

# Why are Average Hours Worked Lower in Richer Countries?

## The Roles of Income Effects, Taxes, and Structural Change

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- Two candidates of driving forces:
  - **Income effects** in preferences (Keynes 1930; Boppart and Krusell 2018)
  - **Tax-and-transfer systems** (Prescott 2004; Rogerson 2006, 2008)

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- This paper:
  - Build a model with structural change explaining the facts
  - Decompose relative roles of driving forces
  - Find that income effects are the main driving force behind the decline of average hours

## **Cross-Country Evidence**

## Hours Worked Across Countries

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	Country Income Group		
	Poor	Middle	Rich
Hours per Adult	28.5	21.7	19.0

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Employment Rate	<b>75.3</b>	<b>52.7</b>	54.5
Hours per Worker	38.4	<b>41.1</b>	<b>35.0</b>

- Employment rate decreases b/w poor & middle-inc. countries
- Hours per worker decrease b/w middle-inc. & rich countries

## Structural Change: Traditional versus Market Sectors

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	Country Income Group		
	Poor	Middle	Rich
Traditional Sec. Hours	35.4	36.8	39.2
Market Sec. Hours	46.4	42.1	34.9

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- **Traditional sector:** self-employed individuals with low education
- **Market sector:** all other working individuals
- Hours in traditional sector rather flat, in market sector decreasing
- Poor countries: hours in traditional sector 11 hours below hours in market sector

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Traditional Sec. Hours	35.4	36.8	39.2
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Traditional Sec. Share	64.6	19.9	5.9

- **Traditional sector:** self-employed individuals with low education
  - **Market sector:** all other working individuals
  - Hours in traditional sector rather flat, in market sector decreasing
  - Poor countries: hours in traditional sector 11 hours below hours in market sector
  - Share of traditional sector is sharply decreasing
- ⇒ These patterns drive the shape in aggregate hours per worker



**Model**

## A Model with Intensive/Extensive Margins of Labor Supply

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- Static labor supply model with heterogeneous labor productivity
  - ① Allow for income effects (MaCurdy, 1981; Boppart/Krusell, 2018)
  - ② Add progressive tax-and-transfer systems
  - ③ Add different sectors
    - \* Traditional (self-employed) vs. market sector
    - \* Sector-specific fixed cost of working: accessibility to market sector
    - \* Sectoral shares change endogenously by development
  - ④ Add family insurance

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## Families

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- Measure one of heterogenous families  
     $\hookrightarrow$  Within each family, measure one of heterogeneous individuals
- Families differ in market productivity  $z$  with  $\log(z) \sim N(0, \sigma_z^2)$

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- Families differ in market productivity  $z$  with  $\log(z) \sim N(0, \sigma_z^2)$
- Individuals within family differ in fixed disutility of work  $\eta$
- MaCurdy (1981) preferences for individuals:

$$u(\tilde{c}, \tilde{h}; \eta) = \frac{\tilde{c}^{1-\gamma}}{1-\gamma} - \alpha \frac{\tilde{h}^{1+\frac{1}{\phi}}}{1+\frac{1}{\phi}} - \bar{u}_S \eta \mathbf{1}_{\tilde{h}>0}$$

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- Perfect insurance within, no insurance across families (Heathcote et al., 2014)

## Two Sectors

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- Market sector:
  - Competitive sector with a linear production function and aggregate productivity  $A_M$
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- Market sector:
  - Competitive sector with a linear production function and aggregate productivity  $A_M$
  - Pre-tax family income in market sector:  $y_M = wz h$
- Traditional (self-employment) sector:
  - Decreasing returns to scale production function with aggregate productivity  $A_T$
  - Pre-tax family income in traditional sector:  $y_T = A_T h^\rho$



## Budget Constraint

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- Family budget constraint:

$$(1 + \tau_c)c = y - Tax(y) + \Upsilon$$

- Linear consumption tax  $\tau_c$
- Progressive income tax  $Tax(\cdot)$
- Lump-sum transfers  $\Upsilon$

## Exogenous Cross-Country Differences

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- ① Aggregate productivity  $\{A_M, A_T\}$
- ② Tax-and-transfer system  $\{\tau_c, Tax(\cdot), Y\}$
- ③ Accessibility to M sector  $\{\bar{u}_M\}$

**Bringing the Model to the Data**

## Fiscal Inputs

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Increasing in development:

- Total government revenues (IMF govt. statistics)
- Transfers (IMF govt. statistics)
- Progressivity of labor income tax (Egger et al., 2018)
- Labor income tax share of revenues (Egger et al., 2018)

## Calibration

- Construct “average” poor and rich country

Parameter	Value	Target
$A_M^{poor}$ $M$ sector productivity in poor countries	0.07	avg. output per adult in rich vs. poor countries
$A_T^{poor}$ $T$ sector productivity in poor countries	0.02	avg. % of workers in $T$ sector in poor countries
$A_T^{rich}$ $T$ sector productivity in rich countries	0.12	avg. % of workers in $T$ sector in rich countries
$\rho$ DRS parameter in $T$ sector	0.86	avg. hours per worker in $T$ sector in poor countries
$\gamma$ curvature of consumption function	1.20	avg. hours per worker in rich countries
$\phi$ curvature of disutility of working	0.55	avg. hours per worker in $M$ sector in poor countries
$\bar{u}_M^{rich}$ mean disutility of working in $M$ sector in rich countries	2.44	avg. ER in rich countries
$\bar{u}_M^{poor}$ mean disutility of working in $M$ sector in poor countries	5.51	avg. ER in poor countries

## Model Fit

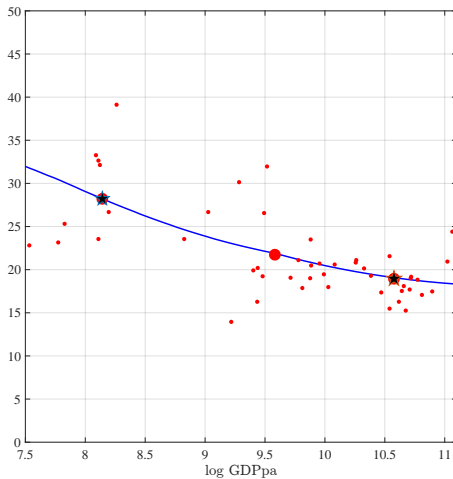
## Country Predictions

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- Assume TFP in M sector  $A_M$  increasing linearly in log
- Taxes/transfers,  $A_T$  and  $\bar{u}_M$  change (piece-wise linearly) with  $A_M$
- For given TFP, solve for optimal hours

## Model Fit: Aggregate Hours per Adult

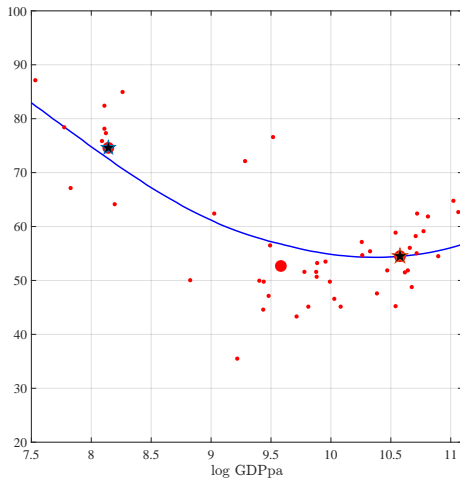
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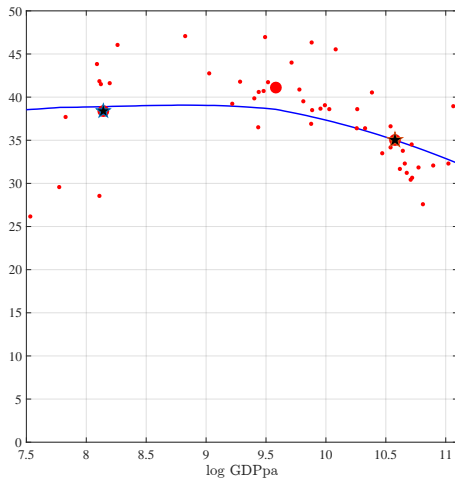
## Model Fit: Employment Rate

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## Model Fit: Average Hours per Worker

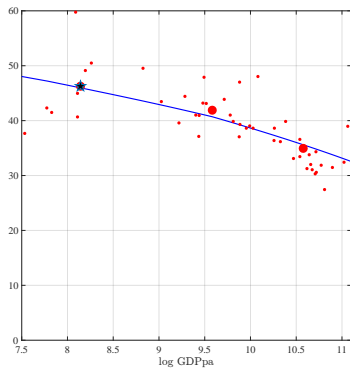
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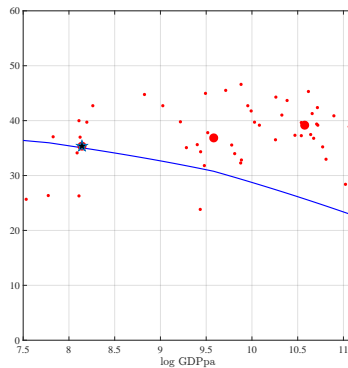
# Model Fit: Sectoral Hours per Worker

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Market Sector

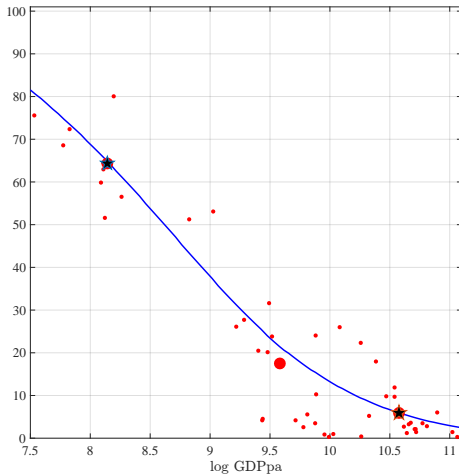


Traditional Sector



## Model Fit: Employment Share in Traditional Sector

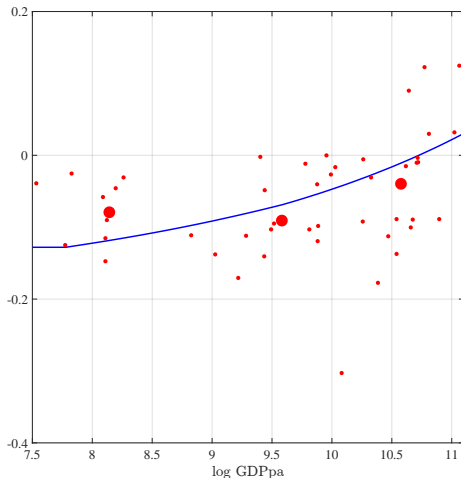
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## Model Fit: Within-Country Hours-Wage Elasticity

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$$\log(h_i) = \alpha + \beta \log(w_i) + \delta_1 \text{age}_i + \delta_2 \text{age}_i^2 + \epsilon_i$$



## Decomposition

## Income Effects vs Tax-and-Transfers

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- Taxes and transfers:
  - Only the fiscal inputs vary as in the data
  - No sectoral choice
- Income effects:
  - Only TFPs vary;  $A_T$  increases proportionally with  $A_M$
  - No sectoral choice
- Other effects:
  - Structural change (sectoral reallocation, change in  $\bar{u}_M$ )
  - interaction

## Decomposition Exercise

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	Hours per Adult $\Delta_{P-R}$	Empl. Rate (pp) $\Delta_{P-R}$	Hours per Worker $\Delta_{P-R}$
Model/Data	9.1	18.1	3.9

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## Decomposition Exercise

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	Hours per Adult $\Delta_{P-R}$	Empl. Rate (pp) $\Delta_{P-R}$	Hours per Worker $\Delta_{P-R}$
Model/Data	9.1	18.1	3.9
Income Effect	6.1	<b>67%</b>	
Tax/Transfer	1.9	21%	
(Struc. ch.)		12%	

## Decomposition Exercise

	Hours per Adult $\Delta_{P-R}$		Empl. Rate (pp) $\Delta_{P-R}$		Hours per Worker $\Delta_{P-R}$	
Model/Data	9.1		18.1		3.9	
Income Effect	6.1	<b>67%</b>	5.6	31%	5.9	152%
Tax/Transfer	1.9	21%	1.2	7%	2.0	52%
(Struc. ch.)		12%		62%		-104%

## Conclusions

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- Quantitative model to explain aggregate and disaggregate facts in labor hours over development spectrum
- Income effects are the main driving force in explaining decreasing hours
- Tax-and-transfer systems play a secondary role, may be important for explaining differences in hours across rich countries
- Structural change is crucial in explaining the extensive and intensive margins of labor supply across countries

**Extra Slides**

## Family Head's Problem: Second Stage

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- Given  $(c, h)$  and sectoral choice, solve

$$\begin{aligned} \max_{\{\tilde{c}(\cdot), \tilde{h}(\cdot)\}} \quad & \int \left[ \frac{\tilde{c}(\eta)^{1-\gamma}}{1-\gamma} - \alpha \frac{\tilde{h}^{1+\frac{1}{\phi}}}{1+\frac{1}{\phi}} - \bar{u}_S \eta l_{\tilde{h}>0} \right] dF \\ \text{s.t.} \quad & \int \tilde{c}(\eta) dF = c \\ & \int \tilde{h}(\eta) dF = h \end{aligned}$$

- F.o.c. for consumption gives perfect risk sharing:  $\tilde{c}(\eta) = c \forall \eta$
- No intensive labor supply variation within family
- Optimal hours function given by:

$$\tilde{h}(\eta) = \begin{cases} \tilde{h}^* > 0 & \text{for } \eta \leq \eta^* \\ 0 & \text{otherwise} \end{cases}$$

## Family Head's Problem: Second Stage (cont.)

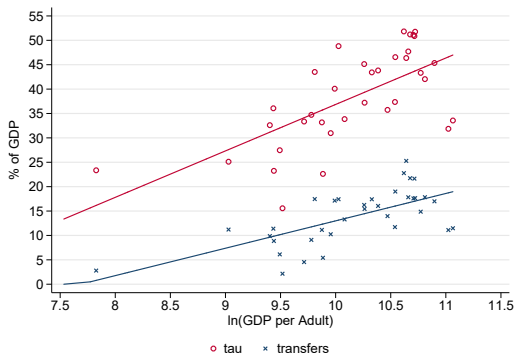
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- Head chooses threshold level  $\eta^*$ , implying  $\tilde{h}^*$
- f.o.c.

$$\underbrace{\alpha \frac{\tilde{h}^*(\eta^*)^{1+\frac{1}{\phi}}}{1+\frac{1}{\phi}} f(\eta^*)}_{\text{disut. of new workers}} + \underbrace{\bar{u}_S \eta^* f(\eta^*)}_{\text{fixed cost of new workers}} = \underbrace{\alpha \tilde{h}^*(\eta^*)^{\frac{1}{\phi}} \tilde{h}^{*'}(\eta^*) F(\eta^*)}_{\triangle \text{ marg. ut. of already working}}$$

- 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  $u(c, h)$

## Fiscal Inputs: Taxes and Transfers

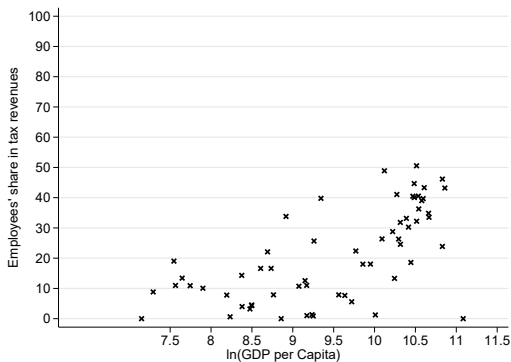


Fiscal parameters  $\Upsilon$ ,  $G$

- Use the IMF govt. statistics
- $\Upsilon/Y$ : social benefits share of GDP
- $G/Y$ : govt. expenditure minus social benefits share of GDP

## Fiscal Inputs: Taxes and Transfers

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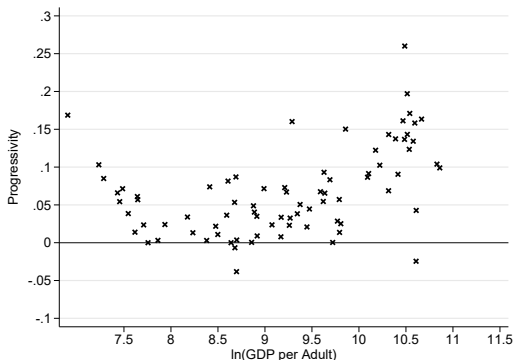
Consumption tax  $\tau_c$

- Target the share of revenues coming from personal taxes



## Fiscal Inputs: Taxes and Transfers

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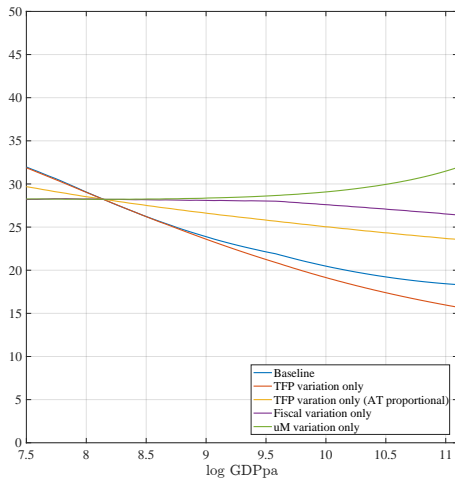


Progressive Benabou (HSV) income tax:  $Tax(y) = y - \lambda y^{1-\tau}$

- Estimate progressivity parameter  $\tau$ : use cross-country Gini coefficients, simulate log-normally distributed earnings and apply statutory tax codes
- $\lambda$ : set to close the government budget

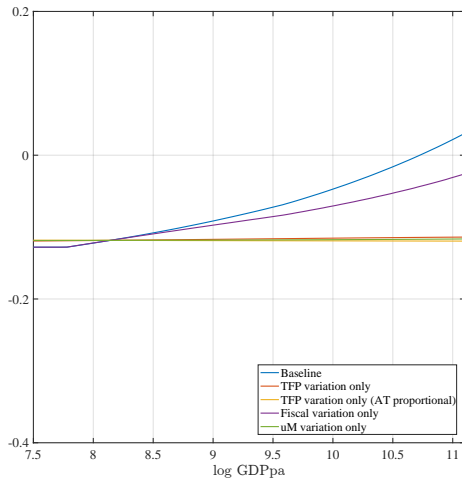
## Decomposition Results: Hours per Adult

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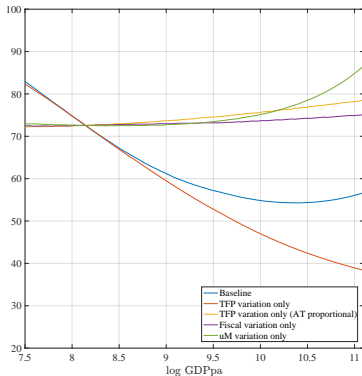
## Decomposition Results: Hours-Wage Elasticity

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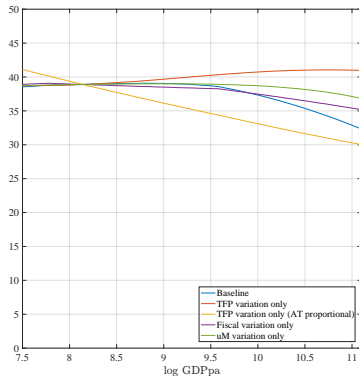


# Decomposition Results: Employment and Hours

## Employment Rate



## Hours per Worker



## Decomposition Results: Sectoral Choice

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