social Progress;* www.stiglitz-sen-fitoussi.fr.