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

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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 can be attributed to the transition from household production of services to market production, known as marketization. This paper presents novel findings about the extent of this shift. We construct household production in the United States over the period 1929-2023. When we incorporate household production into consumption expenditure, the natural accounting concept when discussing preferences, we find that the share of services remains constant for nearly 100 years. This contrasts sharply with the 30 percentage point increase in market consumption when household production is excluded. These findings suggest income effects do not account for the long-run trends in a standard model of structural transformation when household production is included. We find income effects within services. Low income consumption is concentrated in "subsistence services" like cooking and child care. Marketization occurs when market services grow with income, not from purchasing subsistence services from the market.

Keywords: Structural transformation; Household production; Marketization.

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JEL Classification: D13, E21, O4.

1 Introduction

Structural transformation, the shift of the economy from goods to services, is a major economic change that has generated enormous interest (See Herrendorf, Rogerson & Valentinyi (2014) and van Neuss (2018) for surveys of this literature). Despite an expanding literature examining this question, its causes remain unsettled. The literature generally examines structural transformation within the market economy. However, part of the rise of market services reflects the shift of service production to the market of household production or 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), employees (Ngai & Petrongolo 2017), and value added (**?**, Moro, Moslehi & Tanaka 2017).

This paper examines structural transformation when we include household production *expenditure*. This allows for direct comparison to Personal Consumption Expenditures (PCE). Consumption expenditure is the natural concept when examining household preferences. For example, this framework allows us to examine 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 similarly include the value of ingredients in the home meal. The structural transformation literature has emphasized preferences recently, particularly income effects in preferences (Boppart 2014, Herrendorf, Rogerson & Valentinyi 2021, Alder, Boppart & Muller 2022, Hubmer 2023).

This paper establishes structural transformation facts when we include household production using an expenditure basis. We modify PCE to include household production and examine services share for the U.S. from 1929 to 2023. We use these data to estimate a standard multisector model to investigate the implications for theories of structural transformation.

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 over 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.

We find that non-homothetic preferences are not required to explain long run structural transformation trends across good and services when household production is included in consumption. We estimate a standard structural transformation model with preferences that can include income effects. When household production is included, the model is able to replicate the trend of structural transformation without income effects. 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 "subsistence 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 subsistence services, so higher incomes lead to marketization. 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 subsistence 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: $C_{st} = u_s(C_{ht}, C_{mt})$.

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 **?** and exclude domestic servants' consumption from the model.

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 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

Household production hours are calculated as follows. We use the same data sources as those used by the Bureau of Economic Analysis's Household Production Satellite Accounts. (The most recent release is Bridgman, Craig & Kanal (2022)).

HP labor 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 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 **?**, 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

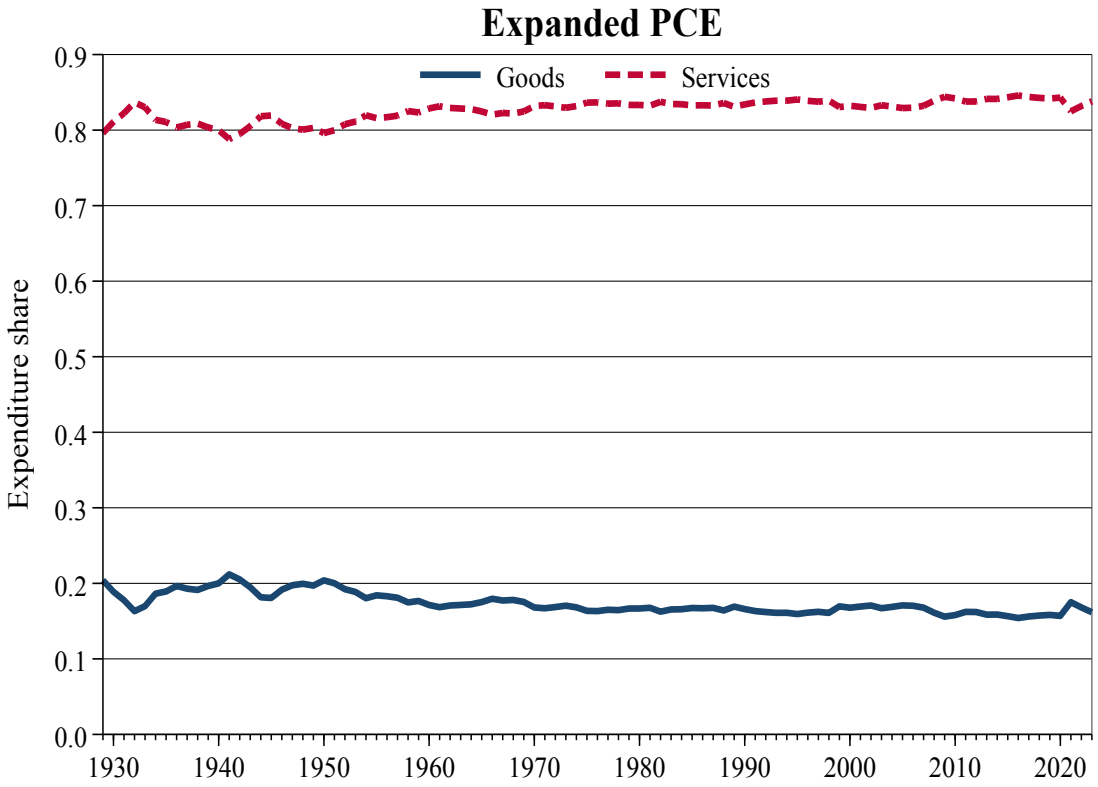


Figure 1: US Personal Consumption Expenditure, with and without home production 1929-2022

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 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 investment 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 ST

We use the facts developed above to examine the implications of marketization of consumption on the what forces account for structural transformation. We estimate the preferences log Stone–Geary CES 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.)

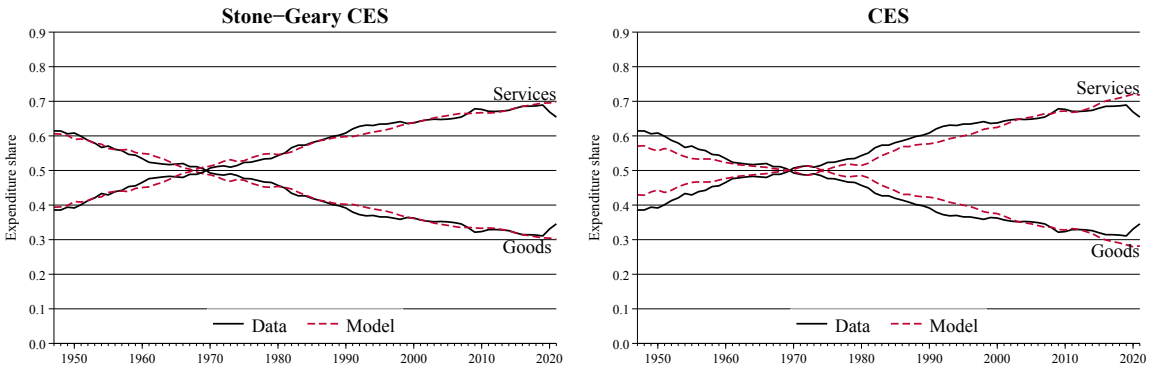
When household production is included, the predicted paths are very close to the data both with and without the Stone-Geary term. The model with homothetic preferences does very well at capturing structural transformation.

This is not true when household production is excluded. In that case, homothetic preferences miss a lot of structural transformation that the non-homothetic model does capture.

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, Rebelo & Xie (2001) speculation that services non-homotheticity they use is 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.

Figure 2: Personal consumption expenditure share

home production excluded



home production included

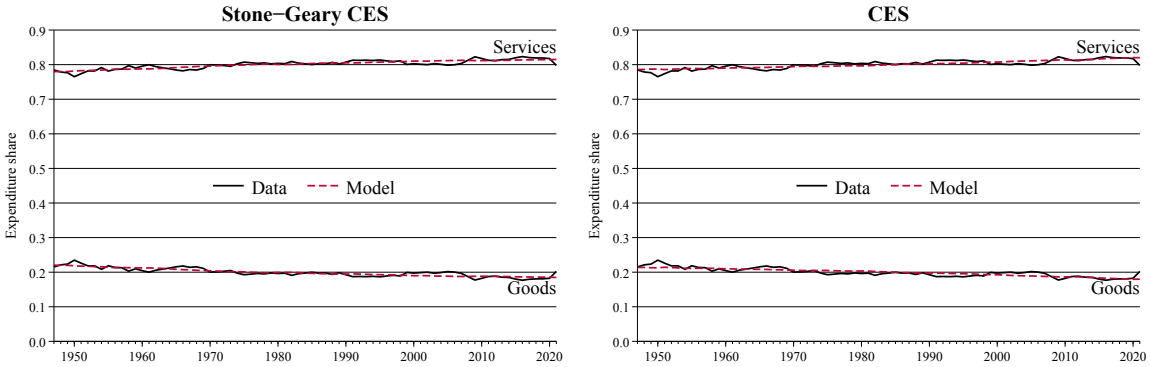


Table 1: Personal consumption expenditure shares

	Home production			
	excluded		included	
	(1)	(2)	(3)	(4)
σ	0.528***	0.037***	0.953***	0.850***
	(0.054)	(0.005)	(0.028)	(0.014)
$\bar{c}_s$	7856.443***		5052.612***	
	(1135.924)		(1475.551)	
ω_g	0.270***	0.348***	0.167***	0.189***
	(0.008)	(0.005)	(0.006)	(0.001)
ω_s	0.730***	0.652***	0.833***	0.811***
	(0.008)	(0.005)	(0.006)	(0.001)
AIC	−438.669	−339.103	−533.231	−519.547

Standard errors in parentheses

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

The regression results are reported in Table 1. The parameter estimations of all four specifications are statistically significant. However, there are differences in terms of fit measured with the Akaike information criteria (AIC). (1) and (2) imply that the preferences over goods and services excluding home production are non–homothetic. The fit of homothetic preferences (CES) in (2) is much worse than the non–homothetic one in (1) as indicated by the large rise in AIC (the lower the AIC is the better is the fit).

The implication of (3) and (4) are different where home production included in services. There is very little difference in terms of AIC between the two specifications with the non-homothetic specification having slightly better AIC. However, the visual inspection of the fit on two graphs suggests that the difference between the two specification not large enough to make any difference in applications.

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. 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. See Herrendorf, Rogerson & Valentinyi (2013) for a

Table 2: 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

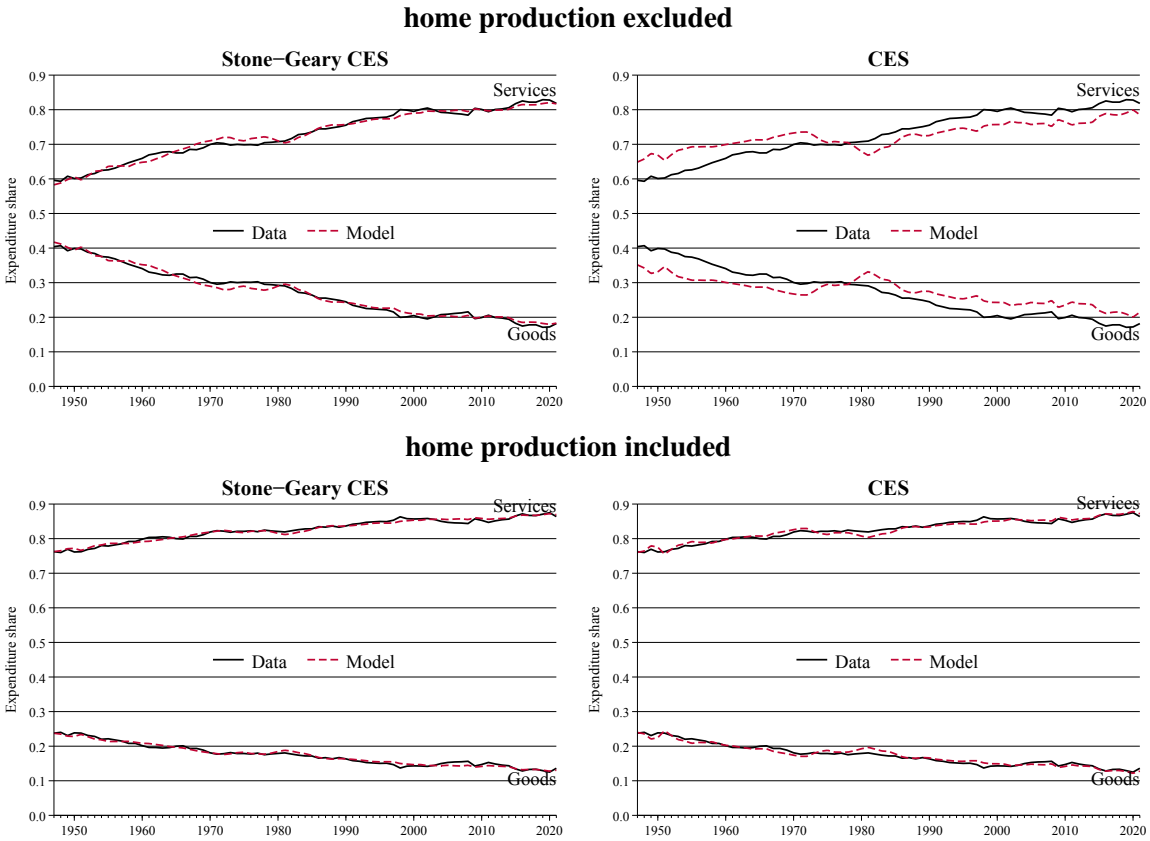
Standard errors in parentheses

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

discussion of the differences.

The value-added results are quite similar to those using expenditure, as reported in Table 2 and Figure 3. The model predictions do poorly without the Stone-Geary term when household production is excluded. They are nearly the same with household production.

Figure 3: Personal consumption expenditure share in value added



We conclude this section by examining 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

$$C_t = \left(\omega_a^{\frac{1}{\varepsilon}} (C_{at} + \bar{C}_a)^{\frac{\varepsilon-1}{\varepsilon}} + \omega_m^{\frac{1}{\varepsilon}} C_{gt}^{\frac{\varepsilon-1}{\varepsilon}} + (1-\omega_a-\omega_m)^{\frac{1}{\varepsilon}} (C_{st} + \bar{C}_s)^{\frac{\varepsilon-1}{\varepsilon}} \right)^{\frac{\varepsilon}{\varepsilon-1}}, \tag{3.2}$$

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

Table 3: Personal consumption expenditure share in value added

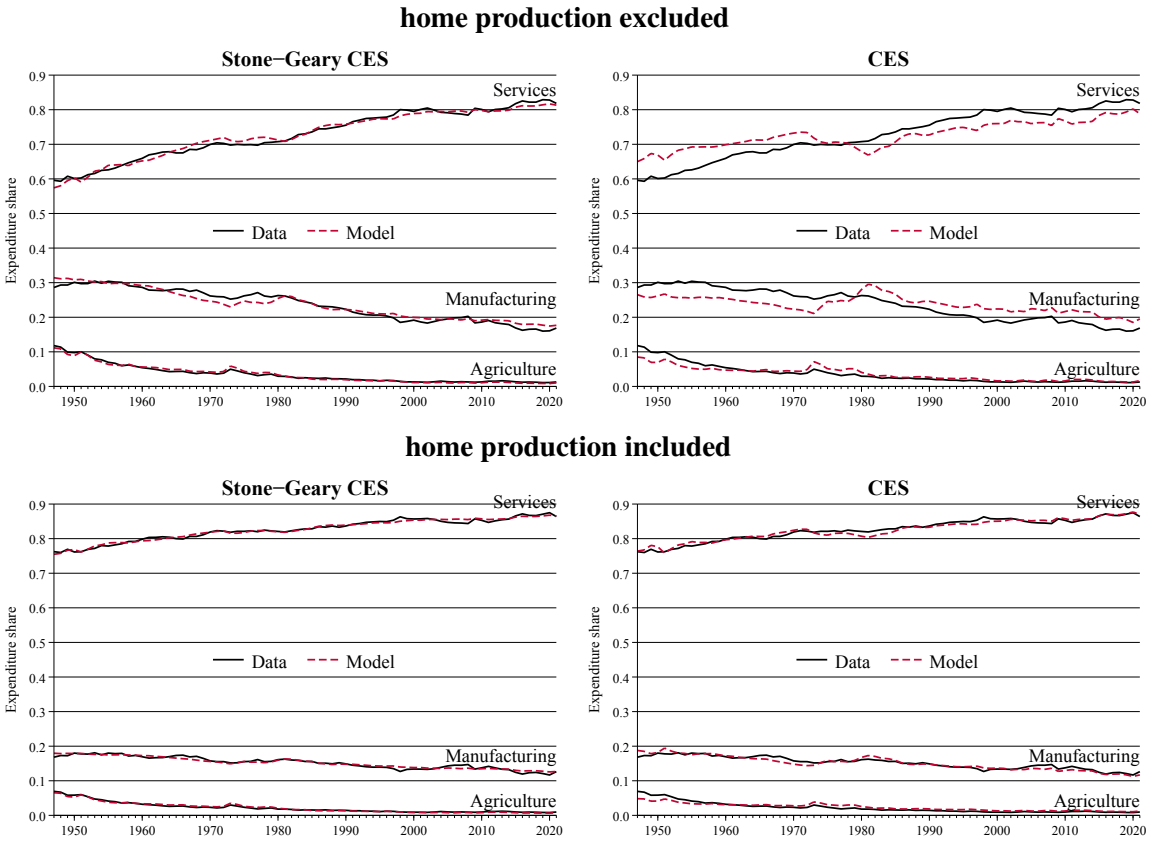
	Home production			
	excluded		included	
	(1)	(2)	(3)	(4)
σ	0.499***	0.000	0.684***	0.338***
	(0.040)	(.)	(0.033)	(0.015)
$\bar{c}_a$	−130.637***		−137.529***	
	(5.258)		(4.874)	
$\bar{c}_s$	8296.593***		714.719***	
	(546.610)		(134.293)	
ω_a	0.005***	0.015***	0.007***	0.040***
	(0.000)	(0.001)	(0.001)	(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

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

do. What accounts for the difference? The lower two graphs in Figure 4 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 4: Personal consumption expenditure share in value added



3.2 What Drives Structural Transformation?

Our results present a paradox. There are or are not income effects depending 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. There are "subsistence 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. HP-type services dominate subsistence services, so higher incomes lead to marketization. When examining only market consumption, this income effect looks like an income effect in goods.

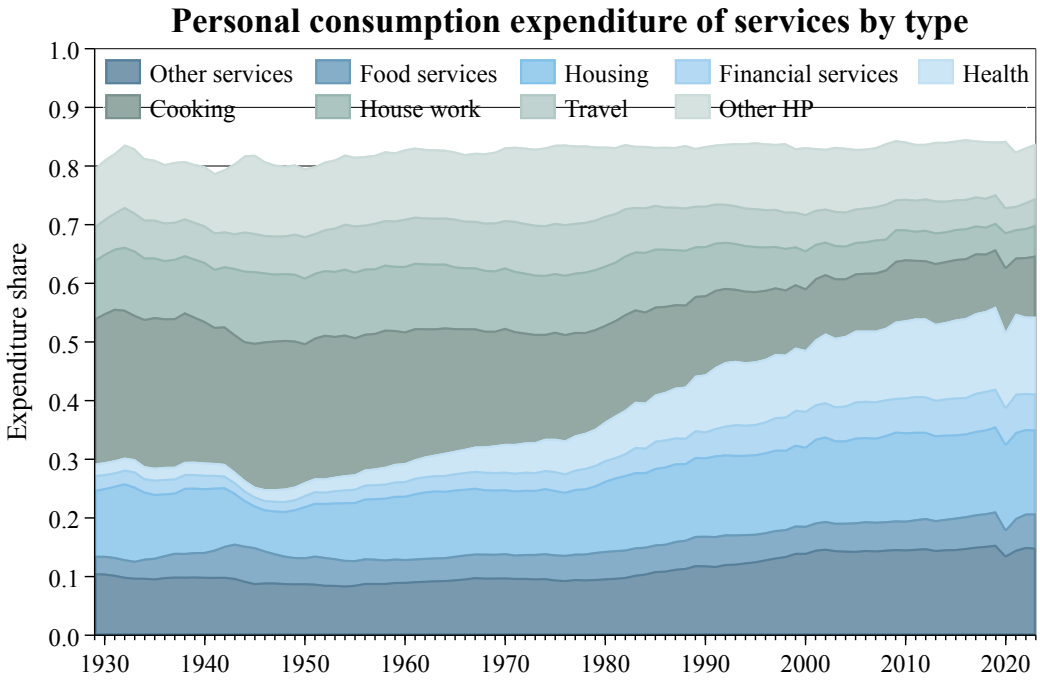


Figure 5: Expanded PCE Service Shares

We begin the analysis by showing that marketization is due to growth in non-HP-type services (broad marketization). Broad marketization suggests that preferences are important. 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, strict marketization suggests a technological reason: the productivity of market sources of HP-type services improve and people purchase those services from the market.

Figure 5 shows that there is little strict 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 strict,

marketization.

A concern is that this only reflects the impact of food within services. 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 subsistence services. Figure 5 shows that housing and food services dominate market PCE share early on, when incomes are their lowest. Other services, which includes several HP-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.

The evidence does not support a primary role for technology. The price ratios of market to household production products are relatively flat. Technological change in household production, such as electric appliances, do not increase demand for those services. Improvements in providing 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. If income effects were not a primary concern, we should find that lowering the cost of producing the good should increase its demand.

Subsistence 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). The demand for subsistence services may be a force that tends to allocate women's labor to the home. Subsistence services are typically produced by women outside the market. Women do not move to market work until the subsistence 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, Seshadri & Yorukoglu 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 HP is included in measuring consumption. We find a major role for household production. Once household production is included, there is essentially no structural transformation in consumption in 100 years of data. Most of what looks like structural transformation is marketization of household production. Since there is so little structural change in expanded consumption, there are no income effects 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 "subsistence 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 subsistence 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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