Structural Transformations with Long-Run Income and Price Effects

Martí Mestieri (TSE)

joint with Diego Comin (Dartmouth) and Danial Lashkari (Harvard)

EFJK Meeting
February 26, 2015

Kaldor Facts

Aggregate

Technological Differences across Sectors

Sectorial

Kaldor Facts

Non-homothetic Engel Curves

Sectorial

Demand Side

Technological Differences across Sectors

Kaldor Facts

Non-homothetic Engel Curves

Demand side

$C(C_{at}, C_{mt}, C_{st})$

Demand Side

Technological Differences across Sectors

Kaldor Facts

Non-homothetic Engel Curves

Stone-Geary

$$CES(C_{at} - \overline{C}_a, C_{mt}, C_{st} + \overline{C}_s)$$

Asymptotically Homothetic

Details

Supply Side

Technological Differences across Sectors

Kaldor Facts

Non-homothetic Engel Curves

Supply side

$$Y_{it} = K_{it}^{\alpha_i}(A_{it}L_{it})^{1-\alpha_i},$$
$$i \in \{a, m, s\}.$$

Details Partial Corr.

What We Do

Technological Differences across Sectors

Kaldor Facts

Non-homothetic Engel Curves

What We Do

- We introduce an alternative utility function (Hanoch, 75),
  - generates log-linear demand.
- Consistent with Kaldor facts, trends in relative prices, non-homothetic demand for *any* number of goods .

What We Do

- We introduce an alternative utility function (Hanoch, 75),
  - generates log-linear demand.
- Consistent with Kaldor facts, trends in relative prices, non-homothetic demand for *any* number of goods .
- Additional desirable properties:
  1. Generates a hump-shape in manufacturing.
  2. Not relying on a knife-edge condition.
  3. Income and price elasticities as separate fundamentals.
  4. Generates a positive correlation between nominal and real VA.

What We Do

- We introduce an alternative utility function (Hanoch, 75),
    - generates log-linear demand.
- Consistent with Kaldor facts, trends in relative prices, non-homothetic demand for *any* number of goods .
- Additional desirable properties:
    1. Generates a hump-shape in manufacturing.
    2. Not relying on a knife-edge condition.
    3. Income and price elasticities as separate fundamentals.
    4. Generates a positive correlation between nominal and real VA.
- Show it provides a parsimonious fit of the data.
    - Cross-country panel postwar period.
    - Household Expenditure micro-data for US and Mexico.

Outline

1. Theory
   - Intertemporal Problem
   - Within Period Problem
2. Empirics
   - Panel 30 Countries
   - Household micro-data estimation for the US
   - Extensions
3. Conclusions

Household Problem - Intertemporal Decision

- Household maximizes $\{C_t\}_{t=0}^{\infty}$

$$\sum_{t=0}^{\infty} \beta^t \left(\frac{C_t^{1-\theta} - 1}{1-\theta} \right), \tag{1}$$

subject to budget constraint

$$K_{t+1} + P_t C_t \leq w_t + K_t \left(1 + r_t\right).$$

- Within period utility,

$$C_t(C_{1t}, \ldots, C_{it}, \ldots, C_{It}). \tag{2}$$

Within Period Utility

$$\sum_{i=1}^{I} C_t^{\frac{\varepsilon_i - \sigma}{\sigma}} C_{it}^{\frac{\sigma-1}{\sigma}} = 1,$$

- σ is the elasticity of substitution.
- ε_i is the real income elasticity $\rightarrow$ constant

$$\varepsilon_i = \frac{\partial \ln C_{it}}{\partial \ln C_t}.$$

- If $\varepsilon_i = 1$, we recover homothetic CES.
- Income and price elasticities are independent (Hanoch, 75).

Production

- Follow Herrendorf, Rogerson and Valentinyi (2014)

$$\begin{aligned} Y_{it} &= K_{it}^{\alpha} \left(A_{it} L_{it}\right)^{1-\alpha}, \qquad i = 1, \ldots, I, \\ X_t &= K_{0t}^{\alpha} \left(A_{0t} L_{0t}\right)^{1-\alpha}. \end{aligned}$$

- There is sectoral-specific technological progress,

$$\frac{A_{0,t+1}}{A_0 t} = 1 + \gamma_0, \qquad \frac{A_{i,t+1}}{A_{it}} = 1 + \gamma_i.$$

Production

- Follow Herrendorf, Rogerson and Valentinyi (2014)

$$
\begin{aligned}
Y_{it} &= K_{it}^{\alpha}\left(A_{it}L_{it}\right)^{1-\alpha}, \qquad i = 1,\ldots,I, \\
X_t &= K_{0t}^{\alpha}\left(A_{0t}L_{0t}\right)^{1-\alpha}.
\end{aligned}
$$

- There is sectoral-specific technological progress,

$$
\frac{A_{0,t+1}}{A_0 t} = 1+\gamma_0, \qquad \frac{A_{i,t+1}}{A_{it}} = 1+\gamma_i.
$$

- Study Competitive Equilibrium. ▸ Definition

Household Behavior

Within-Period Characterization

Given $\left\{w_t, r_t, \{p_{it}\}_{i\in I}, E_t\right\}_{t=0}^{\infty}$, Household choses,

$$C_{it} = \left(\frac{p_{it}}{P_t}\right)^{-\sigma} \left(\frac{E_t}{P_t}\right)^{\varepsilon_i}, \qquad i \in \mathcal{I}.$$

Household Behavior

Within-Period Characterization

Given $\left\{w_t, r_t, \{p_{it}\}_{i\in I}, E_t\right\}_{t=0}^{\infty}$, Household choses,

$$
\begin{aligned}
C_{it} &= \left(\frac{p_{it}}{P_t}\right)^{-\sigma} C_t^{\varepsilon_i}, \qquad i \in \mathcal{I}, \\
P_t &\equiv \frac{E_t}{C_t} = \frac{1}{C_t}\left[\sum_{i=1}^{I} C_t^{\varepsilon_i-\sigma} p_{it}^{1-\sigma}\right]^{\frac{1}{1-\sigma}}.
\end{aligned}
$$

Euler Equation

Household Behavior

Within-Period Characterization

Given $\left\{w_t, r_t, \{p_{it}\}_{i\in I}, E_t\right\}_{t=0}^{\infty}$, Household choses,

$$C_{it} = \left(\frac{p_{it}}{P_t}\right)^{-\sigma} C_t^{\varepsilon_i}, \qquad i \in \mathcal{I},$$

$$P_t \equiv \frac{E_t}{C_t} = \frac{1}{C_t}\left[\sum_{i=1}^{I} C_t^{\varepsilon_i-\sigma} p_{it}^{1-\sigma}\right]^{\frac{1}{1-\sigma}}.$$

Euler Equation

- Relative demand in logs:

$$\log\left(\frac{C_{it}}{C_{jt}}\right) = -\sigma \log\left(\frac{p_{it}}{p_{jt}}\right) + (\epsilon_i - \epsilon_j)\log C_t,$$

$$\log\left(\frac{\omega_{it}}{\omega_{jt}}\right) = (1-\sigma)\log\left(\frac{p_{it}}{p_{jt}}\right) + (\epsilon_i - \epsilon_j)\log C_t, = \log\left(\frac{L_{it}}{L_{jt}}\right)$$

Constant Growth Path (CGP) Characterization

- There exists a unique CGP, $\frac{C_{t+1}}{C_t} = 1 + \gamma^*$.
- Suppose there is at least one sector with $\epsilon_i > \sigma$ and $\sigma < 1$,

$$\gamma^* = \min_{i \in \mathcal{I}: \epsilon_i > \sigma} \left[(1+\gamma_0)^{\alpha} (1+\gamma_i)^{1-\alpha} \right]^{\frac{1-\sigma}{\epsilon_i - \sigma}} - 1,$$

$$r^* = \frac{1+\gamma_0}{\beta (1+\gamma^*)^{1-\theta}} - 1.$$

Plot

Constant Growth Path (CGP) Characterization

- There exists a unique CGP, $\frac{C_{t+1}}{C_t} = 1 + \gamma^*$.
- Suppose there is at least one sector with $\epsilon_i > \sigma$ and $\sigma < 1$,

$$\gamma^* = \min_{i \in \mathcal{I} : \epsilon_i > \sigma} \left[(1+\gamma_0)^{\alpha} (1+\gamma_i)^{1-\alpha} \right]^{\frac{1-\sigma}{\epsilon_i - \sigma}} - 1,$$

Plot

$$r^* = \frac{1+\gamma_0}{\beta (1+\gamma^*)^{1-\theta}} - 1.$$

- Preferences remain asymptotically non-homothetic,

$$\frac{C_{it+1}}{C_{it}} = (1+\gamma_i)^{(1-\alpha)\sigma} (1+\gamma_0)^{\alpha\sigma} (1+\gamma^*)^{\epsilon_i - \sigma}.$$

Hump-Shape in Manufacturing | Aggregation

Empirical Application: 30 Country Panel, 1947-2005

- 10 Asian, 9 European, 9 Latin Am., US and South Africa.
- Estimating equations:

$$\log\left(\frac{L^c_{a,t}}{L^c_{m,t}}\right) = \alpha^c_{am} + (1-\sigma)\log\left(\frac{p^c_{a,t}}{p^c_{m,t}}\right) + (\varepsilon_a - \varepsilon_m)\log C^c_t + \nu^c_{am,t},$$

$$\log\left(\frac{L^c_{s,t}}{L^c_{m,t}}\right) = \alpha^c_{sm} + (1-\sigma)\log\left(\frac{p^c_{s,t}}{p^c_{m,t}}\right) + (\varepsilon_s - \varepsilon_m)\log C^c_t + \nu^c_{sm,t}.$$

Baseline Estimation

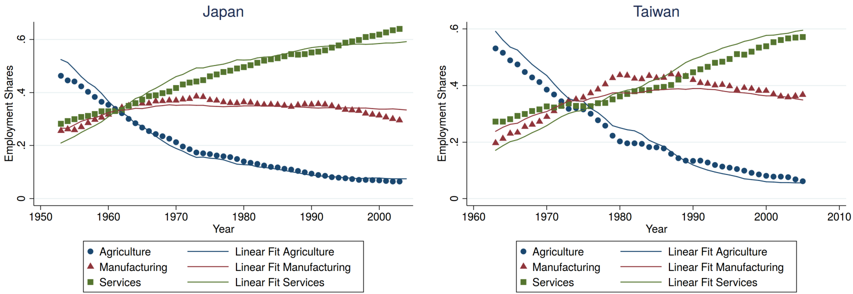
Dep. Var.:	World		
Rel. Emp.	(1)	(2)	(3)
σ	0.66	0.75	0.72
	(0.19)	(0.11)	(0.11)
$\varepsilon_a - \varepsilon_m$	-0.81	-1.09	-1.03
	(0.24)	(0.10)	(0.14)
$\varepsilon_s - \varepsilon_m$	0.32	0.32	0.32
	(0.08)	(0.10)	(0.13)
Obs.	1006	1006	916
$c \cdot sm$ FE	N	Y	Y
Trade Controls	N	N	Y

Standard Errors Clustered by Country

- Similar Estimates if done by Regions Estimates

Estimation Fit

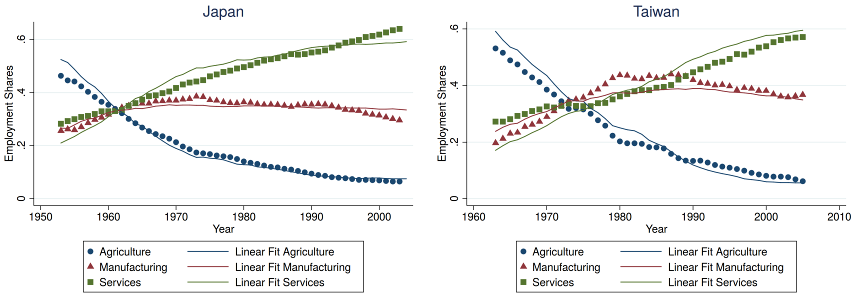
Uses World Estimates for All Elasticities, $\{\sigma, \varepsilon_a - \varepsilon_m, \varepsilon_s - \varepsilon_m\}$



▸ Stone-Geary Comparison ▸ More Asian Countries ▸ Latin America ▸ OECD

Estimation Fit

Uses World Estimates for All Elasticities, $\{\sigma, \varepsilon_a - \varepsilon_m, \varepsilon_s - \varepsilon_m\}$



▸ Stone-Geary Comparison ▸ More Asian Countries ▸ Latin America ▸ OECD

- % Variation Accounted by Income Effects in median year
  - 86% for Agriculture,
  - 57% for Manufacturing,
  - 82% for Services.

Consumption Expenditure + Random Timing Tax Rebates

$$\log\left(\frac{\omega^h_{i,t}}{\omega^h_{nd,t}}\right) = (1-\sigma)\log\left(\frac{p_{i,t}}{p_{nd,t}}\right) + (\epsilon_i - \epsilon_{nd})\log C^h_t + \delta^h + \delta_{i,t} + \eta^h_{i,t}.$$

	(1)	(2)	(3)	(4)
σ	0.69	0.64	0.69	0.64
	(0.02)	(0.02)	(0.02)	(0.02)
$\epsilon_{\text{Food}} - \epsilon_{\text{Non-Durables}}$	-0.44	-0.43	-0.45	-0.44
	(0.02)	(0.02)	(0.02)	(0.02)
$\epsilon_{\text{Housing}} - \epsilon_{\text{Non-Durables}}$	-0.17	-0.16	-0.18	-0.17
	(0.03)	(0.03)	(0.03)	(0.03)
$\epsilon_{\text{Services}} - \epsilon_{\text{Non-Durables}}$	0.51	0.52	0.51	0.52
	(0.04)	(0.04)	(0.04)	(0.04)
$\epsilon_{\text{Durables}} - \epsilon_{\text{Non-Durables}}$		1.31		0.93
		(0.09)		(0.09)
			First Stage	
Tax Rebate Indicator			0.02	0.02
			(0.01)	(0.01)

Non-durables exclude Food Consumption. Std. Err. clustered at HH level.

Concluding Remarks

- Introduced a new non-homothetic demand to growth theory.
- More desirable properties than Stone-Geary:
  - Asymptotically non-homothetic.
  - Can have hump-shape in manufacturing.
  - No knife-edge condition for existence of CGP.
- Can be combined with trends in relative prices (à la Ngai-Pissarides and/or Acemoglu-Guerrieri).
  - Positive correlation between nominal and real variables.
- Parsimonious fit of data.

Demand Side

$$C_t(C_{at}, C_{mt}, C_{st}) \;=\; \left((C_{at} - \overline{c}_a)^{\frac{\sigma-1}{\sigma}} + C_{mt}^{\frac{\sigma-1}{\sigma}} + (C_{st} + \overline{c}_s)^{\frac{\sigma-1}{\sigma}} \right)^{\frac{\sigma}{\sigma-1}}$$

Back

Demand Side

$$C_t(C_{at}, C_{mt}, C_{st}) \;=\; \left((C_{at} - \overline{c}_a)^{\frac{\sigma-1}{\sigma}} + C_{mt}^{\frac{\sigma-1}{\sigma}} + (C_{st} + \overline{c}_s)^{\frac{\sigma-1}{\sigma}} \right)^{\frac{\sigma}{\sigma-1}}$$

- Cannot have sectorial price trends to generate BGP.

$$p_{at} C_{at} + p_{mt} C_{mt} + p_{st} C_{st} = E_t + p_{at}\overline{c}_a - p_{st}\overline{c}_s,$$

$$\Longrightarrow \qquad p_{at}\overline{c}_a = p_{st}\overline{c}_s.$$

Estimates of Trends in Relative Prices

Back

Demand Side

$$C_t(C_{at}, C_{mt}, C_{st}) \;=\; \left((C_{at} - \overline{c}_a)^{\frac{\sigma-1}{\sigma}} + C_{mt}^{\frac{\sigma-1}{\sigma}} + (C_{st} + \overline{c}_s)^{\frac{\sigma-1}{\sigma}} \right)^{\frac{\sigma}{\sigma-1}}$$

- Cannot have sectorial price trends to generate BGP.
- Constant Expenditure/Employment Share in manufacturing,

$$\frac{p_{mt} C_{mt}}{E_t} = \left(\frac{p_{mt}}{P_t} \right)^{1-\sigma}.$$

Back

Demand Side

$$C_t(C_{at}, C_{mt}, C_{st}) \;=\; \left((C_{at} - \overline{c}_a)^{\frac{\sigma-1}{\sigma}} + C_{mt}^{\frac{\sigma-1}{\sigma}} + (C_{st} + \overline{c}_s)^{\frac{\sigma-1}{\sigma}} \right)^{\frac{\sigma}{\sigma-1}}$$

- Cannot have sectorial price trends to generate BGP.
- Constant Expenditure/Employment Share in manufacturing,
- Asymptotically Homothetic (non-homotheticity is transitional)

$$C_{it} \gg \overline{c}_i \quad \Longrightarrow \quad \varepsilon_i \equiv \frac{\partial \ln C_{it}}{\partial \ln C_t} \to 1.$$

Back

Supply Side

$$
\begin{aligned}
C_t(C_{at}, C_{mt}, C_{st}) &= \left(C_{at}^{\frac{\sigma-1}{\sigma}} + C_{mt}^{\frac{\sigma-1}{\sigma}} + C_{st}^{\frac{\sigma-1}{\sigma}} \right)^{\frac{\sigma}{\sigma-1}}, \\
\frac{A_{it+1}}{A_t} &= 1 + \gamma_i, \quad i \in \{a, m, s\}.
\end{aligned}
$$

Back

Supply Side

$$C_t(C_{at}, C_{mt}, C_{st}) = \left(C_{at}^{\frac{\sigma-1}{\sigma}} + C_{mt}^{\frac{\sigma-1}{\sigma}} + C_{st}^{\frac{\sigma-1}{\sigma}} \right)^{\frac{\sigma}{\sigma-1}},$$

$$\frac{A_{it+1}}{A_t} = 1 + \gamma_i, \quad i \in \{a, m, s\}.$$

- As $0 < \sigma < 1 \Rightarrow$ cannot fit real and nominal VA (corr $> .8$).
- Sectoral Demands,

$$\text{Nominal: } \frac{p_{at} C_{at}}{p_{mt} C_{mt}} = \left(\frac{p_{mt}}{p_{at}} \right)^{(1-\sigma)}, \quad \text{Real: } \frac{C_{at}}{C_{mt}} = \left(\frac{p_{mt}}{p_{at}} \right)^{-\sigma}.$$

Back

Supply Side

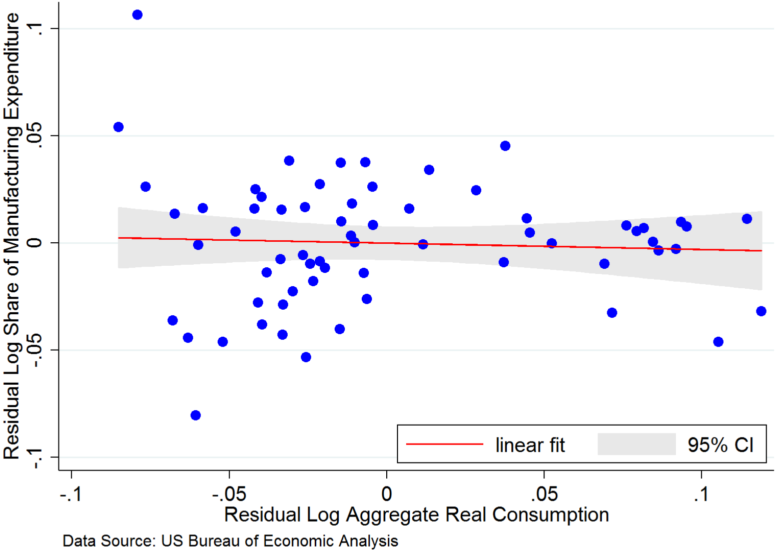
$$
\begin{aligned}
C_t(C_{at}, C_{mt}, C_{st}) &= \left(C_{at}^{\frac{\sigma-1}{\sigma}} + C_{mt}^{\frac{\sigma-1}{\sigma}} + C_{st}^{\frac{\sigma-1}{\sigma}} \right)^{\frac{\sigma}{\sigma-1}}, \\
\frac{A_{it+1}}{A_t} &= 1 + \gamma_i, \quad i \in \{a, m, s\}.
\end{aligned}
$$

- As $0 < \sigma < 1 \Rightarrow$ cannot fit real and nominal VA (corr $> .8$).
- Expenditure Share Uncorrelated with Income

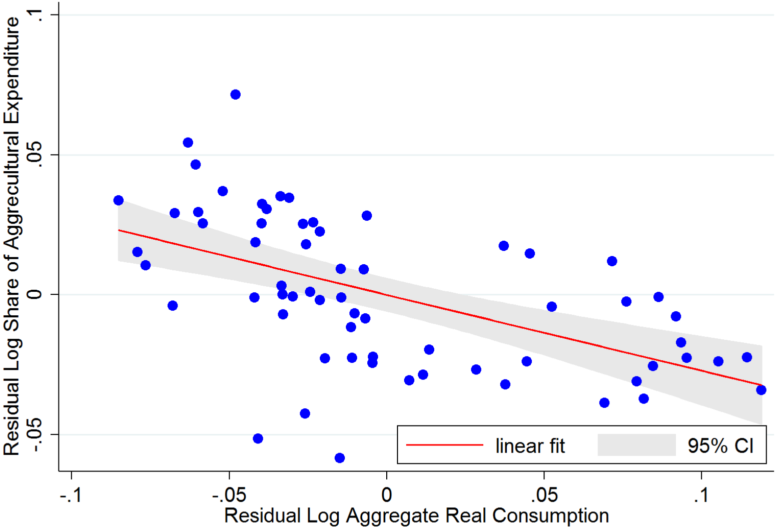
$$
\frac{p_{it} C_{it}}{E_t} = \left(\frac{p_{it}}{P_t} \right)^{1-\sigma}, \qquad i \in \{a, m, s\}.
$$

Back

Partial Correlation Log Manufacturing Share - Log Income

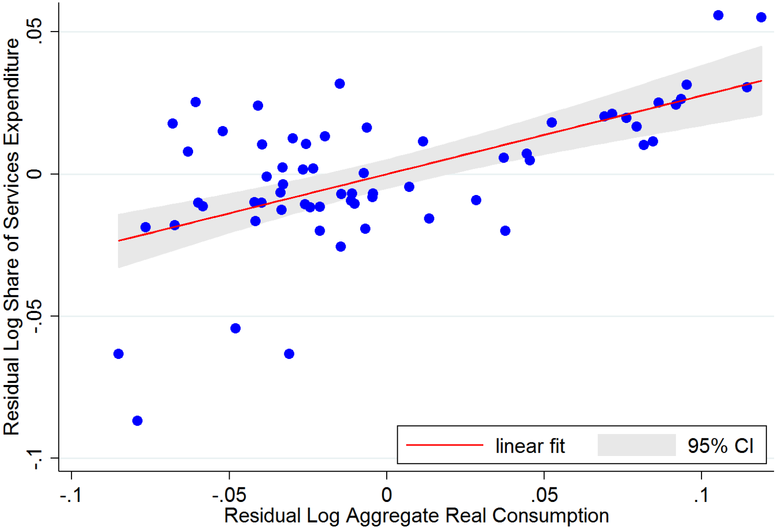


Partial Correlation Log Agriculture Share - Log Income



Data Source: US Bureau of Economic Analysis

Partial Correlation Log Services Share - Log Income

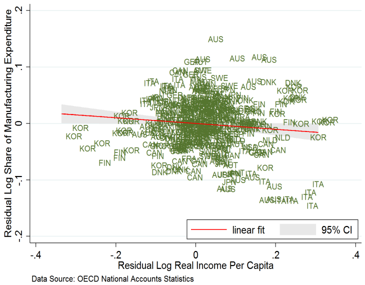


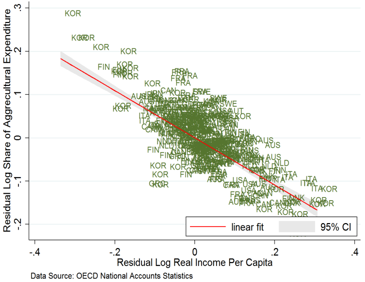
Data Source: US Bureau of Economic Analysis

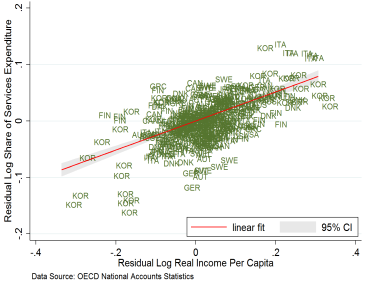
Split Sample | OECD Countries | Back

Aggregate Engel Curves Across OECD Countries

- Partial correlations between shares of consumption expenditure and income, regressing out prices.
- OECD National Accounts: 26 Countries, 1970–2007.







Split Sample Back

Trends in Relative Prices

Table: Growth Rates of Relative Prices in 30-Country Panel

$$\log\left(\frac{p^c_{i,t}}{p^c_{m,t}}\right) = \alpha^c_{im} + \beta_i \cdot \text{Year} + \varepsilon^c_{im,t}, \qquad i = \{s, a\}$$

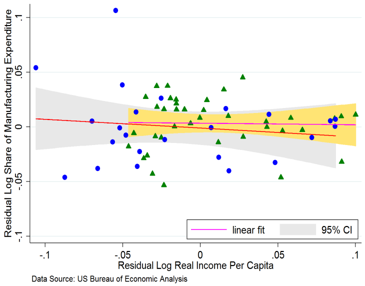
	$\log\left(\frac{p^c_a}{p^c_m}\right)$	$\log\left(\frac{p^c_s}{p^c_m}\right)$
Year	-0.59	0.13
	(0.05)	(0.04)
Country-Sector FE	Yes	Yes
R^2	0.49	0.41
Observations	1680	1680

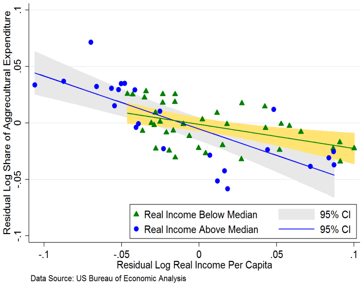
Note: Year has been re-scaled to Year/100.

Back

Aggregate Engel Curves for the US

- How stable is this pattern over time?
- Compare the patter when income is below and above median

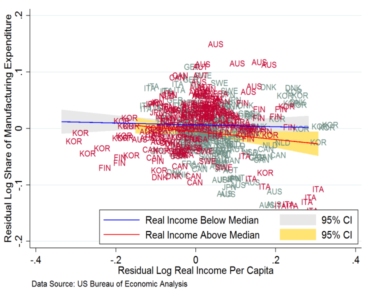


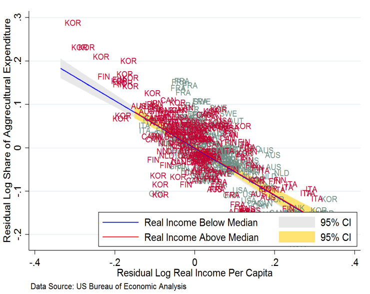


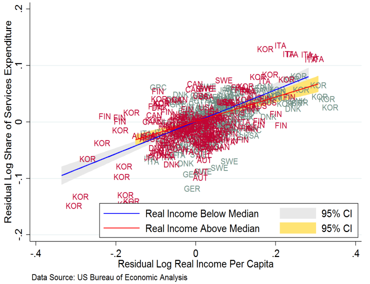
Back

Aggregate Engel Curves Across OECD Countries

- How stable is this pattern over time?
- Compare the patter when income is below and above median

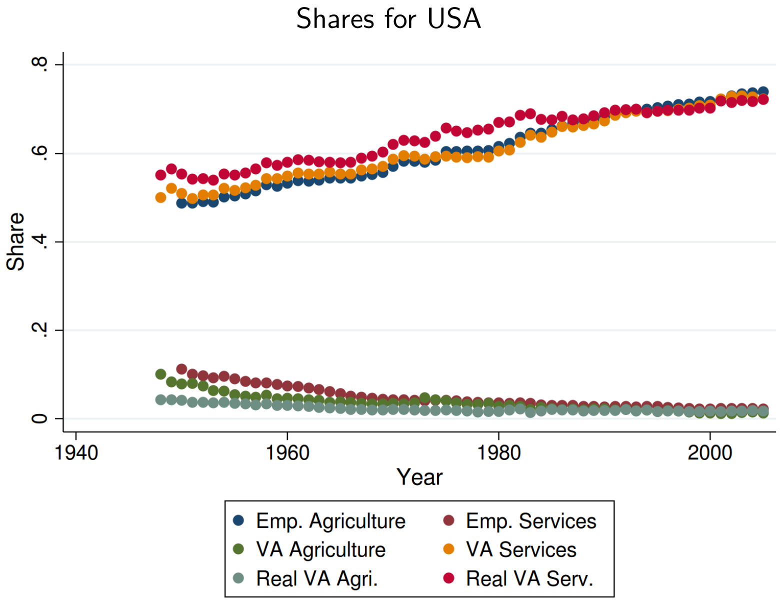






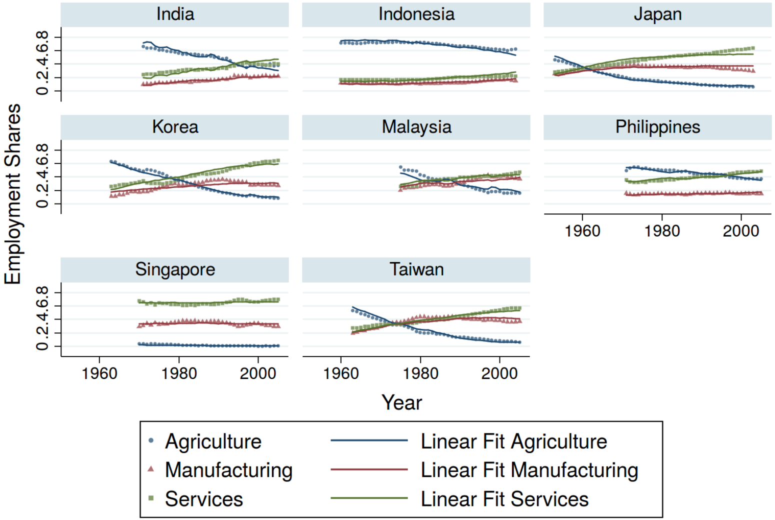
Back

Employment, Real VA and Nominal VA



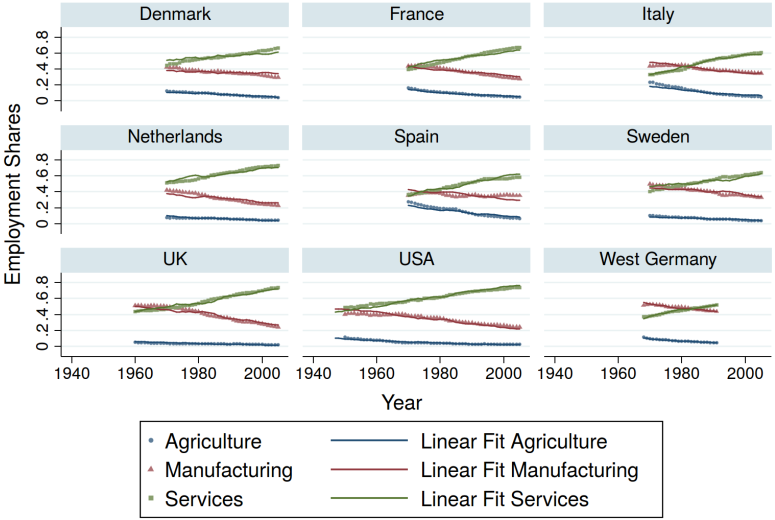
Asia

Uses Asia Estimates for All Elasticities, $\{\sigma, \varepsilon_a - \varepsilon_m, \varepsilon_s - \varepsilon_m\}$



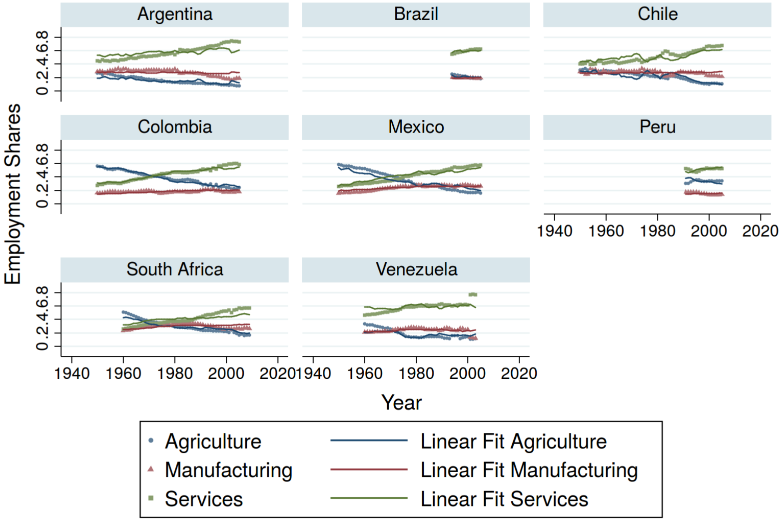
OECD

Uses OECD Estimates for All Elasticities, $\{\sigma, \varepsilon_a - \varepsilon_m, \varepsilon_s - \varepsilon_m\}$



Latin America

Uses Latin America Estimates for All Elasticities, $\{\sigma, \varepsilon_a - \varepsilon_m, \varepsilon_s - \varepsilon_m\}$



Competitive Equilibrium

Definition

Given initial stock of capital K_0 and a sequence of sectoral productivities $\left\{ \{A_{it}\}_{i=1}^{I} \right\}_{t \geq 0}$, the equilibrium is characterized as a sequence of allocations $\{C_t, K_{t+1}, X_t\}_{t=0}^{\infty}$, $\left\{ \{C_{it}, K_{it}, L_{it}\}_{i \in \mathcal{I}} \right\}_{t=0}^{\infty}$ and a sequence of prices $\left\{ w_t, r_t, \{p_{it}\}_{i \in \mathcal{I}}, P_t \right\}_{t=0}^{\infty}$ such that

1. Household maximizes utility s.t. budget constraint.

Back

Competitive Equilibrium

Definition

Given initial stock of capital K_0 and a sequence of sectoral productivities $\left\{\{A_{it}\}_{i=1}^{I}\right\}_{t\geq 0}$, the equilibrium is characterized as a sequence of allocations $\{C_t, K_{t+1}, X_t\}_{t=0}^{\infty}$, $\left\{\{C_{it}, K_{it}, L_{it}\}_{i\in\mathcal{I}}\right\}_{t=0}^{\infty}$ and a sequence of prices $\left\{w_t, r_t, \{p_{it}\}_{i\in\mathcal{I}}, P_t\right\}_{t=0}^{\infty}$ such that

1. Household maximizes utility s.t. budget constraint.
2. Firms maximize profits,

$$\max_{L_{it}, K_{it}} \quad p_{it} K_{it}^{\alpha} \left(A_{it} L_{it}\right)^{1-\alpha} - w_t L_{it} - r_t K_{it}, \quad i \in \mathcal{I} \cup 0.$$

Back

Competitive Equilibrium

Definition

Given initial stock of capital K_0 and a sequence of sectoral productivities $\left\{ \{A_{it}\}_{i=1}^{I} \right\}_{t \geq 0}$, the equilibrium is characterized as a sequence of allocations $\{C_t, K_{t+1}, X_t\}_{t=0}^{\infty}$, $\left\{ \{C_{it}, K_{it}, L_{it}\}_{i \in \mathcal{I}} \right\}_{t=0}^{\infty}$ and a sequence of prices $\left\{ w_t, r_t, \{p_{it}\}_{i \in \mathcal{I}}, P_t \right\}_{t=0}^{\infty}$ such that

1. Household maximizes utility s.t. budget constraint.
2. Firms maximize profits.
3. Markets clear,

$$
\begin{aligned}
1 &= L_{0t} + \textstyle\sum_{i=1}^{I} L_{it}, & Y_{it} &= C_{it}, \\
K_t &= K_{0t} + \textstyle\sum_{i=1}^{I} K_{it}, & \Delta K_{t+1} &= X_t.
\end{aligned}
$$

Back

Household Behavior - Intertemporal Problem

Intertemporal Characterization (Euler Equation)

Given price indices, real aggregate consumption:

$$C_t^{-\theta} = (1 + r_t)\,\frac{P_t}{P_{t+1}}\left(\frac{\overline{\varepsilon_t} - \sigma}{\overline{\varepsilon_{t+1}} - \sigma}\right) C_{t+1}^{-\theta},$$

where

$$\overline{\varepsilon_t} = \sum_{i=1}^{I} \omega_{it}\varepsilon_i.$$

plus No-Ponzi condition.

- "Wedge" from E_t to C_t depends on $\bar{\varepsilon} = \sum_{i=1}^{I} \varepsilon_i \omega_{it}$.

Back

Four Sector Model

- Suppose there are three setors in the economy satisfying

$$\epsilon_s > \epsilon_m > \epsilon_a, \tag{3}$$

$$\gamma_a > \gamma_m > \gamma_s. \tag{4}$$

Structural Transformation

Let $K_0 < \underline{K}$. Then Employment Shares and Nominal Consumption shares are increasing for services, decreasing for agriculture and hump shaped for manufacturing.

Back

Aggregation

- Consider an economy composed of $h \sim F(h)$ households.
- Individual expenditure shares,

$$\omega_{it}^{h} = \Omega_i^{h} \left(\frac{p_{it}}{P_t^{h}}\right)^{1-\sigma} \left(C_t^{h}\right)^{\varepsilon_i - 1}, \qquad \text{for all } h.$$

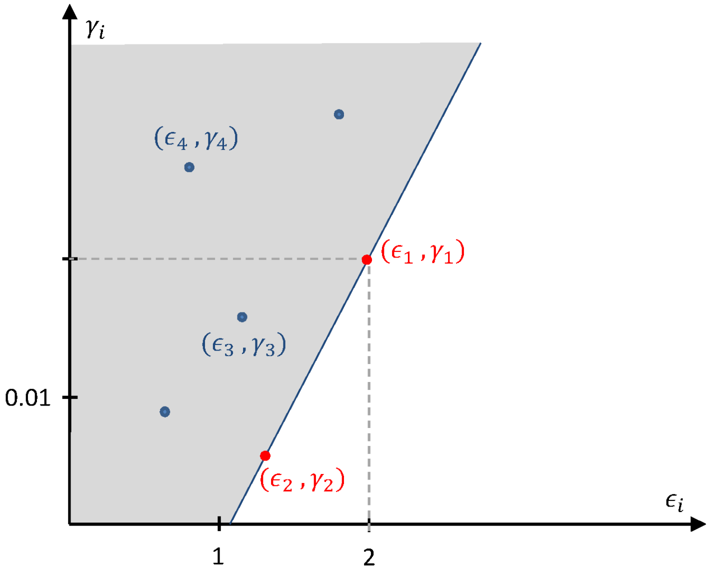
- Aggregating across households

$$\begin{aligned} \omega_{it} \equiv \int \omega_{it}^{h} dF(h) &= \phi_{it} \left(\frac{p_{it}}{P_t}\right)^{1-\sigma} C_t^{\varepsilon_i - 1}, \\ \phi_{it} &= \int dF(h) \left(\frac{C_t^{h}}{C_t}\right)^{\varepsilon_i} \frac{\sum_{j=1}^{I} C_t^{\varepsilon_i} p_i^{1-\sigma}}{\sum_{j=1}^{I} \left(C_t^{h}\right)^{\varepsilon_i} p_i^{1-\sigma}}. \end{aligned}$$

- Along CGP, $\phi_{it} = \phi_i$.

Back

More than One Sector Can Survive Asymptotically



Back

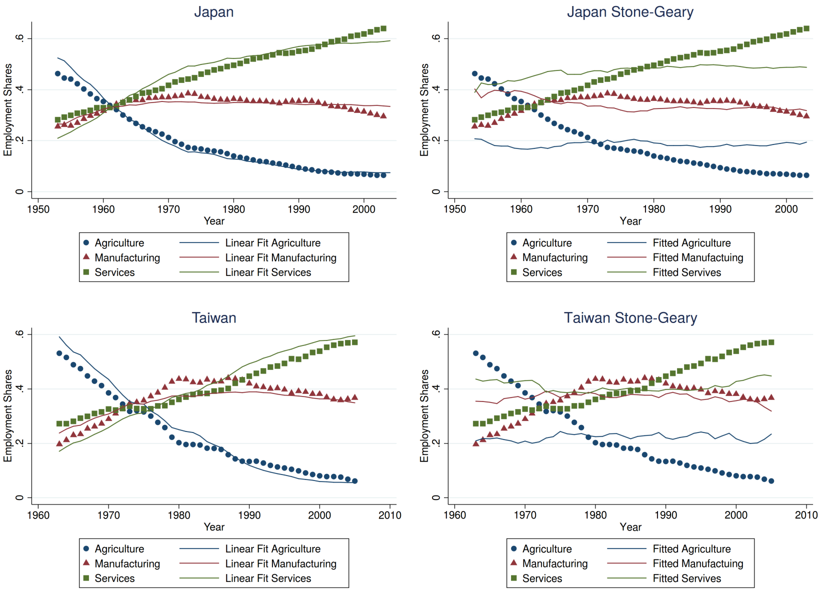
Estimation By Regions

Dep. Var.:	World			OECD		Asia		Latin America	
Rel. Emp.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
σ	0.66	0.75	0.72	0.69	0.69	0.73	0.77	0.77	0.68
	(0.19)	(0.11)	(0.11)	(0.17)	(0.19)	(0.18)	(0.23)	(0.08)	(0.05)
$\varepsilon_a - \varepsilon_m$	-0.81	-1.09	-1.03	-0.99	-0.94	-1.19	-1.26	-1.20	-0.90
	(0.24)	(0.10)	(0.14)	(0.19)	(0.18)	(0.12)	(0.17)	(0.25)	(0.17)
$\varepsilon_s - \varepsilon_m$	0.32	0.32	0.32	0.40	0.49	0.07	0.09	0.59	0.54
	(0.08)	(0.10)	(0.13)	(0.19)	(0.15)	(0.04)	(0.08)	(0.14)	(0.11)
Obs.	1006	1006	916	436	407	319	297	295	245
$c \cdot sm$ FE	N	Y	Y	Y	Y	Y	Y	Y	Y
Trade Controls	N	N	Y	N	Y	N	Y	N	Y

Back

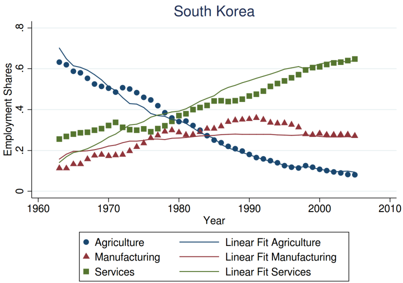
Asia

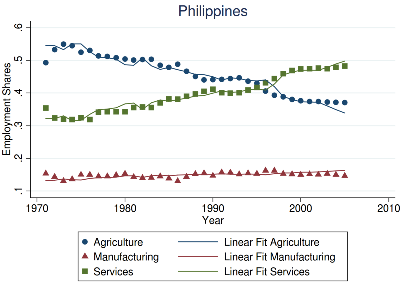
Uses World Estimates for All Elasticities, $\{\sigma, \varepsilon_a - \varepsilon_m, \varepsilon_s - \varepsilon_m\}$



Asia

Uses World Estimates for All Elasticities, $\{\sigma, \varepsilon_a - \varepsilon_m, \varepsilon_s - \varepsilon_m\}$

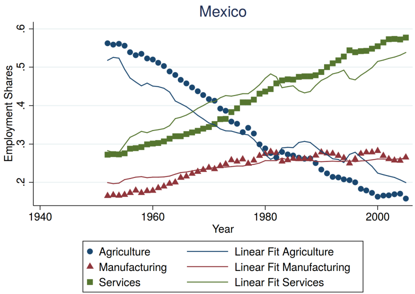


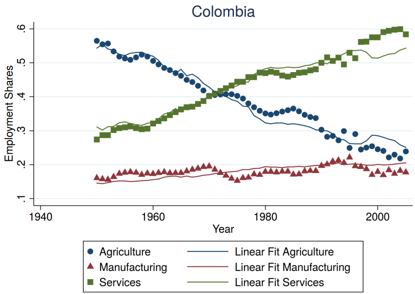


Back

Latin America

Uses World Estimates for All Elasticities, $\{\sigma, \varepsilon_a - \varepsilon_m, \varepsilon_s - \varepsilon_m\}$

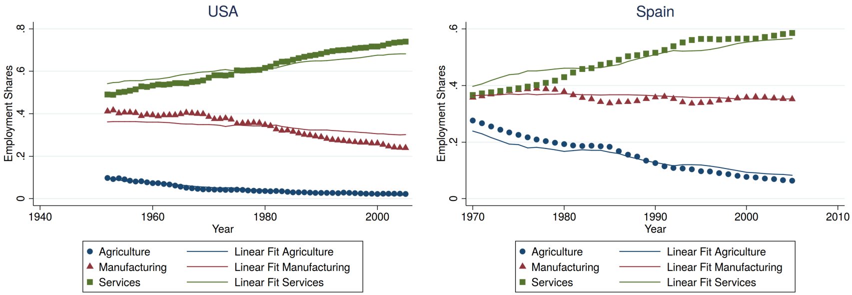




Back

OECD

Uses World Estimates for All Elasticities, $\{\sigma, \varepsilon_a - \varepsilon_m, \varepsilon_s - \varepsilon_m\}$



Back

Partial Correlation

Partial Correlations

Reg. Equation	Consumption: Part. Corr.	Consumption: Part. Corr.^{2}	Relative Prices: Part. Corr.	Relative Prices: Part. Corr.^{2}
L_a/L_m	-0.89	0.78	0.16	0.02
L_s/L_m	0.47	0.22	0.14	0.02

Back

First Differences Estimation

	(1)	(2)	(3)	(4)
σ	0.64	0.64	0.63	0.63
	(0.02)	(0.01)	(0.01)	(0.01)
Food	-0.46	-0.44	-0.49	-0.48
	(0.02)	(0.02)	(0.02)	(0.02)
Housing	-0.31	-0.31	-0.27	-0.26
	(0.02)	(0.02)	(0.02)	(0.02)
Services	0.57	0.52	0.62	0.57
	(0.02)	(0.03)	(0.03)	(0.03)
Durables			0.94	0.93
			(0.06)	(0.06)
Time FE	N	Y	N	Y

Std. Err. Clustered at Household Level. HH FE for all estimates.

Back

IV Strategy

- Use (detrended) total earnings (and wage).

	(1)	(2)
σ	0.70	.69
	(0.01)	(0.01)
Food	-0.70	-.69
	(0.02)	(0.02)
Housing	-0.69	-.69
	(0.02)	(0.02)
Services	0.69	.69
	(0.04)	(0.03)
Time FE	N	Y
First Stage		
Total Earnings	1.25	1.22
	(.19)	(.19)

Std. Err. Clustered at Household Level. HH FE for all estimates. Back

Estimation By Quartiles

Elasticities relative to non-durables (excl. Food)

	(1)	(2)	(3)	(4)
σ	0.63	0.76	0.75	0.67
	(0.01)	(0.01)	(0.01)	(0.01)
Food	-0.44	-0.31	-0.41	-0.48
	(0.02)	(0.07)	(0.09)	(0.02)
Housing	-0.20	-0.44	-0.37	-0.23
	(0.02)	(0.06)	(0.07)	(0.02)
Services	0.47	0.75	0.77	0.68
	(0.03)	(0.15)	(0.18)	(0.04)

Std. Err. Clustered at Household Level. HH FE for all estimates.

Back

HH CPI

	(1)	(2)	(3)	(4)
σ	0.64	0.60	0.64	0.60
	(0.02)	(0.02)	(0.02)	(0.02)
Food	-0.38	-0.38	-0.37	-0.36
	(0.02)	(0.02)	(0.02)	(0.02)
Housing	-0.14	-0.13	-0.14	-0.13
	(0.02)	(0.02)	(0.02)	(0.02)
Services	0.52	0.52	0.47	0.47
	(0.03)	(0.03)	(0.03)	(0.03)
Durables		2.74		2.75
		(0.06)		(0.06)
Time FE	N	N	Y	Y

Std. Err. Clustered at Household Level. HH FE for all estimates.

Back

Mexico - Progresa

- Construct consumption categories from HH surveys.
- Use median price per village.
- Progresa: conditional cash transfer program, $\leq$750 Pesos/month.
- Instrument expenditure with eligibility for Progresa.
- For now, these categories:
  - Food (baseline),
  - Health & Hygiene (soap, cleaning, medical exp.,...),
  - Fuel & Energy (electricity, gas, carbon,...),
  - Durables (cooking utensils, furniture, cars, blankets,...).

Mexico - Progresa

$$\log\left(\frac{\omega^h_{i,t}}{\omega^h_{food,t}}\right) = (1-\sigma)\log\left(\frac{p_{i,t}}{p_{food,t}}\right) + (\epsilon_i - \epsilon_{food})\log C^h_t + \delta^h + \delta_{i,t} + \eta^h_{i,t}.$$

σ	0.84
	(0.01)
Health & Hygiene	.41
	(0.86)
Fuel & Energy	.33
	(0.9)
Durables	1.57
	(1.12)
First Stage	
Eligibility	1.50
	(.83)

Std. Err. Clustered at Household Level. HH FE for all estimates. Back