

STEG Lecture 4

Structural transformation, Home Production, and Labour Markets

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- Structural Transformation is about the changing structure in the economy, in terms of both output and employment shares: decline of agriculture, hump-shape manufacturing and rising services
- Another important production sector is home production, whose output is excluded from GDP and input excluded from employment.
- Today's lecture:
 - What is home production and how is it measured?
 - Home production and structural transformation
 - Implications for aggregate labour market
 - Implications for labour market outcomes by gender
 - Refer to the papers discussed on related literature and proofs.

It consists of those unpaid activities which are carried on, by and for the members, which activities might be replaced by market goods, or paid services, if circumstances such as income, market conditions, and personal inclinations permit the service being delegated to someone outside the household group. (Reid 1934: 11)

- What is home production?
 - Time spent at home that could be done by paid worker (can be marketized)
 - We enjoy the product of home production, not the action
 - In contrast, leisure is time that we enjoy spending
- Home production has been studied extensively in micro and macro, see Gronau 1997 for a survey.

Measurement of home production: time use data

- Leeds (1917) dissertation recorded time use for 60 families in Pennsylvania
- In the U.S., the first “nationwide” survey started from 1965, 1975, 1985 and 1993, the American Time Use Survey of the BLS started in 2003. See Aguiar and Hurst 2007, Ramey and Francis 2009.
- Time use for other countries: Harmonised European Time Use Survey and the Multinational Time Use Survey, time use surveys at national level in many countries
 - International Labor Organization (2018) provides a summary of 64 national time use surveys
 - African Gender and Development Index includes gender gaps in time use for many African countries

Table 1: **Differences in Weekly Hours in Home Production by Housewives**

	U.S. 1920s	U.S. 1965	U.S. 2010	South Africa 2010	Ghana 2009
Total weekly hours	51.7	51.8	43.8	48.0	45.8
Cooking	23.5	16.5	8.6	16.4	24.3
Cleaning	9.6	9.5	7.8	11.1	2.6
Laundry	11.3	6.9	3.3	5.3	2.2
Care of children, adults	3.9	8.5	11.3	6.4	9.6
Household management	3.3	10.5	12.8	8.8	7.2
Household size	4.3	4.1	3.2	4.6	5.2
N. households	559	536	1,661	3,491	1,754

Notes: USA 1920s data are from Ramey (2009). We compute all other columns using national time use survey data. Weekly hours are weighted averages calculated for married women: farm housewives in 1920s, all housewives in 1965, all married women with zero minutes in education and zero minutes in work in Ghana (ages 15-64), the USA (ages 18-59), and South Africa (ages 15-59). Variable definitions: Cooking (food preparation, clean up, fetching wood and water in SA and Ghana); cleaning (care of house, gardens); laundry (mending, laundry, making clothes); care (of children and adults in the household); household management (buying food, shopping, home management, travel for home management, other).

Source: Table 1, Dinkelman and Ngai (2021)

- Attempt to include the value of home production to create an extended GDP, two general approaches:
 - The output evaluation focuses on the market value of a home output
 - The input evaluation puts value on the home hours (based on wages) and return on household durables
- For the U.S., Bridgman (2016) find that the extended GDP is 42% higher than measured GDP in 1929. Over time, this ratio declines, but is still at 27% in 2010.

Transformation at home

Reid (1934, p.47) “As time went on, one form of production after another, spinning, weaving, ... and other [manufacturing] tasks have wholly or in part been transferred to commercial production. In addition, child care, education, and the care of the sick are now to a large extent carried on by paid workers.”

Vanek (1973, p. 111) finds that “there has been a reallocation of the tasks of household work ... a shift from maintenance and production to managerial and interactional tasks.”

Lebergott (1993, p.60) writes about the advent of “consumerism”, by quoting a 1932 paper by Viva Belle Boothe, as arguing that “modern industrial processes have robbed the home of almost every vestige of its former economic function.” Lebergott continued by noting that the remaining home work “consists largely of services.”

- These earlier studies pointed to a process of *marketization of home production*. See Freeman and Schettakat (2005) for cross-country evidence.

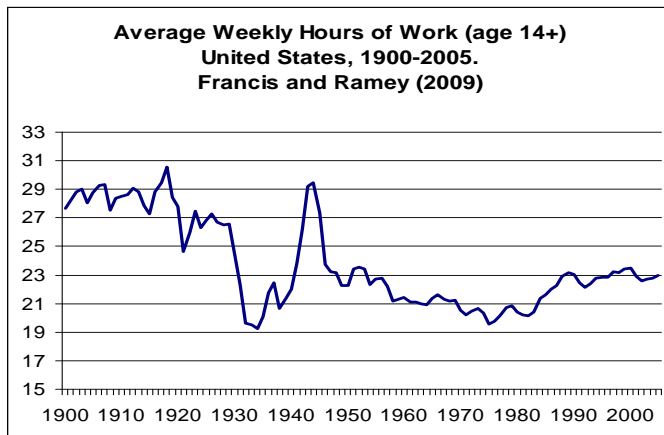
Structural Transformation, Home Production and Aggregate Labour Market

Dynamics in aggregate hours of work

- Most growth and business cycle models focus on a *balanced growth path* (BGP) where hours of work stay constants, Cooley and Prescott (1995) “*Frontiers of Business Cycle Research*” King, Plosser and Rebelo (1988) for the *BGP preference*.
- Recent works show market hours per capita are not constants:
 - U.S. historical: Ramey and Francis (2009)
 - Cross-country: Rogerson (2006) and Bick, Fuchs-Schündeln and Lagakos (2018)
- Boppart and Krusell (2020) propose a *generalized BGP preference* to obtain changing aggregate hours of work along BGP.
- Ngai and Pissarides (2008): structural transformation and marketization can generate trends in market hours along BGP, and separate trends for home and leisure hours.

Aggregate market hours

- Typically, market hours was falling during early development stage.
- For the US, market hours experienced a long decline before the recent rise since 1970s.



Ngai-Pissarides 2008 – benchmark setup

- Utility is defined over 3 final consumption goods and leisure

$$\int_0^\infty e^{-\rho t} [\ln \phi(.) + v(1 - l)] dt; \quad \phi(.) = \left(\sum_{i=a,m,s} \omega_i c_i^{(\varepsilon-1)/\varepsilon} \right)^{\varepsilon/(\varepsilon-1)}$$

where l is total time allocated to work (both home and market work).

- Each final consumption goods $i = a, m, s$ is a CES composite of a market-produced good and a home-produced good

$$c_i = \left[\psi_i c_{im}^{(\sigma_i-1)/\sigma_i} + (1 - \psi_i) c_{ih}^{(\sigma_i-1)/\sigma_i} \right]^{\sigma_i/(\sigma_i-1)}.$$

- $\sigma_i > 1$ market-produced goods are good substitutes with home-produced goods.
- $\varepsilon < 1$, final consumption goods are poor substitutes
- Production function

$$F^{ij} = A_{ij} F(l_{ij} k_{ij}, l_{ij}); \quad \dot{A}_{ij}/A_{ij} = \gamma_{ij} \quad i = a, m, s, \quad j = m, h.$$

Solve the model in three stages:

- ① Allocations between market and home (marketization)
 - ② Allocations across sectors (structural transformation)
 - ③ Allocations over time (capital accumulation and growth)
- Equating marginal rate of substitution to the marginal rate of technical substitution implies allocations of labour across sectors.
 - The economy can then be reduced to a one-sector model to solve for allocation over time, and derive the aggregate BGP.

Marketization and structural transformation

- The marketization:

$$\frac{\dot{l}_{im}}{l_{im}} - \frac{\dot{l}_{ih}}{l_{ih}} = (\sigma_i - 1)(\gamma_{im} - \gamma_{ih}).$$

If $\gamma_{im} > \gamma_{ih}$, and $\sigma_i > 1$, home production of good i is marketized.

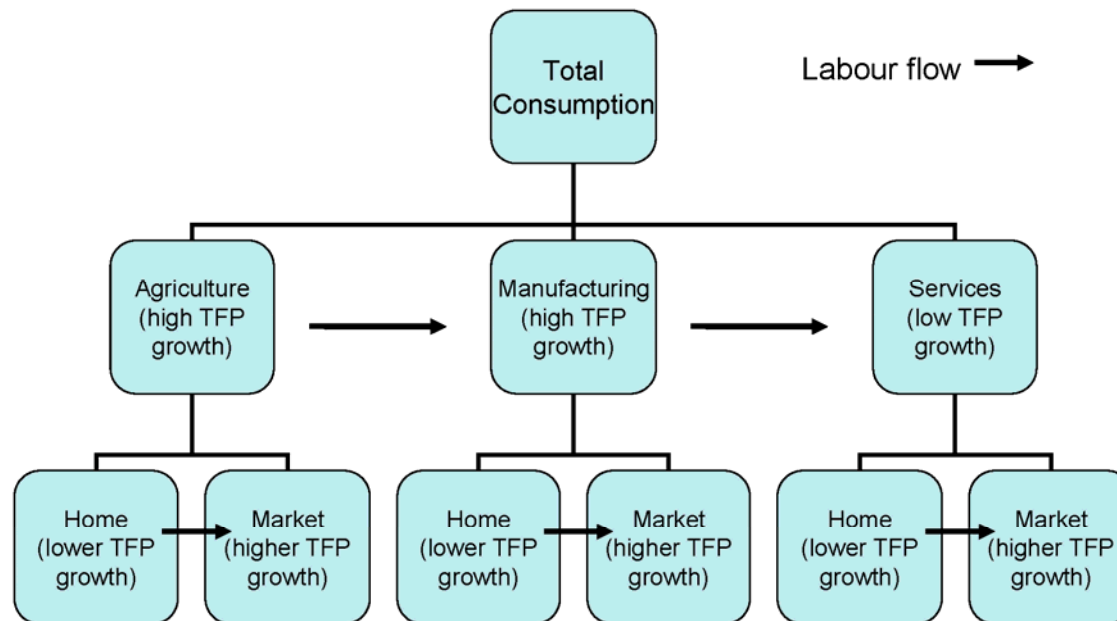
- The structural transformation:

$$\frac{\dot{l}_i}{l_i} - \frac{\dot{l}_j}{l_j} = (1 - \varepsilon)(\gamma_j - \gamma_i) \quad i, j = a, m, s.$$

$$\gamma_j \equiv \left(1 - \frac{l_{jh}}{l_j}\right) \gamma_{jm} + \frac{l_{jh}}{l_j} \gamma_{jh}.$$

where $l_i = l_{im} + l_{ih}$ is total labour allocated to goods i .

Employment flows during structural change



$$R1 : \sigma_a \geq \sigma_m \geq \sigma_s > 1 > \varepsilon$$

$$R2m : \gamma_{am} \geq \gamma_{mm} > \gamma_{sm}$$

$$R2h : \gamma_{im} \geq \gamma_{ih}$$

Trends in home hours

- Agricultural home production loses hours for two reasons
 - composite loses labour because of structural transformation
 - home production loses labour to market because of marketization
- Manufacturing home production eventually loses labour for the same reasons, although at first it may gain labour from agriculture
- But home production of services
 - gains labour because the service composite gains
 - loses labour because of marketization
- Hence: agriculture and manufacturing home production should vanish fast, service home production may rise at first and fall later.

Trends in market hours

- When home production of all goods is still active, and employment share of agriculture is high, both marketization force and structural transformation forces are strong and acting in opposite direction:
 - no significant change in total market hours
 - fall in agriculture and rise in service employment shares, flat or small rise in manufacturing
- As home production of agriculture and manufacturing disappeared, but employment share of agriculture is still significant, structural transformation force dominate marketization:
 - fall in total market hours
 - fall in agriculture and rise in manufacturing and service employment shares
- As agriculture employment shrink, the marketization of services take over:
 - rise in total market hours
 - fall in manufacturing and rise in service employment shares

Properties of the aggregate balanced growth path

- Aggregate balanced growth path in the benchmark model
 - total work (home plus market) is constant
 - aggregate capital growing at the rate of labour-augmenting productivity growth in manufacturing
- Trends in hours
 - Fast decline in home production of agriculture and manufacturing
 - Employment shares: agriculture falling, service rising, and hump-shape manufacturing
 - The aggregate market hours first fall then rise

Trends in leisure

- Leisure in the benchmark model: time yields utility.
- Time use surveys reveal a large amount of leisure is enjoyed with the use of capital.
- The full model introduces leisure good c_l , produced with time and capital goods.
- Compare to the benchmark model:
 - Traditional leisure is still constant, but time allocated to leisure production rise monotonically, so total leisure is rising.
 - Due to the rise in leisure, the initial fall in market hours would be faster but subsequent rise in market hours would be mitigated.
- Aguiar and Hurst 2007: trend in leisure in the U.S. time use.
- Boppart and Ngai 2021: theory on different trends in hours across skill groups.

- Lecture 3 on the two sources of structural transformation:
 - Income effects: income growth shifts the allocation of resources towards services as long as the demand for services is more income elastic than the demand for goods – the *Engel* curve.
 - Relative price effects: changes in relative prices alter the resource allocation whenever the elasticity of substitution between goods and services is not unity – the *Baumol* effect.
- The preference used in Ngai and Pissarides (2008) is homothetic, but the presence of *home production* allows it to capture the Engel curve.
 - If home production is a better substitute to services than goods, marketization implies an increase in the relative demand for services.
 - See Moro, Moslehi and Tanaka (2017) for the importance of home production in understanding the income effect on services.

Remarks on the cross-country comparison

- Rogerson (2008): deterioration of European labour market outcomes relative to the US – hours worked decline by almost 45 percent relative to U.S. during 1956-2003.
 - He shows the important role of home production and finds that the deterioration is because Europe has a much smaller market service sector than the US (due to taxes and productivity).
- Outlier: Scandinavian countries with high market hours despite having very high tax rates.
 - Rosen (1997) points to the Scandinavian childcare subsidy policy
 - Ngai and Pissarides (2011): subsidies lowering the cost of outsourcing home production to market services.
 - Duval-Hernandez, Fang and Ngai (2019): effects on market hours of low-skill women, which contributes substantially to cross-country differences in aggregate market hours.

Structural Transformation, Home Production and Labour Market Outcomes by Gender

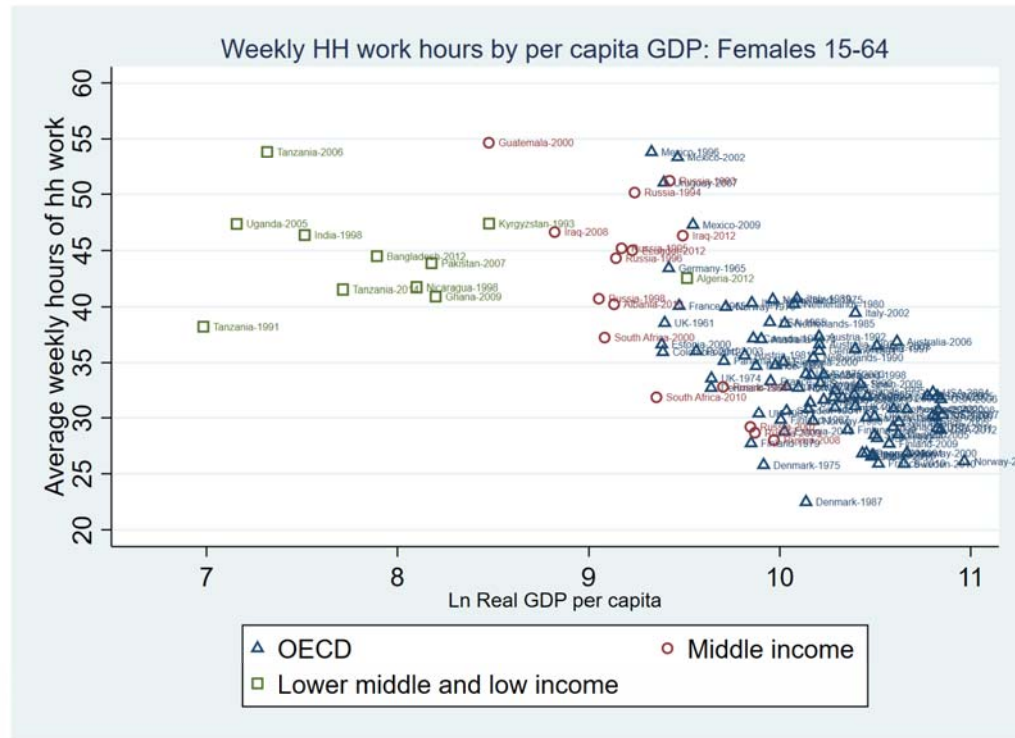
Recent rise in female employment

- Vast literature on the recent rise in female employment in many developed countries.
- Mostly gender specific factors implying a rise in female intensity across the whole industry structure:
human capital accumulation, technological progress in the household, medical advances, cultural changes - among others.
- Predominantly supply-side mechanisms, difficulty in accounting for both the rise in female employment and female wages.
- Ngai-Petrongolo (2017) proposes a gender-neutral mechanism that boosts female employment and wages through marketization and structural transformation.

Home production, structural transformation and gender

- The evolution of home production and structural transformation has important implications for labour market outcomes by gender.
- The ILO (2018) reports that
 - Women's home production hours are triple that of men, based on 64 national time use surveys
 - Demands of home production are the main self-reported barriers to women entering the labour market
- The development of market services that produce substitutes for home production creates jobs for women because these sectors are usually female intensive.
 - Potentially two market jobs for women can be created by marketizing home production.

Figure 1: **Weekly hours in home production by level of development**



Notes: Weekly hours of work in home production computed for females age 15 and older from [Bridgman et al. \(2018\)](#). Real GDP per capita (2011 international dollars) from Penn World Tables v9.1

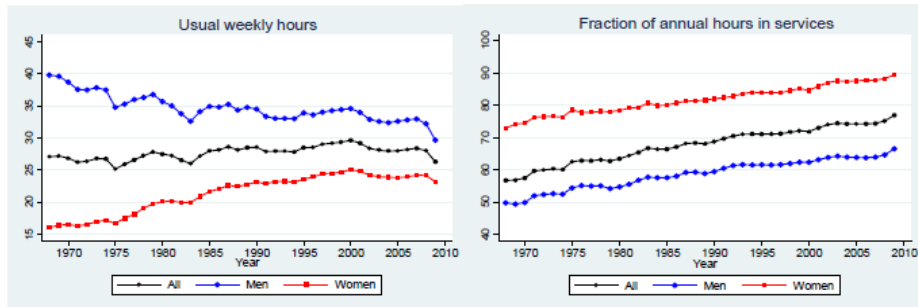
Source: Figure 1, Dinkelman and Ngai (2021)

Gender gaps and the service economy

- Reid (1934), Fuchs (1968), Lebergott (1993) suggested there may be a link between female market work and the rise in services.
 - Galor and Weil (1996) and Rendall (2018) propose mechanisms for gender-biased demand shifts *within* industries: brain vs. brawn.
- Ngai and Petrongolo (2017) argue that the rise in services and the fall in gender gaps are related, due to women's comparative advantage in producing services
 - The expansion of the service sector creates jobs for which women.
 - Marketization of home production draws women's work into the market.
 - Together can account for the rise in women's market hours, fall in men's market hours and fall in gender wage gap.

Structural transformation and market hours

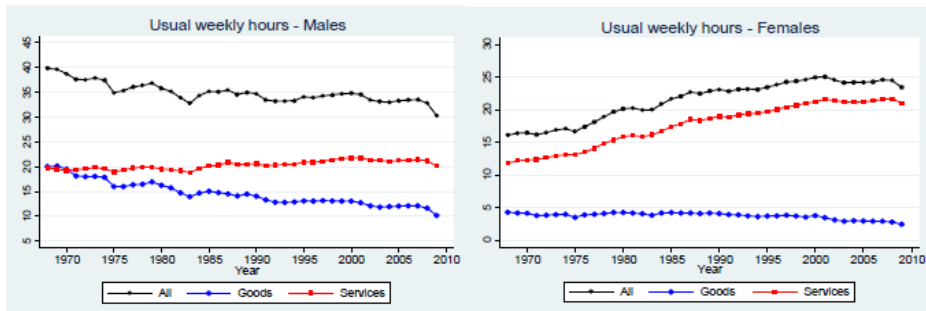
The rise in female hours and the rise in services



Men and women age 21-65. Source: U.S. CPS

Gender hours allocations across sectors

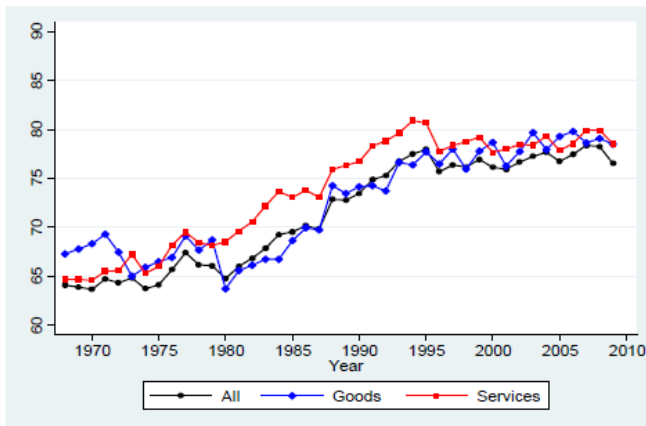
- The rise in female hours took place entirely in the service sector
- The decline in male hours took place entirely in the goods sector



Men and Women age 21-65. Source: U.S. CPS

The gender wage ratio

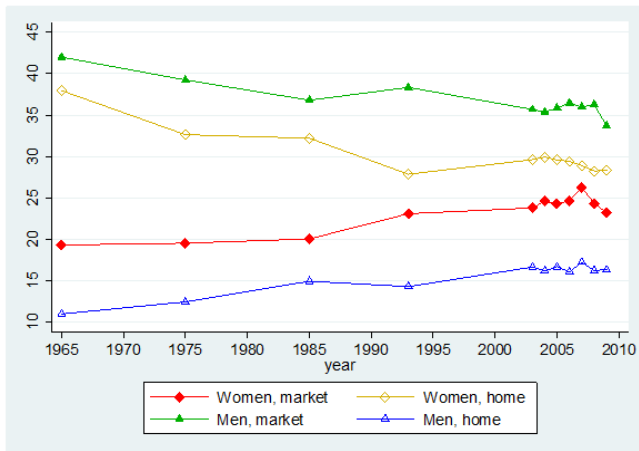
Convergence in wages (adjusted):



The wage ratio is obtained as (the exponential of) the coefficient on a female dummy from yearly log wage regressions that control for gender, age, age squared, education (four categories), and ethnicity (one nonwhite dummy). Source: U.S. CPS

Narrowing gender gap at home

Trends in gender gaps at home symmetric to market.



Men and women age 21-65. Source: U.S. time use surveys

- The sectoral dimension is similar to Ngai-Pissarides (2008). The new gender-specific assumption is that women have comparative advantage in producing services
 - Brain vs brawn skills, communication skills
- For understanding gender gaps in hours, the allocation of total work between market and home is more relevant than leisure decisions. During 1965 – 2009:
 - the gender total hours ratio changes only slightly from 1.03 to 1.05 (iso-work as in Burda Hamermesh Weil, 2013)
 - the share of market hours (out of total hours) rises from 0.34 to 0.46 for women and falls from 0.77 to 0.68 for men
- Present a simplified version of Ngai-Petrongolo model without leisure.

- Utility is defined over goods and services:

$$U(c_g, c_s, c_h) \equiv \left[\omega c_g^{\frac{\varepsilon-1}{\varepsilon}} + (1-\omega) c_2^{\frac{\varepsilon-1}{\varepsilon}} \right]^{\frac{\varepsilon}{\varepsilon-1}}, \quad \varepsilon < 1$$
$$c_2 = \left[\psi c_s^{\frac{\sigma-1}{\sigma}} + (1-\psi) c_h^{\frac{\sigma-1}{\sigma}} \right]^{\frac{\sigma}{\sigma-1}}, \quad \sigma > 1$$

- Production function

$$c_j = A_j L_j, \quad L_j = \left[\zeta_j L_{fj}^{\frac{\eta-1}{\eta}} + (1-\zeta_j) L_{mj}^{\frac{\eta-1}{\eta}} \right]^{\frac{\eta}{\eta-1}}, \quad j = 1, s, h$$

with $\zeta_s = \zeta_h > \zeta_g$, $\dot{A}_j / A_j \equiv \gamma_j$.

Structural transformation and gender wage gap

- The wage ratio in a one-sector model:

$$\frac{w_f}{w_m} = \frac{\zeta}{1 - \zeta} \left(\frac{L_m}{L_f} \right)^{1/\eta}$$

The rise in aggregate ζ is referred as “gender-biased demand shifts”, see Heathcote et al 2010.

- In the two-sector model, free mobility of labour across sectors implies:

$$\frac{w_f}{w_m} = \frac{\zeta_j}{1 - \zeta_j} \left(\frac{L_{mj}}{L_{fj}} \right)^{1/\eta}; \quad j = g, s.$$

- Structural transformation provides an *endogenous* mechanism for the growth in aggregate ζ .
 - Given $\zeta_s > \zeta_g$, a shift into services increases aggregate ζ .
 - Structural transformation leads to a rise in the female/male wage ratio.

Structural transformation, marketization and market hours by gender

- Structural transformation decreases market hours for all, because part of services is produced in home production
- Marketization increases market hours for all.
- Given women's comparative advantage in services, marketization bites relatively more for women
 - Rise in women's market hours and falls in men's market hours
- Overall: a seemingly gender-neutral mechanism through sector-specific productivity growth \implies rise in service sector \implies rise in female's relative employment and relative wage.

- The calibrated marketization and structural transformation predict
 - the entire rise in the service share between 1970 and 2006,
 - 20 percent of the gender convergence in wages,
 - one-third of the rise in female market hours,
 - 9 percent of the fall in male market hours.
- These between-sector forces alone can explain nearly 60 percent of the variation in the time allocation structure,
 - adding within-sector forces (due to exogenous fall in discrimination or changes in gender norm) explains a further 30 percent.

- An alternative productivity hypothesis for the recent rise in female employment is availability of cheaper household durables – *engine of liberalization* by Greenwood, Seshadri and Yorukoglu (2005)
- Could availability of household durable create more home work?
 - Mokyr (2000) discusses the “Cowan Paradox” – Cowan asked, “*why did homemakers end up working longer hours in their homes in the century after 1870, despite the growing mechanization of household activities.*” The answer proposed by Mokyr is that increases in knowledge on the causes and transmission mechanisms of infectious diseases created an increased demand for cleaner homes and better-prepared food, which required more home-production time.
 - Reversal of marketization, e.g. the shift from using laundromat to the washing machine at home (Buera and Kaboski 2012).

Remarks on U-shape female employment

- The rise in female employment is a rather recent phenomenon for a set of developed countries.
- Both historically for the developed countries and recently for developing countries, female employment has experienced decline.
- During early development stage, female employment tends to fall before it starts to rise – a U-shape, see Sinha 1965 and Boserup 1970.
- Ngai, Olivetti and Petrongolo (2021) provide a framework to understand the U-shape in a model with structural transformation where home production and agriculture play important roles.

Remarks on structural transformation and skill

- Buera and Kaboski (2012) the rise in service are concentrated mainly in high-skilled sectors.
- Buera, Kaboski, Rogerson and Vizcaino (2020): this *skill-biased structural change* contributes to the rise in skill-premium.
- Ngai and Sevinc (2021): rising relative prices of high-skill sectors contribute to stagnation in low-skill workers' wages and the wage-productivity divergence.
- Autor and Dorn (2013) and Barany and Siegel (2018): structural transformation and *polarization* – wage and employment growth concentrated on upper and bottom of occupation skill distribution, measured by the mean wage of an occupation.
- Low-skill wage stagnation and rise in skill-premium v.s. polarization:
 - The former is about *workers* of certain education levels whereas polarization is about different *occupations*.
 - Sevinc (2019): skill heterogeneity within an occupation.

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