Time Use Data
STEG Virtual Course on "Data in Macro Development"

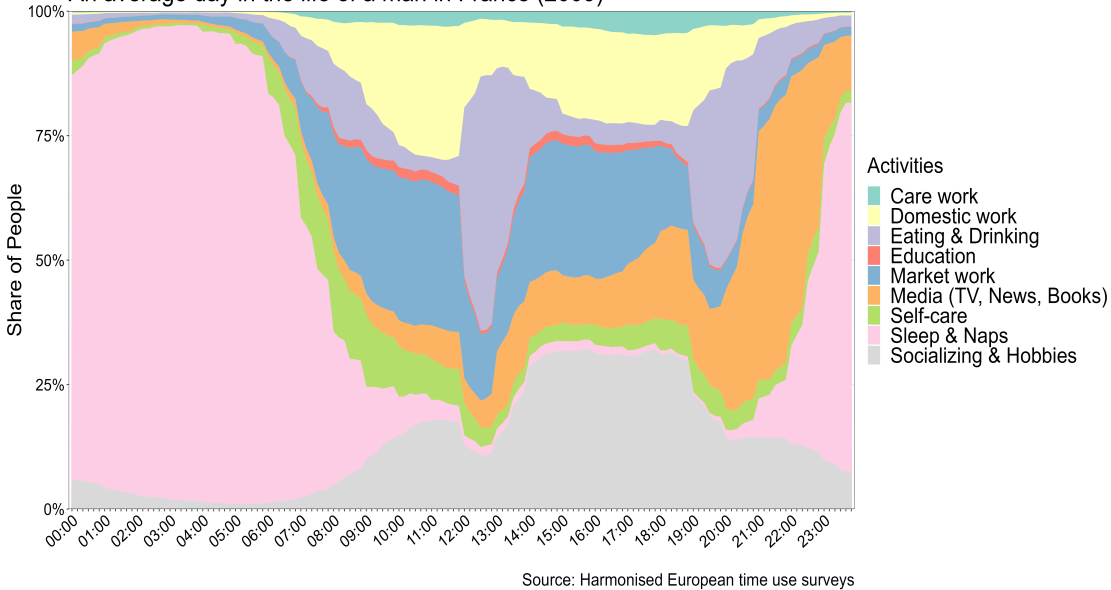
Charles Gottlieb, Aix-Marseille School of Economics

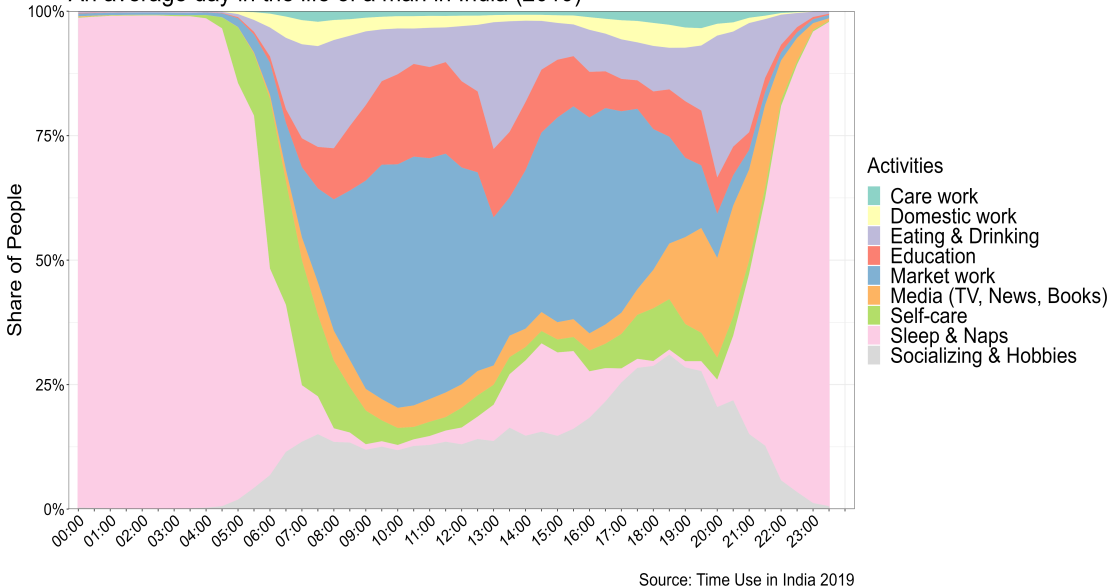
June 21, 2024

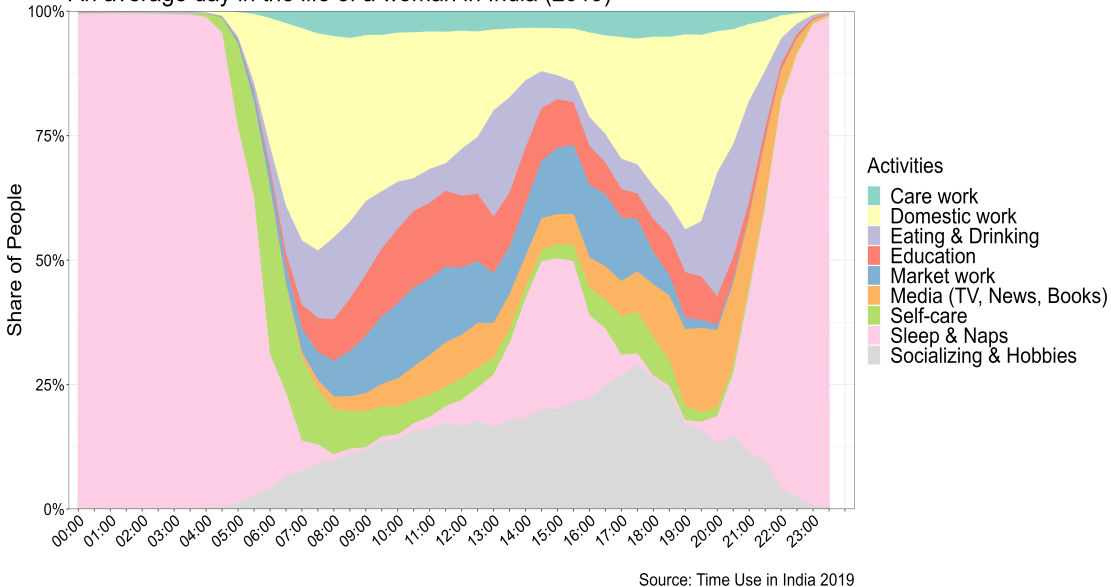
Introduction

- Human life is finite. Average life expectancy today is 71 years.
- Life time budget amounts to 621'960 hours.
- Time-use surveys (TUS) provide a complete account of all human activities and
- ... can help us understand how we spend our time budget!
- Used for the study of behavioral trends in sociology, public health, economics, ...

Today: Time Use data for Macro Development.


An average day in the life of a man in France (2009)
Share of People
100%
75%
50%
25%
0%
00:00
01:00
02:00
03:00
04:00
05:00
06:00
07:00
08:00
09:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
Activities
Care work
Domestic work
Eating & Drinking
Education
Market work
Media (TV, News, Books)
Self-care
Sleep & Naps
Socializing & Hobbies
Source: Harmonised European time use surveys


An average day in the life of a man in India (2019)
Share of People
100%
75%
50%
25%
0%
00:00
01:00
02:00
03:00
04:00
05:00
06:00
07:00
08:00
09:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
Activities
Care work
Domestic work
Eating & Drinking
Education
Market work
Media (TV, News, Books)
Self-care
Sleep & Naps
Socializing & Hobbies
Source: Time Use in India 2019


An average day in the life of a woman in India (2019)
Share of People
100%
75%
50%
25%
0%
00:00
01:00
02:00
03:00
04:00
05:00
06:00
07:00
08:00
09:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
Activities
Care work
Domestic work
Eating & Drinking
Education
Market work
Media (TV, News, Books)
Self-care
Sleep & Naps
Socializing & Hobbies
Source: Time Use in India 2019

Introduction: Policies

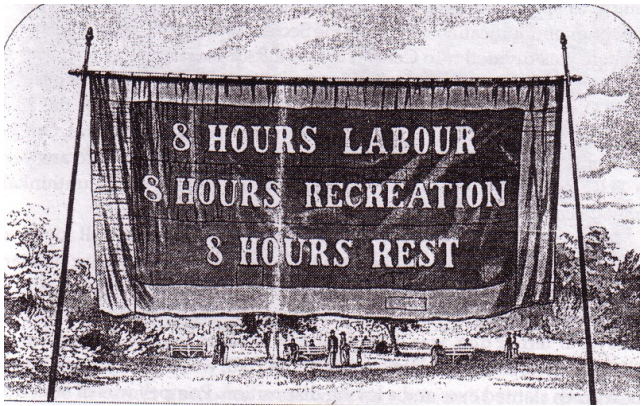
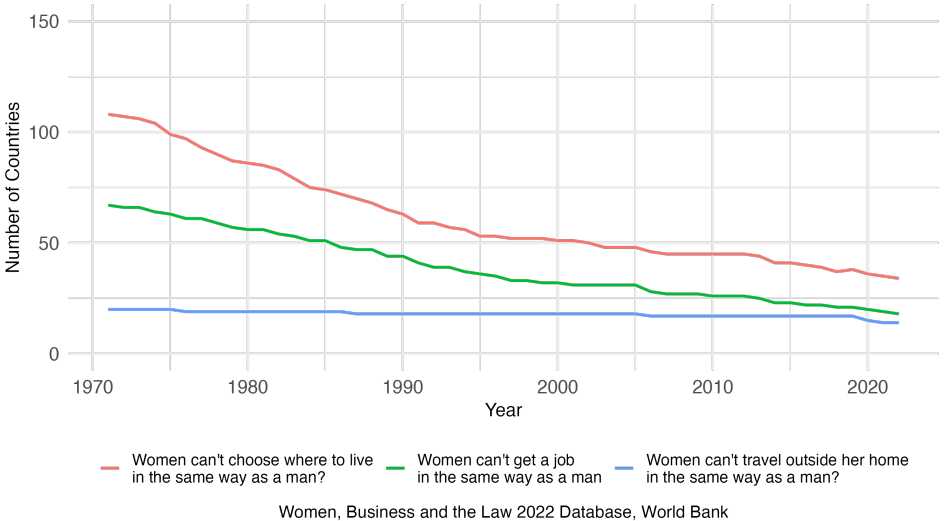


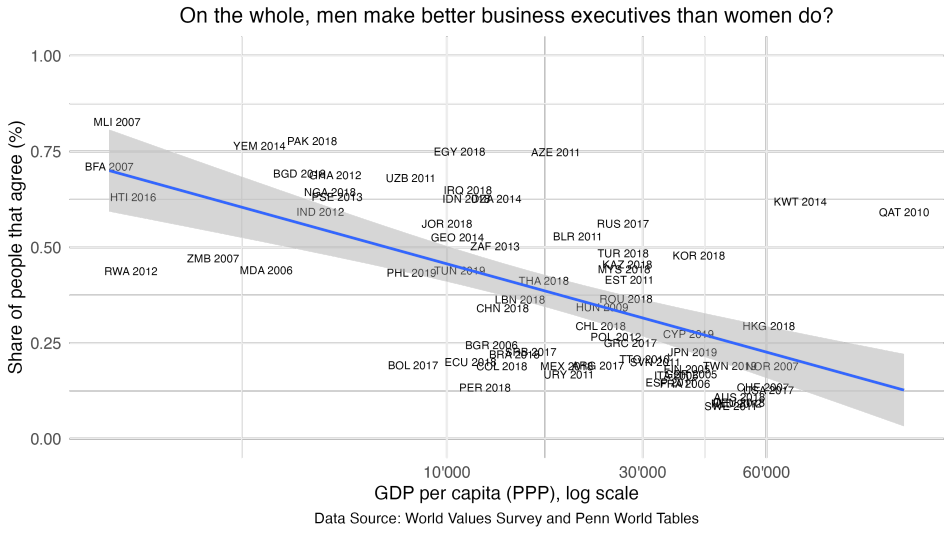
Figure: Political manifesto in the 18th century

Figure: Poster for a popular vote in Switzerland, 1920.

Introduction: Legal barriers



Introduction: Social norms



Introduction: Hours worked across countries: Working Age population

Source: Harmonized World Time Use Survey, Gottlieb et al. [2024]

Outline

Measurement

Measurement: Time use survey data is the future

- International Committee for Labour Statistics (ICLS)

ICLS 13 (1982) "attempts should be made to collect *periodically* statistics on time-use".
ICLS 19 (2013) *Recommendation* to measure non-market work and provide estimates of total working time.

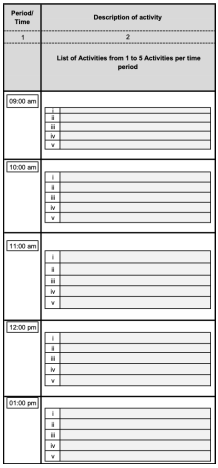
→ *Time Use Surveys (TUS) will become a standard survey type.*

- Policy goals set by United Nations
  - **SDG 5.4.1:** Proportion of time spent on unpaid domestic and care work, by sex, age and location
  - **Gender Indicators I.1:** Proportion of time spent on unpaid domestic and care work, by sex, age and location
  - **Gender Indicators I.2:** Average number of hours spent on total work (paid and unpaid), by sex

→ *TUS are used to inform policy.*

Measurement: Structure of time use surveys

- Three questionnaires:
  - Demographic
  - Work
  - **Time diary** of one (up to three) days
- Information on *all activities* carried out during *a short (24h) reference period.*
- *Duration and timing of their different activities* in sequence throughout the day(s) of the reference period.
- Context of the activities, i.e., "*where*" the activities are performed, "*with whom*" and "*for what purpose*".



Measurement: Diary Types

Attribute	Full Diary	Light Diary	Household Survey
Reference period	Day	Day	Week
Diary duration	24 hours with 10/30 min intervals	24 hours with 10/30 min intervals	–
Reporting	Open ended, coded ex-post	Specific activities ($\approx$ 25)	Few specific activities
Activity	Primary & secondary	Primary & secondary	Not specified
Examples	France EET 2009, Ghana TUS 2009	Serbia TUS 2010, Cambodia LSMS 2019	LATAM and LSMS

Measurement: Data Sources

- National Statistical Offices (NSO)
  - Albania Time Use Survey, 2010 Link to dataset
  - Ghana Time Use Survey, 2009 Link to dataset
  - Marocco - Enquête Emploi du Temps, 2012 Link to dataset
- Multinational Time Use Survey (MTUS); Centre for Time Use Research (CTUR)
  - Own activity classification based Szalai and Gershuny - see Gershuny et al. [2020]
  - Historical coverage for EU and anglo-saxon countries
  - Middle / high-income countries.
- Harmonized European Time Use Survey (HETUS)
- Harmonized World Time Use Survey (HWTUS)
  - Covers countries at all income levels [Gottlieb et al., 2024]
- UN Gender Indicators – Aggregates

Measurement: Activity Classifications

- Diaries provide a full account of human activities.
- Existing activity classifications
  - Classification of Time-Use Activities for Latin America and the Caribbean (CAUTAL) developed by CEPAL
  - Activity Coding List (ACL) developed by Eurostat
  - Activity Coding Lexicon (ACL) developed by U.S. Bureau of Labor Statistics
  - International Classification of Activities for Time-Use Statistics (ICATUS) developed by United Nations Statistics Division.
  - Different level of granularity – 1/2/3 digits.
- Made to account for local customs - *Example:* sauna, own-use production, ...
- ICATUS best suited for cross-country studies ← **Macro Development**
- Reference: Jacques Charmes . 2015. *Time Use Across the World: Findings of a World Compilation of Time Use Surveys.* New York. [Link]

International Classification of Activities for Time-Use Statistics (ICATUS)

Activity	Type of work	Definition	ICATUS (1d)	National Accounts
Work		*Activities that can be delegated to a third party*		
	Market	Production of goods and services destined to the market	1	Y
		Production of goods for own final use	2	Y
		Production of services for own final use (non-market work)		
	Services	- Domestic services	3	N
	Care	- Household and family members	4	N
		- Others (incl. volunteering and community work)	5	N
Non-work activities				
Education		Education and related activities	6	
Leisure		Socializing, community participation and religious practice	7	
		Culture, leisure, mass-media and sports practices	8	
Self-care		Activities for self-care and maintenance (sleep, food, cleaning)	9	

- Work vs Non-work : Third party criterion – Marshall and Marshall [1879] Reid [1934]

Measurement: Mapping time use to national accounts

The System of National Accounts (2008) is a statistical framework that provides accounting rules for the measurement of macroeconomic accounts [Nations et al., 2009]

Production boundary encompasses all production actually destined for the market whether for sale or barter ← **ICATUS 1 and 2.**

- Includes all production of goods for own use *but not services for own use.*
- Key distinction: decision whether goods are to be sold or retained for own use can be made after its production.
- *Example:* Collecting firewood and water, subsistence farming.

General production boundary includes services produced for own use by households. ← **ICATUS 1 to 5.**

- Development of satellite accounts for home production – see Bridgman [2016]

Measurement: Leisure

- Leisure is an important component of welfare.
- Time series evidence by Aguiar and Hurst [2007] Ramey and Francis [2009]
- Patterns of leisure depend on treatment of care activities.
- Measures differ slightly due to disagreement on classification of:
  - Childcare
  - Help and care for other adults
  - Pet care
  - Meals and breaks during work.
- Promising alley for research : measurement of leisure and welfare across countries.

Measurement: Some strengths and weaknesses

Strengths

- Shorter reference period.
- Reporting is consistent with full day length.
- Distinction between primary and secondary activity.

Weaknesses

- Most TUS don't have a panel component.
- Sample sizes smaller than labor force surveys.
- Diaries are recorded for few household members.

Evidence

Evidence:

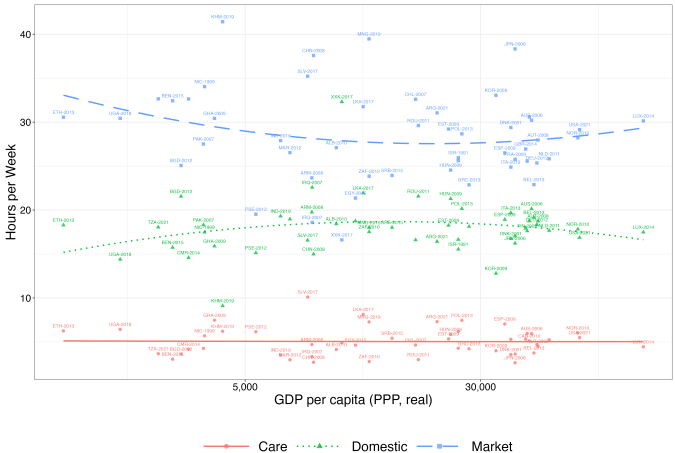
Cross-country

- Market hours – Bick et al. [2018]
- Gender gaps – Chiplunkar and Kleineberg [2023]
- Home hours – Bridgman et al. [2018]
- Total work and gender gaps – Gottlieb et al. [2024]

US time series

- Leisure – Aguiar and Hurst [2007] Ramey and Francis [2009]
- Home hours – Greenwood et al. [2005]
- Women's work – Ngai et al. [2024]
- Inequality – Boerma and Karabarbounis [2021]
- Productivity of home production – Bridgman [2016]

Evidence: Gender Division of work

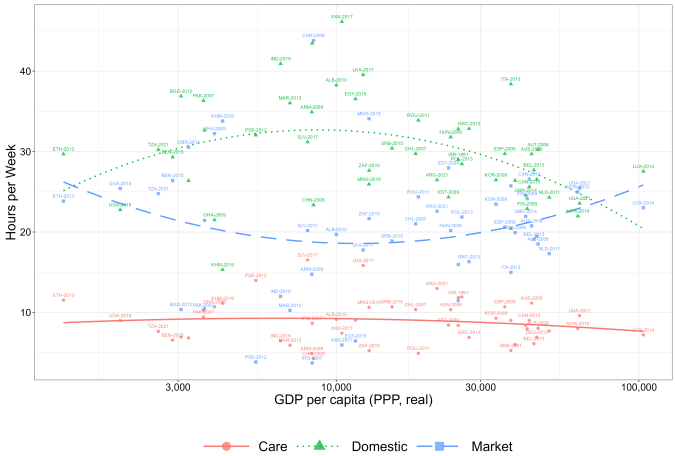


Source: Harmonized World Time Use Survey, Gottlieb et al. [2024]

Evidence: Gender Division of work

Source: Harmonized World Time Use Survey, Gottlieb et al. [2024]

Evidence: Gender Division of work



Source: Harmonized World Time Use Survey, Gottlieb et al. [2024]

A Model of Time Use

A Model of Time Use:

- Income effect : Income growth reduces hours worked – Boppart and Krusell [2020]
- Taxes : Affects incentives to work – Rogerson [2024]. Joint taxation – Bick and Fuchs-Schündeln [2017]
- Structural Transformation : Ngai et al. [2024], Chiplunkar and Kleineberg [2023]
- Marketization : Increased demand for services raises labor demand for women's work who have a comparative advantage in services – Ngai and Petrongolo [2017]
- Appliances: Labor saving technology – Greenwood et al. [2005]
- Institutional factors : Wedges – Gottlieb et al. [2024]

A Model of Time Use

Standard Labor supply model. A representative household has preferences over consumption and leisure – MaCurdy [1981]

$$U(C_m, L_m) = \frac{C_m^{1-\sigma}}{1-\sigma} - D\frac{L_m^{1+1/\phi}}{1+1/\phi}$$

where σ and ϕ are CRRA and Frisch elasticity of labor supply. D the valuation of market goods relative to leisure. Her budget constraint is

$$C_m = (1-\tau)\, wL_m$$

where τ is a labor income tax and w the hourly wage.

A Model of Time Use

$$L_m^{1/\phi+\sigma} = \frac{1}{D_m}\left((1-\tau)w\right)^{1-\sigma}$$

Hours worked depend on

- Hourly wage (w)
- Taxes (τ)
- Disutility of market work (D_m)

Parametrization: $\sigma = 1.1$; $\phi = 1.5$; D_m so that hours are 45 at intercept.

A Model of Time Use

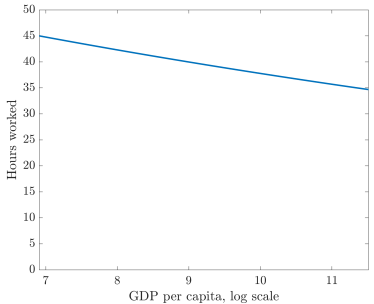


Figure: MaCurdy preferences

Figure: Hours worked of married women

A Model of Time Use

This simple framework broadly fits aggregate patterns of hours worked

- Over time – Boppart and Krusell [2020]
- Across countries – Bick et al. [2018]
- Across high-income countries – Prescott [2004] Rogerson [2024]

A lot of cross-country heterogeneity is unexplained

- Match the cross-country heterogeneity using D_m.
- Little to learn from attributing difference to a single preference parameter.

$\rightarrow$ Alternative model with choice of time use.

A Model of Time Use

A model of time use. Introduce a non-market service C_n.

$$U(C_m, C_n, L_m, L_n) = \frac{\left(C_m^{\frac{\varepsilon-1}{\varepsilon}} + BC_n^{\frac{\varepsilon-1}{\varepsilon}} \right)^{\frac{\varepsilon}{\varepsilon-1}(1-\sigma)}}{1-\sigma} - D_m \frac{L_m^{1+1/\phi}}{1+1/\phi} - D_n \frac{L_n^{1+1/\phi}}{1+1/\phi}$$

where C_m are market goods and services. ε is the elasticity of substitution. Each activity generates disutility which is additively separable. Her budget constraint reads:

$$C_m = (1-\tau)\, wL_m$$

Production function for non-market services

$$C_n = zL_n$$

where z is non-market productivity and L_n hours.

A Model of Time Use

Choice of time use across activities:

$$\left(\frac{L_m}{L_n}\right)^{1/\phi+1/\varepsilon} = \frac{\left((1-\tau)\,w\right)^{\frac{\varepsilon-1}{\varepsilon}}}{B(z)^{\frac{\varepsilon-1}{\varepsilon}}}\frac{D_n}{D_m}$$

Hours worked :

$$L_m^{1/\phi+\sigma} = \frac{\left((1-\tau)\,w\right)^{1-\sigma}}{D_m}\left[1+\frac{B(z)^{\frac{\varepsilon-1}{\varepsilon}}}{\left((1-\tau)\,w\right)^{\frac{\varepsilon-1}{\varepsilon}}}\left(\frac{L_n}{L_m}\right)^{\frac{\varepsilon-1}{\varepsilon}}\right]^{\frac{1-\sigma\varepsilon}{\varepsilon-1}}$$

Hours worked depend on

- Hourly wage (w)
- Taxes (τ)
- Disutility of market work (D_m)
- Disutility of non-market work (D_m)
- Non-market productivity (z)
- Preference for non-market services (B)

A Model of Time Use:

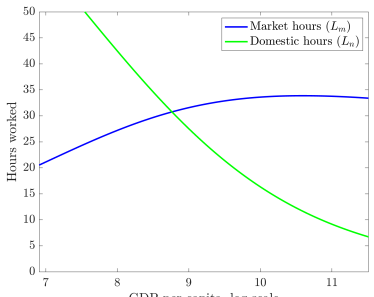


Figure: Time use model

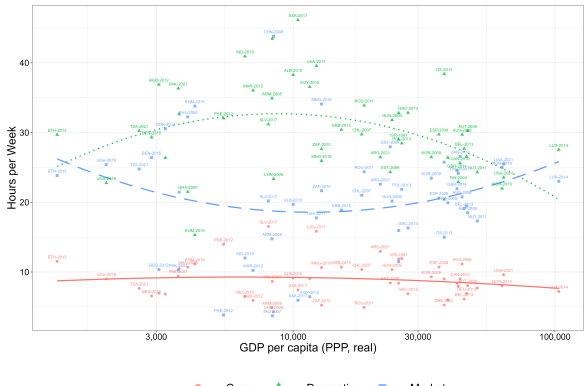


Figure: Hours worked of married women

Parametrization: $\sigma = 1.1$; $\phi = 1.5$; D_m ; $\varepsilon = 2$; $D_n = D_m/2$; $B = 2$, $z = 400$.

Conclusion

- Time Use data provides a detailed account onto human activities.
- Focusing on work, we document lots of heterogeneity both across countries and across groups (gender) within countries.
- A simple model of time-use generates patterns of time use across country income levels that are broadly consistent with the data.

References I

Mark Aguiar and Erik Hurst. Measuring trends in leisure: the allocation of time over five decades. *The Quarterly Journal of Economics*, 122:969–1006, 2007.

Alexander Bick and Nicola Fuchs-Schündeln. Taxation and Labour Supply of Married Couples across Countries: A Macroeconomic Analysis. *The Review of Economic Studies*, 85(3):1543–1576, 10 2017. ISSN 0034-6527. doi: 10.1093/restud/rdx057. URL https://doi.org/10.1093/restud/rdx057.

Alexander Bick, Nicola Fuchs-Schündeln, and David Lagakos. How do hours worked vary with income? cross-country evidence and implications. *American Economic Review*, 108(1):170–199, Jan 2018. doi: 10.1257/aer.20151720.

Job Boerma and Loukas Karabarbounis. Inferring inequality with home production. *Econometrica*, 89(5):2517–2556, 2021.

Timo Boppart and Per Krusell. Labor supply in the past, present, and future: A balanced-growth perspective. *Journal of Political Economy*, 128(1):118–157, 2020. doi: 10.1086/704071. URL https://doi.org/10.1086/704071.

References II

Benjamin Bridgman. Home productivity. *Journal of Economic Dynamics and control*, 71:60–76, 2016.

Benjamin Bridgman, Georg Duernecker, and Berthold Herrendorf. Structural transformation, marketization, and household production around the world. *Journal of Development Economics*, 133:102–126, 2018.

Gaurav Chiplunkar and Tatjana Kleineberg. Gender barriers, structural transformation and economic development. Technical report, mimeo, 2023.

Jonathan Gershuny, Marga Vega-Rapun, and Juana Lamote. Multinational time use study. https://www.timeuse.org/mtus, 2020.

Charles Gottlieb, Cheryl Doss, Douglas Gollin, and Markus Poschke. The gender division of work across countries. *STEG Working Paper*, 2024.

Jeremy Greenwood, Ananth Seshadri, and Mehmet Yorukoglu. Engines of liberation. *The Review of Economic Studies*, 72(1):109–133, 2005. ISSN 00346527, 1467937X. URL http://www.jstor.org/stable/3700686.

References III

Thomas E MaCurdy. An empirical model of labor supply in a life-cycle setting. *Journal of political Economy*, 89(6):1059–1085, 1981.

Alfred Marshall and Mary Paley. Marshall. *The economics of industry / by Alfred Marshall and Mary Paley Marshall*. Macmillan London, 1879.

United Nations, European Commission, International Monetary Fund, Organisation for Economic Co-operation, Development, and World Bank. *System of National Accounts 2008*. United Nations, 2009. ISBN 9789211615227.

L Rachel Ngai and Barbara Petrongolo. Gender gaps and the rise of the service economy. *American Economic Journal: Macroeconomics*, 9(4):1–44, 2017.

Rachel Ngai, Claudia Olivetti, and Barbara Petrongolo. Structural transformation over 150 years of women's and men's work. *mimeo*, 2024.

Edward C Prescott. Why do americans work so much more than europeans? Working Paper 10316, National Bureau of Economic Research, February 2004. URL http://www.nber.org/papers/w10316.

References IV

Valerie A. Ramey and Neville Francis. A century of work and leisure. *American Economic Journal: Macroeconomics*, 1:189–224, 2009.

M.G. Reid. *Economics of Household Production*. Books in home economics. J. Wiley & Sons, Incorporated, 1934. URL https://books.google.ch/books?id=YbDRAAAAMAAJ.

Richard Rogerson. Why labor supply matters for macroeconomics. *Journal of Economic Perspectives*, 38(2):137–58, May 2024. doi: 10.1257/jep.38.2.137. URL https://www.aeaweb.org/articles?id=10.1257/jep.38.2.137.