Structural Transformation, Marketization, and Household Production around the World*

Benjamin Bridgman (Bureau of Economic Analysis)
Georg Duernecker (University of Mannheim)
Berthold Herrendorf (Arizona State University)

First version: May 2014
This version: October 5, 2015

Abstract

We provide evidence on household and market production in 36 countries since 1960. On average the household sector accounts for almost half of total hours worked. As GDP per capita increases, the employment share of household production in total hours worked initially declines and then hardly changes while the employment shares of market goods and services decrease and increase. Estimating the value added of household production yields similar patterns. Labor productivity of household production is lower than and positively correlated with that in the market. These findings can be used as an input into quantitative work involving household production.

Keywords: household production; marketization; structural transformation.
JEL classification: O3.

*For helpful comments and suggestions, we would like to thank Richard Rogerson, Todd Schoellman, and Ákos Valentinyi. We also thank many people for help with the data collection, including Karamat Ali (Bangladesh Bureau of Statistics), Sylvain Ouellet (Statistics Canada), Carsten Ernst (Danish National Archives), Hannu Pääkkönen (Statistics Finland), Jean Imbs and Jamal Ibrahim Haidar (PSE, France), Szabolcs Szilagyi and Edit Pékné (Hungarian Central Statistical Office), Anjana Dutt and Anil Chopra (Government of India, Ministry of Statistics & P.I.), Marco Musu (ISTAT, Italy), Sachiko Nakano (Japan Broadcasting Corporation, NHK), Kwang Yung Choo and Jae–Hyun Lee (Seoul National University), Halina Dabrowko (Central Statistical Office of Poland), Rihard Inglic (The Statistical Office of the Republic of Slovenia), Margareta Johansson and Martin Brandhagen (Swedish National Data Service), Yuchen Tsai (Department of Census, Taiwan), and Phil Bardsley (Carolina Population Center, UNC). Herrendorf thanks the Spanish Ministry of Education for research support (Grant ECO2012-31358). The views expressed in this paper are solely those of the authors and are not necessarily those of the U.S. Bureau of Economic Analysis or the U.S. Department of Commerce.

1 Introduction

The reallocation of production factors across broad market sectors is among the prominent stylized facts of modern economic growth: as GDP per capita grows, the goods sector shrinks while the service sector expands. A large literature shows that this structural transformation is a crucial force behind important economic phenomena.[1] Although most of the literature on structural transformation is about reallocation among *market* sectors, there is also important reallocation between the market sectors and the *household* sector. Recent work has documented and studied that reallocation in the U.S. and other rich countries.[2]

What is still missing from the existing literature is systematic evidence on the behavior of hours, value added, and labor productivity of household production in a large panel of countries of all levels of development. The contribution of this paper is to provide such evidence in a form that can be used as an input into quantitative work involving the household sector.[3] Achieving this involves a major effort of obtaining and harmonizing the required data from time use surveys and NIPA. We collect 126 time use surveys from 36 countries during the time period 1961–2012.[4] The 36 countries in our sample cover more than 40% of the world population and more than three quarters of world GDP in 2000. While most of our countries are OECD members, we also have collected data for low–income countries such as Algeria, Bangladesh, Colombia, India, and South Africa.

We find that in most countries the household sector is responsible for a sizeable part of economic activity. On average it accounts for 46% of total hours worked (where total refers to market plus household). Moreover, the variation in the shares of household hours in total hours is large in our sample, ranging from around a quarter to about two thirds. We find the following stylized facts about the behavior of the household sector in comparison with the market sectors. As GDP per capita increases, the employment share of the household sector initially declines somewhat and then hardly changes whereas the employment shares of market goods and market services decrease and increase, respectively. These facts imply that the employment share of total services increases with GDP per capita (where total services refers to market–produced plus household–produced services).

Our findings have two implications. First, the main stylized fact of structural transformation continues to hold for broad sectors: as GDP per capita grows, the goods sector shrinks while the broad service sector expands. Second, our sample of countries experiences marketization

[1] Herrendorf et al. (2014) provide a review of the literature. Contributions to it include Echevarria (1997), Kongsamut et al. (2001), Ngai and Pissarides (2007), Rogerson (2008), Herrendorf et al. (2013), Boppart (2014), Herrendorf et al. (2015), and Duernecker and Herrendorf (2015b).

[2] Benhabib et al. (1991) started the modern literature on household production. Subsequent contributions include Greenwood et al. (2005), Rogerson (2008), Ngai and Pissarides (2008), Olovsson (2009), McDaniel (2011), Ngai and Petrongolo (2013), Ragan (2013), and Duernecker and Herrendorf (2015a).

[3] Examples include those mentioned in 2.

[4] All data used for our analysis is available from our websites.

of services in that labor is reallocated from the household sector to the market–service sector. The fact that the employment share of the household sector does not change much with GDP per capita must mean that the opposing effects of structural transformation and marketization on the employment of the household sector largely offset each other.

We also calculate the value added of household production for a subsample that still contains 33 countries, which yields similar patterns of structural transformation and marketization in terms of value added shares, although the variation of value added produced in the household turns out to be rather large. Since the value added of household production is not traded in the market, calculating it involves an imputation that follows the methodology underlying the BEA's Satellite Account for Household Production. This methodology is based on the income approach of calculating value added, which combines information about the production factors used in household production with the rental prices for comparable production factors in the market. Specifically, value added of household production is obtained as the sum of capital and labor used in household production, each multiplied with an appropriate rental price. Kendrick (1979), Landefeld et al. (2009) and Bridgman (2013) offer detailed descriptions of this methodology and Schreyer and Diewert (2014) provide a theoretical justification for it.

Given estimates of the hours worked and the value added of household production, it is straightforward to estimate the labor productivity of household production as the ratio of the two. We find that while the labor productivity of household production is positively correlated with the labor productivity of market production, it is typically less than half of that in the market. Moreover, for countries with similar labor productivities in the market, the difference in household labor productivities can be sizable. Lastly, in the U.S. the labor productivity of household production has all but stagnated since 1960, which is similar to what Bridgman (2013) found. In contrast, in most other countries the labor productivity of household production experienced sustained increases, and it often caught up with or even overtook that in the U.S.

Estimates of the labor productivity of household production are essential when one seeks to connect models with a household sector to the data. This statement applies both to estimations like Rupert et al. (1995), Fang and Zhu (2012), and Moro et al. (2015) and to calibrations of the growth model with household production like Ngai and Pissarides (2008), Rogerson (2008) and McDaniel (2011). Most of such calibrations deliver what our imputation implies, that is, household labor productivity stagnates in the U.S. Regarding countries other than the U.S., a popular approach is to postulate that the ratio of the labor productivities in the household relative to the market shows the same behavior as in the U.S.; see for example Rogerson (2008) or McDaniel (2011). We find that among the countries for which we have long enough time series only a minority conforms with this pattern. In contrast, most of the countries for which we have long enough time series are catching up with the high level of labor productivity

of household production in the U.S., and so their labor productivity of household production increases considerably more than in the U.S.

The work of Bridgman (2013) is closely related to our work. Bridgman uses a similar imputation method as we do to obtain time series estimates for the labor productivity of household production in the US during the last hundred or so years. In contrast, we focus on a panel of over thirty countries during the last fifty or so years. The work of Fang and McDaniel (2014), who document the behavior of household hours in a panel of countries, is also closely related to our work. In contrast to us, they restrict their attention to Europe and the U.S., and so they do not cover poor countries. Other differences between their and our work is that we describe the cross–country differences in household production depending on the level of development, put them into the context of structural transformation and marketization, and estimate the value added and the labor productivity, in addition to hours worked, of household production.

The rest of the paper is organized as follows. The next section describes the facts about hours worked in the household sector in comparison with the market sectors. Section 3 presents our findings about the value added and the labor productivity of the household sector. Section 4 discusses the robustness of our imputation of value added produced by the household sector. Section 5 concludes. We have provided an extensive online appendix to accompany this paper, available with all the data at our websites.

2 Employment in the Household Sector

2.1 Time use data

Table 1: Sample of countries (number of time use surveys in parenthesis)

Albania (1)	Ecuador (1)	Japan (8)	Russia (9)
Algeria (1)	Estonia (2)	Korea (7)	Slovenia (1)
Australia (4)	Finland (4)	Macedonia (1)	South Africa (2)
Austria (3)	France (5)	Mexico (2)	Spain (2)
Bangladesh (1)	Germany (3)	Netherlands (7)	Sweden (4)
Basque Country (4)	Hungary (1)	New Zealand (2)	Taiwan (3)
Canada (7)	India (1)	Norway (5)	U.K. (7)
Colombia (1)	Iraq (2)	Panama (1)	Uruguay (1)
Denmark (4)	Italy (4)	Poland (1)	U.S. (14)

Probably the most often used statistic for describing the household sector is hours worked in household production based on high quality time use surveys.[5] We collect 126 time–use

[5]Household production is often also referred to as home production. We prefer the term household production,

surveys for 36 countries starting in 1960. In 2000, these 36 countries cover more than 40% of the world population and more than two thirds of world GDP.[6] While many time–use surveys that are an input into our analysis come from the Multinational Time Use Surveys (MTUS; Gershuny and Fisher (2013)), for twenty countries we have augmented MTUS information with additional time use surveys that we obtained from national statistical agencies. To the best of our knowledge, we are the first to document the behavior of hours worked in the household for a large sample of 36 rich, middle–income and poor countries. Table 1 lists the countries. Tables 9–10 in the appendix give the detailed data sources.[7]

The level of disaggregation differs across the different time use surveys that we have access to. We aggregate the available information up to the broad categories of activities listed in Table 2 and define household production time as the sum of the time spent on any of these activities. This definition essentially follows Ramey (2009). In Section 4 below we will discuss to robustness of our findings to different definitions.

Table 2: Broad classification of household production activities

Household production activities	Examples
Cleaning, household upkeep	Dishwashing, bedmaking, sweeping, disposal of garbage
Household management	Planning, supervising, paying bills
Construction and repairs	Repairs of dwelling, renovation, vehicle maintenance
Food management	Food preparation, baking, preserving food
Textiles care	Laundry, ironing
Animal care	Walking the dog
Gardening	Care of plants, harvesting
Childcare	Washing, dressing, bathing, feeding, help with homework
Adultcare	Physical care, health care, companionship
Shopping	Purchase of goods, clothing, private services (bank, post office, ...)
Travel connected to activities above	

2.2 The size of the household sector versus the market sector

Figure 1 plots household hours, market hours, and total hour worked against GDP per capita from the Conference Board.[8] The figure also contains the legend used throughout the paper. All

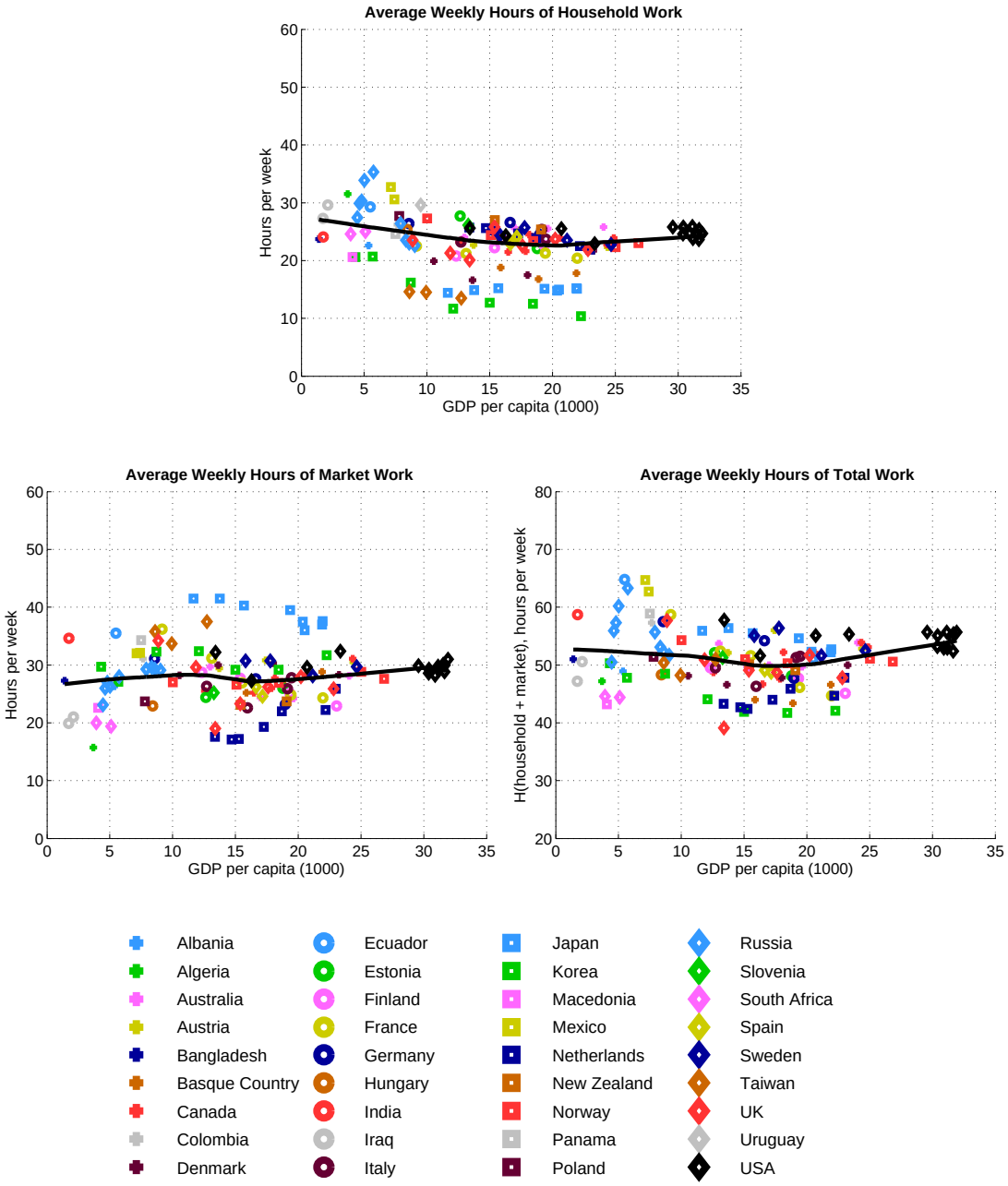
because while it is done outside of the market, household production may also be done outside of the home. Gardening and travel are examples.

[6]These shares are calculated from the World Development Indicator in constant ppp–adjusted international dollars. The WDI does not list information for the Basque Country and Taiwan.

[7]We have included data from the Basque Country although it is not an independent country. The reason for doing this is that MTUS has high–quality time use data for the Basque Country, which show rather different patterns from the Spanish numbers.

[8]GDP per capita is in 1990 prices and is PPP adjusted. The lines are from locally weighted regressions. We include these regression lines in all Figures for which we have sufficiently many observations.

Figure 1: The Size of the Household Sector – Employment Levels



hours are weekly averages for the working–age population 15–64 years old that we calculate from time use surveys as described above. Hours worked in the market are the hours worked for a wage plus commuting time.

We find that the household sector is big in most countries, but that its size varies rather widely. Specifically, average weekly hours worked in household production are typically between 20 and 30 hours. This is a large share of average total hours worked in the household and the market, which vary between 30 and 60 hours. To be precise, the 25^{th} percentile is 42%, the median is 45%, the average is 46%, and the 75^{th} percentile is 49%.

A key finding of this paper is that household hours, market hours, and total hours do not change much with GDP per capita. This feature of our data is consistent with the usual way of calibrating the growth model that assumes that hours worked are constant along the BGP. Focusing on household hours worked, we can see that while they decline somewhat as GDP per capita increases from very low levels, for middle– and high–income countries they hardly change when GDP per capita changes. Since effective taxes vary widely across countries, this finding implies that there is no systematic relationship between hours worked in the household, or in the market, and effective labor income taxes in our panel of 36 countries. Indeed, the correlation coefficient between the two equals 0.02. The lack of a clear relationship between hours worked in the household and effective labor income taxes generalizes what Duernecker and Herrendorf (2015a) found for the U.S. and France, and it suggests that other forces like difference in relative household productivity offset the effects of differences in taxes.[9]

Figure 1 features three notable outliers: Japan, Korea, and Taiwan have much lower average weekly household hours than the other countries. A key difference between these three countries and the rest of our sample is that men devote very little time to household production in Japan, Korea, and Taiwan. While every country shows a gender gap, with women performing more hours of household production than men, the gender gap in Japan, Korea, and Taiwan is much starker: the ratio of male–to–female average household hours was 0.12 in Japan in 1996, 0.17 in Korea in 1995, and 0.1 in Taiwan in 1994. In comparison, that ratio is 0.62 in the U.S. in 1995; see Table 3 for more details and Huh and Yuh (2005) for more discussion. Since women in these East Asian countries do not work more in the household than in other countries, the lower household hours of men are not offset by higher household hours of woman, implying that average hours worked in the household sector are much lower than in the other countries of our sample.

The next natural question to ask is how the size of the household sector evolves relative to the size of the market sector when economies develop and GDP per capita increases. We divide the market sector into goods and service production. The rationale behind doing this is that market–produced services are more substitutable with household production than market–

[9]See Rogerson (2008), Olovsson (2009), McDaniel (2011), and Ragan (2013) for studies of how taxes affect hours worked in the household and the market.

Table 3: Weekly household hours for men and women in South–East Asia and the U.S.

	year	men	women	men/women
Japan	1996	3.2	26.4	0.12
Korea	1995	2.9	17.1	0.17
Taiwan	1994	2.6	25.3	0.10
U.S.	1995	17.6	28.3	0.62

produced goods. We take hours worked in the household and the market from time use surveys. We split hours worked in the market between those producing goods and those producing services by using information on the number of persons engaged in each of these two sectors. The main data source in this context is the Groningen Growth and Development Center (GGDC) 10–sector data base, which we supplement with KLEMS and the OECD if the GGDC 10–sector data base does not have the required information. The market–service share in total hours is the share of hours of Utilities; Trade, restaurants and hotels; Transport, storage and communication; Finance, insurance, real estate and business services; Government services; Community, social and personal services in total value added. The market–goods share in total hours is one minus the market–service share. An issue with that way of proceeding is that the time use data is in hours whereas the numbers from the GGDC 10–sector data base are in persons engaged. This is not a problem if relative hours per worker in the two sectors are similar across countries.

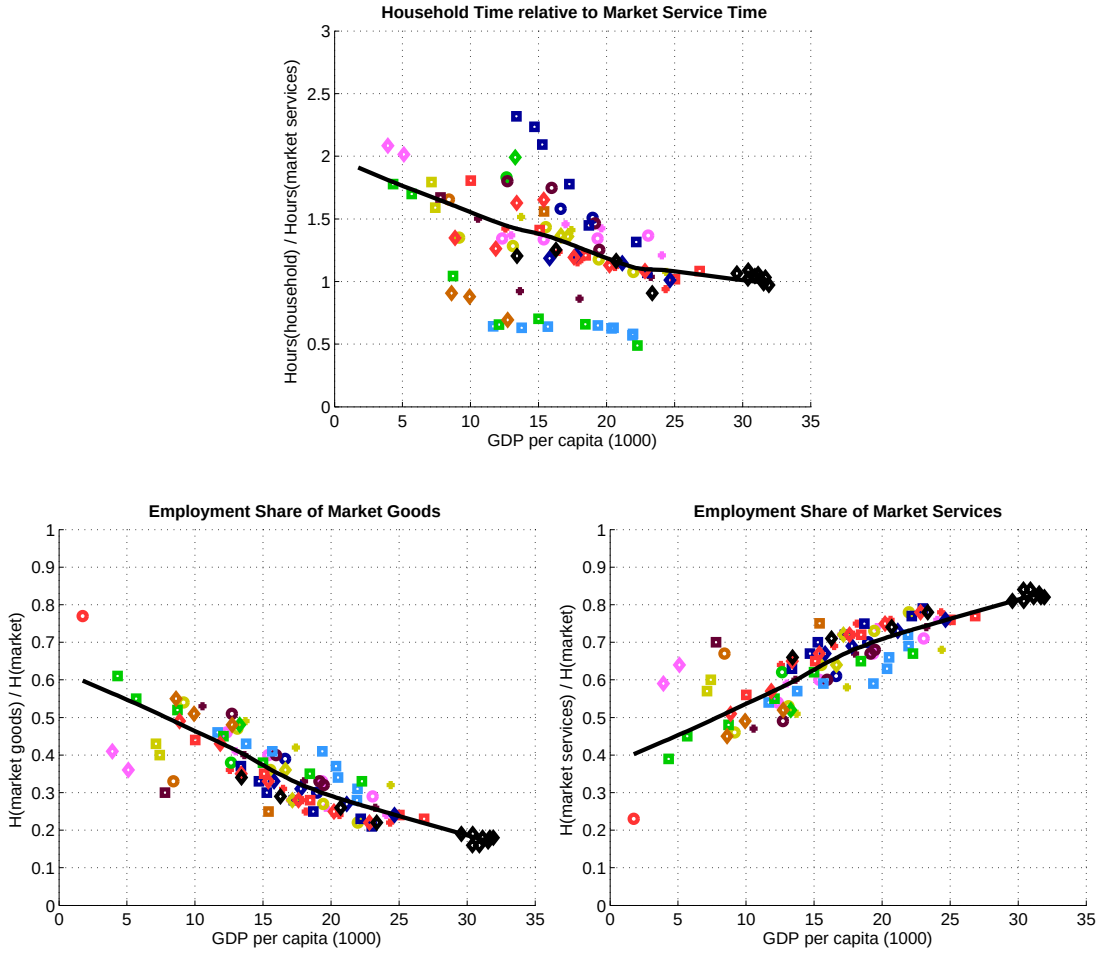
The upper panel of Figure 2 plots the hours in the household sector relative to the market–service sector against GDP per capita (in 1990 prices, PPP converted from the Conference Board). We can see that the hours of the household sector tend to fall relative to the market–service sector when GDP per capita rises. As countries develop people substitute market–produced services for household–produced services, which Freeman and Schettkat (2001) called the marketization of services. We emphasize that the marketization of services comes through clearly in our sample of rich and poor countries, which is considerably broader than the usual ones.

Note that, again, Japan, Korea, and Taiwan are outliers. This suggests that it would be fruitful if future work devoted more detailed attention to studying their experiences, and perhaps to those of other countries in East Asia.

2.3 Literature comparison and robustness

In this subsection, we compare our findings with those in the literature and establish that they are robust to several different definitions of household production.

Figure 2: Marketization of Services and Structural Transformation among Market Sectors – Employment Shares

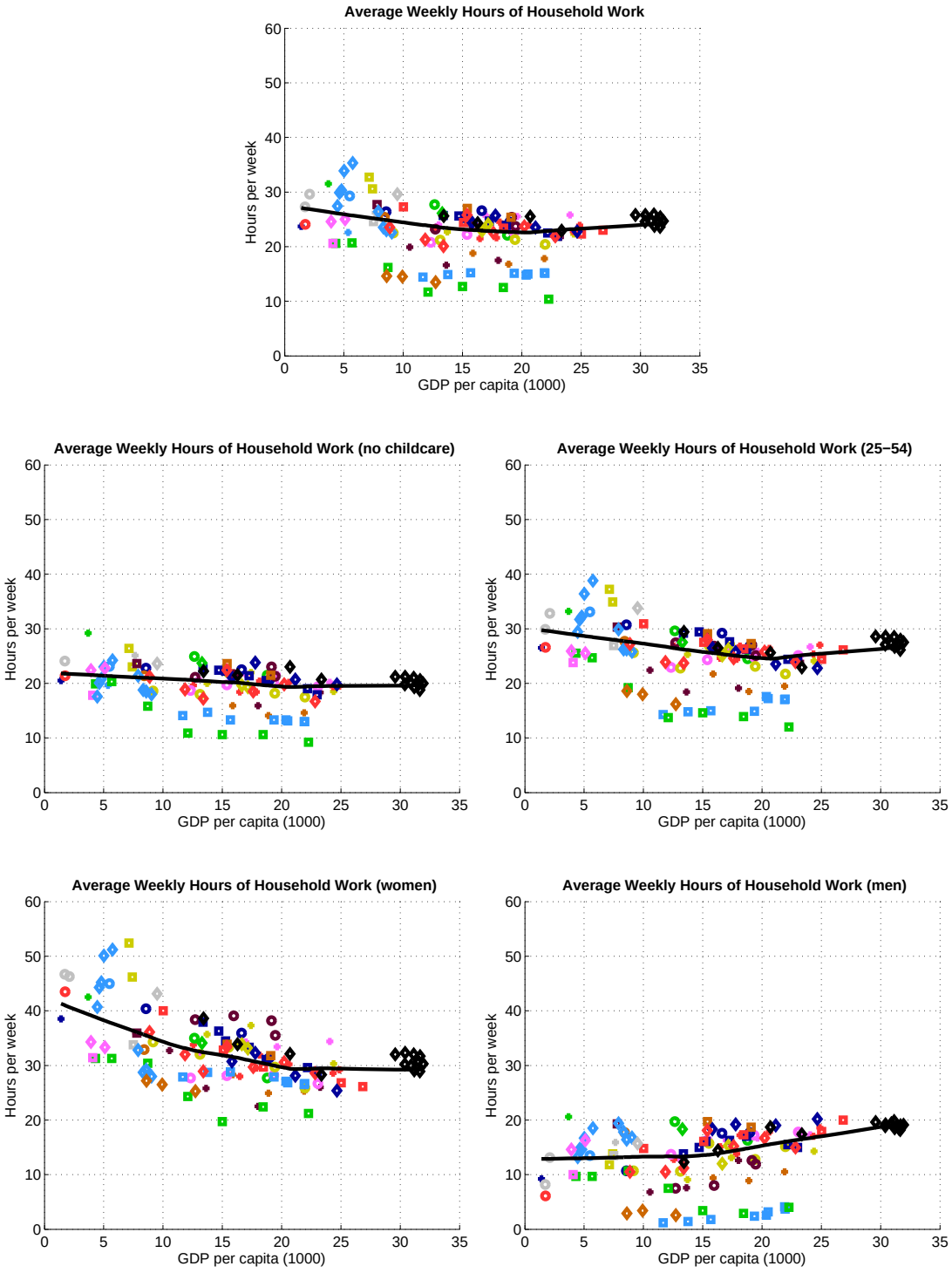


Aguiar and Hurst (2007), Ramey (2009), and Ramey and Francis (2009) found that household hours fell in the 1960s as the U.S. got richer. This might seem at odds with our finding that weekly hours of household production hardly change with GDP per capita for middle– and high income countries. The last statement is particularly true since we essentially follow Ramey's choices of the time use categories that constitute household production. In Duernecker and Herrendorf (2015a), we used the same categorization as here and established that the differences between our work and their work are due to two main differences. To begin with, the age groups differ across the studies: in order to ensure comparability with the literature on cross–country labor supply, we focus on the working–age population 15–64 years old whereas the other two studies start later at 18 and 21 years. Second, as in Ramey and different from Aguiar–Hurst, our numbers include students and retirees, they include childcare, and they do not control for demographic change.

In what follows, we show that our conclusions do not change if we focus on the prime–age population (25 to 54 years of age) and if we exclude childcare from household production (and thereby assign it to leisure). We also provide results when we disaggregate into women and men. This serves to show that even though there are rather large changes in household hours in both groups, they largely offset each other. Figure 3 summarizes the findings of this exercise. To facilitate comparison, we replot the average weekly hours of household production from Figure 1. We can see that taking childcare out of household production has a downward level effect and all but eliminates the mild negative relationship between weekly hours of household production and GDP per capita for poor countries. Overall, the main stylized fact remains: weekly hours of household production hardly change with GDP per capita. Focusing on prime age workers (25–54 years old) has an upward level effect on weekly household hours while leaving the overall pattern almost unchanged. Disaggregating into the average weekly hours of men and women reveals rather large changes by subgroup: while women strongly decrease their average weekly hours of household work when GDP per capita increases, men strongly increase them. The net effect is that average weekly hours of household work hardly change.

The work of Fang and McDaniel (2014) is related to our work. These authors documented the behavior of household hours in a panel of rich countries and found that in a given country household hours hardly change. Gimenez-Nadal and Sevilla-Sanz (2012) documented facts about leisure for several countries from the 1970s to the 2000s and Juster and Stafford (1991), Freeman and Schettkat (2001), Burda et al. (2008) and Ragan (2013) provided evidence from limited cross sections. Our data cover considerably more observations than these papers. Moreover, these papers neither explored household production in the context of structural transformation nor did they attempt to estimate the value added and the labor productivity of household production.

Figure 3: Alternative Definitions of Household Employment



2.4 Structural transformation

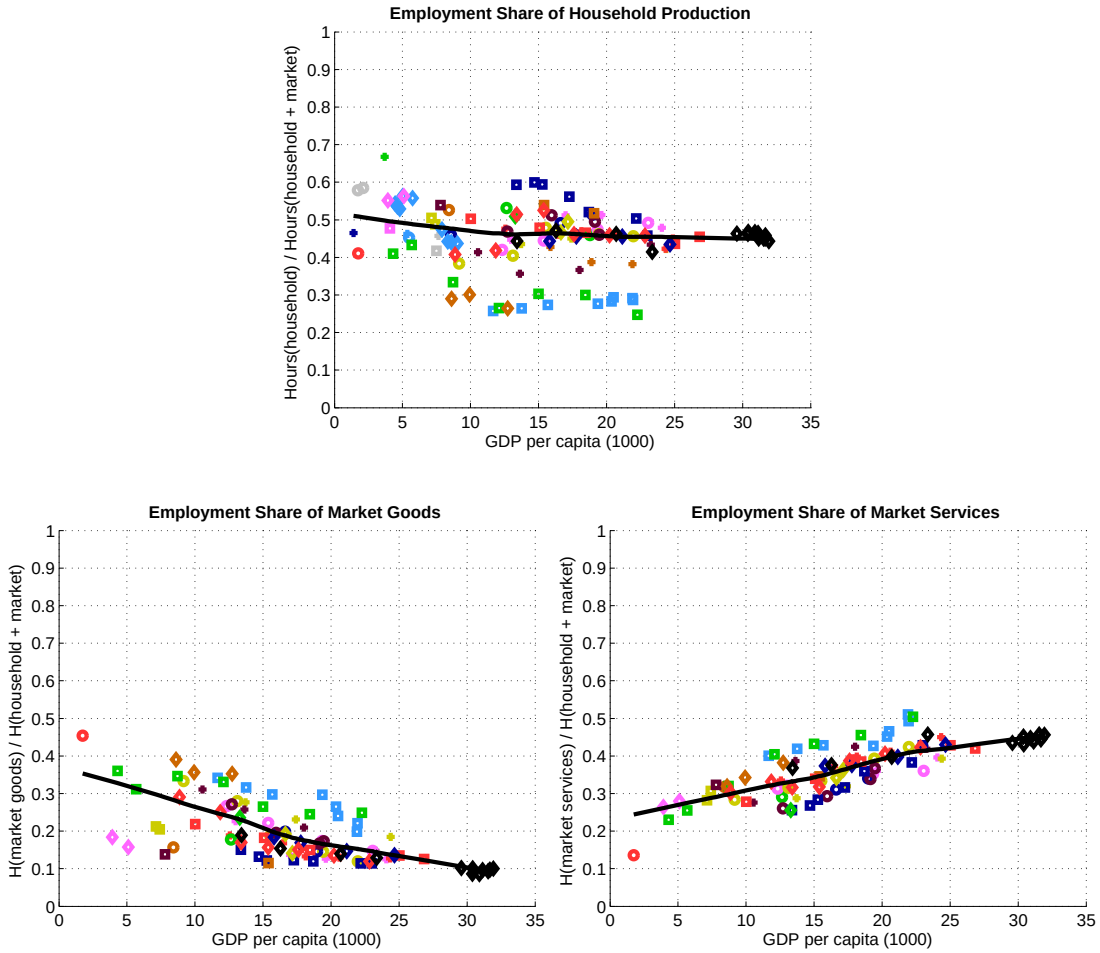
The conventional way of looking at structural transformation focuses on the reallocation of resources within the market sector. The literature then finds that as GDP per capita increases, the employment share of the goods–producing sector decreases whereas the employment share of the service–producing sector increases. The lower panel of Figure 2 confirms that these patterns also hold in our sample of countries. This suggests that there is nothing special about our sample with regards to the structural transformation within the market sector, which is reassuring to know for what follows.

The conventional way of looking at structural transformation does not address what happens if one adopts a broader notion of sectors as comprising economic activity both in the market and the household. Adopting this broader notion presents at least two challenges. The first one is that information about the household sector is not as readily available as information about the market sectors. By collecting time use data about hours worked in the household for 36 countries, we have been able to overcome the first challenge. Nonetheless we still face a second challenge that we have little systematic information about the composition of the value added produced in the household. For now, we make the usual assumption that all value added produced in the household takes the form of services, implying that the service sector comprises both market– and household–produced services whereas the goods sector comprises just market–produced goods. This assumption is motivated by the common view that services are the most important component of value added produced in the household, at least in rich countries. Below we will discuss the implications of allowing goods to be produced also in the household, which is of some importance in poorer countries.

Figure 4 reports the employment shares relative to total hours worked both in the market and the household. As GDP per capita increases, the employment share of the household sector remains roughly unchanged while the employment share of the goods sector decreases and the employment share of the market–services sector increases. That the employment share of the household sector remains roughly unchanged must mean that the opposing effects of structural transformation and marketization on household hours largely cancel each other, leaving no clear correlation between GDP per capita and hours worked in the household sector. The decline in the employment share of the goods sector implies that the employment share of the broad service sector, which comprises market and household services, increases. In other words, the usual patterns of structural transformation still hold for market goods and broad services, which comprise both market– and household–produced services.

In poor countries part of household production falls into the goods sector, because households also produce clothes, food, furniture, etc. Instead, we have attributed all household production to the service sector. This oversimplification is not likely to invalidate the qualitative patterns of structural transformation that we have identified though. The reason for this is that

Figure 4: Structural Transformation among Household and Market Sectors – Employment Shares in Total Time



only in poor countries a non–negligible part of household production falls into the goods sector. That implies that all we have abstracted from is an additional structural transformation from goods to services that takes place *within* the household sector. If anything, taking this additional structural transformation into account intensifies the overall structural transformation from goods to services that we obtained under our crude assumption that household produce only services.

3 Value Added and Labor Productivity of Household Production

3.1 Data and Methodology

So far we have looked at the main input into household production, hours worked. A different way of describing the economic activity of the household sector is to look at what it produces. This presents a new challenge because the value added of household production is not traded in the market and, therefore, is not part of NIPA.[10] One way of dealing with this challenge is to impute the value added produced in the household. For our imputation, we use the income method of calculating value added, which combines information about the use of the production factors with market rental prices for comparable production factors. Specifically, value added of household production equals the sum of capital and labor used in the household each multiplied with an appropriate market rental price:

$$Y_t^h = (r_t + \delta)K_t^h + w_t H_t^h \tag{1}$$

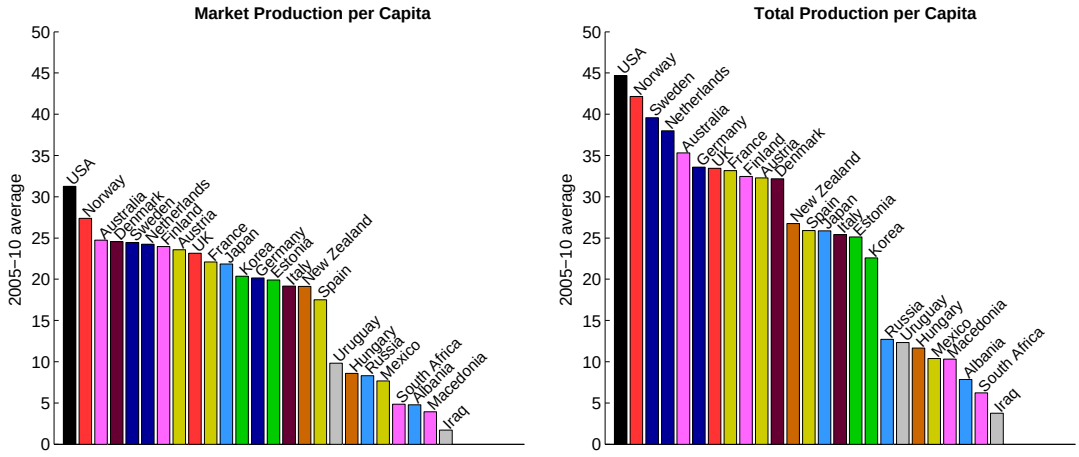
where Y^h denotes value added produced by the household, r denotes the real interest rate in the market, δ denotes the depreciation rate, K^h denotes capital used in the household, w denotes an appropriate market wage, and L^h denotes hours worked in the household. Note that as usual the rental price of capital is the sum of the real interest rate and the deprecation rate. Kendrick (1979), Landefeld et al. (2009) and Bridgman (2013) offer detailed descriptions of this methodology and Schreyer and Diewert (2014) provide a theoretical justification for it. Our contribution here is to come up with comparable estimates according to this methodology for a large sample of 33 countries.[11]

We define capital used for household production as the stock of consumer durables. We choose to include all consumer durables, not just household appliances, in household capital because many capital goods that are used in household production are part of consumer durables but not of household appliances. Examples include equipment for gardening, tools for maintenance, cars etc. There are also consumer durables that are not used for household production, for example, audio equipment, sporting equipment, televisions etc. Including them overestimates the stock of household capital. Since the share of household capital in household value added is rather small, this is not of first–order importance in our context though. Some authors include part of residential housing in household capital; see for example Bridgman (2013). We have not done that here for at least two reasons. First, the imputed services from

[10] An exception to this statement is the imputed value added for owner–occupied housing, which is included in GDP.

[11] Our approach and that of Bridgman (2013) are generally the same. The main difference is that we selected a method we could implement in a wide variety of counties which was not a concern for his work.

Figure 5: Market and Total Production per capita



residential housing are already included in NIPA value added, so including them in household value added would require us to change all market numbers. Second, it is even less clear than with consumer durables which part of residential housing is an input into household production and which part is an input into leisure (or personal care and sleep). This only impacts the home productivity numbers, though Bridgman (2013) shows that the time series is not significantly changed if residential capital is excluded.

To calculate the stock of capital used for household production, we obtain investment as the sum of the final expenditure on consumer durables in constant prices from NIPA and then use the perpetual inventory method. We convert capital in constant prices into capital in current prices by using the price index of investment in consumer durables in the current period. We use the ten–year rates of return on government bonds plus the depreciation rate as the rental price for household capital. This is slightly different from Bridgman (2013), who uses the BEAs estimates of household financial asset returns while we create our own stock using perpetual inventory and the 10–year government bond rate.

Above we already calculated hours worked in the household, so we only need an appropriate factor price from the market to value hours worked in household production. We use the average hourly compensation of market workers that are hired by the private–households sector as reported in NIPA. To calculate real labor productivity of household production, we translate nominal value added into constant–price, constant–PPP value added by using the OECD price indexes for expenditure on close market substitutes to household consumption. Section 4 below reports several robustness checks that suggest that in the U.S. this method works well.

To appreciate what the imputation of the value added of labor entails, it may be useful to recall the NAICS definition of this sub–sector: *"Industries in the Private Households subsector include private households that engage in employing workers on or about the premises in ac-*

tivities primarily concerned with the operation of the household. These private households may employ individuals, such as cooks, maids, and butlers, and outside workers, such as gardeners, caretakers, and other maintenance workers." To avoid confusion, we stress that these hired workers receive wages, and so the value added they produce is part of the value added of the market sector and an intermediate input into the household sector.

To compute the sectoral value added shares of market production, we again use sectoral information from the GGDC 10–Sector Data Base, appropriately complemented by data from KLEMS and OECD data if required. The market–service share in total value added is the share in current local prices of the value added of Utilities; Trade, restaurants and hotels; Transport, storage and communication; Finance, insurance, real estate and business services; Government services; Community, social and personal services in total value added. The market–goods share in total value added is one minus the market–service share.

3.2 Market versus total production per capita

To get a sense of how large household produced value added is, Figure 5 list the 2005–2010 averages of market production per capita versus total production per capita (i.e., GDP versus GDP plus household value added per capita in constant 2005 international dollars). We can see that including household value added in production considerably increases the production in all countries. Moreover, in line with an often heard argument, including household value added in production both mitigate the inequality across countries and changes the ranking of countries: the difference in production per capita shrinks from a factor of 18.4 to 11.9; there is some notable reshuffling of countries, with Germany gaining and Japan and Korea losing several places, and switching ranks as a result.

3.3 Marketization and structural transformation in terms of value added

Figures 6 and 7 show that qualitatively, the patterns for employment shares reported above also hold for value added shares, with the exception that the value added shares of household production are now too noisy to see clear patterns. Otherwise, as GDP per capita increases, the value added produced in the goods sectors declines as a share of the market value added and as a share of the total value added while the value added produced in the service sectors increases as a share both of market value added and total value added.

3.4 Labor productivity

Given that we have estimated both the value added and the hours worked in household production, it is straightforward to produce estimates for the labor productivity of the household sector. Figure 8 shows the results. The upper left panel shows that in the U.S., the labor productivity

Figure 6: Marketization of Services and Structural Transformation among Market Sectors – Value–added Shares

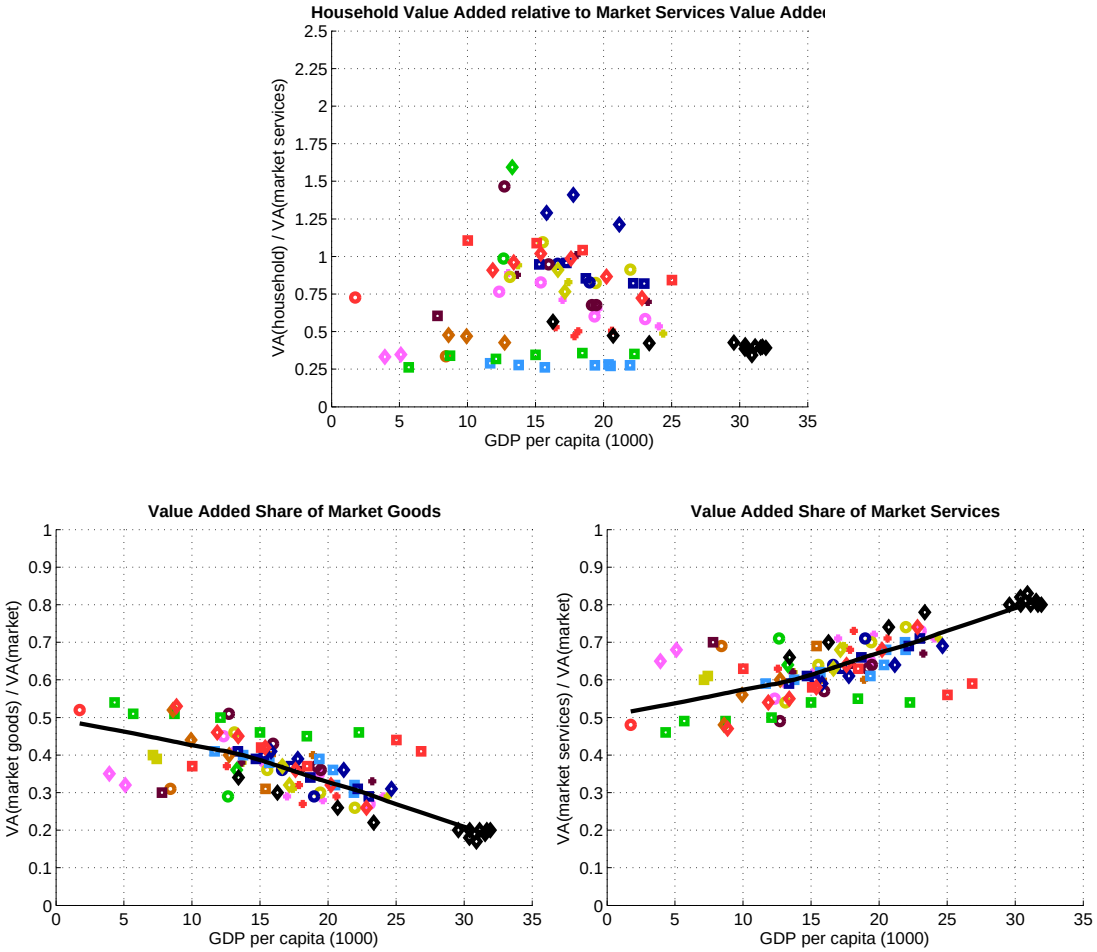


Figure 7: Structural Transformation among Household and Market sectors – Value–added Shares in Total Value Added

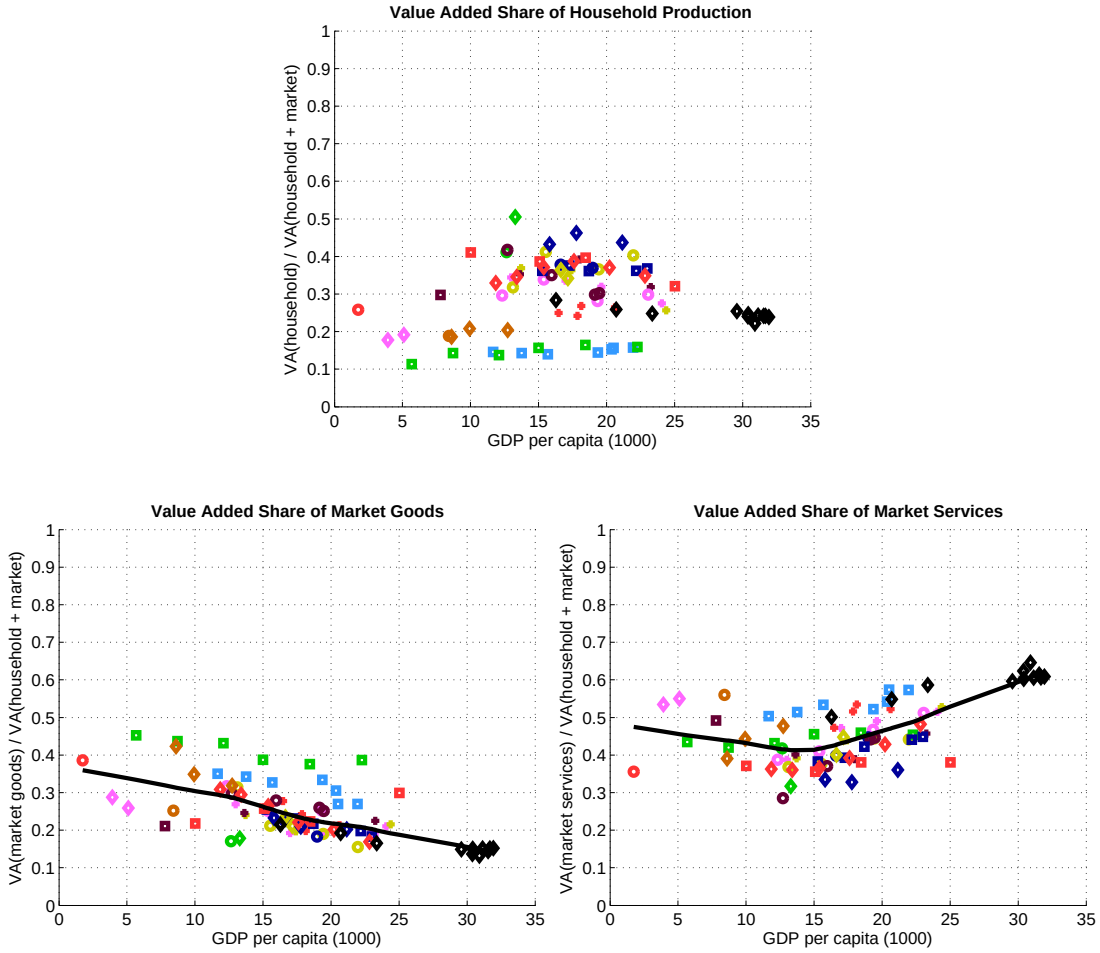
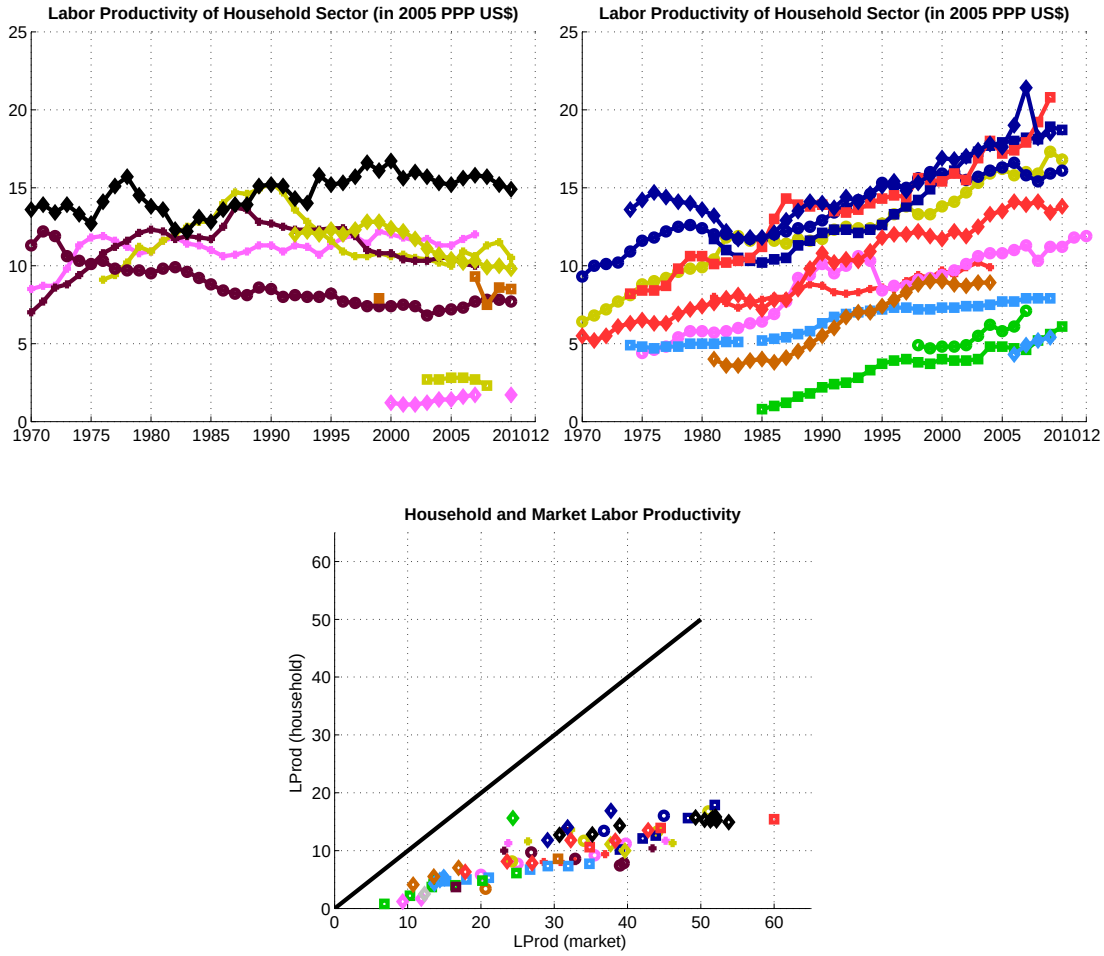


Figure 8: Labor productivity of household production



of household production has all but stagnated since 1960. This figure also plots the experience of the other countries in which the labor productivity of household production has mostly stagnated, namely Australia, Austria, Denmark, Italy, Mexico, New Zealand, and Spain. The upper right panel plots the remaining countries, in which the labor productivity of household production has caught up, or even overtaken, that of the U.S..

The lower panel of Figure 8 shows that while the labor productivity in household production is positively correlated which labor productivity in market production, the household sector tends to be considerably less productive than the market sector. In particular, our estimates of the labor productivity of the household sector rarely exceed one half of the labor productivity of the market sector, and often they remain below that.

Estimates of the labor productivity of household production are helpful when one seeks to connect models with a household sector to the data. This statement applies to both estimations like Fang and Zhu (2012) and Moro et al. (2015) and to calibrations like Ngai and Pissarides

(2008), Rogerson (2008), and McDaniel (2011). Calibrations of the growth model with household production deliver that household productivity stagnates in the U.S., which is also what our imputation implies. The typical approach in the literature then is to postulate that the ratio of the labor productivities in the household relative to the market shows the same behavior around the world as in the U.S.; see for example Rogerson (2008) or McDaniel (2011). We find that this is born out of the data only for a minority of countries in our sample. In contrast, in most other countries the labor productivity of household production experienced sustained increases, and it often caught up with or even overtook that in the U.S.

4 Robustness of the Labor Imputation

Quantitatively, a key input into our imputation of the value added of household production is the wage of household workers. The reason for this is that labor has a much larger share in household production than capital. In this section, we discuss issues related to the robustness of imputing the value of the labor input into household production.

4.1 Opportunity cost approach

Instead of using the wages of workers in the private–households sector, we could have used the market wages of all workers as the rental price of hours worked in the household. This might seem more appealing at first sight because it captures the opportunity costs of working in the household instead of working in the market. Nonetheless, it is not appropriate to use the opportunity cost approach here, because it would imply that the productivity of working in the household is determined by a person's productivity of working in the market. This would mean, for example, that doctors have higher productivities when working in the household than professional household workers. Schreyer and Diewert (2014) argued that this is implausible. Estimating a life–cycle model with household production, House et al. (2008) found evidence that supports the view of Schreyer and Diewert: for each dollar women earned in the market, they gave up only 28 cents worth of household production. This suggests that the average market wage is not the appropriate rental price for household production time.

4.2 Wages in the U.S. Household Sector

In this subsection, we provide additional evidence that a specialized household worker is not likely to be much more productive in performing household work than a private individual, in which case it is a reasonable first pass to use the average wage of household workers as a proxy for the return to an individual's labor input in household production. To establish this, we will document that there is a low degree of wage dispersion in the U.S. household sector

compared to the aggregate economy. This evidence suggests that the productivity differences of workers employed in the household sector are small and that there is only a limited role for the accumulation of occupation–specific human capital in the household sector.

We use data from the CPS (accessed via IPUMS CPS) for the period 1994–2013 to analyse in more detail the behavior of wages in the U.S. household sector in comparison with the aggregate economy.[12] The upper–left panel in Figure 9 plots the percentiles of the hourly wage distribution in 2005 for the household sector and the aggregate economy. We can see that wages in the household sector are less dispersed and more closely centered around the median wage. For example, the difference between the 75^{th} and the 25^{th} percentile is about \$3 for the household sector in contrast to \$8 for the aggregate economy, and the difference between the 90^{th} and the 10^{th} percentile is \$7 vs \$16. The upper–right panel plots the deviation of each percentile from the median wage. To address the question whether this is a robust observation or we cherry picked 2005, the two lower panels show the 90^{th}–to–10^{th} and the 75^{th}–to–25^{th} difference for the period from 1994 to 2013. The relatively low degree of wage dispersion in the household sector is a very stable phenomenon during the 1990s and 2000s.

As a robustness check, we compute the labor productivity of the household sector with the 25^{th} and the 75^{th} percentile wage instead of the average wage. The results are depicted in Figure 10. We find that the use of the lower– and upper–wage percentiles leads only to a minor shift in the level of productivity. The evolution over time is largely unaltered. The finding reflect the facts that the wage distribution for household sector wages is compressed around the mean and stable over time.

4.3 Disaggregate occupations and household production

Next, we compute the labor input to household production as the sum of more disaggregate activities. Specifically, instead of imputing household value added as before in (1), we use the more elaborate approach:

$$Y_t^h = (r_t + \delta)K_t^h + \sum_i w_{it} H_{it}^h \tag{2}$$

where H_i^h is the time spent on household production activity i and w_i is the average market wage in the occupation which is associated with activity i. The reason for doing this is to avoid a mismatch between the average wage and household production activities that occurs when the distribution of the employment share of occupations in the household sector differs from the distribution of hours worked over time use activities in household production. To be concrete,

[12] We face the usual problem that wages in the CPS are top–coded. Since this is more likely to be relevant for market workers than for household workers, the estimated gaps between market and household wages are likely to be somewhat downward biased.

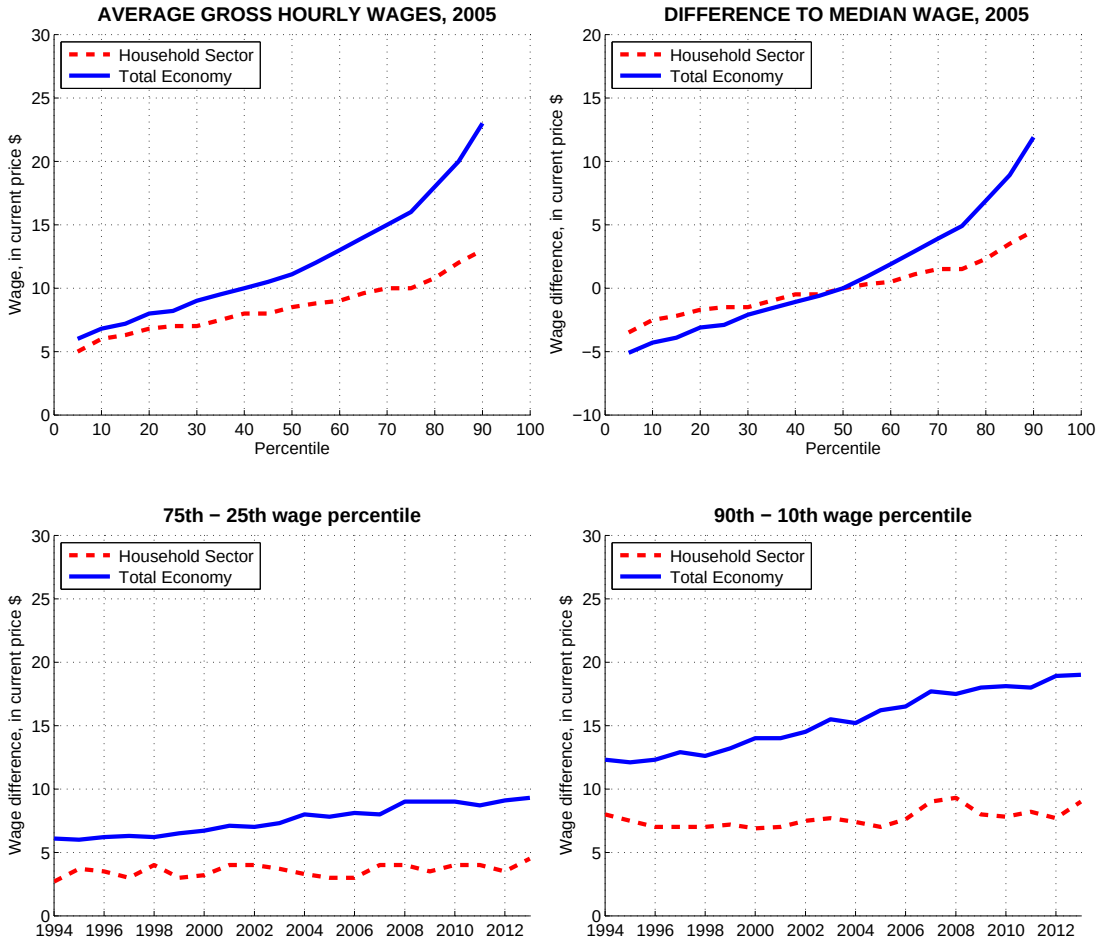


Figure 9: Wages in the total economy and the household sector

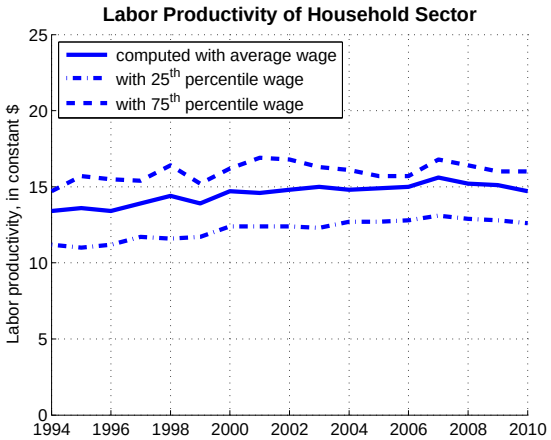


Figure 10: Labor productivity for different assumptions about rental price of labor

suppose that 90% of household–sector employment is child care workers and 10% is cooks but 10% of total household hours is spent on cooking and 90% is spent on childcare. In this admittedly extreme example, the use of the average household sector wage would not properly reflect the factor return to labor (especially if there was a large wage differential between cooks and nannies).

We apply the following multi–step procedure to compute $\sum_i w_{it} H_{it}^h$:

Step 1: determine the occupations that account for the major part of employment in the household sector;

Step 2: use time–use data to compute the average hours of work for broad categories of household production activities;

Step 3: match the occupations from step 1 to the activities from step 2;

Step 4: compute the average market wage for each activity/occupation group.

Step 1 (major occupations in the U.S. household sector): We identify the seven occupations in the U.S. household sector with the largest employment shares. Table 4 shows for 1995, 2000, 2005 and 2010 the employment shares of all occupations that are employed by the household sector.

Table 4: Employment shares of the seven major occupations in U.S. private household sector

	1995	2000	2005	2010
Cleaners and servants (405,407)	41.1	49.0	48.7	50.7
Child care workers (468)	39.7	34.8	32.2	29.1
Nursing aides, orderlies, attendants (447)	8.7	7.9	13.7	12.2
Gardeners and groundskeepers (486)	2.4	3.5	1.3	1.5
Laborers outside construction (889)	1.1	0.5	1.2	2.2
Cooks (436)	0.8	0.2	0.4	0.0
Janitors (453)	0.3	0.0	0.4	0.7

Numbers in brackets are CPS occupation codes.
Source: CPS, accessed via IPUMS CPS

Step 2 (time use and activities in household production): Next, we decompose the total household production time and compute how much time an average American spends on each sub–category of household production. The results for selected years are in Table 5. Table 6 shows how the different activity categories are aggregated into the broad activity groups.

Step 3 (matching time–use activities and occupations): Table 7 shows how each of the major household sector occupations is assigned to one of the household production activities.

Step 4 (wages in household–sector occupations): Next, we compute average wages for each broad household sector occupation group. Table 8 has the results. It also shows the average

Table 5: Time used in household production activities in the U.S.

	1995	2000	2005	2010
Cleaning	5.2	5.0	5.2	4.8
Childcare	2.8	3.9	4.9	4.7
Adultcare	3.2	3.4	3.4	3.1
Cooking	3.4	3.4	3.4	3.7
Repair	3.0	2.5	2.1	1.9
Gardening	0.5	0.9	1.1	1.1
Shopping	5.3	5.7	5.7	5.5

Average weekly hours. Source: AHTUS

Table 6: Aggregation of household production activities

Cleaning			**Cooking**		
	1	cleaning		15	food preparation, cooking
	2	laundry, ironing, clothing repair		16	set table, wash/put away dishes
	3	pet care, walk dogs	**Repair**		
Childcare				17	household care
	4	care of infants		18	home repairs, maintain vehicle
	5	general care of older children		19	other domestic work
	6	medical care of children	**Gardening**		
	7	play with children		20	gardening
	8	supervise child or help with homework	**Shopping**		
	9	read to, talk with child		21	purchase routine goods
	10	other child care		22	purchase consumer durables
	11	travel related to child care		23	purchase personal services
Adultcare				24	purchase medical services
	12	adult care		25	purchase repair, laundry services
	13	personal medical care		26	purchase financial/government services
	14	personal or adult care travel		27	purchase other services
				28	travel related to consumption

Table 7: Matching time–use activities and occupations

Cleaning, Shopping	Cleaners and servants (405,407)
Childcare	Child care workers (468)
Adultcare	Nursing aides, orderlies, and attendants (447)
Cooking	Cooks (436)
Gardening, Repair	Gardeners and groundskeepers (486)
	Laborers outside construction (889)
	Janitors (453)

wage in the total economy for the same occupation groups. We can see that while there is some variation, the variation is relatively small.

Now we have all the ingredients to impute household sector value added according to the

Table 8: Average hourly wages (in current $): private household sector and total market sector

	1995	2000	2005	2010
	Household sector			
Cleaners and servants	7.1	8.0	9.5	10.2
Child care workers	4.6	6.7	8.4	9.8
Nursing aides, orderlies, and attendants	8.4	8.4	9.4	11.7
Cooks	6.1	10.0	10.3	-
Gardeners and groundskeepers, Laborers outside construction, Janitors	7.3	8.0	11.5	11.7
	Total economy			
Cleaners and servants	6.7	7.9	9.1	10.2
Child care workers	5.5	7.6	8.7	10.1
Nursing aides, orderlies, and attendants	7.6	8.9	9.8	11.1
Cooks	6.2	7.7	9.1	10.3
Gardeners and groundskeepers, Laborers outside construction, Janitors	7.8	9.2	10.8	11.9

disaggregate method described in equation (2). The results are in Figure 11 below. The solid blue line represents the benchmark case in which we use the average wage of household workers. The broken red line represents the case in which we distinguish between occupations and use disaggregate average wages for these occupations. The dotted–dashed black line is like the red one except we now use averages wages in the total economy for the household occupations. We can see that the differences among these cases are negligible, suggesting that compositional issues are not of first–order importance for our imputation of value added produced by hours worked in the household.

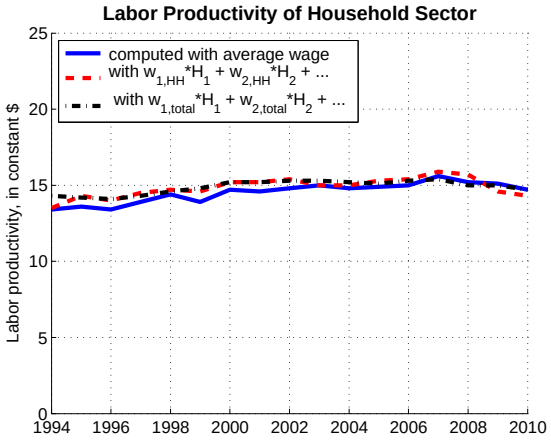


Figure 11: Labor productivity of household production with disaggregated labor

5 Conclusion

We have provided new evidence on household production in 36 countries since 1960. We have found that the household sector is big, accounting for on average 46% of total hours worked. As GDP increases, the employment share of household production in total hours worked initially declines somewhat and then hardly changes while the employment share of market goods decreases and the employment share of market services increases. We have computed the value added of household production and have confirmed that these patterns still hold, although it is surrounded by much more noise. We have found that labor productivity of household production is positively correlated with and lower than labor productivity in the market. Lastly, while the labor productivity of household production stagnated in the U.S., it caught up with the U.S. level in most other countries.

These findings are a useful input for calibrating models with household production. We hope that future work will broaden the panel of countries for which we were able to obtain data. As more time–use surveys and more data for household capital become available, it should become feasible to make more robust statements about middle–income and poor countries. This should be useful in assessing whether the patterns established here hold more generally.

References

Aguiar, Mark and Eric Hurst, "Measuring Leisure: The Allocation of Time Over Five Decades," *Quarterly Journal of Economics*, 2007, *122*, 969–1006.

Benhabib, Jess, Richard Rogerson, and Randall Wright, "Homework in Macroeconomics: Household Production and Aggregate Fluctuations," *Journal of Political Economy*, 1991, *99*, 1166–1187.

Boppart, Timo, "Structural Change and the Kaldor Facts in a Growth Model with Relative Price Effects and Non–Gorman Preferences," *Econometrica*, 2014, *82*, 2167–2196.

Bridgman, Benjamin R., "Home Productivity," Manuscript, Buerau of Economic Analysis 2013.

Burda, Michael C., Daniel S. Hamermesh, and Philippe Weil, "The Distribution of Total Work in the EU and US," in Tito Boeri, Michale C. Burda, and Francis Kramarz, eds., *Working Hours and Job Sharing in the EU and the USA: Are Europeans Lazy? Are Americans Crazy?*, Oxford: Oxford University Press, 2008.

Duernecker, Georg and Berthold Herrendorf, "On the Allocation of Time – A Quantitative Analysis of the U.S. and France," Manuscript, Arizona State University, Phoenix 2015.

—— **and** ——, "Structural Transformation of Occupation and Sector Employment," Manuscript, Arizona State University, Phoenix 2015.

Echevarria, Cristina, "Changes in Sectoral Composition Associated with Economic Growth," *International Economic Review*, 1997, *38*, 431–452.

Fang, Lei and Cara McDaniel, "Trends in Home Hours in the U.S and Europe," Manuscript, Arizona State University and Federal Reserve Bank of Atlanta 2014.

—— **and Guozhong Zhu**, "Home Production Technology and Time Allocation: Empirics, Theory, and Implications," Working Paper 2012–19, Federal Reserve Bank of Atlanta 2012.

Freeman, Richard B. and Ronald Schettkat, "Marketization of Production and the US–Europe Employment Gap," *Oxford Bulletin of Economics and Statistics*, 2001, *63*, 647–670.

Gershuny, Jonathan and Kimberly Fisher, "Multinational Time Use Study," Centre for Time Use Research, University of Oxford 2013.

Gimenez-Nadal, Jose Ignacio and Almudena Sevilla-Sanz, "Trends in Time Allocation: A Cross–Country Analysis," *European Economic Review*, 2012, *56*, 1338–1359.

Greenwood, Jeremy, Ananth Seshadri, and Mehmet Yorukogly, "Engines of Liberation," *Review of Economic Studies*, 2005, *72*, 100–133.

Herrendorf, Berthold, Christopher Herrington, and Ákos Valentinyi, "Sectoral Technology and Structural Transformation," *American Economic Journal – Macroeconomics*, 2015, *7*, 1–31.

——**, Richard Rogerson, and Ákos Valentinyi**, "Two Perspectives on Preferences and Structural Transformation," *American Economic Review*, 2013, *103*, 2752–2789.

——**,** ——**, and** ——, "Growth and Structural Transformation," in Philippe Aghion and Steven N. Durlauf, eds., *Handbook of Economic Growth*, Vol. 2, Elsevier, 2014, pp. 855–941.

House, Christopher, John Laitner, and Dmitriy Stolyarov, "Valuing Lost Home Production of Dual Earner Couples," *International Economic Review*, 2008, *49*, 701–736.

Huh, Kyungok and Yoonkyung Yuh, "Values of Household Production in Korea Compared to U.S., Australia, Finland, and Canada: An Analysis from a Cross-National Comparative Perspective," *International Journal of Human Ecology*, 2005, *6*, 61–74.

Juster, F. Thomas and Frank P. Stafford, "The Allocation of Time: Empirical Findings, Behavioral Models, and Problems of Measurement," *Journal of Economic Literature*, 1991, *29*, 471–522.

Kendrick, John W., "Expanding Imputed Values in the National Income and Product Accounts," *Review of Income and Wealth*, 1979, *25*, 349–363.

Kongsamut, Piyabha, Sergio Rebelo, and Danyang Xie, "Beyond Balanced Growth," *Review of Economic Studies*, 2001, *68*, 869–882.

Landefeld, J. Steven, Barbara M. Fraumeni, and Cindy M. Vojtech, "Accounting for Household Production: A Prototype Satellite Account Using the American Time Use Survey," *Review of Income and Wealth*, 2009, *55*, 205–225.

McDaniel, Cara, "Forces Shaping Hours Worked in the OECD, 1960–2004," *American Economic Journal: Macroeconomics*, 2011, *3*, 27–52.

Moro, Alessio, Solmaz Moslehi, and Satoshi Tanaka, "Does Home Production Drive Structural Transformation?," Manuscript, University of Cagliari, Calgiari 2015.

Ngai, L. Rachel and Barbara Petrongolo, "Gender Gaps and the Rise of the Service Economy," Manuscript, London School of Economics 2013.

—— **and Chrisopher A. Pissarides**, "Structural Change in a Multisector Model of Growth," *American Economic Review*, 2007, *97*, 429–443.

—— **and** ——, "Trends in Hours and Economic Growth," *American Economic Journal: Macroeconomics*, 2008, *11*, 239–256.

Olovsson, Conny, "Why do Europeans Work so Little?," *International Economic Review*, 2009, *50*, 39–61.

Ragan, Kelly S., "Taxes and Time Use: Fiscal Policy in a Household Production Model," *American Economic Journal: Macroeconomics*, 2013, *5*, 168–192.

Ramey, Valerie A., "Time Spent in Home Production in the Twentieth–Century United States: New Estimates from Old Data," *Journal of Economic History*, 2009, *69*, 1–47.

Ramey, Valery A. and Neville Francis, "A Century of Work and Leisure," *American Economic Journal: Macroeconomics*, 2009, *1*, 189–224.

Rogerson, Richard, "Structural Transformation and the Deterioration of European Labor Market Outcomes," *Journal of Political Economy*, 2008, *116*, 235–259.

Rupert, Peter, Richard Rogerson, and Randall Wright, "Estimating Substitution Elasticities in Household Production Models," *Economic Theory*, 1995, *6*, 179–193.

Schreyer, Paul and W. Erwin Diewert, "Household Production, Leisure, and Living Standards," in Dale W. Jorgenson, J. Steven Landefeld, and Paul Schreyer, eds., *Measuring Economic Sustainability and Progress*, Chicago, IL: University of Chicago Press, 2014.

Appendix

Data source

The Tables 9–10 list all countries for which we have information on household production time. For each country, the tables report (i) the year with the time use information, (ii) whether or not we use microdata to compute household production time, (iii) the data source and (iv) [for the web–sources] the access date.

Table 9: Datasource for information on time use

Country	Year	Data source and date of access
Albania	2010	Republic of Albania, Institute of Statistics: *Time Use Survey, 2010–2011*. Available at: www.instat.gov.al/media/171100/albanian_time_use_survey_2010-2011.pdf. Accessed: 10/2/2014.
Algeria	2012	Office National des Statistiques: *Enquete sur l'emploi du temps enet Algerie 2012*. Available at: www.ons.dz/IMG/pdf/RAPPORT_ENET_2012_FRAN_2_.pdf. Accessed: 9/15/2014.
Australia	1974*	Australian Data Archive: *Australians' Use of Time, Albury–Wodonga and Melbourne, 1974*.
	1992	Australian Bureau of Statistics: *How Australians Use Their Time, 1992*. Available at: www.ausstats.abs.gov.au/ausstats/free.nsf/0/20B53461F3AA25F2CA2572250004957 6/$File/41530_1992.pdf. Accessed: 9/9/2014.
	1997	Australian Bureau of Statistics: *How Australians Use Their Time, 1997*. Available at: www.ausstats.abs.gov.au/Ausstats/subscriber.nsf/0/CA25687100069892CA256889001D5545/$File/41530_1997.pdf. Accessed: 9/9/2014.
	2006	Australian Bureau of Statistics: *How Australians Use Their Time, 2006*. Available at: www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/4153.02006?OpenDocument. Accessed: 9/9/2014.
Austria	1981, 1992	Österreichisches Statistisches Zentralamt: *Zeitverwendung 1992/1981*. Available at: http://www.statistik.at/web_de/static/zeitverwendung_19921981_--_ergebnisse_des_mikrozensus__069150.pdf. Accessed: 8/21/2014.
	2008*	STATISTIK AUSTRIA: *Zeitverwendungserhebung 2008/09* (erstellt im Auftrag der Bundesministerin für Frauen und Öffentlichen Dienst).
Bangladesh	2012*	Bangladesh Bureau of Statistics: *Time Use Pilot Survey 2012*
Basque Country	1992*, 1997*, 2002*, 2008*	Centre for Time Use Research: Multinational Time Use Studies
Canada	1971*, 1981	Centre for Time Use Research: Multinational Time Use Studies
	1986*, 1992*, 1998*, 2005*, 2010*	Statistics Canada: *General Social Survey, Cycle 2,7,12,19,24*. This analysis is based on the Statistics Canada *General Social Survey, Time Use Cycle 2, 7, 12, 19, 24. Reference Year: 1986, 1992, 1998, 2005, 2010*. All computations, use and interpretation of these data are entirely that of Georg Duernecker.
Colombia	2012*	Departamento Administrativo Nacional de Estadstica: *Encuesta Nacional de Uso del Tiempo – ENUT–2012 – 2013*.
Denmark	1964*	Danish Data Archives: *Danish National Study of Leisure 1964*.
	1975*	Danish Data Archives: *Fritidsundersøgelsen 1975*.
	1987*	Danish Data Archives: *Befolkningens tidsanvendelse 1987*.
	2001*	SFI – The Danish National Centre for Social Research: *The Danish Time Use Survey*.
Ecuador	2012*	Instituto Nacional de Estadistica y Censos: *Encuesta Especfica de Uso del Tiempo, EUT 2012*.
Estonia	2000, 2010	Statistics Estonia. Available at: http://pub.stat.ee/px-web.2001/I_Databas/Social_Life/17TIME_USE/17TIME_USE.asp. Accessed: 10/1/2014.
Finland	1979	Printed report provided by Statistics Finland.
	1987, 1999, 2009	Statistics Finland: *Time Use Survey*. Available at: http://193.166.171.75/Database/StatFin/eli/akay/akay_en.asp. Accessed: 9/4/2014.
France	1965*, 1974*, 1998*	Centre for Time Use Research: Multinational Time Use Studies
	1985	*Les Rythmes Quotidiens en France; Résultats de l'enquête "Emplois du temps" 1985–1986*. Available at: Bibliothéque de l'Insee, 18 Boulevard Adolphe Pinard, 75014 Paris, France.
	2010	*Enquête Emploi du temps 2009–2010*. Available at: http://www.insee.fr/fr/publications-et-services/irweb.asp?id=edt2010. Accessed: 8/20/2014.
Germany	1965*, 1991*, 2001*	Centre for Time Use Research: Multinational Time Use Studies
Hungary	2010*	Hungarian Central Statistical Office: *Time survey 2010*
India	1998*	Ministry of Statistics & Programme Implementation: *Time Use Survey for India, 1998*
Iraq	2007*	*Iraq Household Socio–Economic Survey 2007*
Italy	1979*, 1989*	Centre for Time Use Research: Multinational Time Use Studies
	2002*, 2009*	ISTAT *Uso del tempo 2002/03* and *Uso del tempo 2008/09*
Japan	1976, 1981, 1986, 1991	Statistics Japan: *Survey on Time Use and Leisure Activities*. Available at: http://www.stat.go.jp/english/data/shakai/2001/jikei.htm. Accessed: 8/19/2014.
	1996, 2001, 2006, 2011	Statistics Japan: *Survey on Time Use and Leisure Activities*. Available at: http://www.stat.go.jp/english/data/shakai/index.htm. Accessed: 8/19/2014
Korea	1981, 1985, 1990, 1995, 2000, 2005, 2010	Korean Broadcasting System and Institute for Communications Research at Seoul National University.
Macedonia	2009	Republic of Macedonia, State Statistical Office: *Time Use Survey, 2009*. Available at: http://www.stat.gov.mk/Publikacii/2.4.11.01.pdf. Accessed: 10/2/2014.
Mexico	2002*, 2009*	INEGI: *Encuesta Nacional sobre Uso del Tiempo 2002* and *Encuesta Nacional sobre Uso del Tiempo 2009*.
Netherlands	1975*, 1980*, 1985*, 1990*, 1995*, 2000*, 2005*	Centre for Time Use Research: Multinational Time Use Studies

The years with a * are those for which we use micro time–use data to compute the household production time. For the years without a *, we do not have access to microdata and we use instead pre–aggregated data that is obtained from the source listed in the respective entry.

Table 10: Datasource for information on time use, cont'd

Country	Year	Data source and date of access
New Zealand	1998, 2009	Statistics New Zealand: *Time Use Surveys 1999 and 2009/10*. Available at: http://www.stats.govt.nz/browse_for_stats/people_and_communities/time_use.aspx. Accessed: 9/2/2014
Norway	1970, 1980, 1990, 2000, 2010	Statistics Norway. Available at: http://www.ssb.no/tidsbruk/ and https://www.ssb.no/statistikkbanken/selecttable/hovedtabellHjem.asp?KortNavnWeb=tidsbruk&CMSSubjectArea=kultur-og-fritid&PLanguage=1&checked=true. Accessed: 9/2/2014.
Panama	2011	Instituto Nacional de Estadistica y Censo: *La Encuesta de Uso del Tiempo*. Available at: http://www.contraloria.gob.pa/inec/publicaciones/Publicaciones.aspx?ID_SUBCATEGORIA=63&ID_PUBLICACION=515&ID_IDIOMA=1. Accessed: 7/29/2015.
Poland	2003*	Central Statistical Office: *Time Use Survey 2003–2004*.
Russia	1993*-1996*, 1998*, 2006*-2009*	*Russia Longitudinal Monitoring Survey – Higher School of Education*. We thank the Russia Longitudinal Monitoring survey, RLMS-HSE, conducted by the National Research University Higher School of Economics and ZAO "Demoscope" together with Carolina Population Center, University of North Carolina at Chapel Hill and the Institute of Sociology RAS for making these data available.
Slovenia	2000*	Statistical Office of the Republic of Slovenia: *Time use Survey 2001*.
South Africa	2000*, 2010*	Statistics South Africa: *Time Use Survey 2000* and *Time Use Survey 2010*.
Spain	2003*, 2009*	Istituto Nacional de Estadística: *Encuesta de Empleo del Tiempo 2002–2003*. Available at: http://www.ine.es/en/prodyser/micro_emptiem_en.htm. Accessed: 9/2/2014.
Sweden	1984*	Swedish National Data Service: *HUS 1984*.
	1990	Statistics Sweden. Available at: http://www.scb.se/statistik/_publikationer/LE0103_1990I91_BR_LE79SA9201.pdf. Accessed: 9/15/2014.
	2000	Statistics Sweden. Available at: http://www.scb.se/statistik/le/le0103/2003m00/le99sa0301.pdf. Accessed: 9/15/2014.
	2010	Statistics Sweden. Available at: http://www.scb.se/statistik/_publikationer/LE0103_2010A01_BR_LE123BR1201.pdf. Accessed: 9/15/2014.
Taiwan	1987*, 1990*, 1994*	Directorate–General of Budget,Accounting and Statistics,Central Taiwan Division: *Time Utilization Surveys 1987, 1990, 1994*.
U.K.	1961*, 1974*, 1983*, 1987*, 1995*, 2000*, 2005*	Centre for Time Use Research: Multinational Time Use Studies
Uruguay	2007*	Instituto National de Estadistica: *Encuesta continua de hogares, Uso del tiempo y trabajo no remunerado*.
U.S.	1965*, 1975*, 1985*, 1992*, 2003*–2012*	Centre for Time Use Research: American Heritage Time Use Study

The years with a * are those for which we use micro time–use data to compute the household production time. For the years without a *, we do not have access to microdata and we use instead pre–aggregated data that is obtained from the source listed in the respective entry.