Hours Worked Across the World

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Hours Worked Across the World

1 Measurement

2 Facts

3 Implications

4 Driving Forces

5 The Future of Hours Worked
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Hitoshi Tsujiyama (Surrey University)

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Hannah Paule-Paludkiewicz (Bundesbank)
1. MEASUREMENT
Measurement of Hours Worked per Person

- Hours per person = employment rate \times \text{hours per worker}
- Employment rates easier to measure than hours per worker
Measurement of Hours Worked per Person

- Hours per person = employment rate * hours per worker

- Employment rates easier to measure than hours per worker

- Rich countries: Data from OECD / Total Economy Database (TED)
  - Prescott (2004); Rogerson (2006); Ohanian, Raffo, Rogerson (2008); McDaniel (2011); Ragan (2013)
  - Problem: Subject to regular major revisions

- Poor countries: Time-series data from TED / Penn World Tables
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- Poor countries: Time-series data from TED / Penn World Tables
  - Problem: Many data points are inter-/extrapolated or taken from other countries
Low-Income Countries: Few Independent Observations

• Historical Maddison Data (25 countries)
  - 1870 & 1913
    * Use weekly hours worked per worker for UK
    * Multiply with weeks worked in each country

• TED / PWT: annual data for 67 countries starting 1950
  - 304 “low-income” observations from 17 countries
  - Omitting data from Maddison, inter- or extrapolated observations,
    and observations with unknown data source:
    - 42 observations from 4 countries left
Low-Income Countries: Few Independent Observations

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    * Australia: hours assumed to be the same as in US
    * Austria: extrapolation from 1964 survey
    * Peru: average of 6 other Latin American countries
    * ...

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Alternative: Use of Labor Force Surveys

- Household surveys from 80 countries from 2005 or closest avail. year: Nationally representative and have 5,000+ individuals aged 15+

- Focus on 49 “core countries” with most comparable data:
  
  1. Hours Information
     
     a. Producing output counted in NIPA:
        includes informal work, self-employment, and unpaid family work

     b. Actual (not usual) hours worked at all jobs (not just primary job)

     c. In the last/recent reference week

  2. Survey covers a full year
Sample Countries
2. FACTS
Three Facts on Hours Worked Across the World

Over the development spectrum:

1. Hours per adult decrease

2. Employment rates are convex, hours per worker concave

3. Share of workers in subsistence self-employment declines
Fact 1: Decreasing Hours per Adult
Adults in poor countries work 9 hours (50%) more than in rich ones.
Heterogeneity: Key Fact is Broad-Based

- Hours per adult are higher in low-income countries
  - by gender
  - by education
  - by age group

- Decline in hours by GDP not driven by compositional effects
Decreasing Hours per Adult for Both Genders

- Decrease of 9 hours for both men and women
Cross-Country Evidence in Line with U.S. Time-Series

Fact 2: Convex Employment Rates, Concave Hours per Worker
Convex Employment Rates, Concave Hours per Worker

- Employment rates convex, hours per worker concave over development spectrum
- Between poor and rich
  - Employment rates decrease by 20 percentage points
  - Hours per worker fall by 3.3 hours
Shapes of Two Margins the Same for Both Genders

(a) Employment Rates
Men

(b) Hours per Worker
Men

(c) Employment Rates
Women

(d) Hours per Worker
Women
Fact 3: Decreasing Share of Workers in Subsistence Self-Employment
Decreasing Share of Subsistence Self-Employment

Empirical proxy for subsistence self-employment (traditional sector): Self-employed individuals with low education
Hours per worker in subsistence self-employment slightly increasing from 35.4 to 39.2 hours between poor and rich
Strongly Decreasing Hours in Wage Work

Hours per worker in wage work (modern sector) 11 hours higher in poor countries and strongly decreasing from 46.3 to 35 hours
Concave Hours per Worker Caused by Compositional Effect

Concave shape in hours per worker due to sectoral reallocation from subsistence self-employment into wage work.
3. IMPLICATIONS
Larger Welfare Differences Across Countries

- Measurement of welfare differences:
  - Based on only consumption:
    Rich countries have 12 times higher welfare than poor countries
  - Based on consumption and hours worked:
    19 times higher welfare
Larger Welfare Differences Across Countries

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  - Based on consumption and hours worked:
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  - Jones and Klenow (2016): differences in life expectancy and inequality further increase welfare differences between rich and poor countries
Larger Labor Productivity Differences Across Countries

• Measurement of labor productivity differences:
  
  - GDP per worker 14 times higher in rich countries
  
  - GDP per hour worked 17 times higher in rich countries

⇒ Further challenge for development accounting (Caselli, 2005)
4. DRIVING FORCES
Potential Driving Forces of Hours Decrease by Development

- **Income effects** (Keynes, 1930; Boppart/Krusell, 2020)

- **Taxation** (Prescott, 2004; Rogerson, 2006)
Potential Driving Forces of Hours Decrease by Development

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⇒ Challenge: Matching different shapes of two margins
Potential Driving Forces of Hours Decrease by Development

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⇒ Challenge: Matching different shapes of two margins

• **New driving force**: Structural change in labor supply

  1. Sectoral reallocation

  2. Varying fixed costs of working
Potential Driving Forces of Hours Decrease by Development

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- **Taxation** (Prescott, 2004; Rogerson, 2006)

⇒ **Challenge:** Matching different shapes of two margins

- **New driving force:** Structural change in labor supply
  
  ① Sectoral reallocation

  ② Varying fixed costs of working

- **Driving forces matter for predictions about future hours**
A Static Model of Structural Change in Labor Supply

- MaCurdy (1981) preferences (special case of Boppart/Krusell, 2020)
- Non-linear labor taxes, consumption taxes, transfers
- Traditional (subsistence self-empl.) vs. modern (wage) sectors
- Fixed costs of work in modern sector (Rogerson/Wallenius, 2013)
Households

- Measure one of heterogenous households

- Households differ in modern sector prod. $z$ with $\log(z) \sim \mathcal{N}(0, \sigma_z^2)$

- Within each household, measure one of heterogeneous individuals

- Individuals differ in fixed disutility of work $\eta$

- MaCurdy (1981) preferences for individuals:

$$ u(c, h; S, \eta) = \frac{c^{1-\gamma}}{1-\gamma} - \alpha \frac{h^{1+\frac{1}{\phi}}}{1 + \frac{1}{\phi}} - \bar{u} S \eta \mathbf{1}_{h>0} $$
Budget Constraint and Household Problem

- Budget constraint:

\[(1 + \tau_c)C = Y_S - T_S(Y_S) + \Upsilon\]

\(\tau_c\) is linear cons. tax rate, \(T_S(y_S)\) are non-linear labor income taxes, \(\Upsilon\) are lump-sum transfers
• Budget constraint:

\[(1 + \tau_c)C = \mathcal{Y}_S - T_S(\mathcal{Y}_S) + \Upsilon\]

\(\tau_c\) is linear cons. tax rate, \(T_S(\mathcal{Y}_S)\) are non-linear labor income taxes, \(\Upsilon\) are lump-sum transfers

• Two-stage problem of household head, maximizing joint utility:

1. First stage: given \(z\), choose sector \(S\), household hours \(H\), cons. \(C\)

2. Second stage: given \(\eta\), choose individual hours \(h\), consumption \(c\)
Two Sectors

- Two sectors defined by production technology, not nature of goods
- Modern sector:
  - Competitive sector with constant returns to scale production
  - Pre-tax household income in modern sector: \( Y_M = wzH = A_M zH \)
  - Fixed cost of working \( \bar{u}_M \)
Two Sectors

- Two sectors defined by production technology, not nature of goods
- Modern sector:
  - Competitive sector with constant returns to scale production
  - Pre-tax household income in modern sector: \( Y_M = wzH = A_M zH \)
  - Fixed cost of working \( \bar{u}_M \)
- Traditional (subsistence self-employment) sector:
  - Decreasing returns production function: \( Y_T = A_T H^p \) (Bandiera et al. 2017)
  - No fixed cost of working
  - No taxation of labor income (Jensen, 2019)
Cross-Country Differences

- **Exogenous model input:**
  - Tax-and-transfer system \( \{\tau_c, T(\cdot), \Upsilon\} \)

- **Endogenously estimated:**
  - Aggregate labor productivities \( \{A_M, A_T\} \)
  - Fixed cost of working in modern sector \( \{\bar{u}_M\} \)
Novel Cross-Country Facts on Non-Linear Labor Income Taxes

Progressivity

- Tax function: $Y^{\text{net}} = Y - T(Y) = \lambda Y^{1-\tau}$ (Heathcote et al. 2017)
- Cross-country data from Egger et al. (2018)
- Estimate $\tau$ for each country

⇒ Progressivity increasing between middle and rich countries
Novel Cross-Country Facts on Non-Linear Labor Income Taxes

• Tax function: $Y^{net} = Y - T(Y) = \lambda Y^{1-\tau}$ (Heathcote et al. 2017)

• Cross-country data from Egger et al. (2018)

• Set $\lambda$ to match share of govt. revenues from labor income taxes

$\Rightarrow$ Labor taxation increasing between **middle and rich** countries

implied average income tax rate
Consumption Taxes and Redistribution

- “Consumption” taxes set to match govt. revenues over GDP
- Υ set to match social benefits over GDP

⇒ Consumption taxes and transfers increasing with GDP
Estimation

- Estimate model to key facts of average poor and rich country:
  - Employment rates
  - Fraction of workers in traditional sector
  - Average hours per worker in each sector
  - Output per adult

- Non-targeted moments:
  - Middle-income countries
## Estimated Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\gamma$</td>
<td>Curvature of consumption in preferences</td>
<td>1.21</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(1.13, 1.29)</td>
</tr>
<tr>
<td>$\alpha$</td>
<td>Weight of labor supply in preferences ($\times 10^{-6}$)</td>
<td>3.6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(2.1, 5.6)</td>
</tr>
<tr>
<td>$\phi$</td>
<td>Curvature of labor supply in preferences</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>(0.45, 0.58)</td>
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<tr>
<td>$\bar{u}_M^P$</td>
<td>Fixed cost of working, poor countries</td>
<td>0.39</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.20, 0.79)</td>
</tr>
<tr>
<td>$\bar{u}_M^R$</td>
<td>Fixed cost of working, rich countries</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>(0.12, 0.23)</td>
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<tr>
<td>$\rho$</td>
<td>Returns to scale in traditional sector</td>
<td>0.85</td>
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<tr>
<td></td>
<td></td>
<td>(0.65, 0.99)</td>
</tr>
<tr>
<td>$A_T^P$</td>
<td>Traditional sector productivity, poor countries</td>
<td>118</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(73, 195)</td>
</tr>
<tr>
<td>$A_T^R$</td>
<td>Traditional sector productivity, rich countries</td>
<td>624</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(445, 1044)</td>
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<tr>
<td>$A_M^P$</td>
<td>Modern sector productivity, poor countries</td>
<td>210</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(144, 270)</td>
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<tr>
<td>$A_M^R$</td>
<td>Modern sector productivity, rich countries</td>
<td>2575</td>
</tr>
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<td>(1918, 3385)</td>
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</tbody>
</table>
Estimated Model Fit

(a) Hours Worked per Adult

(b) Traditional Sector Share

(c) Employment Rate

(d) Hours per Worker
Decomposition: Quantitative Importance of Driving Factors

Start from average low-income country, impose no sectoral reallocation, and vary by development:

1. Aggregate labor productivities:
   - $A_M$ and $A_T$ increase

2. Additionally taxes and transfers:
   - Fiscal inputs as in the data

3. Additionally fixed cost of working in modern sector:
   - $\tilde{u}_M$ decreases

4. Finally, allow for sectoral reallocation

Which percentage of hours decline is explained?
Decomposition of Hours per Adult: Poor-Rich

<table>
<thead>
<tr>
<th></th>
<th>Hours</th>
<th>% Explained</th>
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<tr>
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<td>9.9</td>
<td>100.0</td>
</tr>
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<td>Higher Productivity</td>
<td>5.7</td>
<td>57.6</td>
</tr>
<tr>
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<td>2.3</td>
<td>23.2</td>
</tr>
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<td><strong>Structural Change in Labor Supply</strong></td>
<td></td>
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<td>4.3</td>
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- Income effects and sectoral reallocation most important drivers of decrease of hours over development spectrum
Decomposition of Hours per Adult: Poor-Rich

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**Structural Change in Labor Supply**

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- Income effects and sectoral reallocation most important drivers of decrease of hours over development spectrum
- Decreasing fixed costs as counteracting force
## Decomposition of Hours per Adult: Poor-Middle-Rich

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<td><strong>11.1</strong></td>
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### Structural Change in Labor Supply

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- Sectoral reallocation loses importance and taxes gain importance over development spectrum
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- Sectoral reallocation loses importance and taxes gain importance over development spectrum
- Decreasing fixed costs become stronger countervailing force
  ⇒ How will hours worked evolve in future?
5. THE FUTURE OF HOURS WORKED
Data on European countries and US from 1997/99 to 2017/19:

- Employment rates mostly increasing (despite population ageing)
- Hours per worker decreasing
Negative Correlation between Changes in Two Margins

- Countries w/ large increases in employment have large decreases in hours per worker
Model Predictions for Future Hours Worked

- Only income effects: Hours continue to decrease
- Adding increasing taxes and transfers:
  Predicted decrease becomes even stronger
Model Predictions for Future Hours Worked

- Adding decreasing fixed cost of working:
  Decrease overturned into slight increase
Increasing Employment Rates, Decreasing Hours per Worker

- Decreasing fixed costs lead to increasing employment rates
- For hours per worker, all three driving forces go in same direction
Evidence on Decreasing Fixed Costs of Work

Daily Commuting Time

Fatal Occupational Injuries

Looking ahead:

- Work from home
- Hours flexibility
Conclusion
Hours Worked Across the World

1. New data set of internationally comparable hours worked measures

2. Hours per adult are decreasing in GDP per capita
   - Convex employment rates, concave hours per worker

3. Structural change in labor supply as a new driver of hours worked
   - Matters for prediction of future hours
THANK YOU!


Extra Slides
Larger Welfare Differences Across Countries

- Measurement of welfare differences:
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    Rich countries have 12 times higher welfare than poor countries
  - Based on consumption and hours worked:
    19 times higher welfare
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Larger Labor Productivity Differences Across Countries

• Measurement of labor productivity differences:

  - GDP per worker 14 times higher in rich countries

  - GDP per hour worked 17 times higher in rich countries

⇒ Further challenge for development accounting (Caselli, 2005)
Average Weekly Hours per Adult (Ages 25+) by Education

Less than Secondary

Secondary

More than Secondary
Average Weekly Hours per Adult by Age

Prime

Young

Old
### Average Hours per Adult with U.S. Demographics

<table>
<thead>
<tr>
<th></th>
<th>Country Income Group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low</td>
</tr>
<tr>
<td>Actual Hours per Adult</td>
<td>28.5</td>
</tr>
<tr>
<td>Hypothetical Hours: U.S. Age Composition</td>
<td>29.5</td>
</tr>
<tr>
<td>Actual Hours per Adult (Ages 25+, Non-miss. Educ.)</td>
<td>33.0</td>
</tr>
<tr>
<td>Hypothetical Hours: U.S. Educ. Comp.</td>
<td>38.3</td>
</tr>
<tr>
<td>Hypothetical Hours: U.S. Age &amp; Educ. Comp.</td>
<td>34.9</td>
</tr>
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- Cross-country differences in hours per adult not driven by demographic compositions
Average Hours per Adult with Ghanaian Demographics

<table>
<thead>
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<th>Country Income Group</th>
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<th>Middle</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actual Hours per Adult (Ages 25+, Non-miss. Educ.)</td>
<td>33.0</td>
<td>25.2</td>
<td>20.7</td>
</tr>
<tr>
<td>Hypothetical Hours: U.S. Age &amp; Educ. Comp.</td>
<td>34.9</td>
<td>24.8</td>
<td>22.8</td>
</tr>
<tr>
<td>Hypothetical Hours: Ghanaian Age &amp; Educ. Comp.</td>
<td>29.6</td>
<td>19.5</td>
<td>15.8</td>
</tr>
</tbody>
</table>

- Cross-country differences in **hours per adult** not driven by demographic compositions
- Similar difference when imposing U.S. or Ghanaian demographics
Facts for Men Aged 25-54

(a) Hours Worked per Adult

(b) Employment Rate

(c) Average Hours Worked per Worker

- Between poor and rich
  - hours per adult decrease by 7.2 hours
  - employment rates decrease by 8.4 percentage points
  - hours per worker fall by 4.1 hours
### Average Weekly Hours per Adult by Gender

<table>
<thead>
<tr>
<th></th>
<th>Low-High</th>
</tr>
</thead>
<tbody>
<tr>
<td>All</td>
<td>9.5***</td>
</tr>
<tr>
<td>Women</td>
<td>10.0***</td>
</tr>
<tr>
<td>Men</td>
<td>8.9***</td>
</tr>
</tbody>
</table>

***/**/ denotes significance at the 1%/5%/10% level.

⇒ Hours per adult decrease for both gender
### Average Weekly Hours per Adult by Education

<table>
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</tr>
</thead>
<tbody>
<tr>
<td>All</td>
<td>9.5***</td>
</tr>
<tr>
<td>Ages 25+ (Non-missing Educ.)</td>
<td>12.3***</td>
</tr>
</tbody>
</table>

**Ages 25+**

<table>
<thead>
<tr>
<th>Education Level</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than Secondary</td>
<td>19.3***</td>
</tr>
<tr>
<td>Secondary Completed</td>
<td>13.7***</td>
</tr>
<tr>
<td>More than Secondary</td>
<td>12.5***</td>
</tr>
</tbody>
</table>

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⇒ Hours per adult decrease for all education groups
Life-Cycle Profiles of Average Weekly Hours per Adult

⇒ Hours per adult decrease for each age

• Caveat: cannot distinguish between age- and cohort-effects!
Shape of Extensive Margin Decrease is Broad Based

<table>
<thead>
<tr>
<th>Country Income Group</th>
<th>Low</th>
<th>Middle</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>All</td>
<td>74.5</td>
<td>52.4</td>
<td>54.6</td>
</tr>
<tr>
<td>Men</td>
<td>80.6</td>
<td>63.2</td>
<td>62.0</td>
</tr>
<tr>
<td>Women</td>
<td>68.5</td>
<td>42.1</td>
<td>47.7</td>
</tr>
<tr>
<td>Young (15-24)</td>
<td>57.4</td>
<td>32.4</td>
<td>37.9</td>
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<tr>
<td>Prime (25-54)</td>
<td>86.2</td>
<td>70.6</td>
<td>78.9</td>
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<tr>
<td>Old (55+)</td>
<td>69.8</td>
<td>30.5</td>
<td>24.0</td>
</tr>
</tbody>
</table>
Shape of Intensive Margin Decrease is Broad Based

<table>
<thead>
<tr>
<th>Country Income Group</th>
<th>Low</th>
<th>Middle</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>All</td>
<td>38.4</td>
<td>41.3</td>
<td>35.1</td>
</tr>
<tr>
<td>Men</td>
<td>40.8</td>
<td>43.7</td>
<td>38.2</td>
</tr>
<tr>
<td>Women</td>
<td>35.0</td>
<td>37.0</td>
<td>31.5</td>
</tr>
<tr>
<td>Young (15-24)</td>
<td>36.1</td>
<td>39.8</td>
<td>32.6</td>
</tr>
<tr>
<td>Prime (25-54)</td>
<td>40.6</td>
<td>42.3</td>
<td>35.9</td>
</tr>
<tr>
<td>Old (55+)</td>
<td>32.6</td>
<td>37.5</td>
<td>33.6</td>
</tr>
</tbody>
</table>
Hours per Worker in Agriculture vs. Rest

The graph compares the hours per worker in agriculture versus non-agriculture across different GDP per adult levels ($1,000). The data points are differentiated by triangular and circular markers, representing agriculture and non-agriculture, respectively. The x-axis represents GDP per adult ($1,000) ranging from 2 to 64, while the y-axis represents hours per week ranging from 0 to 60. The distribution of data points suggests a correlation between GDP per adult and hours worked, with a tendency for lower GDP per adult to be associated with higher hours worked.
### Some Evidence on Division Bias

<table>
<thead>
<tr>
<th>Dep. Var.: Hours</th>
<th>$\beta_w$</th>
<th>Obs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline - USA</td>
<td>Usual Main J.</td>
<td>0.125***</td>
</tr>
<tr>
<td>Robustness</td>
<td>Usual Main J.</td>
<td>0.124***</td>
</tr>
<tr>
<td></td>
<td>Actual All J.</td>
<td>0.125***</td>
</tr>
<tr>
<td>Baseline - Turkey</td>
<td>Actual All J.</td>
<td>$-0.303***$</td>
</tr>
<tr>
<td>Robustness</td>
<td>Actual All J.</td>
<td>$-0.303***$</td>
</tr>
<tr>
<td></td>
<td>Usual Main J.</td>
<td>$-0.211***$</td>
</tr>
<tr>
<td>Baseline - Peru</td>
<td>Actual All J.</td>
<td>$-0.108***$</td>
</tr>
<tr>
<td>Robustness</td>
<td>Actual All J.</td>
<td>$-0.150***$</td>
</tr>
<tr>
<td></td>
<td>Usual All J.</td>
<td>$0.056***$</td>
</tr>
<tr>
<td>Baseline - Mongolia</td>
<td>Actual All J.</td>
<td>$-0.213***$</td>
</tr>
<tr>
<td>Robustness</td>
<td>Actual All J.</td>
<td>$-0.213***$</td>
</tr>
<tr>
<td></td>
<td>Usual Main J.</td>
<td>$-0.189***$</td>
</tr>
<tr>
<td>Baseline - Uganda</td>
<td>Actual All J.</td>
<td>$-0.176***$</td>
</tr>
<tr>
<td>Robustness</td>
<td>Actual All J.</td>
<td>$-0.155***$</td>
</tr>
<tr>
<td></td>
<td>Usual All J.</td>
<td>$-0.055*$</td>
</tr>
<tr>
<td></td>
<td>Usual Main J.</td>
<td>$-0.070**$</td>
</tr>
</tbody>
</table>

- Robust evidence on bias, but except for Peru rather small
Country-Specific Elasticities of Hours to Wages: Women

Family Head’s Problem: Second Stage

- Given \((C, H)\) and sectoral choice, solve

\[
\max_{\{c(\cdot), h(\cdot)\}} \int \left[ \frac{c(\eta)^{1-\gamma}}{1-\gamma} - \alpha \frac{h^{1+\frac{1}{\phi}}}{1+\frac{1}{\phi}} - \bar{u}_S \eta \mathbb{I}_{h>0} \right] dF
\]

s.t.
\[
\int c(\eta) dF = C \\
\int h(\eta) dF = H
\]

- F.o.c. for consumption gives perfect risk sharing: \(c(\eta) = C\ \forall \eta\)

- No intensive labor supply variation within family

- Optimal hours function given by:

\[
h(\eta) = \begin{cases} 
h^* > 0 & \text{for } \eta \leq \eta^* \\
0 & \text{otherwise}
\end{cases}
\]
Family Head’s Problem: Second Stage (cont.)

- Head chooses threshold level $\eta^*$, implying $h^*$

- f.o.c.

\[
\alpha \frac{h^*(\eta^*)}{1 + \frac{1}{\phi}} f(\eta^*) + \bar{u}_S \eta^* f(\eta^*) = \alpha h^*(\eta^*) \frac{1}{\phi} h^*(\eta^*) F(\eta^*)
\]

The disutility of new workers plus the fixed cost of new workers equals the marginal utility of already working.

- Solution expresses $\eta^*$ as a function of family hours $H$, i.e.

$\eta^* = \eta^*(H)$

- If $\eta \sim U(0, 1)$, get closed form solution for $\eta^*(H)$ and $u(C, H)$
Family Head’s Problem: First Stage

Substituting optimal decisions into objective function gives family utility:

\[ U(C, H) \equiv C^{1-\gamma} - \gamma \frac{H^{1+\frac{1}{\phi}}}{1 + \frac{1}{\phi}} \left( F(\eta^*) \right)^{-\frac{1}{\phi}} - \bar{u}_S \int_0^{\eta^*} \eta dF \]  

(1)

see (Constantinides 1982)

First stage maximization problem:

\[
\max_{C, H, S \in \{T, M\}} \quad U(C, H) \\
\text{s.t.} \quad (1 + \tau_{C,S})C = Y_S - T_S(Y_S) + \gamma, \\
\text{where} \quad Y_M = wzH \text{ and } Y_T = A_T H^\rho
\]  

(2)
Taxation by Country Income

Notes: Data on share of workforce subject to tax from Jensen (2019)
Restrictions on Intensive Margin of Hours Worked

(a) Legal Limits on Hours per Day

(b) Legal Limits on Days per Week

Source: Doing Business 2005, World Bank
Implied Tax Rates

Average Labor Income Tax Rate

Consumption Tax Rate

GDP per adult ($1,000)

GDP per adult ($1,000)
Estimated Model Fit: Hours-Wage Elasticities

Model qualitatively matches shape, but not quantitatively
Importance of Structural Change: Omit Traditional Sector

(a) Hours Worked per Adult

(b) Traditional sector share

(c) Employment Rate

(d) Hours per Worker
Importance of Structural Change: Omit Variation in Fixed Costs

(a) Hours Worked per Adult

(b) Traditional sector share

(c) Employment Rate

(d) Hours per Worker
Omit T Sector and Variation in Fixed Costs

(a) Hours Worked per Adult

(b) Traditional sector share

(c) Employment Rate

(d) Hours per Worker
# Decomposition Poor-Rich: All Permutations

<table>
<thead>
<tr>
<th>Model</th>
<th>Hours</th>
<th>% Explained</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Min</td>
</tr>
<tr>
<td>Model</td>
<td>9.9</td>
<td></td>
</tr>
<tr>
<td>Higher Productivity</td>
<td>5.7</td>
<td>5.3</td>
</tr>
<tr>
<td>Higher Taxes &amp; Transfers</td>
<td>2.3</td>
<td>2.1</td>
</tr>
<tr>
<td>Lower Fixed Costs</td>
<td>-2.4</td>
<td>-3.1</td>
</tr>
<tr>
<td>Sectoral Reallocation</td>
<td>4.3</td>
<td>4.3</td>
</tr>
</tbody>
</table>
## Decomposition Poor-Middle: All Permutations

<table>
<thead>
<tr>
<th>Model</th>
<th>Hours</th>
<th>% Explained</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Min</td>
</tr>
<tr>
<td>Model</td>
<td>6.3</td>
<td></td>
</tr>
<tr>
<td>Higher Productivity</td>
<td>3.3</td>
<td>3.1</td>
</tr>
<tr>
<td>Higher Taxes &amp; Transfers</td>
<td>0.7</td>
<td>0.6</td>
</tr>
<tr>
<td>Lower Fixed Costs</td>
<td>-1.2</td>
<td>-1.4</td>
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<tr>
<td>Sectoral Reallocation</td>
<td>3.5</td>
<td>3.5</td>
</tr>
</tbody>
</table>
## Decomposition Middle-Rich: All Permutations

<table>
<thead>
<tr>
<th>Model</th>
<th>Hours</th>
<th>% Explained</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Min</td>
</tr>
<tr>
<td>Model</td>
<td>3.6</td>
<td></td>
</tr>
<tr>
<td>Higher Productivity</td>
<td>2.5</td>
<td>2.1</td>
</tr>
<tr>
<td>Higher Taxes &amp; Transfers</td>
<td>1.6</td>
<td>1.4</td>
</tr>
<tr>
<td>Lower Fixed Costs</td>
<td>-1.2</td>
<td>-1.7</td>
</tr>
<tr>
<td>Sectoral Reallocation</td>
<td>0.8</td>
<td>0.8</td>
</tr>
</tbody>
</table>
Model Predictions for Future Employment Rates

- Decreasing fixed costs lead to increasing employment rates
For hours per worker, all three driving forces go in same direction
Fact 4: Within-Country Hours-Wage Elasticities Turn from Negative to Positive
Individual Hours-Wage Elasticities by Country

• Do low-wage workers work longer hours than high-wage workers?

• Run regression country by country:

\[
\log(h_i) = \alpha + \beta \log(w_i) + \delta_1 a_{gei} + \delta_2 a_{gei}^2 + \epsilon_i
\]

• Costa (2000) runs same regression on historical US data
• Elasticity negative for most countries, positive for richest
• Cross-country evidence in line with US time-series evidence