Structural Transformation or Marketization? The Role of Household Production in Consumption Expenditure*

Benjamin Bridgman (Bureau of Economic Analysis)

Akos Valentinyi (University of Manchester & Corvinus University Budapest)

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Abstract

Structural transformation, the shift from goods to services in the economy, is a significant economic change, but its underlying causes remain uncertain. Part of the rise in market services reflects a shift away from household production, known as marketization. This paper argues that U.S. structural transformation in consumption expenditures is nearly entirely due to marketization. We construct U.S. household production over the period 1929-2023. We find that services share is constant for nearly 100 years when household production is included. There are income effects *within* services which drive market structural transformation. Low income consumption is concentrated in home services.

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Marketization occurs when market services grow with income, not from purchasing home services from the market.

Keywords: Structural transformation; Household production; Marketization.

JEL Classification: D13, E21, O4.

1 Introduction

Structural transformation, the shift of the economy from goods to services, is a key feature of modern economic growth (Kuznets 1973). Despite a large and expanding literature examining structural transformation, its causes remain unsettled. (See Herrendorf, Rogerson & Valentinyi (2014) and van Neuss (2018) for surveys). Some theories emphasize sectoral differences in technology (Ngai & Pissarides 2007, Acemoglu & Guerrieri 2008) while others emphasize income effects (Kongsamut, Rebelo & Xie 2001, Boppart 2014, Herrendorf, Rogerson & Valentinyi 2021, Alder, Boppart & Muller 2022, Hubmer 2023).

The literature generally examines structural transformation within the market economy, but part of the rise of market services reflects the shift of service production to the market of household production (HP), called marketization (Freeman & Schettkat 2005). Marketization has been found to be quantitatively important in structural transformation as measured by the shift of hours (Ngai & Pissarides 2008, Rogerson 2008), workers (Ngai & Petrongolo 2017), and value added (Bridgman 2016, Moro, Moslehi & Tanaka 2017). Since marketization is quantitatively large, the underlying forces driving structural transformation could be different once we account for household production.

What drives the reallocation of goods and services *expenditure* when we include household production? We use the expenditure concept since it gives a clear interpretation when evaluating income effects. This theory posits that the people demand a different basket of items with increasing income. A consumption item is a basket of different value-added industries. For example, a meal is a combination of value added from several industries: raw food items from agriculture, cooking services, and so on. While preferences can be represented over value added, they will represent a combination of wants (e.g. eating) and input-output structure that creates the products that satisfy those wants. (See Herrendorf, Rogerson & Valentinyi (2013) for a discussion.) For similar reasons, expenditure also is the natural concept for examining

marketization decisions, such as the decision to substitute home meals with restaurant meals. Since the value of the restaurant meal includes value of ingredients in the meal, we need to include the value of ingredients in the home meal as well.

To answer our question, we estimate U.S. expenditure on household production services from 1929 to 2023. We modify Personal Consumption Expenditures (PCE) to include household production and examine services share for the U.S. We then examine how preference estimation changes with the inclusion of HP. We estimate a standard multisector model to test how important income effects are in driving structural transformation from goods to services and from home to market services.

We find that marketization of household production has central role in explaining expenditure structural transformation. U.S. PCE services share is nearly constant from 1929 to 2023 when household production included. This is a significant difference from market PCE services share, which shows a 30pp rise over that period. Therefore, there is very little change in PCE services share over a nearly 100 year period, when incomes grew significantly.

The results are driven by two forces. Putting household production on an expenditure basis shifts home goods purchases inputs into services production. Food is treated as a material input into meal preparation services in the expenditure method. Food is a significant share of consumption and a major portion of goods PCE. This force significantly reduces the level of goods consumption. Also, a lot services are missed by excluding household production value added. All household production value added produces services, so increases services share regardless of what concept is used to measure consumption (expenditure or value added). Using the value added concept, there is a 10pp increase in services share between 1929 and 2021 with household production versus a 25pp increase without. Both of these forces are strongest at lower levels of income.

Since including household production largely eliminates the shift of goods to services,

income effects are not need to explain sectoral shares in expanded PCE. We estimate a standard structural transformation model with preferences that can include Stone-Geary constants to generate income effects. When household production is included, the model rejects income effects. The Stone-Geary constant is insignificant and worsens model fit. This contrasts with the case without household production, where income effects significantly improve the fit of the model.

The paradox of income effects existing in market consumption but not expanded consumption is resolved by the presence of income effects *within* expanded services. Household production services are dominated by "necessity services," basic services that sustain life, such as cooking and child care. Output is concentrated in these services until incomes are high enough that the subsistence requirement no longer binds and services consumption shifts to services that are mostly provided by market producers. When examining only market consumption, this income effect looks like an income effect in goods.

Our results have important implications for the growth process. A concern is that resources are being reallocated from high productivity goods to low productivity services, making the economy subject to Baumol's cost disease. We find that the U.S. economy has been shifting from low productivity home services to more dynamic market services, weakening the cost disease dynamic. The omission of household production from the standard accounts hides this change.

The paper proceeds as follows. Section 2 describes the data and presents the empirical results. Section 3 discusses the theoretical implications of the facts. Section 4 concludes.

2 Household Production in Consumption Expenditure

The goal of this paper is compare structural transformation with and without household production services. This section provides the theoretical basis for the estimates and describes how that theory is taken to the data. We then examine structural transformation in PCE when household production is included.

2.1 Theory

We use the method of estimating expenditure on household production developed in Bridgman (2023). This section reports that method.

Preferences are represented by the utility function

$$\sum_{t=0}^{\infty} \beta^t \left\{ \log \left[u(C_{gt}, C_{st}) \right] - v(1 - L_{ht}) \right\} \tag{2.1}$$

where $C_{g,t}$ and $C_{g,t}$ are consumption of goods and services respectively and L_{ht} is household production hours. Services consumption made up of household and market produced services using a consumption aggregator: $C_{st} = u_s(C_{ht}, C_{mt})$.

We are concerned with imputing household production. To simplify the presentation, we do not include materials inputs to market production. In the empirical application, we will use the expenditure basis that does include materials inputs to market production.

The production technologies use capital K_{it}, labor hours L_{it} for $i \in \{g, m, h, x\}$ and

materials inputs Z_{gt}

$$
\begin{aligned}
X_t &= A_{xt} K_{xt}^{\theta} L_{xt}^{1-\theta} \\
C_{gt} + Z_{gt} &= A_{gt} K_{gt}^{\theta} L_{gt}^{1-\theta} \\
C_{mt} &= A_{mt} K_{mt}^{\theta} L_{mt}^{1-\theta} \\
C_{ht} &= A_{ht} \left(K_{ht}^{\theta} (L_{ht} + L_{dt})^{1-\theta} \right)^{\eta} Z_{gt}^{1-\eta}
\end{aligned}
$$

to produce consumption and investment goods X_t. The parameters θ and η are with in the unit interval (0,1). Domestic servants can provide labor hours L_{dt}. For simplicity, we take the convention from Schreyer & Diewert (2014) and exclude domestic servants' consumption from the model.

The law of motion for capital is $K_{t+1} = X_t + (1 - \delta)K_t$. The resource constraints are:

$$
\begin{aligned}
K_t &= \textstyle\sum_{i \in \{x,g,m,h\}} K_{it} \\
1 &= \textstyle\sum_{i \in \{x,g,m,h\}} L_{it} \\
\bar{L}_d &\geq L_{dt}
\end{aligned}
$$

The value of gross household production is:

$$
P_{ht} Y_{ht} = P_{ht} A_{ht} K_{ht}^{\theta\eta} (L_{ht} + L_{dt})^{(1-\theta)\eta} Z_{gt}^{1-\eta} = R_{ht} K_{ht} + W_{ht} L_{ht} + W_{dt} L_{dt} + P_{gt} Z_{gt} \tag{2.2}
$$

We need to measure the home wage W_{ht} and the return to capital R_{ht}. A no-arbitrage condition implies that $R_{ht} - \delta$ must be equal to net return to an alternative market asset. We use household financial returns from the Flow of Funds. The home wage is the wage of domestic servants W_{dt} because L_{ht} and L_{dt} are perfect substitutes.

2.2 Data

This section reports the source data for the estimates. We generally follow the sources used by the Bureau of Economic Analysis's Household Production Satellite Accounts. (The most recent release is Bridgman, Craig & Kanal (2022)). Our estimates cover a longer period. We include additional data to cover the additional years.

Household production hours are estimated using time use surveys. Average home hours per person are from several time use surveys. The Multinational Time Use Study (MTUS) has data for the years 1965, 1975, and 1985. The American Time Use Survey (ATUS) provides annual data for 2003-2023.

For the initial 1929 time use estimate, we use a United States Department of Agriculture study of non-employed women's time use for the years 1924-28. The micro data were collected by Gershuny & Harms (2016). Since the USDA only cover non-employed women (the largest source of HP time), we use 1965 data for the other demographics (men and employed women). Aggregate time use is nearly constant for non-employed women, so we conjecture that the 1965 hours are a reasonable indicator of 1929 hours.

For the missing years, we interpolate using population by gender (male, female) and employment status (employed, not-employed). We calculate the resident noninstitutional population as the sum of the civilian noninstitutional population (16+ years old) and the Resident armed forces from the Census Bureau.

We separate hours into six activities: cooking, housework, gardening, shopping, childcare, domestic travel, and oddjobs. This grouping is from the MTUS, which makes the data comparable across the different surveys. (The ATUS has more activity detail.)

Home wages are the Compensation of private household employees. This is the ratio of compensation of private household employees over full-time equivalent employees (assuming full time is 2080 hours a year).

Home capital and depreciation is net stock and depreciation of consumer durables related to household production from BEA Fixed Assets Tables. These are household items and appliances plus half of the stock of automobiles. This apportionment is due to Landefeld, Fraumeni & Vojtech (2009), who assume half of domestic travel is in support of household production.

Return on assets is the ratio of Personal income receipts on assets from BEA and Financial assets held of household excluding proprietors' equity in non-corporate business from flow-of-funds accounts of the Board of Governors of the Federal Reserve System.

Following Bridgman (2023), material input in household production is three items in PCE: Food purchased for off-premises consumption, Household supplies, and half of motor vehicle fuels, lubricants, and fluids. Again, we assume that half of domestic travel is household production related.

2.3 Services Share of PCE

This section compares structural transformation within PCE when we include household production to the standard market measure.

Figure 1 reports U.S. PCE services share with and without household production. The most striking fact is that services share is constant for nearly 100 years! This implies all of the market structural transformation is due to marketization. In contrast, there is a 30 percentage point increase without household production.

Including household production causes PCE to be dominated by services at 80 percent of expenditure. While the market economy was heavily skewed to goods consumption early on, total consumption was not. The finding that low income economies are dominated by goods consumption is a consequence of only looking at market production.

Why are the results so different when household production is included? There are two

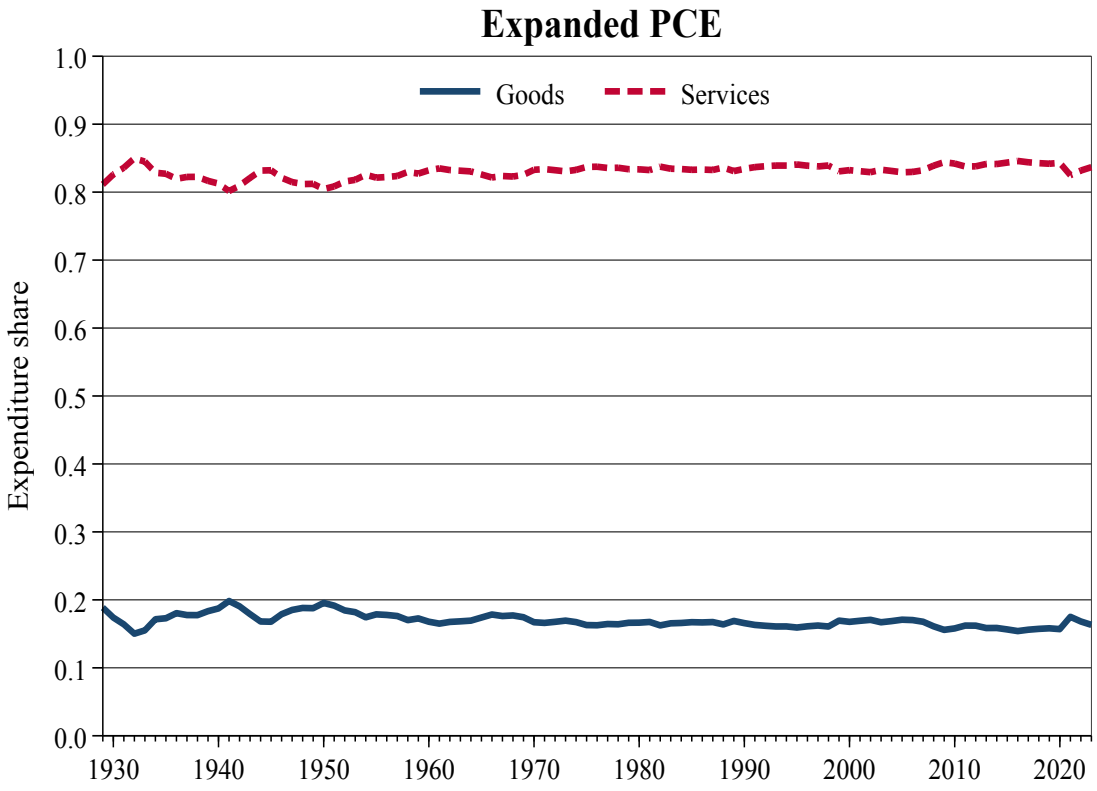


Figure 1: US Personal Consumption Expenditure, with and without home production 1929-2022

effects. Putting household production on an expenditure basis shifts food purchased by the household from a good to service. Again, food is an important component of consumption early on. It was about a quarter of total PCE in the 1930s. As consumption has shifted to the market, this share has declined to less than 10 percent.

The other force is that omitting household production omits a lot of services. Since the household sector only makes services, adding it increases services share. Household production is particularly important early on.

This exercise examines structural transformation within consumption, excluding in-

vestment expenditures. Since we include the capital services of consumer durables in household production, expenditure on durables represent investment. Excluding consumer durables does not change the basic results. Services share remains constant but at a higher level, at 85 percent share rather than 80 percent. The share of durables expenditure in PCE is flat so omitting them just represents a level shift.

3 Implications for Theories of Structural Transformation

We use the facts developed above to examine the implications of marketization of consumption on the what forces account for structural transformation. We estimate Stone–Geary Constant Elasticity of Substitution (CES) preferences on final expenditures and value added both with and without imputed home production. We find that including household production eliminates the need for non-homothetic preferences.

3.1 Preference Estimation

We estimate preferences with and without household production, splitting consumption into goods C_{gt} and services C_{st} using the data developed above.

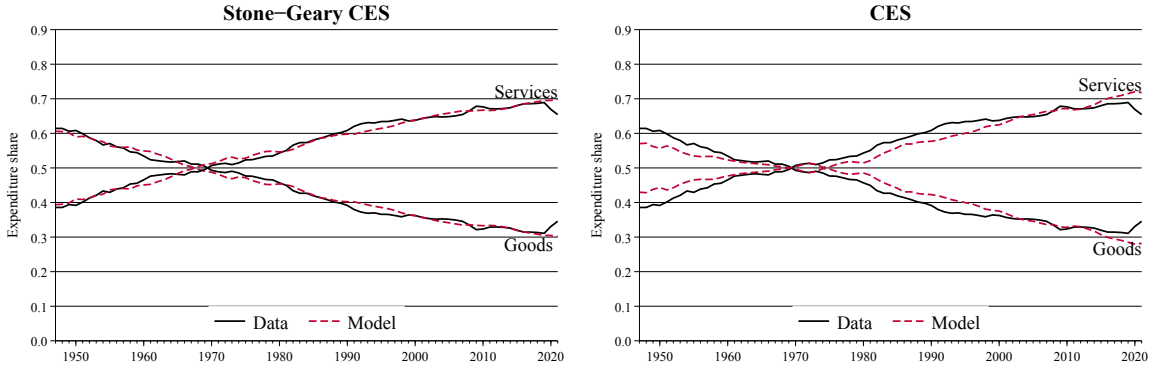
The Stone–Geary CES has the form

$$C_t = \left(\omega_g^{\frac{1}{\varepsilon}} C_{gt}^{\frac{\varepsilon-1}{\varepsilon}} + (1-\omega_g)^{\frac{1}{\varepsilon}} (C_{st} + \bar{C}_s)^{\frac{\varepsilon-1}{\varepsilon}} \right)^{\frac{\varepsilon}{\varepsilon-1}}, \tag{3.1}$$

We estimate these preferences with and without the Stone-Geary term $\bar{C}_s$. The predicted consumption shares are reported in Figure 2. (Due to data constaints, we begin the estimation in 1947.) The regression results are reported in Table 1.

Figure 2: Personal consumption expenditure share

home production excluded



home production included

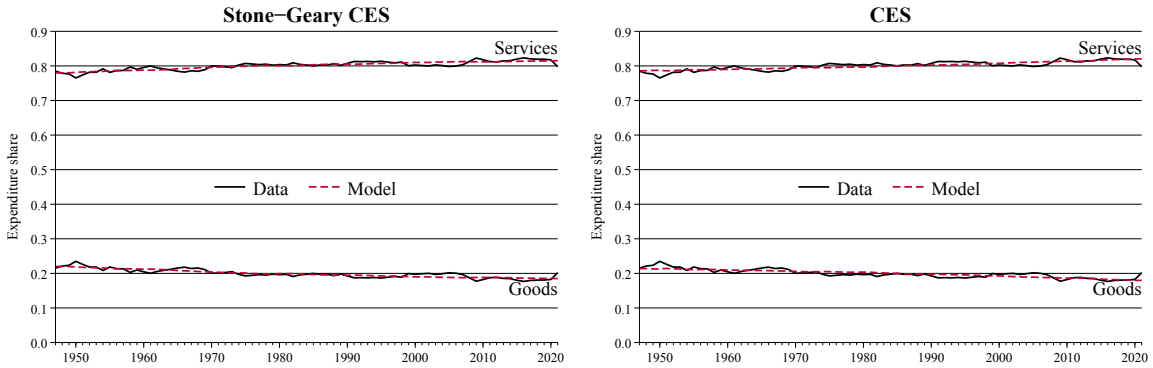


Table 1: Personal consumption expenditure shares

	PCE		Expanded PCE	
	(1)	(2)	(3)	(4)
σ	0.147	0.022	0.912	0.915
	{0.002}	{.}	{0.000}	{0.000}
$\bar{C}_s$	1886.5		−115.25	
	{0.000}		{0.926}	
ω_g	0.285	0.304	0.160	0.159
	{0.000}	{0.000}	{0.000}	{0.000}
ω_s	0.715	0.696	0.840	0.841
	{0.000}	{0.000}	{0.000}	{0.000}
AIC	−458.112	−407.183	−650.873	−652.854

$p-$values in braces.

When household production is included, income effects are not needed. The Stone-Geary constant is not statistically significant and the model fit is a bit worse, as measured with the Akaike information criteria (AIC). The predicted paths are very close to the data both with and without the Stone-Geary term. The model with homothetic preferences does very well at capturing the data. This confirms statistically what one would expect given the very flat expenditure shares for expanded PCE reported in Figure 1. With little structural transformation to explain, we do not need income effects.

The picture is very different within market PCE. In that case, homothetic preferences miss a lot of structural transformation that the non-homothetic model does capture. The Stone-Geary constant is statistically significant and the model fit is improved. The predicted paths are worse without the Stone-Geary term.

There is a lot of sectoral reallocation to explain. Prices alone fail since the relative price of market services to goods is increasing. Preferences have to be very inelastic to price to keep consumption from shifting to relatively cheap goods. In contrast, non-homothetic preferences do a good job in matching the reallocation. Falling relative goods prices mean the subsistence

demand for goods is easier to satisfy and demand shifts to services.

These results have implications for interpretation of income effects. A recent line of inquiry in the structural transformation literature has emphasized non-homothetic preferences in generating income effects, including Boppart (2014), Alder et al. (2022), and Marto (2022). The results suggest that income effects reflects marketization. This supports the Kongsamut et al. (2001) speculation that services non-homotheticity they use is due to non-market consumption. Of course, household production data are often missing. This suggests a role for non-homothetic preferences for goods in such cases, but the interpretation changes. The non-homotheticity is a way of building in marketization.

The same data can be represented using a value-added concept. Given that much prior work has used this concept, we re-do the expenditure preference estimates using value added for completeness. (We prefer the expenditure concept in this application.) As discussed above, the interpretation of preferences is different. The input-output linkages that are incorporated in the value of expenditure are now included in the preference relations.

The value-added results are quite similar to those using expenditure. The model predictions do poorly without the Stone-Geary term when household production is excluded. They are nearly the same with household production. This also holds for a three sector version of the model, with agriculture, manufacturing, and services. A full treatment is available in Appendix A

3.2 Income Effects within Services Drive Structural Transformation

Our results present a paradox. There are or are not income effects depending on how consumption is measured. They exist within market consumption, but not within expanded consumption. This paradox is resolved by the presence of income effects *within* expanded services.

We estimate a three product version of the model with goods, home and market ser-

vices, reported in Equation 3.2. Home services C_{ht} are household production plus imputed rent for owner occupied dwellings. Market services C_{mt} are all remaining services. This system allows for non-homothetic preferences across aggregate services and goods consumption as well as within the services aggregator C_{st}. The non-homethetic preferences are implemented using the Stone-Geary constants $\bar{C}_s$ and $\bar{C}_m$ respectively.

$$u(C_{gt}, C_{st}) \equiv C_t = \left(\omega_g^{\frac{1}{\sigma_c}} C_{gt}^{\frac{\sigma_c - 1}{\sigma_c}} + (1 - \omega_g)^{\frac{1}{\sigma_c}} (C_{st} + \bar{C}_s)^{\frac{\sigma_c - 1}{\sigma_c}} \right)^{\frac{\sigma_c}{\sigma_c - 1}} \tag{3.2}$$

$$u^s(C_{ht}, C_{mt}) \equiv C_{st} = \left(\omega_h^{\frac{1}{\sigma_s}} C_{ht}^{\frac{\sigma_s - 1}{\sigma_s}} + (1 - \omega_n)^{\frac{1}{\sigma_s}} (C_{mt} + \bar{C}_m)^{\frac{\sigma_s - 1}{\sigma_s}} \right)^{\frac{\sigma_s}{\sigma_s - 1}} \tag{3.3}$$

This system generates the expenditure shares reported in Equation array 3.4. Since these expenditure shares sum up to one, the error covariance matrix is singular. Therefore, we drop the goods demand function and estimate the services demand.

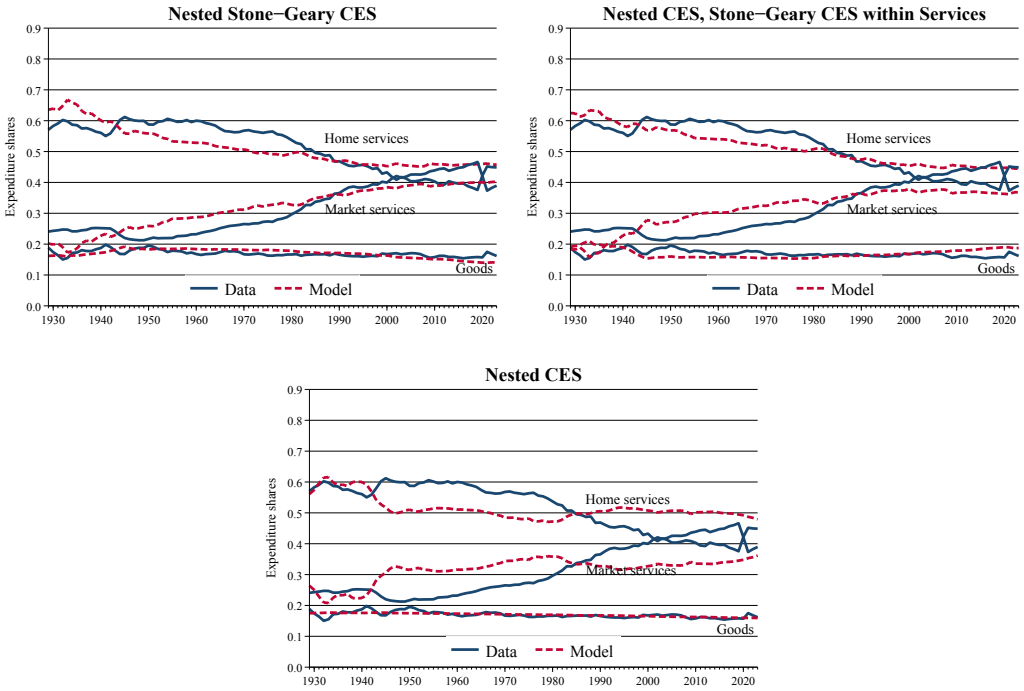
$$\frac{P_{gt} C_{gt}}{E_t} = \frac{\alpha_s P_{st}^{1-\sigma_c}}{\alpha_g P_{gt}^{1-\sigma_c} + \alpha_s P_{st}^{1-\sigma_c}} \left(1 + \frac{P_{st} \bar{C}_s + P_{mt} \bar{C}_m}{E_t} \right) \tag{3.4a}$$

$$\frac{P_{mt} C_{mt}}{E_{st}} = \frac{\alpha_m P_{mt}^{1-\sigma_s}}{\alpha_h P_{ht}^{1-\sigma_s} + \alpha_m P_{mt}^{1-\sigma_s}} \left(1 + \frac{P_{mt} \bar{C}_m}{E_{st}} \right) - \frac{P_{mt} \bar{C}_m}{E_{st}} \tag{3.4b}$$

$$\frac{P_{ht} C_{ht}}{E_{st}} = \frac{\alpha_h P_{ht}^{1-\sigma_s}}{\alpha_h P_{ht}^{1-\sigma_s} + \alpha_m P_{mt}^{1-\sigma_s}} \left(1 + \frac{P_{mt} \bar{C}_m}{E_{st}} \right) \tag{3.4c}$$

Figure 3 reports the model's predictions under three versions of these preferences. The first is the full model, with both Stone-Geary terms included. The second only includes the Stone-Geary term within the services aggregator ($\bar{C}_s = 0$). The third is homothetic ($\bar{C}_s = \bar{C}_m = 0$).

Figure 3: Expanded personal consumption expenditure shares



The estimated parameters, reported in Table 2, show that home and market services are substitutes with a strong income effect. The services non-homothetic terms do a good job of capturing the shift within services. Without them, there is no structural change at all.

Goods and composite services are subject to weak income effects, though the model still does a reasonable job when these effects are omitted. The elasticities change significantly, shifting from goods and composite services being complement to substitutes. The AIC substantially prefers the model with both income effects.

We interpret these results as home services being dominated by "necessity services," basic services that sustain life, such as housing, meals and child care. Output is concentrated in these services until incomes are high enough that the subsistence requirement no longer binds and services consumption shifts "luxury" services that are provided by market producers. When examining only market consumption, this income effect looks like an income effect in goods.

Technology-based theories have difficulty capturing this change. The price ratios of market to household production products are relatively flat, limiting their ability to generate large shifts in expenditure shares. The estimated market-HP service elasticity is very high when the Stone-Geary constants are omitted (Table 2, column 3). In this case, we should find that lowering the cost of producing household services should increase its demand. The evidence shows the opposite. Technological change in household production, such as electric appliances, do not increase demand for those services. The automation of subsistence services shifts resources to other services. Dinkelman (2011) finds that electrification, which allows for automation of some HP services, shifted labor out of the household in South Africa. Federov (2025) finds that U.S. demand for domestic help falls with electrification. The treatment of appliances in Greenwood, Seshadri & Yorukoglu (2005) features income effects through a satiation point for HP services.

Table 2: Expanded Personal consumption expenditure shares

	Expanded PCE		
	(1)	(2)	(3)
σ_c	0.590	1.323	0.925
	{0.000}	{0.000}	{0.000}
σ_s	0.0	0.0	3.060
	{·}	{·}	{0.000}
$\bar{C}_s$	−27853.2		
	{0.000}		
$\bar{C}_m$	19464.9	17170.06	
	{0.000}	{0.000}	
ω_g	0.171	0.140	0.161
	{0.000}	{0.000}	{0.000}
ω_s	0.829	0.860	0.839
	{0.000}	{0.000}	{0.000}
ω_h	0.368	0.388	0.659
	{0.000}	{0.000}	{0.000}
ω_m	0.632	0.612	0.341
	{0.000}	{0.000}	{0.000}
AIC	−953.070	−894.021	−868.344

$p-$values in braces.

Looking at the mix of services provides additional evidence that income effects are the primary force. Marketization is due to increasing consumption of market services, not simply substituting HP for market services, or "narrow marketization." At low incomes, people consume the goods and services required to sustain life. Once these basics are covered, people can consume other (mostly market) services. On the other hand, narrow marketization suggests a technological reason: the productivity of market sources of HP-type services improve and people purchase those services from the market.

Figure 4 shows that there is little narrow marketization in U.S. data. The HP services cooking and housework fall as a share of expanded PCE, but they are not replaced by market food and cleaning services. Market food services share remains flat. Market cleaning services are too small to be broken out separately and are included in "other services." This category shows little change in share. Therefore, we conclude that explaining overall marketization requires a process that generates broad, not narrow, marketization.

A concern is that our results only reflect the impact of food within services. A subsis-

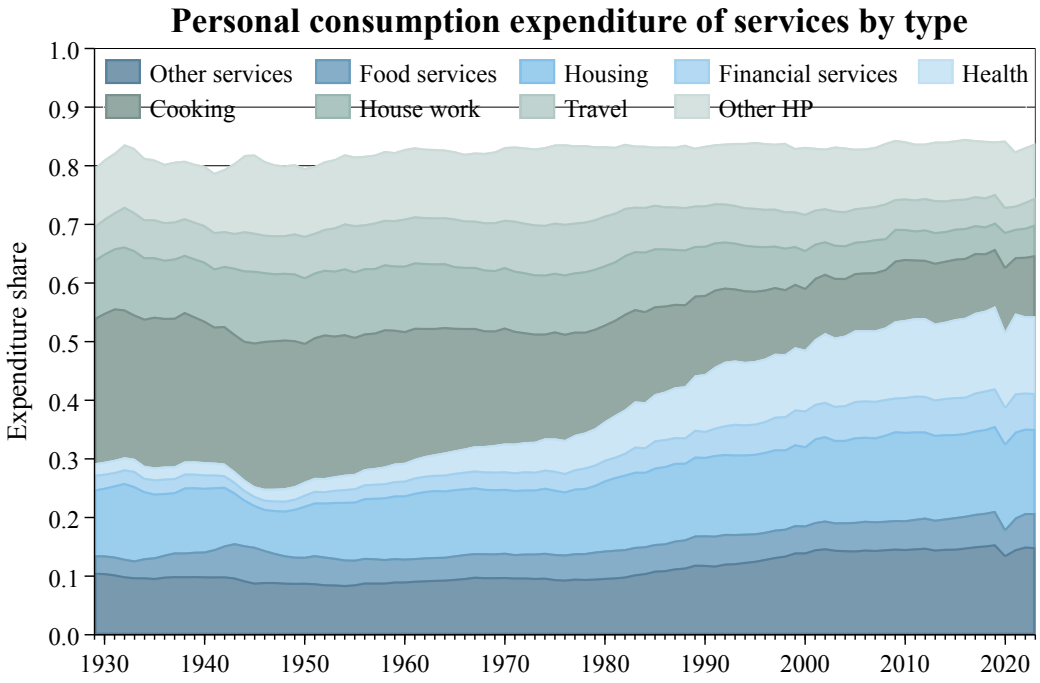


Figure 4: Expanded PCE Service Shares

tence need for food has been suggested as a binding constraint that limits development, called the "food problem" by Schultz (1953). In our framework, food is an input to the HP service meal preparation, so food subsistence is part of the story. Declining shares of agricultural production will show up as falling shares of meal services consumption.

This effect is broader than food. Ngai, Olivetti & Petrongolo (2024) find that women worked in own-account agriculture much more in the 1880s, but still devoted about the same amount of time (about 40 hours a week) to household production as women in 1960. Contemporary low income countries also have significant HP output beyond food. Gottlieb, Doss, Gollin & Poschke (2024) show that very low income countries devote significant resources to non-food production. They find average hours of care work by married women are flat in income per capita, about 10 hours per week. They engage in a further 25 to 30 hours of household production at very low incomes, matching the 40 hours in U.S. historical data.

While many applications of Stone-Geary preferences in the structural transformation literature food (agriculture) is the only non-homothetic consumption item, the original work on such preferences included services. In Richard Stone's article discussing non-homothetic preferences-lending his name to Stone-Geary preferences-he finds British demand for household services and supplies to be non-homothetic along with food (Stone 1954).

It is also notable that market services at low incomes are dominated by home-type services. Figure 4 shows that housing and food services dominate market PCE share early on, when incomes are their lowest. Other services, which includes several home-type services is also important. The use of domestic servants was much more important in that period (Federov 2025). Market dominated finance and health are negligible. This observation is true in cross-country data. Dinkelman & Ngai (2022) find that over half of market work for low income African countries is in HP substitute industries. These data suggest that there is also a "food preparation problem" (along with other HP services) to go along with the food problem.

This need to provide HP services leads to the "time poverty" identified by Vickery (1977).

"Necessity" services are obscured by omitting own-account services from statistics. By System of National Accounts convention, own-account goods production (including food) is market production while own-account services are not. At low levels of development, a lot of production is own-account but only the goods side is captured in the national accounts.

The results provide a new perspective on Baumol's cost disease. A concern is that resources are being reallocated from high productivity goods to low productivity services. We find that the U.S. economy has been shifting from subsistence services to market services with stable goods share. Subsistence services feature relatively low productivity growth (Bridgman 2016, Duernecker & Herrendorf 2018). The market services that are becoming more important are more dynamic. HP-type services have low returns to human capital relative to market services (Bridgman, Duernecker & Herrendorf 2018). There is an expanding literature that has found higher productivity market services are growing faster. See Fang & Herrendorf (2021), Gaggl, Gorry & vom Lehn (2023), Sen (2021), and Duernecker, Herrendorf & Valentinyi (2024). Our finding strengthens this finding by adding additional low productivity services that are declining in relative importance.

The results also provide insight into the process of increasing female labor force participation. Despite economies shifting to areas where women have a comparative advantage, female market work has lagged (Rendall 2018). For example, Feng, Ren & Rendall (2023) finds that women's education attainment is frequently higher than men's, but that does not translate into more market work. This holds despite increasing demand for educated women in the market (Buera & Kaboski 2012, Zhang 2023, Vidart 2023, Uniat 2025). The demand for home services may be a force that tends to allocate women's labor to the home. These services are typically produced by women outside the market. Women do not move to market work until home services are provided. For example, Cardia & Gomme (2018) cite child care

requirements. This can be achieved by technical change in these services (engines of liberation) (Greenwood et al. 2005), public provision of these services (Ragan 2013), or increasing men's provision by changing gender norms (Chiplunkar & Kleineberg 2025).

4 Conclusion

This paper develops structural transformation facts when household production is included in measuring consumption. We find a major role for it. Once household production is included, there is essentially no structural transformation in consumption in 100 years of data. Most structural transformation in market consumption expenditure is marketization of household production. Since there is so little structural change in expanded consumption, income effects are not needed to explain the structural transformation from goods to services. This contrasts with the case when household production is excluded, where income effects significantly improve the fit of the model.

The paradox of income effects existing in market consumption but not expanded consumption is resolved by the presence of income effects *within* expanded services. There are "necessity services," basic services that sustain life, such as housing, meals and child care. We show that output is concentrated in these services until incomes are high enough that the subsistence requirement no longer binds. HP-type services dominate necessity services, so higher incomes lead to marketization. When examining only market consumption, this income effect looks like an income effect in goods.

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Table 3: Personal consumption expenditure share in value added

	Home production			
	excluded		included	
	(1)	(2)	(3)	(4)
σ	0.456***	0.027***	0.533***	0.160***
	(0.051)	(0.006)	(0.036)	(0.023)
$\bar{c}_s$	11258.915***		10392.310***	
	(824.874)		(1616.526)	
ω_g	0.069***	0.064***	0.059***	0.045***
	(0.004)	(0.001)	(0.002)	(0.002)
ω_s	0.931***	0.936***	0.941***	0.955***
	(0.004)	(0.001)	(0.002)	(0.002)
AIC	−475.791	−268.631	−566.605	−506.325

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

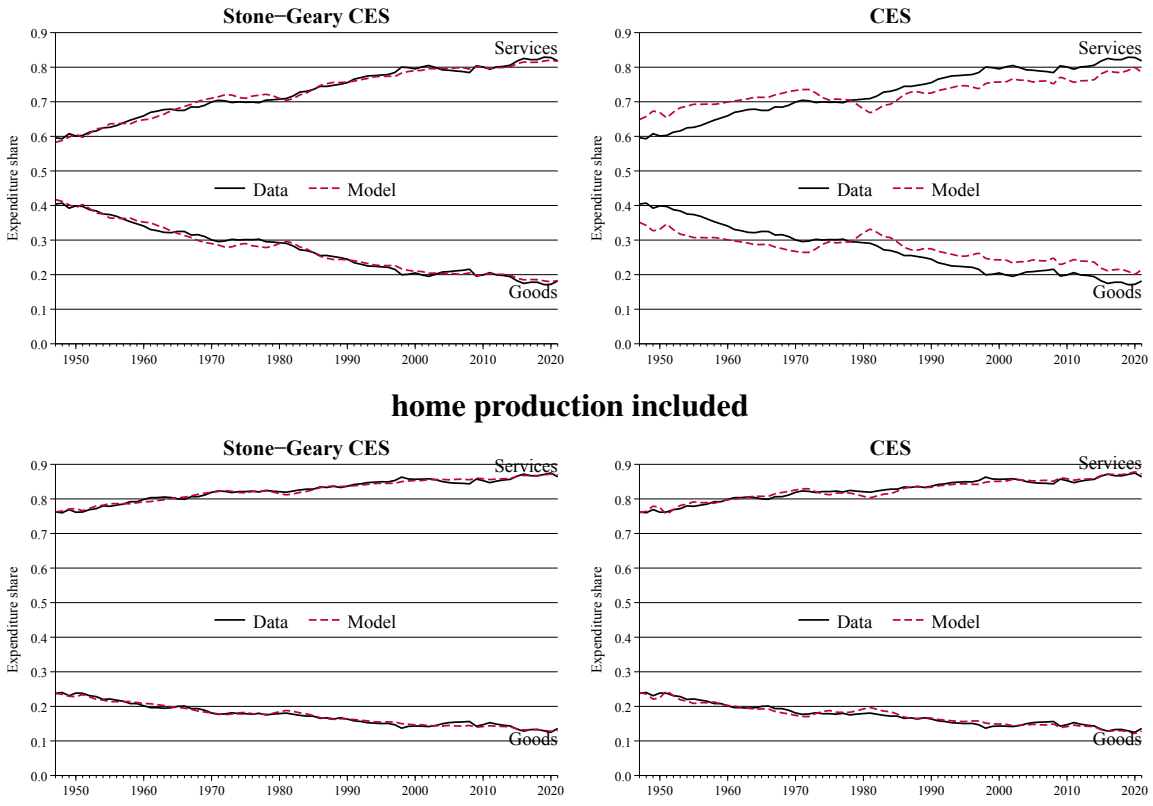
A Value Added Model

This Appendix reports two versions of the model using a value added concept. The first is the goods/services split above. The second is one that is common in the ST literature: Agriculture, Manufacturing, and Services.

A.1 2 Sector Value-Added Model

This section reports the value-added equivalent of the expenditure model. The results are reported in Table 3 and Figure 5. The results are generally similar, though the Stone-Geary constant is now statistically significant. However, the it has little impact on the predictions of the model. The model fit is only slightly better, as measured by the AIC. The predicted series do well with and without that constant.

Figure 5: Personal consumption expenditure share in value added



A.2 Three Sector Value Added Model

This section by examines a version of the value added model with three sectors: Agriculture, Manufacturing, and Services. It is common to make this partition of the data, so allows us to compare our results with the literature.

The Stone–Geary CES for 3-sector value added has the form

$$C_t = \left(\omega_a^{\frac{1}{\varepsilon}} (C_{at} + \bar{C}_a)^{\frac{\varepsilon-1}{\varepsilon}} + \omega_m^{\frac{1}{\varepsilon}} C_{gt}^{\frac{\varepsilon-1}{\varepsilon}} + (1-\omega_a-\omega_m)^{\frac{1}{\varepsilon}} (C_{st} + \bar{C}_s)^{\frac{\varepsilon-1}{\varepsilon}} \right)^{\frac{\varepsilon}{\varepsilon-1}}, \qquad \text{(A.1)}$$

Table 4: Personal consumption expenditure share in value added

	Home production			
	excluded		included	
	(1)	(2)	(3)	(4)
σ	0.499***	0.000	0.684***	0.338***
	(0.040)	(.)	(0.033)	(0.015)
$\bar{c}_a$	−130.637***		−137.529***	
	(5.258)		(4.874)	
$\bar{c}_s$	8296.593***		714.719***	
	(546.610)		(134.293)	
ω_a	0.005***	0.015***	0.007***	0.040***
	(0.000)	(0.001)	(0.001)	(0.002)
ω_m	0.153***	0.225***	0.217***	0.428***
	(0.003)	(0.004)	(0.019)	(0.008)
ω_s	0.842***	0.760***	0.776***	0.532***
	(0.003)	(0.004)	(0.020)	(0.008)
AIC	−1100.005	−769.876	−1262.004	−1078.260

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

The results indicate that home production makes the demand system homothetic even in the 3 sector case. (Moro et al. 2017) find that homothetic demand does not replicate the data well while we do. What accounts for the difference? The lower two graphs in Figure 6 are directly comparable with Figure 2 in (Moro et al. 2017). We aggregated home production to services and found that homothetic demand structure fits the data well. They kept home production and services separate, and found that homothetic demand structure does not fit the data well in this case. Their graph suggests that the two results are consistent with each other. Adding up the home production and service data lines and the corresponding fitted lines, we should get a good overall fit for home production and services together. Thus, there seems to

be a strong non–homotheticity effect in the substitution between home production and market production *within* services.

Figure 6: Personal consumption expenditure share in value added

