ACCOUNTING FOR HOUSEHOLD PRODUCTION: A PROTOTYPE SATELLITE ACCOUNT USING THE AMERICAN TIME USE SURVEY

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This paper presents a satellite account where households are treated as production units. It extends previous work that treats consumer durables as investment and that values nonmarket household production activities such as cooking, cleaning, and childcare. Services from consumer durables and government capital related to household production are also valued. In constructing the updated accounts, this paper incorporates new time use data from the American Time Use Survey (ATUS) and the harmonized time use data from the Multinational Time Use Study (MTUS). This paper also discusses and incorporates recommendations made by the U.S. National Academies panel on nonmarket accounts.

1. Introduction

The American Time Use Survey (ATUS) conducted by the Bureau of Labor Statistics (BLS) fills a major gap in U.S. economic statistics. Labor time is one of the most important inputs into market and nonmarket production. A wide range of issues ranging from understanding consumer spending and the distribution of poverty to the rate of growth in output and productivity require a comprehensive view of production and the time devoted to productive activities. The ATUS will provide the first consistent and comprehensive time series on time use for the United States.

The importance of nonmarket production has been a recurring theme in the U.S. and international national accounts literature since the inception of national accounts. Simon Kuznets (1934) and a long-line of other economists that have worked on the accounts have acknowledged the importance of including household production. However, the challenges of producing a consistent up-to-date set of accounts useful to business and public economic policy officials have led most to follow Pigou (1932), who discouraged the measurement of household production and felt that national income should include only market goods and

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services that could "be brought directly or indirectly into relation with the measuring-rod of money."

A recent National Research Council panel study, *Beyond the Market: Designing Nonmarket Accounts for the United States* (Abraham and Mackie, 2005; hereafter referred to as *Beyond the Market*), argues that, given the developments in national accounting, the detailed data on wages, the data on nonmarket activities such as housing services, and the advent of the ATUS, nonmarket household production *can* be measured "with mild straining" indirectly with the measuring-rod of money.

This paper utilizes the new ATUS data with the harmonized time series database from the Multinational Time Use Study (MTUS) to update earlier "satellite account" estimates of household production.[1] This paper highlights how supplemental household information can improve our understanding of such issues as overall economic growth and the impact of increasing women's labor force participation, household production's role in investment and other spending, and the role of household production over the business cycle.

Household production accounts have been constructed for many other countries. The list of countries, to name a few, includes Australia, Canada, Finland, Germany, Hungary, Mexico, Nepal, and the United Kingdom.[2] The MTUS database provides at least one time-use survey for each of 37 countries. As time-use surveys are an essential ingredient of a household production account, the existence of MTUS now provides an opportunity for many countries to construct household production accounts.

The paper also extends earlier work by exploring recommendations of *Beyond the Market*. Recommendations include the use of quality-adjusted specialist wages for valuing nonmarket household services and the development of satellite accounts that provide quantities and prices for both inputs and outputs used in household production.

2. Satellite Accounts

One of the impediments to the development of nonmarket accounts was the concern that the expansion of the accounts to include what were sometimes perceived as arbitrary and uncertain imputations for nonmarket activities would overburden the existing accounts. Such uncertain values could reduce the accuracy, credibility, and usefulness of the accounts for analyzing, projecting, and managing market policies and activities. Two developments have helped to reduce such concerns. The first was the decision by the *System of National Accounts*—the international guidelines for national accounting (Commission of the European Communities, 1993)—to recommend the use of satellite accounts for nonmarket activities rather than the expansion of existing accounts. Satellite accounts would

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[1]Multinational Time Use Study (2005).

[2]See the following references: Australia: Soupourmas and Ironmonger (2002); Canada: Hamdad (2003) and Harvey and Mukhopadhyay (2005); Finland: Rüger and Varjonen (2008) and Varjonen and Aalto (2006); Germany: Rüger and Varjonen (2008) and Schäfer (2004); Hungary: Szép (2003); Mexico: Gómez Luna (undated); Nepal: United Nations International Research and Training Institute for the Advancement of Women (1996); United Kingdom: Francis and Tiwana (2004) and Holloway *et al.* (2002). Household production accounts exist for two areas in Spain: Basque Spain (see Prado and Abando, undated), and Madrid (see Duran, 2007).

allow for experimentation with changes in scope and measurement for national accounts in the form of supplementary accounts. These accounts would be consistent with and could be used with the existing national accounts without diminishing the usefulness of the core accounts.

A second and related school of thought that developed was that satellite accounts should be limited to production activities, or near-market activities, that can be substituted for, or contribute to, market activity. They also should be valued using proxies for market prices. In Pigou's words, they should be valued indirectly "with the measuring-rod of money." This decision removed normative measures of welfare and other subjective measurement issues where economic accountants have no comparative advantage from active debate. Focusing on production activities facilitated work moving forward on the more tractable components of estimating a set of household accounts.

All of these developments in thinking are included as recommendations in the National Research Council panel report, *Beyond the Market*.

- Nonmarket estimates for household production should be developed in the form of satellite accounts and treated consistently with their market analogs in the national income and product accounts (NIPAs). (Recommendation 3.1)
- Household production satellite accounts should focus on the production of goods and services, including only those household activities that could be readily accomplished using market substitutes for household members' time. (Recommendation 3.2) This is often referred to as the "third-person criterion," the household production boundary proposed by Reid (1934).
- Household production should be valued using replacement cost. For household time inputs to production this would be a replacement wage— the market wage of a specialist (e.g. plumber, cook, or accountant) adjusted for differences in skill and effort between nonmarket household and market production. (Recommendation 3.4)

3. ATUS AND TIME USE SERIES CONTINUITY

Many of the uses of household production accounts require time use series. With a time use series one can measure the effect of such developments as the shift from nonmarket to market production on economic growth, the effect of this shift on trends in consumer spending on durables, or to determine if household production buffers and reduces the volatility in total (market and nonmarket) production.

Over time, the ATUS, a survey that began in 2003, will produce a consistent time use series, which is a significant advantage over other periodic surveys conducted in the United Kingdom and other countries. For example, periodic samples that produce information on differences in work between employed and unemployed men and women can be used to estimate the effect of business cycles on total and household production. However, periodic samples cannot estimate the actual effect of prolonged unemployment on household production during a cyclical downturn (relative to the differences recorded between employed and the mainly transitionally unemployed individuals during a non-recession survey year).

There were a number of time use surveys conducted in the United States, including those conducted at the University of Michigan in 1965–66, 1975–76, and 1985 and at the University of Maryland in 1992–93 and 1998–99. These surveys used different sample designs and were of much smaller sample size than the ATUS survey. ATUS 2003 has a total response size of over 20,000 diary days, and ATUS 2004 has approximately 14,000 diary days. The response sizes of the earlier surveys ranged from 1,200 to 10,000.

The MTUS (2005) has pulled together all of the U.S. time use studies listed above as well as time use studies from 14 other countries into a harmonized database. For the time series used in this paper for individuals aged 18 and over, the MTUS database for 1965, 1975, and 1985 has been combined with the ATUS data for 2003 and 2004.[3] Table 1 presents household production hours for seven definition-similar categories from the ATUS and past time use surveys as categorized by MTUS. The 2003 and 2004 ATUS activity data were aggregated into the seven categories shown in Table 1 generally following the MTUS documentation of its aggregation of 2003 ATUS data. However, following the recommendations of *Beyond the Market*, this study diverged from MTUS by excluding activities involving volunteer activities and personal care activities.[4]

Without additional information on the consistency among the time use surveys, for the purposes of this paper we assume that aggregate hours for household production by population group are consistent and that the differences over time, for the most part, reflect economic and behavioral differences, not differences due to cognitive, sample design, and other survey-related factors. We also make the heroic assumption, bolstered by the MTUS work, that hours across major categories are roughly consistent. Most of the estimates used for this paper are based on aggregate hours, but the specialist/replacement wage estimates (described below) use the distribution of household production hours across the seven activity types and will be affected by inconsistencies. Table 1 compares the time use surveys weighted by population composition, the same weights used in aggregating the household accounts presented in this paper.

How much of the difference in the results from the various surveys, or between MTUS and the original surveys, is to cognitive factors, sample design, sample size, response rates, categorization of time, and potential reporting biases as opposed to economic factors such as the rising market opportunity cost of women's time is unknown.[5] However, one important factor in the increase in childcare time (and corresponding decrease in other categories of time) may be the result of a special ATUS probe for childcare that was intended to address the apparent underreporting of childcare in earlier surveys. Of lesser concern are other factors, such as travel being grouped individually in the MTUS database

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[3]The Maryland surveys were not used in this paper because the 1998–99 survey has a small sample and the 1992–93 survey is biased heavily towards the weekend. See Appendix 1 for more information.

[4]See Appendix 1 for further information about the time use data used in this paper. A complete mapping between the ATUS and the seven household production categories can be obtained on request from the authors.

[5]The notes in the Appendix 1 document some of these differences. Under a grant from the Glaser Foundation, the Yale Program on Nonmarket Accounts has researched and sponsored several papers analyzing time use surveys and their continuity. Their findings may provide more insight into some of these comparison issues.

TABLE 1

TIME USE SURVEY COMPARISON; WEIGHTED AVERAGES BY POPULATION AND TIME USE RANKS

Women

[Weighted average hours per week]	MTUS			ATUS		Rank [1 = most]				
	1965	1975	1985	2003	2004	1965	1975	1985	2003	2004
Cooking	12.8	10.8	9.2	6.0	5.7	1	1	2	2	2
Housework	11.5	9.6	9.3	7.5	7.4	2	2	1	1	1
Odd jobs	3.2	3.0	1.1	4.5	4.4	5	6	6	3	4
Gardening	0.4	0.4	0.8	1.0	1.1	7	7	7	7	7
Shopping	2.8	3.6	4.1	4.4	4.4	6	5	4	4	3
Childcare	4.8	3.9	3.7	3.6	3.8	3	4	5	6	6
Travel	4.3	4.6	4.3	4.0	4.0	4	3	3	5	5
Total	39.7	36.0	32.4	31.1	30.8					

Men

[Weighted average hours per week]	MTUS			ATUS		Rank [1 = most]				
	1965	1975	1985	2003	2004	1965	1975	1985	2003	2004
Cooking	1.8	1.5	2.5	1.9	1.9	3	5	4	6	5
Housework	1.8	2.3	5.1	2.7	2.8	5	3	1	3	3
Odd jobs	2.9	4.0	2.5	4.8	4.6	2	2	3	1	1
Gardening	0.3	0.3	1.0	2.0	1.9	7	7	7	5	6
Shopping	1.8	2.0	2.5	1.8	1.9	4	4	5	7	7
Childcare	1.2	1.1	1.1	2.5	2.4	6	6	6	4	4
Travel	3.9	4.0	3.9	3.3	3.3	1	1	2	2	2
Total	13.6	15.3	18.5	19.0	18.7					

Women & Men

[Weighted average hours per week]	ATUS		MTUS			Rank [1 = most]				
	2003	2004	1965	1975	1985	1965	1975	1985	2003	2004
Cooking	4.0	3.9	7.5	6.4	6.0	1	1	2	3	3
Housework	5.2	5.2	6.8	6.1	7.3	2	2	1	1	1
Odd jobs	4.7	4.5	3.1	3.5	1.8	4	4	6	2	2
Gardening	1.5	1.5	0.3	0.3	0.9	7	7	7	7	7
Shopping	3.1	3.2	2.4	2.9	3.3	6	5	4	5	5
Childcare	3.1	3.1	3.0	2.6	2.4	5	6	5	6	6
Travel	3.6	3.6	4.1	4.3	4.1	3	3	3	4	4
Total	25.2	25.0	27.2	26.1	25.8					

as opposed to being allocated across productive activities such as childcare or shopping.

4. Household Production Satellite Account Estimates, 1965–2004

The satellite estimates presented in this paper adjust the NIPA gross domestic product (GDP) to show households as producers and consumer durables as investment for production. These satellite accounts also incorporate a return to government capital related to household production.[6]

Similar adjustments have been shown in previous studies, including Landefeld and McCulla (2000).[7] However, this study extends this work by (a) incorporating the new ATUS data, (b) narrowing the contribution of government capital to those types most related to household production, (c) examining the effect of satellite account on volatility, and (d) using alternative methods for valuing unpaid work, including quality-adjusted replacement wages as recommended by *Beyond the Market*.

4.1. *Adjustments to NIPA GDP Accounts*

Tables 2 and 3 compare the household production satellite accounts to the NIPA accounts and present the adjustments necessary to include household production in NIPA GDP.[8]

Household Labor and Capital

To maintain the double-entry national accounts, nonmarket household labor and capital are added both to the production side and to the income side, GDP and gross domestic income (GDI), respectively. These additions fully account for household production and household labor income. By recognizing households as part of production, the adjusted accounts also reclassify capital goods purchased by households, consumer durables, as investment.

Consistent with the NIPA accounts, the production side of the household accounts shows the output or services of nonmarket activities, and the income side shows the inputs—the incomes "paid" to labor and capital for their output. While the income side of the accounts is not shown here, the value of nonmarket household services is added to compensation of employees. The services of consumer durables are added to personal income receipts on assets.

To clarify the revised treatment of the household, the summary tables shown as Tables 2 and 3 have slightly rearranged the order of GDP components from their presentation in the NIPAs. Investment in residential structures is moved from

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[6]Capital services are attributed to government capital stocks in roads. Capital services from security and public buildings which relate to household production, e.g. public day care centers, is not included as we do not have stock data for these items.

[7]See Eisner (1989), Jorgenson and Fraumeni (1987), Kendrick (1979), and Ruggles and Ruggles (1970) for other examples.

[8]A full household production treatment on both the income and expenditure sides of the account would require output prices (prices × quantities) less intermediate goods to calculate value added. For example, the value of a deck built would be the sale price of a finished deck minus the cost of wood, nails, and varnish.

TABLE 2

NIPA GDP AND ADJUSTED GDP INCLUSIVE OF HOUSEHOLD PRODUCTION: GDP LEVELS AND RATES OF CHANGE, 1965 AND 2004

[billions of nominal dollars]*	NIPA Measures					Adjusted GDP Measures				
	1965 (1)	2004 (2)	Avg. Annual Rate of Change (%) (3)	Contribution to GDP Growth (%) (4)	Avg. Annual Rate of *** Real Chg. (%) (5)	1965 (6)	2004 (7)	Avg. Annual Rate of Change (%) (8)	Contribution to GDP Growth (%) (9)	Avg. Annual Rate of *** Real Chg. (%) (10)
Gross domestic product	719.1	11,734.3	7.4	100	3.1	996.0	14,855.1	7.2	100	2.9
Personal consumption expenditures and investment	443.8	8,214.3	7.8	71	3.5	752.3	11,972.9	7.4	81	3.1
Personal consumption expenditures	443.8	8,214.3	7.8	71	3.5	659.5	10,381.0	7.3	70	2.9
Nondurables	191.5	2,368.3	6.7	20	2.7	191.5	2,368.3	6.7	16	2.7
Services	189.0	4,858.2	8.7	42	3.6	463.3	7,943.0	7.6	54	2.9
Housing	65.4	1,221.1	7.8	10	3.1	65.4	1,221.1	7.8	8	3.1
Services of consumer durables	0.0	0.0	n.a.	n.a.	n.a.	51.9	865.3	7.5	6	3.2
Depreciation of consumer durables	0.0	0.0	n.a.	n.a.	n.a.	43.4	701.8	7.4	5	3.1
Return to consumer durables	0.0	0.0	n.a.	n.a.	n.a.	8.5	163.5	7.9	1	3.6
Nonmarket household services	0.0	0.0	n.a.	n.a.	n.a.	222.4	2,219.5	6.1	14	1.8
Other	123.6	3,637.1	9.1	32	3.9	123.6	3,637.1	9.1	25	3.9
Consumer durables**	63.3	987.8	7.3	8	5.4	4.7	69.7	7.2	0	5.4
Investment	n.a.	n.a.	n.a.	n.a.	n.a.	92.8	1,591.9	7.6	11	4.4
Residential	n.a.	n.a.	n.a.	n.a.	n.a.	34.2	673.8	7.9	5	2.7
Consumer durables**	n.a.	n.a.	n.a.	n.a.	n.a.	58.6	918.1	7.3	6	5.4
Gross business investment	118.2	1,928.1	7.4	16	3.9	84.0	1,254.2	7.2	8	4.2
Nonresidential fixed investment	74.8	1,198.8	7.4	10	4.4	74.8	1,198.8	7.4	8	4.4
Change in business inventories	9.2	55.4	4.7	0	n.a.	9.2	55.4	4.7	0	n.a.
Residential	34.2	673.8	7.9	6	2.7	n.a.	n.a.	n.a.	n.a.	n.a.
Net exports	5.6	−624.0	n.a.	−6	n.a.	5.6	−624.0	n.a.	−5	n.a.
Government consumption and investment with capital services	151.5	2,215.9	7.1	19	2.1	154.1	2,252.0	7.1	15	2.1
Government consumption expenditure and gross investment	151.5	2,215.9	7.1	19	2.1	151.5	2,215.9	7.1	15	2.1
Services of government capital	0.0	0.0	n.a.	n.a.	n.a.	2.6	36.1	7.0	0	2.7
Other aggregates										
Labor income	399.5	6,687.6	7.5	57	3.2	621.9	8,907.1	7.1	60	2.8
Personal income	555.7	9,713.3	7.6	83	3.3	830.0	12,798.1	7.3	86	3.0
Personal savings	43.0	151.8	3.3	1	−0.8	58.2	368.1	4.8	2	0.7
Private investment	118.2	1,928.1	7.4	16	3.1	176.8	2,846.1	7.4	19	3.1
Gross savings	158.5	1,572.0	6.1	13	1.8	217.1	2,490.1	6.5	16	2.2

Notes:
*All numbers are based on nominal data unless otherwise noted.
**Under current 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.
***Income items and adjustments not in the NIPAs are deflated by personal consumption expenditures prices.

TABLE 3

COMPONENT INCREASE FROM ADJUSTMENT, IMPACT OF ADJUSTMENT ON NIPA GDP, AND ON COMPONENT SHARES, 1965 AND 2004

	Component Incr. from Adjust. (%)		Impact of Adjust. on NIPA GDP (%)		Component Shares of NIPA GDP (%)		Satellite Components Share of Adjusted GDP (%)	
	1965 (1)	2004 (2)	1965 (3)	2004 (4)	1965 (5)	2004 (6)	1965 (7)	2004 (8)
Gross domestic product	39	27	39	27	100	100	100	100
Personal consumption expenditures and investment	70	46	43	32	n.a.	n.a.	76	81
Personal consumption expenditures	49	26	30	18	62	70	66	70
Nondurables	0	0	0	0	27	20	19	16
Services	145	63	38	26	26	41	47	53
Housing	0	0	0	0	9	10	7	8
Services of consumer durables	n.a.	n.a.	7	7	n.a.	n.a.	5	6
Depreciation of consumer durables	n.a.	n.a.	6	6	n.a.	n.a.	4	5
Return to consumer durables	n.a.	n.a.	1	1	n.a.	n.a.	1	1
Nonmarket household services	n.a.	n.a.	31	19	17	31	22	15
Other	0	0	0	0	9	8	12	24
Consumer durables*	−7	−7	−8	−8			n.a.	n.a.
Investment	n.a.	n.a.	13	14	n.a.	n.a.	9	11
Residential	0	0	5	6	n.a.	n.a.	3	5
Consumer durables	0	0	8	8	n.a.	n.a.	6	6
Gross business investment*	−29	−35	−5	−6	16	16	8	8
Nonresidential fixed investment	0	0	0	0	10	10	8	8
Change in business inventories	0	0	0	0	1	0	1	0
Residential	0	0	−5	−6	5	6	n.a.	n.a.
Net exports	0	0	0	0	1	6	1	−4
Government consumption and investment with capital services	2	2	0	0	21	19	15	15
Government consumption expenditure and gross investment	0	0	0	0	21	19	15	15
Services of government capital	n.a.	n.a.	0	0	n.a.	n.a.	0	0
Other aggregates								
Household PCE and investment share of GDP	n.a.	n.a.	n.a.	n.a.	62	70	76	81
Private investment share of GDP	n.a.	n.a.	n.a.	n.a.	16	16	18	19
Household investment share of private investment	n.a.	n.a.	n.a.	n.a.	0	0	52	56
Nonmarket household services and services of consumer durables share of PCE	n.a.	n.a.	n.a.	n.a.	0	0	42	30
Labor income share of national income (GDP)	n.a.	n.a.	n.a.	n.a.	56	57	62	60
Personal saving rate (% of personal income)	n.a.	n.a.	n.a.	n.a.	8	2	7	3
Personal saving rate (% of personal disposable income)	n.a.	n.a.	n.a.	n.a.	9	2	11	4
Personal saving as % of GDP	n.a.	n.a.	n.a.	n.a.	6	1	6	2
National saving rate (gross savings % of GDP)	n.a.	n.a.	n.a.	n.a.	22	13	22	17

Notes:
*The apparent negative impacts of the adjustments are solely a result of the reclassification of residential and consumer durables.

"gross business investment" and included in a new category "investment" under the renamed category "personal consumption expenditures and investment." Purchases of consumer durables are also moved to the new investment category. The value of nonmarket household services and the services of consumer durables are added to services in personal consumption expenditures (PCE).

Other Changes and Adjustments

The other major change in the satellite accounts presented here is to include services of government capital related to household production, namely roads. Only half of the total services from government structures in "highways and streets" are included so as to exclude services provided for non-household production such as general business or government activities.[9]

4.2. *Estimates and Their Impact on Growth, 1965–2004*

Tables 2 and 3 show the impact to the existing GDP accounts between 1965 and 2004 of including nonmarket household services, services of consumer durables, and services of roads. The adjustments decrease nominal GDP growth over the entire period from a 7.4 percent annual rate to a 7.2 percent annual rate and decrease real GDP growth over the entire period from a 3.1 percent annual rate to a 2.9 percent annual rate. The flatter growth shows that market production grew at a faster rate as women entered the labor force and household production grew at a slower rate. In other words, the adjustments to the NIPA accounts increased nominal GDP by 39 percent in 1965 and 27 percent in 2004. Including household production also increases the volatility in GDP growth. The variance for nominal NIPA GDP annual growth is 6.9 percentage points versus 7.4 percentage points in the satellite account.

While the adjustments to include household production change many component growth rates, the relative component contributions remain the same. PCE is still the largest contributor to GDP growth, followed by government, investment, and net exports.

Nonmarket Household Services

The nonmarket household services component is the largest adjustment to create the household production accounts. It is calculated by applying private household (housekeeper) compensation to the household production hours reported by time use surveys. Nonmarket hours are interpolated between survey years (1965–66, 1975–76, 1985, and 2003).[10]

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[9]The 50 percent share of government roads services is based roughly on car passenger mileage adjusted to exclude commuting to work, buses, and trucks as reported by the Census Bureau for 2000. Applying the same percentage for the entire 1965–2004 period is admittedly arbitrary.

[10]Note that in all calculations of not employed persons, the measurements include Current Population Survey (CPS) definitions of both unemployed and persons not in the labor force. Another possible way to categorize the population is by gender, with a further sub-categorization for women by whether or not, and how many, young children they have. The sub-categorization used in this paper is by employed and not employed in recognition of the substantial changes in labor force participation that occurred over the period 1965 to 2004. Another paper could reflect the impact of young children on time use.

Between 1965 and 2004, nonmarket household services grew at a 6.1 percent annual rate, 1.1 percentage points slower than NIPA GDP. Nonmarket household services made up 31 percent of NIPA GDP in 1965 and 19 percent in 2004. This shift in sources of production reflects the increase in women's civilian labor force participation rates from 40 percent in 1965 to 60 percent in 2004. Men's civilian labor force participation rates over the same time period declined from 83 percent to 75 percent.[11] The production shift also demonstrates the changing opportunity costs between market and nonmarket work. In 1965, the average compensation for household workers was 42 percent of the amount received by employed workers ($2,688 vs. $6,379). By 2004, this rate had dropped to 31 percent ($16,464 vs. $53,953).

Services of Consumer Durables

The inclusion of the services of consumer durables raises NIPA GDP by 7 percent in 1965 and in 2004, reflecting the increased reliance on technology and household appliances for household production as more labor hours shifted to the workplace. The household capital–labor ratio, as measured by the chained-dollar net stock of consumer durables per person engaged in household production, increased at an annual rate of 3.9 percent between 1965 and 2004.[12] The capital–labor ratio for private nonresidential capital increased at an annual rate of only 1.7 percent over the same time period. This substitution of capital for labor in household production also reflects the lower relative price change. Between 1965 and 2004, the price of consumer durables rose at a 1.8 percent annual rate compared to a 2.7 percent annual rate for private nonresidential capital.

Government Capital

Including an additional return to government capital related to roads does not noticeably impact NIPA GDP. While net stocks in government "highways and streets" amounted to $1.7 trillion in 2004, the annual growth rate between 1965 and 2004 for net stocks was 7.0 percent. This is 0.2 percentage points lower than the rate of change of adjusted GDP including household production. The investment returns to roads grew at a 7.0 percent annual rate but consisted of only 0.2 percent of GDP in 2004.

Income

Measures of income are also affected by the adjustments. Household production increased labor income by 56 percent in 1965 and by 33 percent in 2004. Using a broader measure of income to include income from consumer durable services, personal income grew at a 7.3 percent annual growth rate in the household production accounts compared to a 7.6 percent rate in the NIPAs.

[11]Figures are based on CPS data published by BLS. Note that the data are for people 18 years and older as used in this paper.
[12]People aged 18 years are older are used to estimate the number of people engaged in household production.

Savings and Investment

The levels of personal investment and personal saving significantly increase by including household production. However, the growth rate of private investment does not change from an annual rate of 7.4 percent. Consumer durables increased private investment by 50 percent in 1965 and 48 percent in 2004. Gross savings grew at an annual rate of 6.5 percent during the entire period in the household production accounts compared to 6.1 percent in the NIPAs.

The level of personal saving is higher in the satellite accounts due to the inclusion of consumer durables as investment, but both the NIPA and household production account saving rate have a downward trend. According to the NIPAs, personal saving as a percent of disposable personal income was 8.6 percent in 1965 and 1.8 percent in 2004. The adjusted accounts report a saving rate of 11.5 percent and 4.2 percent for the same time periods.

4.3. *Estimates and Their Impact during Recent Years, 1985–2004*

Overall, including nonmarket household production into NIPA GDP has little impact on the composition and growth of GDP. The larger effects are from the later sub-period 1985–2004.

NIPA GDP growth between 1985 and 2004 is reduced from 5.5 percent to 5.2 percent when household production is included (see Table 6, "Existing" and "Housekeeper" columns). This reflects continued increases in women's labor force participation. During this period, female labor force participation for women aged 18 years or more increased from 55 percent to 60 percent and average household production hours of women dropped from 32.4 to 30.8.

However, as illustrated in Table 4, the 1.6 hour reduction in average women's hours spent in household production is not purely the result of a higher percentage of women being employed. Household production hours of employed women stayed about the same while not employed women hours dropped over this period. Thus, if the female employment rate was fixed at the 1985 rate, the average household production hours would still have dropped 1.0 hour, from 32.4 to 31.4 hours. Economic effects—such as the increasing opportunity cost per hour of nonmarket work, the rapid decline in the price of labor-saving household consumer durables and appliances, and quality of convenience goods such as pre-prepared food—as well as societal changes explain most of the 1.6 reduction in average hours in household production.

According to NIPA data, the differential between the average hourly compensation of all workers as compared to household workers widened from $7.75 to $18.02 between 1985 and 2004. The price of all consumer durables, including home computers and software, dropped at a 0.3 percent annual rate during this period and the price of kitchen and other household appliances dropped at a 0.8 percent rate.

Interestingly, the personal consumption expenditures price index for purchased meals increased faster (3.0 percent annual rate) than that of food purchased for consumption at home (2.5 percent annual rate). However, if one looks at the weighted total cost of home meal production shown in Table 5—using time use data along with data from the NIPAs on the prices for labor, purchased food, consumer durable services, and housing services used in food preparation—it can

TABLE 4

FEMALE HOUSEHOLD PRODUCTION, 1985–2004

	1985	2004	Change	Abs. Change
Percent of women				
Employed	51.2	57.1	6.0	6.0
Not employed	48.8	42.9	−6.0	6.0
Nonmarket labor hours per week				
Employed women	26.4	26.5	0.1	0.1
Not employed women	38.7	36.5	−2.1	2.1
Weighted average nonmarket labor hours per week				
Employed women	13.5	15.1	1.6	1.6
Not employed women	18.9	15.7	−3.2	3.2
Total	32.4	30.8	−1.6	4.8
Using 1985 employment status weights				
Employed women	13.5	13.5	0.0	
Not employed women	18.9	17.8	−1.0	
Total	32.4	31.4	−1.0	
Percent of total change			*63*	
Using 1985 nonmarket labor hours				
Employed women	13.5	15.1	1.6	
Not employed women	18.9	16.6	−2.3	
Total	32.4	31.7	−0.7	
Percent of total change			*45*	

Note: Numbers may not be additive due to rounding.

be seen that the rising opportunity cost of nonmarket time resulted in a opportunity cost price index for food cooked at home that increased 3.5 percent between 1985 and 2004, 0.5 percentage points above the 3.0 percent rate of increase in restaurant meals. This difference helps to explain why U.S. households ate out more, used more convenience foods, and decreased average cooking hours per week from 6.0 to 3.9 hours per week between 1985 and 2004. This comparison also may suggest that a price index adjusted for the increased variety and quality of packaged, pre-prepared, and frozen foods might show a faster increase in real food consumption that the existing data.[13]

Among other findings, household production hours of employed men rose between 1985 and 2004, but this was offset by the declines in men's labor force participation rates and household hours for men not in the labor force. Average household production hours for employed men rose from 15.8 in 1985 to 17.0 in 2004, while the average of hours for men who were not employed dropped from 25.6 to 23.0 hours.

A final feature of the 1985–2004 results worth noting is the impact of household production on volatility. As noted above, for the entire 1965–2004 period, counting household production increases the volatility of nominal GDP. For the 1985–2004 period, counting household production also raises measured volatility. The variance for GDP increases from 1.5 percentage points to 2.8 percentage points. The larger increase in volatility for the shorter period compared to the period as a whole is the result of the increase in the sensitivity of the wages of household workers to cyclical downturns (see Figure 1). During the last downturn,

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[13]U.S. data on real food consumption have shown a puzzlingly slow rate of increase in light of the average weight gain and eating habits of Americans.

TABLE 5

NIPA GDP FOOD PURCHASED FOR OFF-PREMISE CONSUMPTION AND PURCHASED MEALS AND BEVERAGES, AND HOUSEHOLD PRODUCTION
ACCOUNT HOME MEAL PRODUCTION

NIPA GDP, percent growth 1985–2004

	Prices	Quantities
Food purchased for off-premise consumption	2.5	1.8
Purchased meals and beverages	3.0	2.7

Household production

[billions of dollars]	1985	2004	Avg. Annual Rate of Change (%)	Share of 1985 Expenses (%)	Price Used
Expenses					
Food					
Food purchased for off-premise consumption	311	688	4.3	17	Off-premise consumption growth
Labor					
Cooking hour times private household compensation	1,459	1,591	0.5	78	All worker compensation growth
Capital					
Cooking % of household hour times consumer durable	83	134	2.5	4	Return on consumer durables growth
Cooking % of all hours times housing services	15	28	3.5	1	Return on housing growth
Total	1,868	2,441	1.4	100	
Weighted average growth (%)*	3.5				

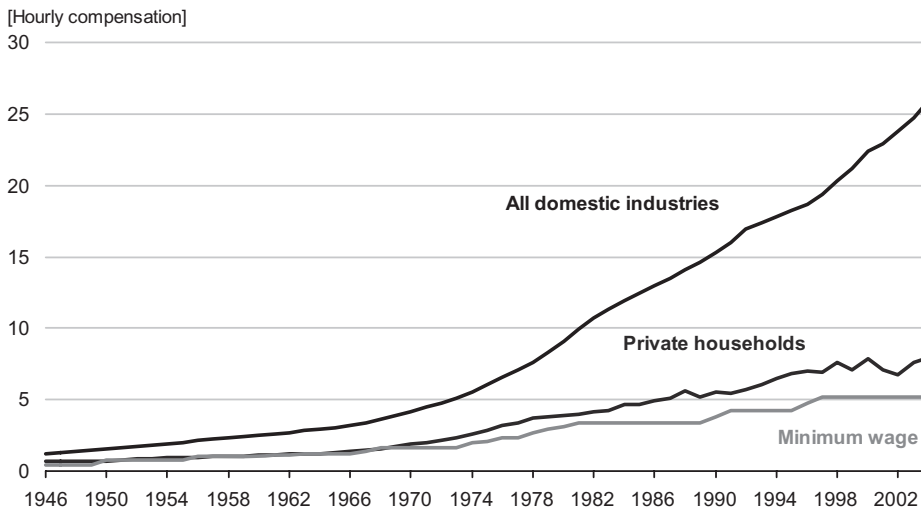*Note:* *Share of total expenses multiplied by the price index under "price used."

Figure 1. Hourly Compensation and Wage Rates for Selected Groups, 1946–2004

the compensation of household workers dropped from a peak of $7.83 per hour in 2000 to $6.78 in 2002 before rebounding in 2003.

5. ALTERNATIVE ESTIMATES OF HOUSEHOLD PRODUCTION TIME INPUTS

Table 6 presents alternative satellite account estimates based on different methods for valuing household production time in 1985 and 2004. This table is organized as follows:

- Column 1 for each year and the growth rate is simply the NIPA GDP estimate.
- Column 2 is the satellite account estimate using the housekeeper wage for valuing household production time (the satellite account as presented above).
- Column 3 uses "specialist" wages for valuing each of the seven categories of household production time. For example, janitorial services wages are used for valuing cleaning time and household goods repair and maintenance wages are used for odd jobs time (see Appendix 2 for a complete listing).
- Column 4 uses judgmental approximations of quality-adjusted replacement cost as recommended in *Beyond the Market*. This approach recognizes that while the average person's productivity in making toast may be equivalent to a professional chef, it is probably lower than that of a roofer in replacing a roof. For those types of work, the specialist wage should be adjusted to reflect the average person's lower productivity (see Appendix 2 for quality adjustment factors).[14]

[14]It was assumed 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, childcare, and travel categories. The choice of a 75 percent adjustment for the adjusted categories is arbitrary except in that it reflects that we believe the factor should be less than 100 percent.

TABLE 6

Adjusted GDP Inclusive of Household Production Using Various Compensation Types for Nonmarket Labor, 1985–2004

[Billions of dollars] Valuation Approach	1985						2004					
	Existing	Housekeeper	Specialist	Quality-adj. Specialist	Opportunity	Minimum Wage	Existing	Housekeeper	Specialist	Quality-adj. Specialist	Opportunity	Minimum Wage
Adjusted gross domestic product	4,220	5,701	5,913	5,713	7,494	5,391	11,734	14,855	15,504	15,043	19,909	14,080
Personal consumption expenditures and investment	2,909	4,354	4,565	4,365	6,146	4,043	8,888	11,973	12,622	12,161	17,027	11,197
Personal consumption expenditures	2,720	3,828	4,040	3,840	5,621	3,517	8,214	10,381	11,030	10,569	15,435	9,606
Nondurables	929	929	929	929	929	929	2,368	2,368	2,368	2,368	2,368	2,368
Services	1,428	2,873	3,085	2,885	4,666	2,562	4,858	7,943	8,592	8,131	12,997	7,168
Housing	413	413	413	413	413	413	1,221	1,221	1,221	1,221	1,221	1,221
Services of consumer durables	0	359	359	359	359	359	0	865	865	865	865	865
Nonmarket household services	0	1,086	1,297	1,097	2,878	775	0	2,219	2,868	2,408	7,273	1,444
Other	1,015	1,015	1,015	1,015	1,015	1,015	3,637	3,637	3,637	3,637	3,637	3,637
Consumer durables	364	26	26	26	26	26	988	70	70	70	70	70
Investment	188	525	525	525	525	525	674	1,592	1,592	1,592	1,592	1,592
Residential	188	188	188	188	188	188	674	674	674	674	674	674
Consumer durables	0	337	337	337	337	337	0	918	918	918	918	918
Gross business investment	548	548	548	548	548	548	1,254	1,254	1,254	1,254	1,254	1,254
Nonresidential fixed investment	526	526	526	526	526	526	1,199	1,199	1,199	1,199	1,199	1,199
Change in business inventories	22	22	22	22	22	22	55	55	55	55	55	55
Net exports	-115	-115	-115	-115	-115	-115	-624	-624	-624	-624	-624	-624
Adjusted government consumption and investment	879	915	915	915	915	915	2,216	2,252	2,252	2,252	2,252	2,252
Government consumption expenditures and gross investment	879	879	879	879	879	879	2,216	2,216	2,216	2,216	2,216	2,216
Plus: Services of government capital investment	0	36	36	36	36	36	0	36	36	36	36	36
Addenda:												
Share of NIPA ("Existing") GDP:												
Nonmarket household services	0	26	31	26	68	18	0	19	24	21	62	12
PCE and household investment	69	103	108	103	146	96	76	102	108	104	145	95
Government capital services	0	1	1	1	1	1	0	0	0	0	0	0
Share of respective adjusted GDP:												
Nonmarket household services	0	19	22	19	38	14	0	15	19	16	37	10
PCE and household investment	69	76	77	76	82	75	76	81	81	81	86	80
Government capital services	0	1	1	1	0	1	0	0	0	0	0	0

Note: "Existing" (or NIPA) GDP accounts are reorganized to compare to the adjusted GDP scenarios shown in this table. As noted above, a portion of consumer durables expenditures are recognized as maintenance and are not capitalized.

- Column 5 shows the opportunity cost approach, which is estimated using the average wage for all workers. This method is not recommended by *Beyond the Market*. As they note, while there is a large consumption value in household production (which is why high-waged physicians work in the garden or cook for their guests), surveys consistently indicate that there is also a large positive consumption value in paid work that is not counted.[15]
- Column 6 is for reference and simply shows what the satellite account would look like if the federal minimum wage was used to value household production time inputs.

The first feature that comes out of this comparison is that in measuring trend growth in production, the method used makes little difference. The growth rate for NIPA GDP over the 1985–2004 period was 5.5 percent. The alternative GDP with household production satellite account growth rates for all scenarios was 5.2 percent, except for the opportunity cost method, which was 5.3 percent.

In terms of levels, as might be expected, the highest level is produced by the opportunity cost measure, followed by the specialist, quality-adjusted specialist, housekeeper, and minimum wage measure. Measured as share of NIPA GDP, the opportunity cost value of household production time is 62 percent of GDP in 2004 as compared to 24 percent for the specialist, 20 percent for the quality-adjusted specialist, 19 percent for the housekeeper, and 12 percent for minimum wage.

Where the estimates do differ is in the volatility of overall GDP and the trend and volatility in household production. As illustrated in Figure 1, the opportunity cost measure based on the average wages of all workers rises much faster and with less volatility than the series based on lower-income housekeeper and minimum-wage workers.

6. Output-based Estimates

An important criterion of the double-entry national accounts, which is echoed in a *Beyond the Market* recommendation, is that:

> Nonmarket accounts should measure the value and quantity of outputs independently from the value and quantity of inputs whenever feasible. (Recommendation 1.3)

Without such estimates, it is not possible to measure contributions and sources of real economic growth from household production, improvements in the productivity of household production, and a number of other questions that nonmarket accounts could address. One difficulty in implementing this recommendation is the absence of data on household products, such as meals cooked, number of children cared for, loads of laundry, lawns mowed, decks built, and shopping trips taken. The other problem is the difficulty in finding an appropriate price for a near market equivalent.

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[15]Except for some activities such as cleaning and grocery shopping, surveys have shown that market work has about the same consumption value as nonmarket work. Nordhaus (2006) summarized these results, concluding that "there is no obvious wedge between work and nonwork that can be interpreted as a marginal wage. Indeed, working is in the middle of the pack in terms of enjoyment."

Some output-based household production accounts exist, such as those for Australia, Canada, and the United Kingdom. Although the majority of the increase in U.S. NIPA GDP when household production is included is due to the addition of an input-based measure—nonmarket household services—the majority of the adjusted GDP is comprised of output-based measures. Household output-based measures in adjusted GDP include the imputations for housing and consumer durables, and residential and consumer durable investment. However, the innovative output-based household production accounts for Australia, Canada and the United Kingdom point to the possibilities as well as the challenges in producing such accounts.

7. Conclusions

The ATUS represents the opening of a new and exciting frontier in economic measurement. With time series data and the rich micro dataset associated with the ATUS, it will be possible to more accurately measure time use and its impact on a number of important economic areas, such as the analysis of consumer demand for items ranging from consumer durables to healthcare. Other expansions that would be possible—with parallel expansions in related source data—include satellite input–output accounts for household production, independent measurements of the inputs and outputs of household production, the cyclical impact of household production, as well as the impact on poverty and other statistics of household production.

Finally, as the United States and other countries—partly through the work of such groups as the MTUS and the UN Delhi Group on Informal Sector Statistics—harmonize their accounting for household production, international comparisons of economic performance will be facilitated, especially for developing economies where nonmarket production is more prevalent.

APPENDIX 1: FURTHER INFORMATION ON THE MTUS DATABASE AND CATEGORIES

	1965–66*	1975–76	1985	1992–93	1998–99	2003	2004
				Not Used for Paper	Not Used for Paper		
Total nonmarket hours							
Males Employed	11.6	12.9	15.8	15.5	20.4	17.0	17.0
Not employed	22.0	22.4	25.6	23.2	25.1	23.7	23.0
Females Employed	27.0	25.8	26.4	22.8	27.7	26.6	26.5
Not employed	47.5	43.6	38.7	34.8	39.4	37.0	36.5
Sample size used							
Males Employed	890	829	1,385	2,419	374	6,292	4,119
Not employed	159	237	485	842	97	2,145	1,571
Females Employed	545	559	1,317	2,355	437	6,577	4,402
Not employed	745	741	1,056	1,686	180	4,470	3,073
Total	2,339	2,366	4,243	7,302	1,088	19,484	13,165
Notes	Survey covered people aged 18–65. Data adjusted to include people 65+ based on data from the 65+ subgroup in the 1975–76 survey.	Consisted of four waves. This paper only uses data from the first wave which also had the highest response rate (72%).	Based primarily from mail-back sample from original survey. Detailed data from phone and face-to-face interviews unavailable.	Survey heavily biased toward the weekend. Individual activities such as cooking, housework, and childcare much lower than the trend.	Small sample with much higher results than other surveys in most categories.	58% response rate for entire survey.	57% response rate for entire survey.

*The sample counts include the 361 from the 66+ subgroup in the 1975–76 survey used to adjust the data.

APPENDIX 2: SPECIALIST WAGE RATES AND QUALITY ADJUSTMENTS

Time Use Category	BLS Industry (CES–SIC)	Hourly Wage 1985	BLS Industry (CES–NAICS)	Hourly Wage 2004	Assumed Quality Adjustment
Cooking	Eating and drinking places	4.33	Food services and drinking places	7.84	75%
Cleaning	Hotels and motels	5.83	Janitorial services	9.51	75%
Odd jobs (average of hourly rates)	Miscellaneous repair services	7.92	Household goods repair and maintenance	14.82	75%
	Nursing and personal care facilities		Individual and family services		
	Accounting, auditing, and bookkeeping		Professional and business services		
Gardening	Landscape and horticultural services	7.56	Landscaping services	12.04	75%
Shopping	Hotels and motels	5.83	Leisure and hospitality	8.91	100%
Childcare	Child day care services	5.02	Child day care services	9.76	100%
Travel	Hotels and motels	5.83	Leisure and hospitality	8.91	100%

References

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

Commission of the European Communities, International Monetary Fund, Organisation for Economic Co-operation and Development, United Nations, and World Bank, *System of National Accounts 1993*, OECD, Paris, 1993.

Duran, Maria-Angeles, *The Satellite Account for Unpaid Work in the Community of Madrid*, La Suma de Todos, Couuminty de Madrid 36, 2007.

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

Francis, Perry and Harminder Tiwana, "Unpaid Household Production in the United Kingdom, 1995–2000," *Economic Trends*, No. 602 (January), Office for National Statistics, London, 58–66, 2004.

Gómez Luna and Maria Eugenia, *Household Satellite Accounts, Valuing Unpaid Domestic Work, The Case of Mexico, Preliminary Version*, INEGI, English translation provided by the Pan American Health Organization in 2007, undated.

Hamdad, Malika, *Valuing Households' Unpaid Work in Canada, 1992 and 1998: Trends and Sources of Change*, Statistics Canada Economic Conference, May 2003.

Harvey, Andrew S. and Arun K. Mukhopadhyay, "Household Production in Canada: Measuring and Valuing Outputs," in T. V. Hoa (ed.), *Advances in Household Economics, Consumer Behaviour and Economic Policy*, Ashgate, U.K., 70–84, 2005.

Holloway, Sue, Sandra Short, and Sarah Tamplin, *Household Satellite Account (Experimental) Methodology*, UK Office for National Statistics (www.statistics.gov.uk/hhsa/hhsa/resources/fileattachments/hhsa-ukaccount.pdf; accessed March 2006), 2002.

Jorgenson, Dale W. and Barbara M. Fraumeni, "The Accumulation of Human and Non-Human Capital, 1948–1984," in R. E. Lipsey and H. Tice (eds), *The Measurement of Saving, Investment, and Wealth*, University of Chicago Press, Chicago, 227–82, 1987.

Kendrick, John W., "Expanding Imputed Values in the National Income and Product Accounts," *Review of Income and Wealth*, 25, 349–63, 1979.

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

Landefeld, J. Steven and Stephanie H. McCulla, "Accounting for Nonmarket Household Production within a National Accounts Framework," *Review of Income and Wealth*, 46, 289–307, 2000.

Multinational Time Use Study, Version 5.5.2 (data accessed February 2006), created by Jonathan Gershuny, Kimberly Fisher and Anne H. Gauthier, with Alyssa Borkosky, Anita Bortnik, 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; ISER, University of Essex, Colchester, U.K. (http://www.iser.essex.ac.uk/mtus/), October 14, 2005.

Nordhaus, William D., "Principles of National Accounting for Nonmarket Accounts," in Dale W. Jorgenson, J. Steven Landefeld, and William D. Nordhaus (eds), *A New Architecture for the U.S. National Accounts*, University of Chicago Press, Chicago, 143–60, 2006.

Pigou, Arthur C., *The Economics of Welfare*, 4th edition (originally published in 1920), Macmillan, London, 1932.

Prado, Cristina and Lourdes Llorens Abando, *Satellite Account of Household Production for the Basque Country* (http://isi.cbs.nl/iamamember/CD2/pdf/846.PDF), undated.

Reid, Margaret, *The Economics of Household Production*, Wiley, New York, 1934.

Rüger, Yvonne and Johanna Varjonen, *Value of Household Production in Finland and Germany, Analysis and Recalculation of the Household Satellite Account System in Both Countries*, National Consumer Research Centre, Working Paper 112, Hesinki, Finland, 2008.

Ruggles, Nancy and Richard Ruggles, *The Design of Economic Accounts*, National Bureau of Economic Research, New York, 1970.

Schäfer, Dieter, "Unbezhlte Arbeit und Bruttoinlandsprodukt 1992 and 2001: Neuberechnung des Haushasts-Satellitensystems," *Wirtschaft und Statistik*, 9, 960–78, 2004.

Soupourmas, Faye and Duncan Ironmonger, "Calculating Australia's Gross Household Product: Measuring the Economic Value of the Household Economy 1970–2000," University of Melbourne, Department of Economics, Working Paper 833.

Szép, Katalin, "Összefoglalás Helyett—A Nemzeti Számlákban nem Kimutatott Häztartási Termelési Szamlája és a Jövöbeli Feladatok," in *A Háztartási Termelés Érteke a Mai Magyarországon*, Hungarian Central Statistical Office, 185–7, 2003.

United Nations International Research and Training Institute for the Advancement of Women (UN–INSTRAW), *Valuation of Household Production and the Satellite Accounts*, INSTRAW, Series B, 52, 1996.

Varjonen, Johanna and Kristiina Aalto, *Household Production and Consumption in Finland 2001: Household Satellite Account*, Statistics Finland and National Consumer Research Centre, 2006.