Gender, Work and Structural Transformation

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Development is accompanied by structural change out of agriculture
This paper

   - Standard theory of structural change does not apply to females
   - Large gender employment gaps across sectors (ag/non-ag) and location.
   - Differences in household employment composition

> Differences in rural/urban female employment act as a mobility cost.

2. Write down model of labor supply provision that features:
   - income effects.
   - preferences for market vs home work
   - return of market work vs home

> Focus on the gender dimension of structural change out of agriculture in LIC.
Introduction: Literature


- Measurement of time use, leisure, and home production [Aguiar and Hurst, 2007, Ramey and Francis, 2009, Bick et al., 2018, Bridgman et al., 2018]

- Family economics [Greenwood et al., 2017]

- Gender, Talent allocation and structural change - Kleineberg and Chiplunkar (2021), [Hsieh et al., 2019]
Outline

1. Harmonized World Labor Force Survey (HWLFS)

2. Stylized facts

3. Model of household labor provision

4. Calibration to a representative LIC

5. Counterfactual analysis
   - Effect of gender norms, labor market wedge and TFP on ag. employment and GDP.
Data: Harmonized World Labor Force Survey

A large scale micro dataset that we assembled.

- Harmonize demographic, education, household and labor market information.
- Household, labor force surveys and censuses from 90+ countries.
- Nests IPUMS Intl., IPUMS-US historical and EU-LFS.
- 1000+ country-year surveys.
- **Observations:** ≈ 200 mio. individuals.
- **Coverage:** $120 (ETH 1999) - $115,000 (LUX 2018)
- **Sample:** working-age population aged 15-65.
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Today use information on:

- Demographics: gender, marital status, age.
- Employment: status, sector or location (urban/rural).
- Wages: hourly wages.
Fact 1: Structural change by gender

- Employment rate → - 1: Agriculture ↓ ; 2: Non-agriculture ↑

→ Standard theory of structural change.
Fact 1: Structural change by gender

- Employment rate is U-shaped - 1: Ag ↓ ; NILF ↑ - 2: NILF ↓ ; Non-ag ↑

→ Not the standard theory of structural change.
Fact 2: Gender employment gap by marital status and location

- Employment gap largest for married women in particular in urban areas.
- Robust to controlling for age and education.
Fact 3: Household employment choices

- With development, drop in agricultural employment is driven by drop in joint employment in agriculture.
Fact 3: Household employment choices

- In LIC, high share of dual earners in agriculture
Fact 3: Household employment choices

- 25% of non-agricultural workers have a spouse that is NILF.
Implications:

- Location choices result from
  
  > labor income, amenities for singles and married, and
  
  > spousal labor income for married households.

- Factors reducing married female urban employment act as a mobility cost
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- Location choices result from
  
  > labor income, amenities for singles and married, and
  
  > spousal labor income for married households.

- Factors reducing married female urban employment act as a mobility cost

- Supporting evidence:
  
  1. Higher marriage rate in rural areas
  
  2. Married males more likely to be in rural area than single males
Marriage rate by rural/urban

In low-income countries, share of married individuals is higher in rural areas.
Married male location choices and female employment opportunities

<table>
<thead>
<tr>
<th></th>
<th>Urbanization rate of married males</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
</tr>
<tr>
<td>Urbanization rate of single males</td>
<td>0.98***</td>
</tr>
<tr>
<td></td>
<td>(0.01)</td>
</tr>
<tr>
<td>ER of female-married-urban</td>
<td>0.17***</td>
</tr>
<tr>
<td></td>
<td>(0.01)</td>
</tr>
<tr>
<td>ER of female-married-rural</td>
<td>−0.18***</td>
</tr>
<tr>
<td></td>
<td>(0.01)</td>
</tr>
<tr>
<td>Log GDP per capita</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>−0.0001</td>
</tr>
<tr>
<td></td>
<td>(0.01)</td>
</tr>
<tr>
<td>Observations</td>
<td>790</td>
</tr>
<tr>
<td>R²</td>
<td>0.96</td>
</tr>
</tbody>
</table>

Note: *p<0.1; **p<0.05, ***p<0.01

- Urbanisation rate of married males is positively correlated with urban FER.
Model

- Write down a model of labor supply provision.

  - Married and single households

  - Preference for market and home produced goods ($\omega$)

  - Preferences for market and home work ($\chi$) (NILF: housework)

  - Gender gaps ($h$) in return to market work (Gender wage gaps HHI: occupations)

- Use model to study their role in driving the structural change out of agriculture.
Model:

- Three types of households
  - Differ by marital status and gender.
  - Households choose market ($L_m$), home hours ($L_h$) and sector/location to maximize utility.

- Two sectors:
  - Agricultural production takes place in rural area,
  - Non-agricultural production takes place in urban area.
Model: Single households

- Household derives utility from consumption and disutility of work

\[ u = \frac{c^{1-\sigma}}{1-\sigma} - \xi \frac{L^{1+1/\phi}}{1+1/\phi}, \]

- Disutility from both market \((L_m)\) and home \((L_h)\) labor supply.

\[ L = \chi L_m + (1 - \chi)L_h. \]

- Consume home goods \((c_h)\) and market goods \((c_m)\).

\[ c = \left[ (1 - \omega) c_m^{\frac{\varepsilon-1}{\varepsilon}} + \omega c_h^{\frac{\varepsilon-1}{\varepsilon}} \right]^{\frac{\varepsilon}{\varepsilon-1}} \]

- Preference structure is borrowed from [Boerma and Karabarbouris, 2017].
Model: Single households: Budget constraints

- Market goods are either agricultural goods ($c_a$) or non-agricultural goods ($c_n$).

$$c_m = \left[ \theta c_a \frac{\psi-1}{\psi} + (1 - \theta) c_n \frac{\psi-1}{\psi} \right] \frac{\psi}{\psi-1}$$

- Income from market work is spent on ag. and non-ag. goods.

$$p_a c_a + c_n = P c_m = w h L_m$$

- Home hours are used to produce a home good.

$$c_h = z L_h$$
Model: Single households: Allocation

- Provision of market work:

\[
(L_m)^{\sigma + 1/\phi} = \left(\frac{1 - \omega}{\chi}\right)^{\frac{\varepsilon(1-\sigma)}{\varepsilon - 1}} \left(\frac{wh}{P}\right)^{1-\sigma} 1^{-\sigma} 1^{\frac{1-\sigma\varepsilon}{\varepsilon - 1} - \frac{1}{\phi}}
\]

- **Substitution effect:** \( \omega \) and \( \chi \) decrease share of market work, while \( h \) increases market work if \( \sigma\varepsilon > 1 \) (via \( \Theta\left(\frac{\sigma}{h}, \frac{\chi}{h}, \frac{\omega}{h}\right)\))

- **Level:** \( \chi \) and \( \omega \) decreases market work. \( h \) may increase / decrease market work.

- **Sectoral indifference condition:**

\[
(1 - \omega_a)^{\varepsilon} \left(\frac{w_a h_a}{P X_a}\right)^{\varepsilon-1} + \omega_a^{\varepsilon} \left(\frac{z_h}{1 - \chi_a}\right)^{\varepsilon-1} = (1 - \omega_n)^{\varepsilon} \left(\frac{w_n h_n}{P X_a}\right)^{\varepsilon-1} + \omega_n^{\varepsilon} \left(\frac{z_h}{1 - \chi_n}\right)^{\varepsilon-1}
\]

- \( h \) increases utility if \( \varepsilon > 1 \). \( \omega \) and \( \chi \) can increase or decrease utility.
Model: Married households: Preferences & budget

- Married households pool resources and maximize weighted sum of utilities.

\[ u = \lambda \left( \frac{c^{m1-\sigma}}{1 - \sigma} - \xi \left( \frac{\chi^m L^m}{1 + 1/\phi} \right)^{1+1/\phi} \right) + (1 - \lambda) \left( \frac{c^{f1-\sigma}}{1 - \sigma} - \xi \frac{L^f}{1 + 1/\phi} \right) \]

- Married males do not supply labor towards home production such that \( L^m_h = 0 \).
- Female provision of labor: \( L^f = \chi^f L^f_m + (1 - \chi^f) L_h \)
- Consumption of market goods is rival, while home goods is non-rival.

\[ P(c^m_m + c^f_m) = w^m L^m_m + w^f h^f L^f_m \]

\[ p_a c^a_a + c^j_n = P c^j_m, \quad j = m, f \]

- Female home hours are used to produce a home good \( (c_h = z_h L_h) \)
Model: Married households: Allocation

Married female market work:

\[ L^f_m \sigma + \frac{1}{\phi} = \frac{w^f h^f}{P} \left( \frac{w^m L^m_m + w^f h^f}{L^m_m + P} \right)^{\sigma} \Lambda(x^f, h^f, \omega). \]

- If \( L^m_m = 0 \), the post-wedge wage would enter as for singles.

- Male labor income controls the income effect of wages on female market work.
**Model: Firms**

CES production function using four types of labor inputs:

\[ Y = A \left[ \sum_j \mu^j N^j \right]^{1/\rho}, \quad j \in \{fu, fs, mu, ms\}. \]

where weights \( \mu^j \) for input type \( j \) and \( \rho < 1 \) controls the substitutability of inputs.

Within each sector, gender wage gaps by marriage type are

\[ \frac{w^{fi}}{w^{mi}} = \frac{\mu^{fi}}{\mu^{mi}} \left( \frac{N^{fi}}{N^{mi}} \right)^{\rho-1}, \quad i = s, m. \]

Sectoral wage gaps by type are

\[ \frac{w^j_n}{w^j_a} = \frac{\mu^j_n}{\mu^j_a} \left( \frac{A_n}{A_a} \right)^{\rho} \left( \frac{Y_n/N^j_n}{Y_a/N^j_a} \right)^{1-\rho}. \]
Model: Equilibrium

An equilibrium consists of $p_a, \pi^j, w^j_k, L^j_{mk}, k = a, n, j = fs, ms, fu, mu$, such that

1. households choose their location optimally,

2. households choose market and home labor supply optimally,

3. firms choose inputs optimally, and

4. goods and labor markets clear.

Goods market clearing condition:

$$\frac{Y_a}{Y_n} = \frac{C_a}{C_n} = \left(\frac{\omega_a}{1 - \omega_a}\right)^\psi p_a^{-\psi}$$
Calibration:

- We calibrate the model to a representative low-income country at 1’000 GDP pc ppp.

- We proceed in 3 steps

  1. Parametrize global parameters.

  2. Use aggregate employment rates and wage gaps to get supply side parameters.

  3. Calibrate $\chi$, $h$, $\omega$ using employment rates by location, gender, marital status.
Calibration: Parametrization

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Parameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frisch elasticity</td>
<td>$\phi$</td>
</tr>
<tr>
<td>Risk aversion</td>
<td>$\sigma$</td>
</tr>
<tr>
<td>Elasticity of substitution ag./non-ag</td>
<td>$\psi$</td>
</tr>
<tr>
<td>Elasticity of substitution home./market good</td>
<td>$\varepsilon$</td>
</tr>
<tr>
<td>Substitutability labor inputs</td>
<td>$\rho$</td>
</tr>
<tr>
<td>Labor productivity of home production</td>
<td>$z$</td>
</tr>
<tr>
<td>Marriage rate</td>
<td>0.625</td>
</tr>
<tr>
<td>Share of singles in rural area</td>
<td>0.8</td>
</tr>
<tr>
<td>Share of married in rural area</td>
<td>0.67</td>
</tr>
<tr>
<td>Share of males in population</td>
<td>0.67</td>
</tr>
</tbody>
</table>
## Calibration:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Labor Input weights</td>
<td>$\mu$</td>
<td>wage gaps</td>
</tr>
<tr>
<td>Labor input</td>
<td>$N$</td>
<td>employment rates</td>
</tr>
<tr>
<td>Agricultural production</td>
<td>$Y_a$</td>
<td>set $A_a = 1$</td>
</tr>
<tr>
<td>Non-Ag. TFP</td>
<td>$A_n$</td>
<td>Non-ag. firm FOC</td>
</tr>
<tr>
<td>Price of agricultural good</td>
<td>$p_a$</td>
<td>Ag. firm FOC</td>
</tr>
<tr>
<td>Pref. for ag. goods</td>
<td>$\theta$</td>
<td>Goods market clearing</td>
</tr>
</tbody>
</table>

- Use data on urban, gender, and marital wage gaps and employment rates to back out value of labor inputs

- Use firm FOC’s and market clearing condition to back out $A_n, p_a$, and $\theta$
Calibration: strategy

<table>
<thead>
<tr>
<th>Household type</th>
<th>Agriculture</th>
<th>Non-Agriculture</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single males</td>
<td>$\omega_a$</td>
<td>$\chi_{s,a}$</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>$\omega_n$</td>
</tr>
<tr>
<td></td>
<td>$\chi_{s,m}$</td>
<td>$\chi_{s,n}$</td>
</tr>
<tr>
<td>Single females</td>
<td>$\omega_a$</td>
<td>$h_a$</td>
</tr>
<tr>
<td></td>
<td>$h_a$</td>
<td>$\chi_{s,f}$</td>
</tr>
<tr>
<td></td>
<td>$\omega_n$</td>
<td>$h_n$</td>
</tr>
<tr>
<td></td>
<td>$\chi_{s,n}$</td>
<td>$\chi_{s,n}$</td>
</tr>
<tr>
<td>Married females</td>
<td>$\omega_a$</td>
<td>$h_a$</td>
</tr>
<tr>
<td></td>
<td>$h_a$</td>
<td>$\chi_{u,a}$</td>
</tr>
<tr>
<td></td>
<td>$\omega_n$</td>
<td>$h_n$</td>
</tr>
<tr>
<td></td>
<td>$\chi_{u,n}$</td>
<td>$\chi_{u,n}$</td>
</tr>
<tr>
<td>Married males</td>
<td>$\omega_a$</td>
<td>$1$</td>
</tr>
<tr>
<td></td>
<td>$\chi_{u,a}$</td>
<td>$\omega_n$</td>
</tr>
<tr>
<td></td>
<td>$\chi_{u,n}$</td>
<td>$\chi_{u,n}$</td>
</tr>
</tbody>
</table>

- Ideally, we would like to estimate 20 parameters.

- We have 11 empirical moments: 8 employment shares and 3 sectoral shares.

- Need to make some assumptions.
Calibration: strategy

<table>
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<th>Non-Agriculture</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single males</td>
<td>$\omega_a^s$</td>
<td>$1$</td>
</tr>
<tr>
<td>Single females</td>
<td>$\omega_a^s$</td>
<td>$h_a$</td>
</tr>
<tr>
<td></td>
<td>$\chi_s^m$</td>
<td></td>
</tr>
<tr>
<td>Married females</td>
<td>$\omega_a^u$</td>
<td>$h_a$</td>
</tr>
<tr>
<td></td>
<td>$\chi_{u,a}^m$</td>
<td></td>
</tr>
<tr>
<td>Married males</td>
<td>$\omega_a^u$</td>
<td>$1$</td>
</tr>
<tr>
<td></td>
<td>$\chi_u^m$</td>
<td></td>
</tr>
</tbody>
</table>

- $\omega$ differs by location and marital status.

- $\chi$ differs by gender and marital status. Also by location for married females.

- $h$ differs by location.
Calibration: results

<table>
<thead>
<tr>
<th>Household type</th>
<th>Agriculture</th>
<th>Non-Agriculture</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$\omega$</td>
<td>$h$</td>
</tr>
<tr>
<td>Single males</td>
<td>0.26</td>
<td>1</td>
</tr>
<tr>
<td>Single females</td>
<td>0.26</td>
<td>0.53</td>
</tr>
<tr>
<td>Married females</td>
<td>0.1</td>
<td>0.53</td>
</tr>
<tr>
<td>Married males</td>
<td>0.1</td>
<td>1</td>
</tr>
</tbody>
</table>

- Large labor market wedge in non-agriculture relative to agriculture.
- Higher share of home goods in non-agriculture/urban areas.
- Larger disutility of work in agriculture for married females.
Counterfactual

Effect on agricultural employment share and GDP of

1. Change in non-ag TFP \((A_n)\)

2. Change in \(h_h\)

3. Change in \(\chi_n^f\)
Elasticity of ag. emp wrt norms (labor market penalty) = $1/7 \ (1/3)$ of non-ag TFP.
Counterfactual

- Elasticity of GDP wrt norms (labor market penalty) = $\frac{2}{3}$ ($\frac{1}{4}$) of non-ag TFP.
Conclusion:

- Structural change out of agriculture is gendered.

> Gender wage gaps and disutility of female work in urban areas acts as a mobility cost for singles.

> Loss of spousal labor income in urban areas acts as a mobility cost for married households.

- These gender differences act as a break to structural change.

- Next steps:
  1. Time use survey data to improve model calibration.
  2. Discipline income effects by gender, marital status and location.
Appendix: Gender education gap

Gender education gap
Average years of education of men relative that of women

LOESS − Each country with weight 1, shaded area marks the 95% confidence interval
Age 15–64
Female employment is concentrated than male employment, in particular in LIC.
Appendix: Marriage rate
Appendix: Urbanization rate

Share of population living in urban area

GDP per capita (PPP)

Gender:  Female  Male

LOESS – Each country with weight 1, shaded area marks the 95% confidence interval
Share of population aged 15–64
Appendix: Reason NILF by gender and urban

NILF reason: Housework

Gender, Urbanisation: Female, rural Female, urban Male, rural Male, urban

LOESS – Each country with weight 1, shaded area marks the 95% confidence interval
Age 15–64, Non-missing NILF-reason
Mincer regression: Gender wage gap

Wage regression
Female dummy

Estimated coefficient

GDP per capita (PPP)
(logarithmic scale)

Quadratic fit, shaded area marks the 95% confidence interval
Wage workers aged 15–64, nationally representative surveys; Min. sample size: 2,000, controls: age, age^2, quadratic fit.
Employment rate by gender
Marriage premium

Wage Premium: Married
Reference Group: Single Males in rural areas

GDP per capita (PPP)

Quadratic fit - Each country with weight 1. shaded area marks the 95% confidence interval
Working age population (Age 15-65), Outcome: Log hourly wage in the main job, excluding in-kind payments
Urban premium

Wage Premium: Urban
Reference Group: Single Males in rural areas

Quadratic fit. Each country with weight 1, shaded area marks the 95% confidence interval.
Working age population (Age 15-65). Outcome: Log hourly wage in the main job, excluding in-kind payments.
Gender wage gap

Wage Premium: Female
Reference Group: Single Males in rural areas

GDP per capita (PPP)

Quadratic fit - Each country with weight 1. Shaded area marks the 95% confidence interval.
Working age population (Age 15-65), Outcome: Log hourly wage in the main job, excluding in-kind payments.
Employment rates by gender x marital status x urban


References II


