

From Street Markets to Shopping Malls: The Modern Service Multiplier

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Introduction

- **Growth goal:** Productive service sector (Rodrik and Sandhu, 2024; Fan et al., 2023)
- Development path features **service modernization** [▶ Link](#)
- **Question:** How does service modernization contribute to development?
 1. Service modernization causes development through **Lewisian gains**
 2. Development causes service modernization through **demand effects**
- $1 + 2 \implies$ self-reinforcing growth, **development multiplier**
- This paper: **define** and **quantify**:
 1. Lewisian gains from service modernization
 2. Demand-driven amplification of gains \rightarrow **modern service multiplier**

Overview

- **Facts** from Brazil
 - Income gradient of modern service consumption
 - Consumption dualism
 - Productivity gap between traditional and modern services
- **Model:**
 - Fixed cost to access modern services → non-homotheticity, dualism
 - Frictions, different RTS between modern and traditional services → productivity gap
 - Under generic conditions: Lewisian modernization gains, amplification
- **Quantification/accounting:** Lewisian gains, amplification across Brazilian regions
 - **Worker/consumer microdata:** Estimate key structural parameters
 - **Census data:** Disentangle drivers of service modernization across space/time
- **Quantitative exercise:** Adding demand effects to the model:
 1. Shrinks variation in model's structural residual
 2. Implies multipliers $\gg 1$ and large Lewisian gains in poorest microregions
 3. Doubles output loss to labor market frictions in poorest microregions

Contribution to Literature

- Novel **microfoundation** and **quantification** of self-reinforcing growth in services:
 - Rosenstein-Rodan (1943), Murphy et al. (1989) Matsuyama (1991), Parente and Prescott (1999), Kaplan and Menzio (2016), Cole et al. (2016), Buera et al. (2023)

Frictions → within-service **productivity gaps** à la Lewis (1954)

- Frictions and development: Song et al. (2011), Meghir et al. (2015), Ulyssea (2018), Narita (2020), Chandrasekhar et al. (2020), Breza et al. (2021) Donovan et al. (2023), Poschke (2023), Donovan and Schoellman (2023), Feng et al. (2024), Dix-Carneiro et al. (2021)

+ **Income effects** on consumer shopping behavior à la Lagakos (2016)

- Consumer choice and development: Bronnenberg and Ellickson (2015), Atkin et al. (2018), Ramos-Menchelli and Sverdlin-Lisker (2022), Vitali (2022), Bachas et al. (2023), Talamas Marcos (2024)

→ **Amplified** modernization and growth in services (Buera et al., 2023)

- New source of **service-led growth**: Buera and Kaboski (2012), Eckert et al. (2022), Hsieh and Rossi-Hansberg (2023), Nayyar et al. (2021), Fan et al. (2023), Rodrik and Sandhu (2024)

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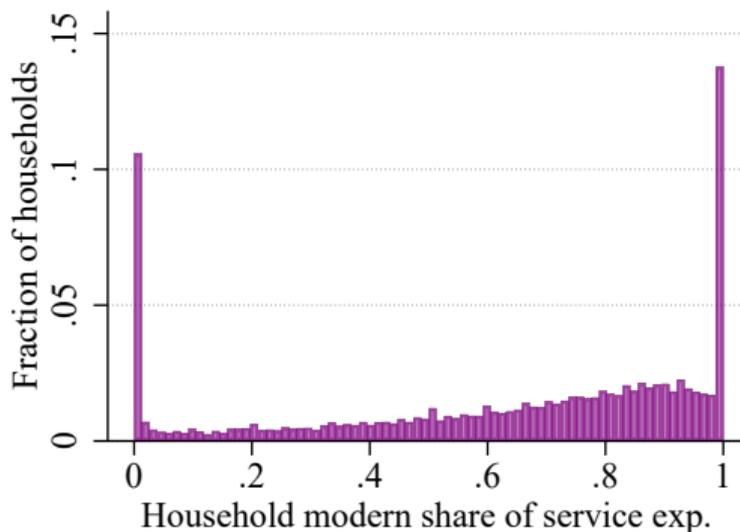
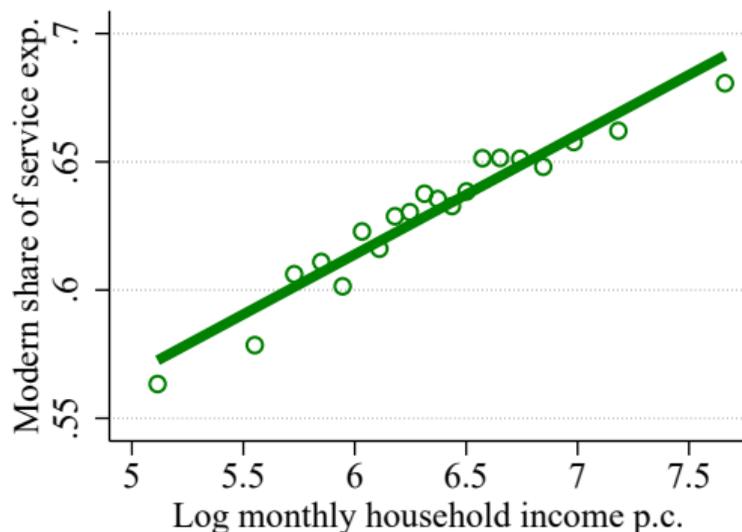
2. Motivating Facts from Brazil

3. Theory

4. Estimation

5. Quantitative Exploration: Amplification, Lewisian Gains, and the Cost of Frictions

Services in Brazil: Income Effects and Consumption Dualism

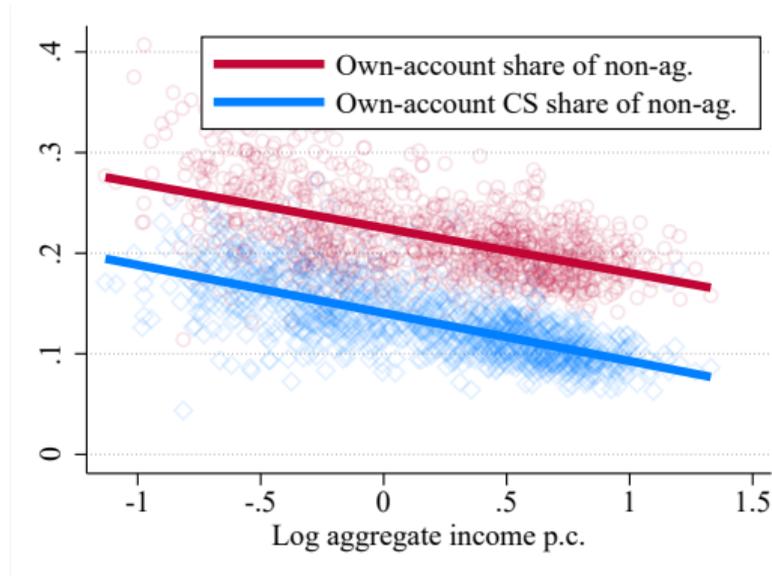


Rich HHs consume more modern services **within location**

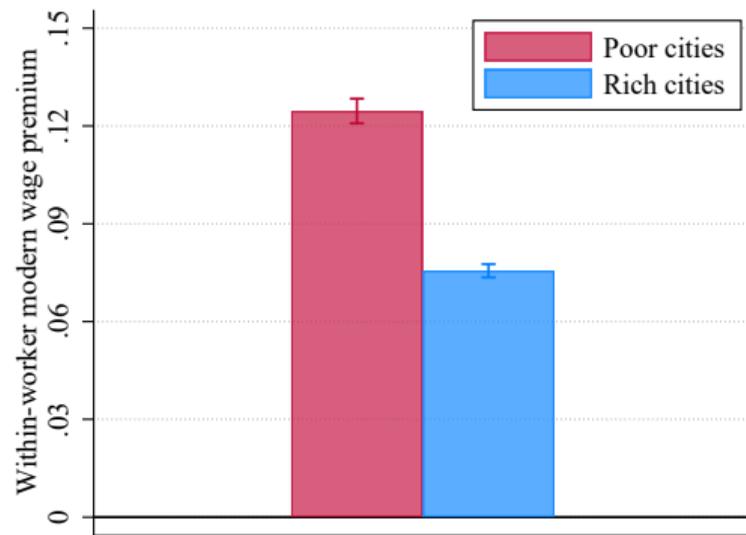
Dualism: Modern consumption depends on **extensive margin**

Note: Figure displays binned scatter of Brazilian households in left panel, and histogram of households in right panel.

Services in Brazil: Surplus Labor and Frictions



Consumer services account for **entire decline** of own-account work outside ag.



Frictions: Modern-trad. gaps in labor productivity **within worker**

Note: Figure displays scatter of Brazilian microregions in left panel and panel regression coefficients in right panel.

Additional Facts in Paper

- Service modernization is a development indicator
- Market size effects favor service modernization

▶ [Link](#)

▶ [Link](#)

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Model: Households and Consumption

- Households consume tradable goods X , modern services M , traditional services T

$$Y_i = \frac{C_{i,X}^{1-\phi} C_{i,S}^\phi}{(1-\phi)^{1-\phi} \phi^\phi} = \frac{C_{i,X}^{1-\phi} \left(\omega_M^{\frac{1}{\xi}} C_{i,M}^{\frac{\xi-1}{\xi}} + \omega_T^{\frac{1}{\xi}} C_{i,T}^{\frac{\xi-1}{\xi}} \right)^{\frac{\xi}{\xi-1} \phi}}{(1-\phi)^{1-\phi} \phi^\phi}, \quad \phi \in (0,1), \xi > 1$$

- Spend e_i , face heterogeneous **fixed cost** $\kappa_i \sim F_\kappa(\kappa)$ (in final goods) to consume $C_{i,M} > 0$:

$$C_i = Y_i - \kappa_i \mathbf{1}\{C_{i,M} > 0\} \implies C_i^* = \max \left\{ \frac{\omega_T^{\frac{\phi}{\xi-1}} e_i}{P_X^{1-\phi} P_T^\phi}, \frac{e_i}{P} - \kappa_i \right\}, P < \frac{P_X^{1-\phi} P_T^\phi}{\omega_T^{\frac{\phi}{\xi-1}}}$$

- Consume from modern sector if $\kappa_i \leq \kappa^*$ ($\frac{e_i}{P} = y_i, P_M/P_T$), $\frac{\partial \kappa^*}{\partial y_i} > 0$

► Full κ^* expression

- Income effects on extensive margin** $F_\kappa(\kappa^*)$: consumption dualism

- Modern share of service exp. $\vartheta_M = F_\kappa \left[\kappa^* \left(y, \frac{P_M}{P_T} \right) \right] \times \omega_M \left(\frac{P_M}{P_S} \right)^{1-\xi}$

Model: Sectoral Production and Frictions

- Tradable goods and modern services feature **love-of-variety** but face **frictions**
 - Use wage employment, pay wedge τ over worker's outside option of producing T :
 $w = (1 + \tau)P_T z_T$

$$Y_X = \left(\int_0^{N_X} \left(\bar{z}_X h_X^P(n_X) \right)^{\frac{\sigma-1}{\sigma}} dn_X \right)^{\frac{\sigma}{\sigma-1}} \quad P_X = \frac{w}{z_X} H_X^{\frac{-1}{\sigma-1}}$$
$$Y_M = \left(\int_0^{N_M} \left(\bar{z}_M h_M^P(n_M) \right)^{\frac{\sigma-1}{\sigma}} dn_M \right)^{\frac{\sigma}{\sigma-1}} \quad \implies P_M = \frac{w}{z_M} H_M^{\frac{-1}{\sigma-1}}$$
$$Y_T = z_T H_T \quad P_T = \frac{1}{1 + \tau} \frac{w}{z_T}$$

- Frictions $\tau > 0$, love-of-variety $\sigma < \infty \implies$ aggregate MPL is higher in M than T
- **Key result:** Allocations, rel. prices, real income can be written $\vec{H}(\vartheta_M), \vec{p}(\vartheta_M), y(\vartheta_M)$

► Full expressions

Equilibrium: Lewisian Gains

- Equilibrium characterized by fixed point in **service modernization** ϑ_M

$$\vartheta_M = \underbrace{F_\kappa \left[\kappa^* \left(y(\vartheta_M|\vec{a}), \frac{P_M}{P_T}(\vartheta_M|\vec{a}) \right) \right]}_{T(\vartheta_M|\vec{a})} \times \omega_M \left(\frac{P_M}{P_S}(\vartheta_M|\vec{a}) \right)^{1-\zeta}$$

where \vec{a} is a vector of primitives

- Consider **growth comparative statics** with respect to any primitive a

$$\frac{d \log y(\vartheta_M|a)}{d \log a} = \overbrace{\frac{\partial \log y}{\partial \log a}}^{\text{Direct effect}} + \overbrace{\frac{\partial \log y}{\partial \log \vartheta_M} \frac{d \log \vartheta_M}{d \log a}}^{\text{Modernization}}$$

- **Proposition 1:** The modernization gain $\frac{\partial \log y}{\partial \log \vartheta_M}$ is positive whenever $\tau > 0$ or $\sigma < \infty$
 - **Lewisian gains:** Productivity gap \implies modernization **causes growth**

► Proof/expression

The Modern Service Multiplier

$$\frac{d \log y(\vartheta_M|a)}{d \log a} = \frac{\partial \log y}{\partial \log a} + \frac{\partial \log y}{\partial \log \vartheta_M} \frac{d \log \vartheta_M}{d \log a}$$

$\frac{\partial \log y}{\partial \log \vartheta_M} \geq 0$ (Lewis), but how big is $\frac{d \log \vartheta_M}{d \log a}$?

$$\vartheta_M = T(\vartheta_M|a) \implies \frac{d \log \vartheta_M}{d \log a} = \frac{\partial \log T(\vartheta_M)}{\partial \log a} + T'(\vartheta_M) \frac{d \log \vartheta_M}{d \log a}$$

- When $T'(\vartheta_M) > 0$, service modernization is **self-reinforcing**
- **Definition:** The **modern service multiplier** is $\mu_M = \frac{1}{1-T'(\vartheta_M)}$, so that

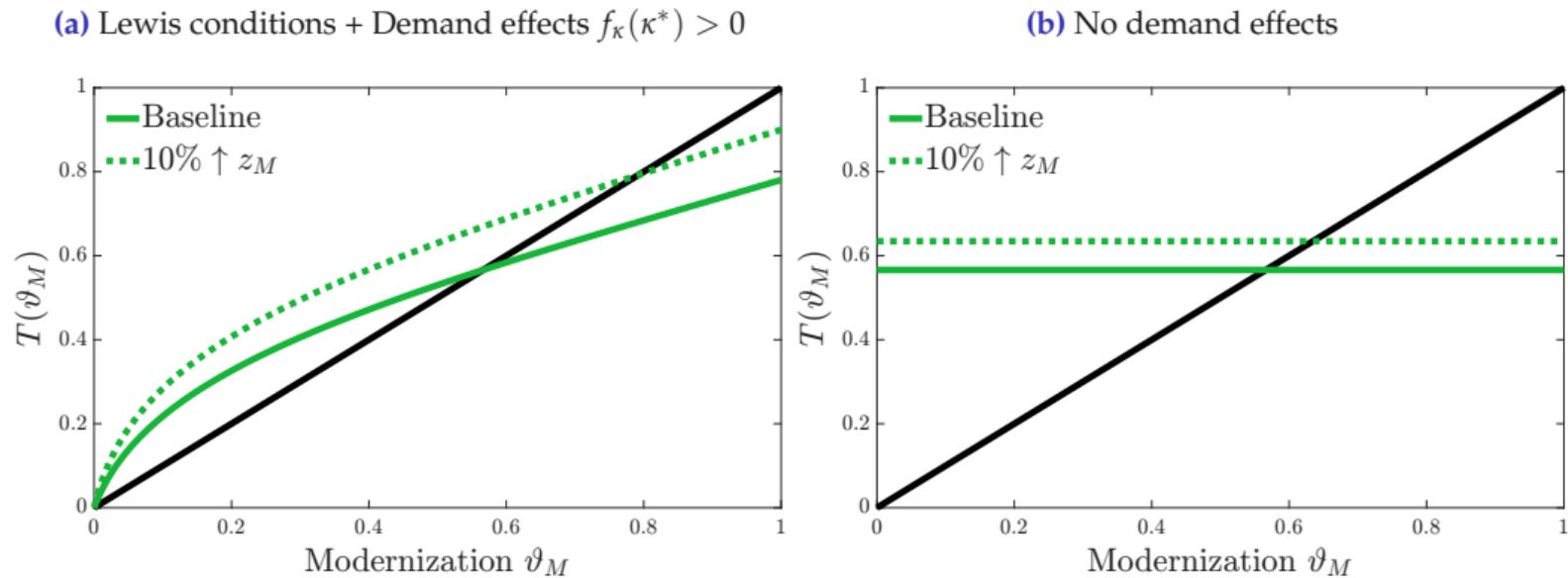
$$\frac{d \log \vartheta_M}{d \log a} = \mu_M \times \frac{\partial \log T(\vartheta_M)}{\partial \log a}$$

- **Proposition 2:** $T'(\vartheta_M) > 0$ when $\sigma < \infty$ or $\tau > 0$, and $f_\kappa(\kappa^*) > 0$
 - Lewisian conditions + **demand effects** $f_\kappa(\kappa^*) \implies$ **amplification**, greater μ_M

► Expressions

Visualizing Amplification

Figure: Equilibrium Comparative Statics With and Without Amplification



Model Extensions

1. Worker heterogeneity and sorting \rightarrow acts as **dampening force**
 - Modern service multiplier may be ≥ 1 , < 1 when $f_{\kappa}(\kappa^*) = 0$ and $\sigma \rightarrow \infty$
2. Trade in goods: shock to terms of trade \leftrightarrow shock to X productivity in closed economy
 - Can use trade shocks to validate model: shock to aggregate income

Worker Heterogeneity: Main Dampening Force

- **2-D heterogeneity:** Absolute ability h , traditional comparative advantage s
 - Supply h efficiency units as wage worker, sh as trad. own-account worker
 - Aggregation: each HH contains continuum of workers with $(h, s) \sim G(h, s)$ within HH
- Worker of type (h, s) earns wh as wage worker, $P_T z_T sh$ as own-account worker
- **Sort** into wage work subject to **frictions**
 - Take wage work if $s \leq s_w = \frac{1}{1+\tau} \frac{w}{P_T z_T}$
 - $s \in (s_w, (1+\tau)s_w)$: involuntary own-account work
 - In equilibrium, can write $s_w(\vartheta_M) \rightarrow$ enters into $T(\vartheta_M)$
- Key for amplification/dampening: marginal distribution of s : $\tilde{G}(s)$
 - Multiplier increases in density $\tilde{g}(s_w(\vartheta_M))$
 - More disperse $s \implies$ lower $\tilde{g}(s_w) \implies$ lower multiplier

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Application and Data

- **Goal:** Quantify Lewisian gains and service multiplier μ_M for all microregion-years
 - Use microregion-year because service modernization is a **local** phenomenon
 - Requires **local** primitives: frictions τ_{rt} , technology $\tilde{z}_{X,rt}, \tilde{z}_{M,rt}$, market size L_{rt}
- **Brazilian Census:** 4 key statistics for each microregion in 2000 and 2010
 1. Modern employment share of services $\hat{\ell}_{M,rt}$
 2. Wage premium of modern service workers $\hat{w}_{M,rt}$
 3. Aggregate income per capita \bar{y}_{rt}
 4. Population density \rightarrow direct measure of market size L_{rt}
- Other key micro-data sources:
 1. Consumer expenditure survey (POF)
 2. Labor force panel survey (PME)

Quantitative Approach: Structural Parameters

- **Structural parameters** constant across space/time:
Demand parameters $F_\kappa(\kappa), \omega_M, \phi, \zeta, \sigma$, worker ability distribution $G(h, s)$
 - Estimate key parameters from **micro-data**
- **Consumer expenditure data:** Estimate fixed cost distribution F_κ from Engel curve
 - Model as logistic distribution $\implies \Pr$ [Modern shopping] is logit wrt log income

$$\log \frac{\Pr_i [\text{Modern shopping}]}{1 - \Pr_i [\text{Modern shopping}]} = \varepsilon_0 + \varepsilon_1 \log y_i + \beta' X_i$$

- **Worker panel:** Estimate ability distribution from earnings/employment
 - Assume $(h, s) \sim$ joint log-normal, allow for correlation ρ

$$\begin{bmatrix} \log h \\ \log s \end{bmatrix} \sim \mathcal{N} \left(\begin{bmatrix} \mu_h \\ \mu_s \end{bmatrix}, \begin{bmatrix} \sigma_h^2 & \rho\sigma_h\sigma_s \\ \rho\sigma_h\sigma_s & \sigma_s^2 \end{bmatrix} \right)$$

- Other parameters set to match aggregate moments or to external estimates

Quantitative Approach: Local Primitives

- Microregion-years characterized by local primitives: $\tau_{rt}, \tilde{z}_{X,rt}, \tilde{z}_{M,rt}$
- Three-step model inversion to obtain primitives

1. $\hat{\ell}_{M,rt}, \hat{w}_{M,rt} \rightarrow \vartheta_{M,rt}, s_{w,rt}, \tau_{rt}$

$$\frac{\vartheta_{M,rt}}{1 - \vartheta_{M,rt}} = \hat{w}_{M,rt} \frac{\hat{\ell}_{M,rt}}{1 - \hat{\ell}_{M,rt}} \mathbb{E} [u^T], \quad s_{w,rt} = \tilde{G}^{-1}(\ell_{w,rt}), \quad (1 + \tau_{rt}) s_{w,rt} = \hat{w}_{M,rt} \frac{\mathbb{E} [sh|s > s_{w,rt}]}{\mathbb{E} [h|s \leq s_{w,rt}]} \mathbb{E} [u^T]$$

- Step uses only worker ability distribution, not demand-side parameters

2. $\bar{y}_{rt}, \tau_{rt}, \vartheta_{M,rt}, s_{w,rt} \rightarrow \tilde{z}_{X,rt}$

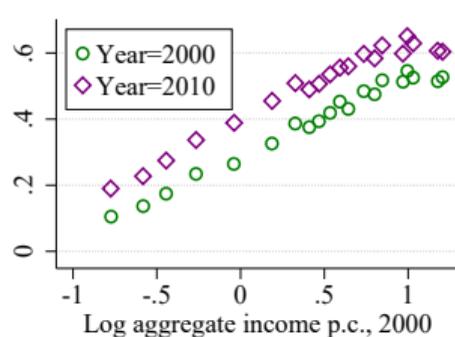
$$\tilde{z}_{X,rt} \propto \frac{\bar{y}_{rt}}{\mathbb{E} [h|s \leq s_{w,rt}]} (H_{X,rt}(s_{w,rt}, \vartheta_{M,rt}, L_{rt}))^{\frac{-1}{\sigma-1}}$$

3. $\vartheta_{M,rt}, \tau_{rt}, \tilde{z}_{X,rt} \rightarrow \tilde{z}_{M,rt}$: **structural residual**

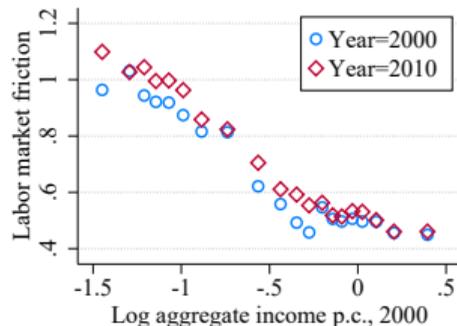
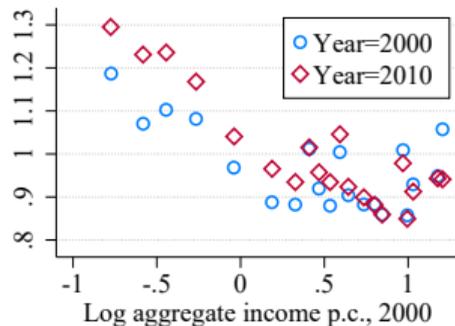
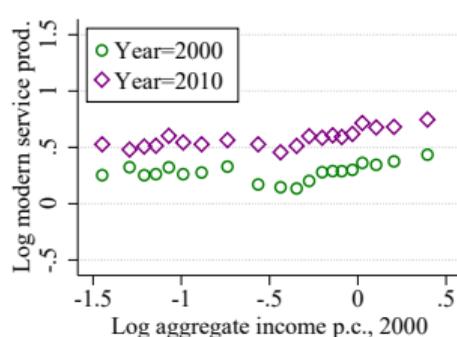
$$\vartheta_{M,rt} = T(\vartheta_{M,rt} | \tilde{z}_{M,rt}, \dots), \quad \frac{\partial T(\vartheta_{M,rt} | \tilde{z}_{M,rt}, \dots)}{\partial \tilde{z}_{M,rt}} > 0$$

Identifying Variation and Fundamentals, by 2000 Aggregate Income

Modern share of service emp.



Modern service technology $\tilde{z}_{M,rt}$



Modern wage premium

Labor mkt. friction τ_{rt}

Model Validation: Untargeted Moments

- Regional variation in modern expenditure [▶ Link](#)
- Selection into traditional employment by individual income [▶ Link](#)
- Natural experiment: Service sector response to trade shock

[▶ Skip to quantitative exploration](#)

Model Validation – Natural Experiment: Brazil's Trade Liberalization

- **Amplification mechanism:** Agg. income gains shift demand to modern services
 - **Ideal test:** Income shock originating outside services \leftrightarrow Shock to \tilde{z}_X
 - **Model prediction:** $\uparrow \tilde{z}_X \rightarrow \uparrow$ real income $\rightarrow \uparrow \vartheta_M \rightarrow \uparrow$ modern share, wage premium
 - Test with shock to **tradable industries** from trade liberalization
- **Natural experiment:** Brazil's unilateral reduction in tariffs in early 1990s
 - Diff. exposure to import competition \rightarrow contraction of goods production sector ($\downarrow \tilde{z}_X$)
- **Empirical approach:** Regress 1991-2000 change in service-sector outcomes on local income growth instrumented by local tariff shock (Dix-Carneiro and Kovak, 2017)

$$\Delta Y_{r,1991}^{2000} = \beta_1 \Delta \log (\text{Avg. Income})_{r,1991}^{2000} + \vec{\gamma}' X_{r,1991} + u_r$$

$$\text{1st stage: } \Delta \log (\text{Avg. Income})_{r,1991}^{2000} = \alpha_1 \text{Regional Tariff Reduction}_{r,1991}^{2000} + \vec{\chi}' X_{r,1991} + \varepsilon_r$$

► Construction of tariff shock

Natural Experiment: Empirical Results

	Modern share of service emp.	Modern wage premium
Log income shock	0.051*** [0.013,0.090]	0.211** [0.028,0.393]
Observations	409	409
State FE	Yes	Yes
Lag Controls	Yes	Yes
Log Income IV	Tariff shock	Tariff shock
1st Stage F-Stat	85.1	85.1

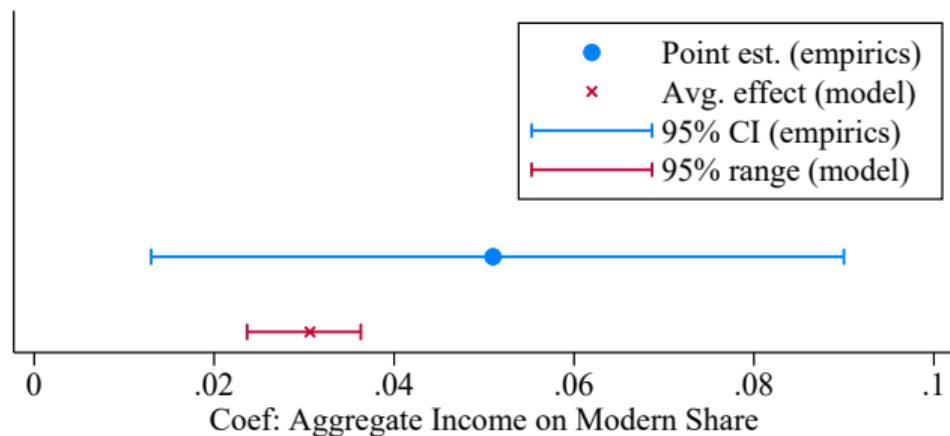
Note: 95% CI from robust standard errors in brackets. Outcomes are in 2000, the first Census year post-trade liberalization. All regressions control for 1991 modern employment share, log income, and modern wage premium.

► First stage

- Income shocks originating in goods sector (\tilde{z}_X) have **positive impact** on modern service employment, wage premium → **Validates qualitative model prediction**
- **Next:** Feed $\tilde{z}_{X,rt}$ shock into model to evaluate quantitative performance

Model Response to Trade-Induced Income Shock

Figure: Impact of Aggregate Income on Modern Service Share: Model vs. Data



- Shock $\tilde{z}_{X,rt}$ in model, compute model equivalent of IV coef: $\frac{d \log \ell_M}{d \log \tilde{z}_X} \Big/ \frac{d \log e_G}{d \log \tilde{z}_X}$

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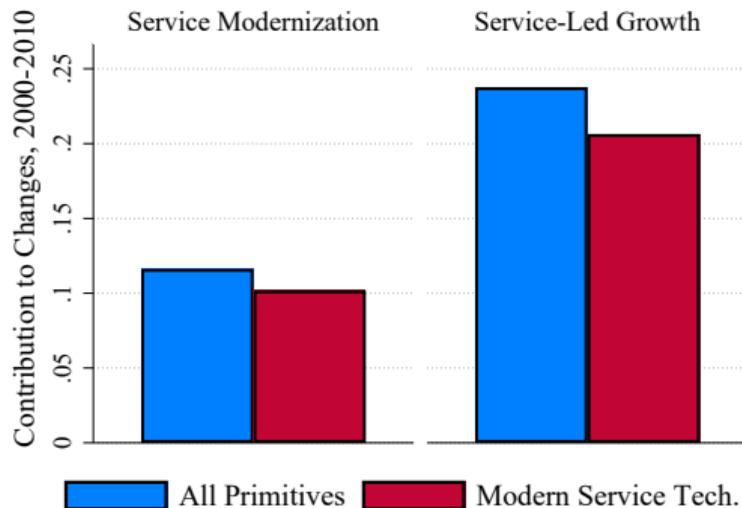
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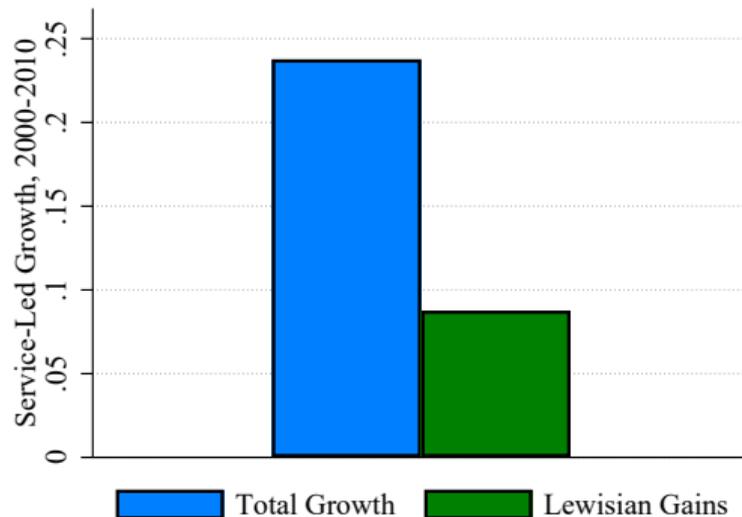
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Accounting for Service Modernization and Growth

(a) The Contribution of z_M



(b) The Lewisian Component of Growth



- Most important primitive driver: Modern service technology z_M
- Quantitatively important growth mechanism: Lewisian gains

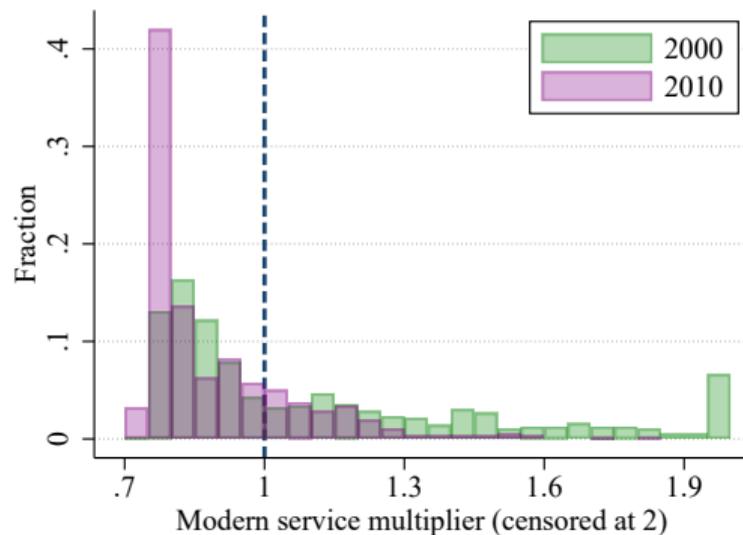
Amplification

- Compare full model against counterfactual with demand effects shut down:
 $F_{\kappa}(\kappa) \equiv 1 \iff f_{\kappa}(\kappa^*) = 0, \quad \sigma \rightarrow \infty$
- Relative to counterfactual, demand effects imply:
 - Reduced variation in structural residual \tilde{z}_M
 - Significant proportion of “amplification microregions” with $\mu_{M,rt} > 1$

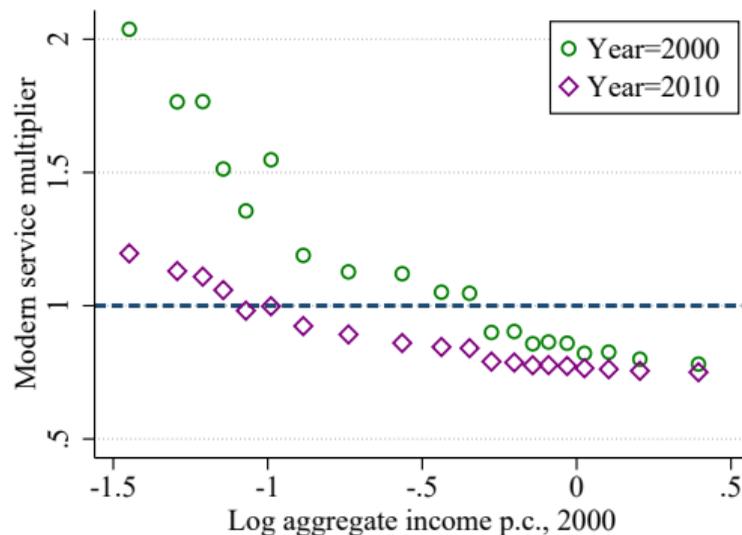
	SD(log $\tilde{z}_{M,2000}$)	SD(log $\tilde{z}_{M,2010}$)	$\overline{\Delta \log \tilde{z}_{M,2000}^{2010}}$	Share $\mu_{M,2000} > 1$	Share $\mu_{M,2010} > 1$
Full Model	0.208	0.166	0.240	46%	21%
No Demand Effects	0.311	0.236	0.300	0%	0%

Heterogeneous Amplification

(a) Histogram of μ_M



(b) μ_M and Aggregate Income

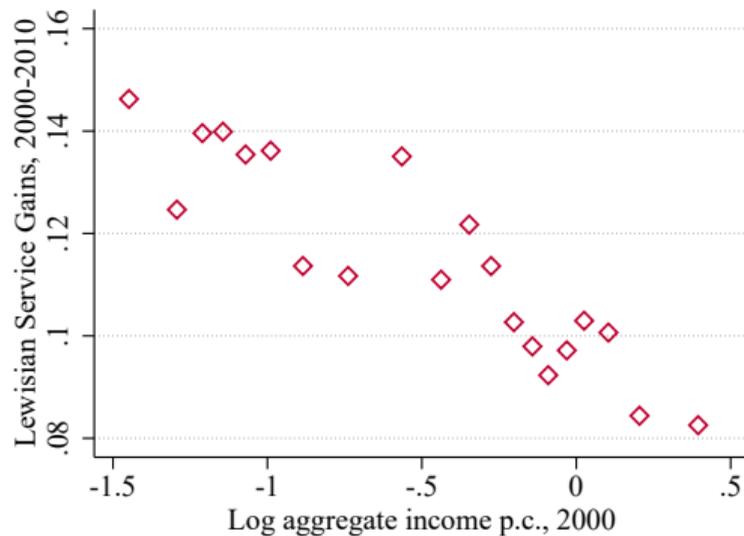


- Poorer regions significantly more likely to have $\mu_{M,rt} > 1$

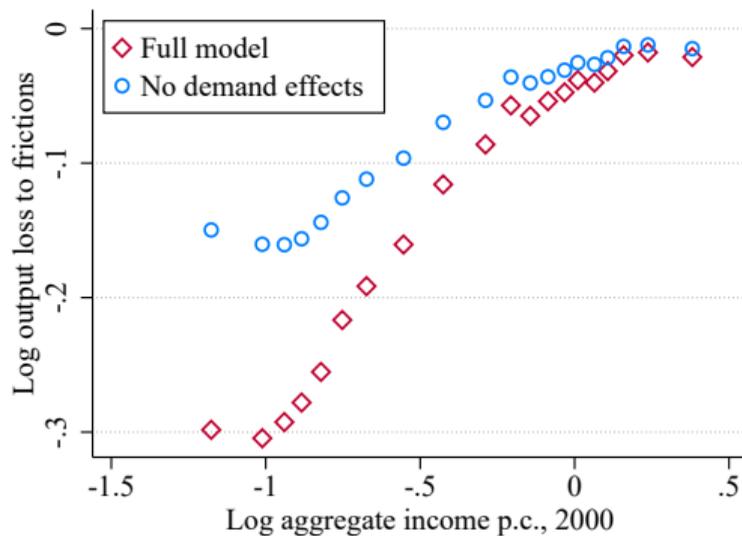
Lewisian Gains and the Amplified Cost of Frictions

- Poorest microregions (largest $\mu_{M,rt}$) have largest Lewisian gains
- Poor microregions lose more output to frictions with demand effects

(a) The Magnitude of Lewisian Gains



(b) The Amplified Real Output Loss to Frictions τ

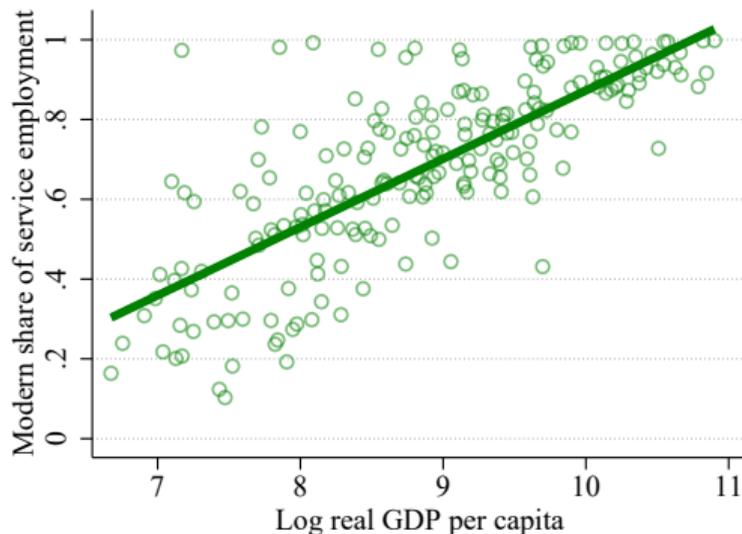


Conclusion

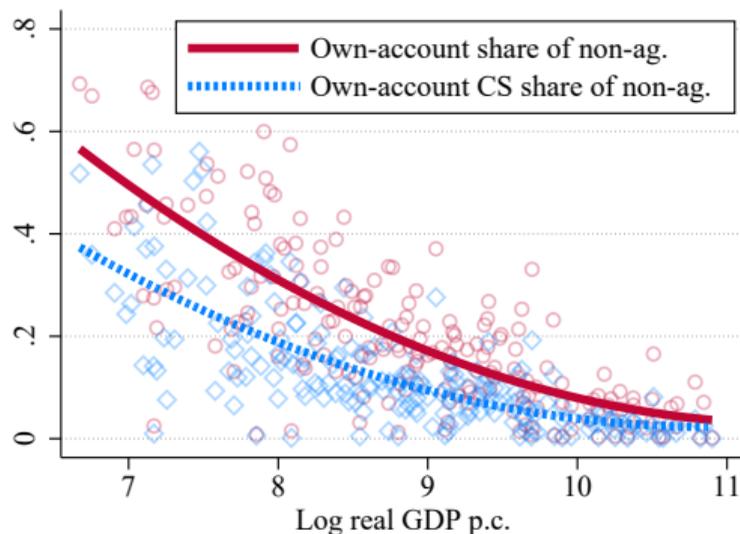
- Service modernization is a widespread feature of development
- Not just a superficial change → A **development multiplier**
- **Reason:** Lewisian gains due to frictions \times amplification from demand effects
- **Corollary:** Frictions \leftrightarrow Misallocation are extra costly
 - But technological improvements can set off **virtuous cycle** of economic development
- Further questions:
 1. What drives growth of modern service technology?
 2. Can labor market policy drive growth through reallocation?
 3. How are gains distributed? → Focus on heterogeneous consumption bundles

Service and Employment Transformation: Globally

Modern service share by country-years



Own-account share of non-ag. by country-years



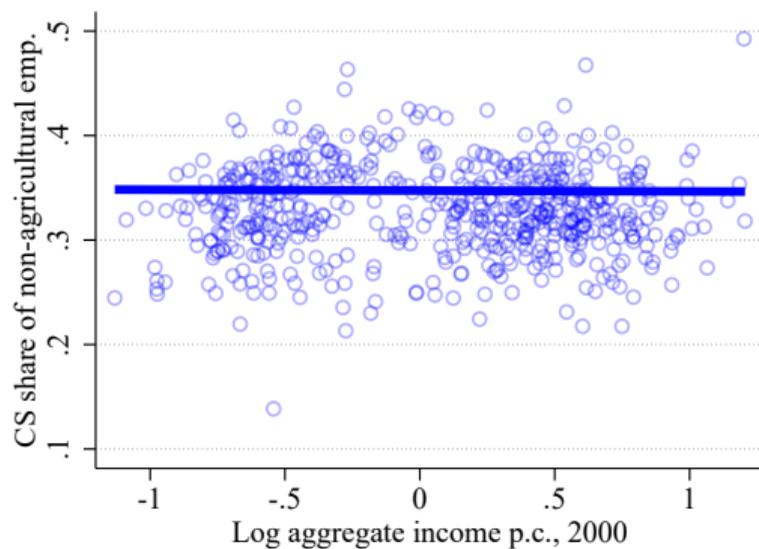
Source: IPUMS + PWT

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Note: Own-account work = Self-employment without hired labor

Consumer Service Share of Non-Ag. Is Flat wrt Income

Consumer Services and Aggregate Income

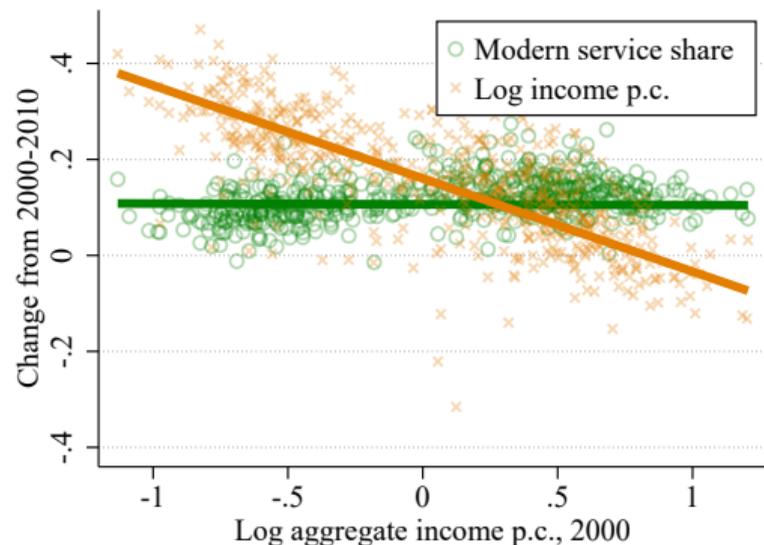


Source: Brazilian Census 2000-2010

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Convergence in Income, Not in Modern Share

Income and Modern Service Growth, 2000-2010



- 2000-2010: significant income convergence
- 10 p.p. shift to modern services throughout Brazil
 - Not purely movement along initial curve: rich areas grew little, still modernized

Source: Brazilian Census 2000-2010

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Worker Panel Microdata → Productivity Gap

- Use **worker panel data** (PME) to test for productivity gaps with regional heterogeneity

$$\log(\text{Earnings}_{ijct}) = \overbrace{\beta_1 \text{Modern Services}_{ijt}}^{\text{Productivity Gap}} + \overbrace{\beta_2 \text{Poor Region}_c \times \text{Modern}_{ijt}}^{\text{Regional Heterogeneity}} + \text{Worker FE} + \text{City-time FE} + u_{ijct}$$

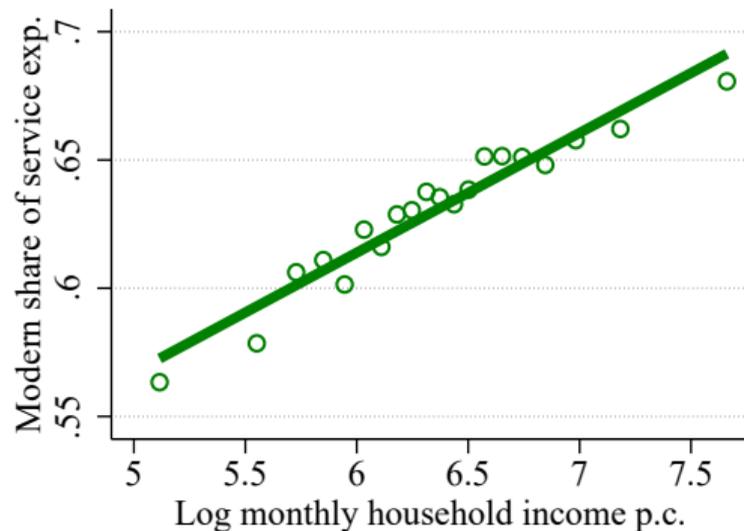
- **Results:**

- Modern premium is significant: $\hat{\beta}_1 = 0.076^{***}$
- Premium is larger in poor places: $\hat{\beta}_2 = 0.046^{***}$

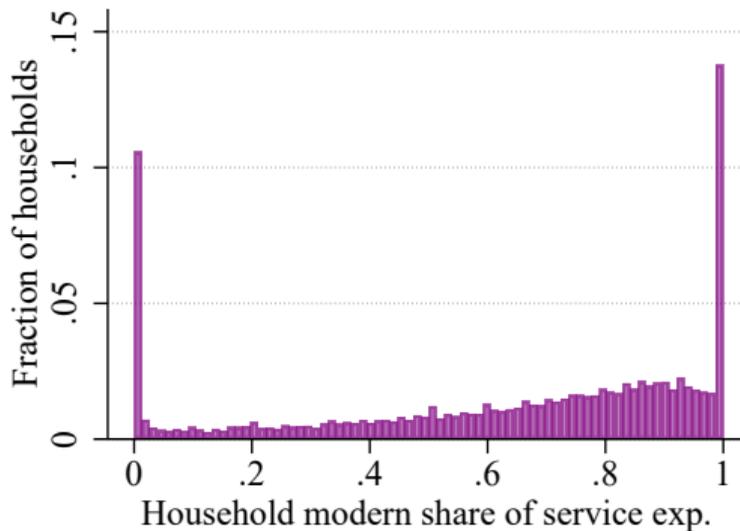
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Consumption Microdata → Extensive Margin Drives Variation

Income gradient
→ Modern services are **luxury**



Choice on **extensive margin**
→ Micro-found with **fixed shopping costs**



Source: POF (Consumer Expenditure Survey). Engel curve controls for household characteristics + geography

▶ PSU-level Histogram, Controls

▶ Back to Facts

▶ Back to Consumer Problem

Modern/Traditional Classification

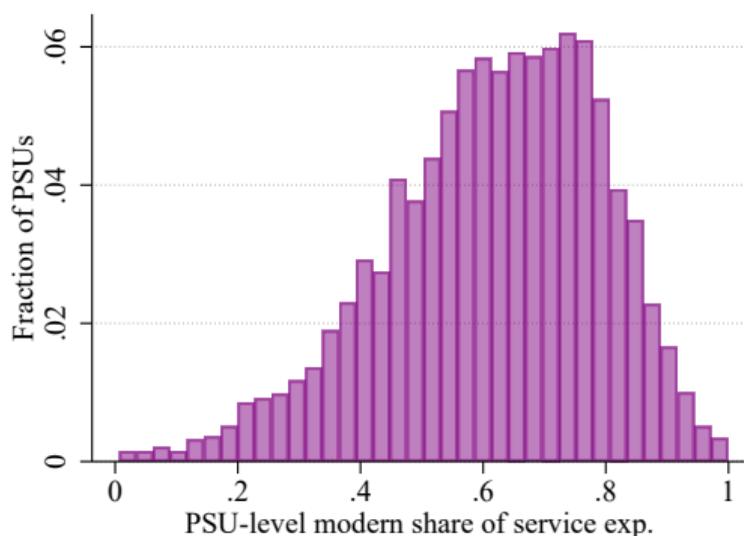
Table: Classification of Establishments

Modern	Traditional
Specialized shops	Non-market
Large stores	No storefront
Service institutions	Convenience/corner shops
Entertainment institutions	Individual service providers
	Informal entertainers

Source: Bachas et al. (2023)

Modern/Traditional Consumption Breakdown

Histogram: PSU-level avg. modern exp. share



- **Engel curve controls:** Number of HH members, number of earners, head's age (10-year dummies), race, sex, education, geography (PSU) fixed effects

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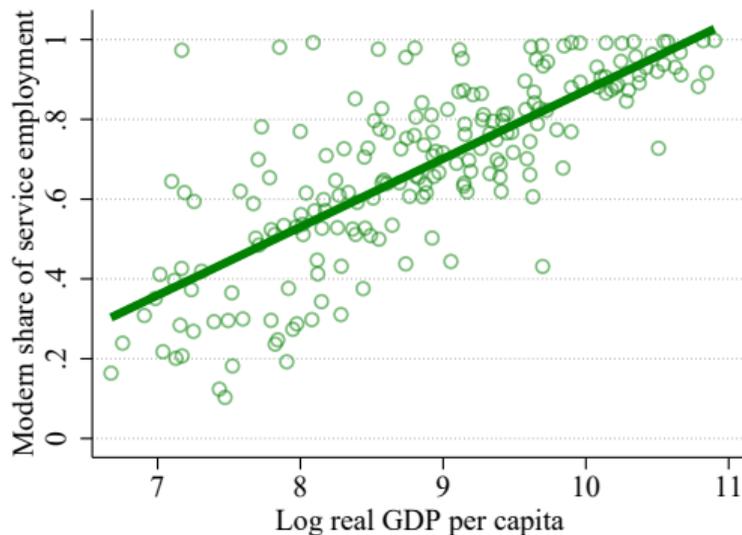
Note: POF sample is 48,706 households from 4,694 primary sampling units (PSUs).

Service Modernization and Development

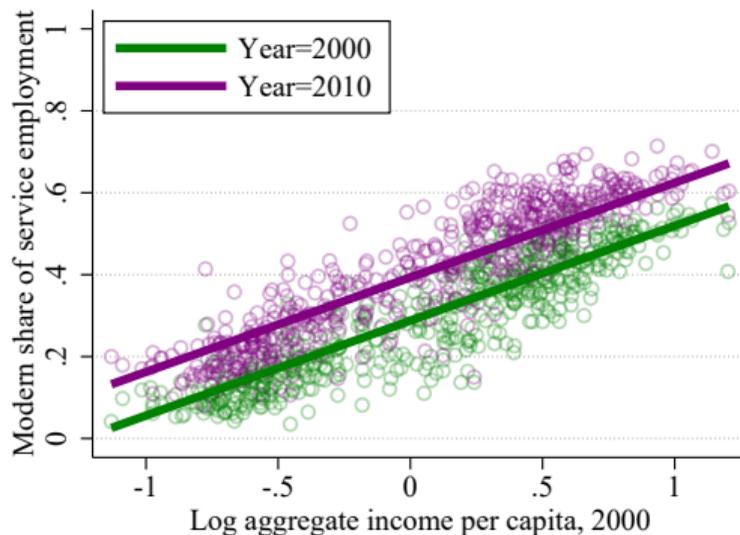
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(a) Service Modernization Worldwide



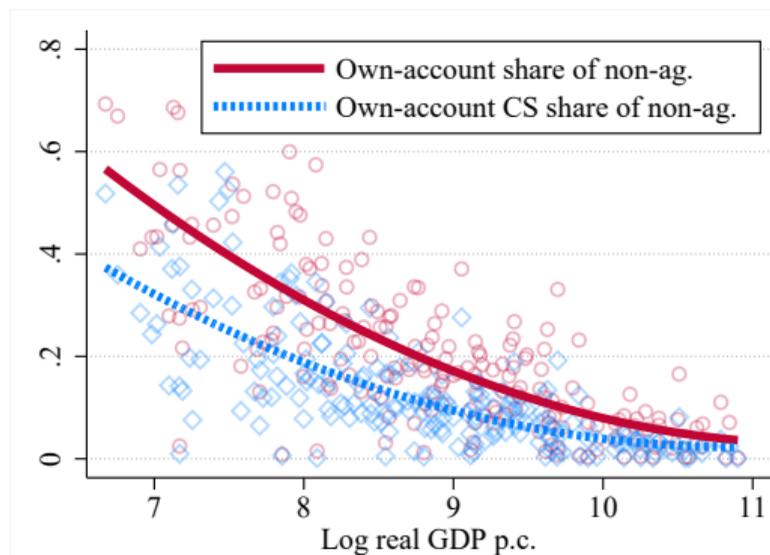
(b) Service Modernization in Brazil by Year



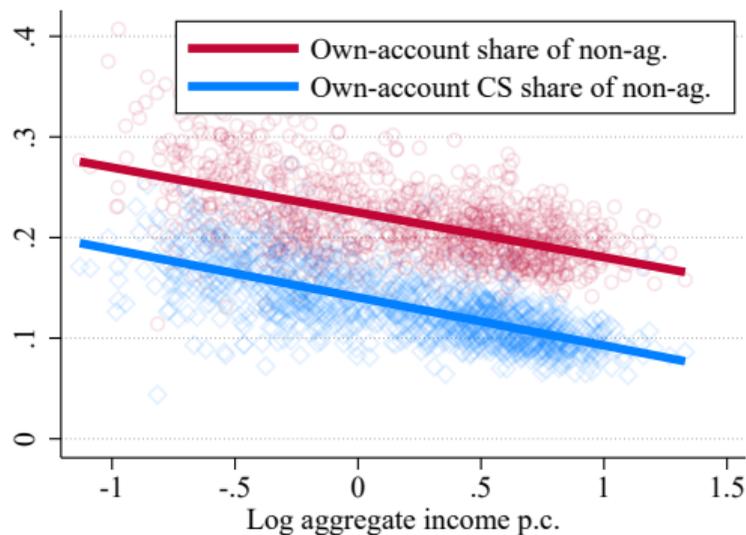
Note: Left panel: Employment data is from IPUMS data on 199 country-years spanning 76 unique countries; real GDP per capita data is from the Penn World Table for the same country-years. Right panel: data on both employment and income from the long form of Brazil's decennial Census. "Consumer services" refers to wholesale and retail trade, hospitality and food service, transportation, and other personal services. Modern employment is work for wages with pension contributions. All aggregations within a region-year use person weights provided by either IPUMS or the Brazilian Census.

Consumer Services, Own-Account Work, and Development

(a) Over country-years

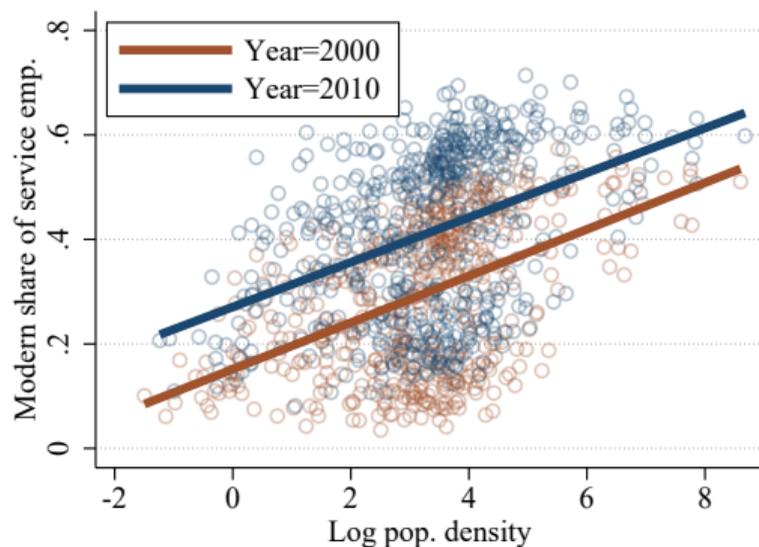


(b) Over Brazilian microregions



Note: Data sources : IPUMS + Penn World Table for country-years, Brazilian Census for microregion-years. Trend lines in the left panel use a quadratic fit, while in the right panel they use a linear fit.

Service Modernization and Population Density



Note: Data from the long form of Brazil's decennial Census. All aggregations within microregion-year use person weights provided by the Census.

Expression for $\kappa^*(e, \vec{P})$

$$C_{i,M} > 0 \iff \kappa_i \leq \kappa^*(e, \vec{P}) = \frac{e}{P} \left(1 - \left[\frac{\omega_M}{\omega_T} \left(\frac{P_M}{P_T} \right)^{1-\zeta} + 1 \right]^{\frac{\phi}{1-\zeta}} \right)$$

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$$wH_X(\vartheta_M) = (1 - \phi)eL$$

$$wH_M(\vartheta_M) = \phi\vartheta_M eL$$

$$\frac{w}{1 + \tau} H_T(\vartheta_M) = \phi(1 - \vartheta_M)eL$$

$$y(\vec{H}(\vartheta_M)) = \frac{1}{1 + \tau\phi(1 - \vartheta_M)} \left(z_X \frac{\sigma - 1}{\sigma^{\frac{\sigma}{\sigma-1}}} \left(\frac{(1 - \phi)L}{f_X(1 + \tau\phi(1 - \vartheta_M))} \right)^{\frac{1}{\sigma-1}} \right)^{1-\phi} \\ \times \left(\omega_M \left(z_M \frac{\sigma - 1}{\sigma^{\frac{\sigma}{\sigma-1}}} \left(\frac{\phi\vartheta_M L}{f_M(1 + \tau\phi(1 - \vartheta_M))} \right)^{\frac{1}{\sigma-1}} \right)^{\xi-1} + \omega_T ((1 + \tau)z_T)^{\xi-1} \right)^{\frac{\phi}{\xi-1}}$$

$$\frac{P_M}{P_T}(\vec{H}(\vartheta_M)) = (1 + \tau) \frac{z_T}{z_M} \frac{\sigma^{\frac{\sigma}{\sigma-1}}}{\sigma - 1} \left(\frac{f_M}{H_M} \right)^{\frac{1}{\sigma-1}} = (1 + \tau) \frac{z_T}{z_M} \frac{\sigma^{\frac{\sigma}{\sigma-1}}}{\sigma - 1} \left(\frac{f_M(1 + \tau\phi(1 - \vartheta_M))}{\phi\vartheta_M L} \right)^{\frac{1}{\sigma-1}}$$

$$\frac{P_M}{P_S}(\vec{H}(\vartheta_M)) = \frac{\frac{P_M}{P_T}(\vec{H}(\vartheta_M))}{\left(\omega_M \left(\frac{P_M}{P_T}(\vec{H}(\vartheta_M)) \right)^{1-\xi} + \omega_T \right)^{\frac{1}{1-\xi}}}$$

Details: Lewisian Gains

$$\begin{aligned}
 \frac{\partial \log y}{\partial \log \vartheta_M} &= \frac{\tau\phi\vartheta_M}{1 + \tau\phi(1 - \vartheta_M)} + \frac{1 - \phi}{\sigma - 1} \frac{\tau\phi\vartheta_M}{1 + \tau\phi(1 - \vartheta_M)} \\
 &+ \frac{\phi}{\sigma - 1} \frac{1 + \tau\phi}{1 + \tau\phi(1 - \vartheta_M)} \frac{\omega_M \left(z_M \frac{\sigma-1}{\sigma^{\frac{\sigma}{\sigma-1}}} \left(\frac{\phi\vartheta_M L}{f_M(1 + \tau\phi(1 - \vartheta_M))} \right)^{\frac{1}{\sigma-1}} \right)^{\xi-1}}{\omega_M \left(z_M \frac{\sigma-1}{\sigma^{\frac{\sigma}{\sigma-1}}} \left(\frac{\phi\vartheta_M L}{f_M(1 + \tau\phi(1 - \vartheta_M))} \right)^{\frac{1}{\sigma-1}} \right)^{\xi-1} + \omega_T ((1 + \tau)z_T)^{\xi-1}} \\
 &= h_M(\vartheta_M) \left(\tau + \frac{\tau(1 - \phi)}{\sigma - 1} + \frac{1 + \tau\phi}{F_\kappa(\kappa^*)(\sigma - 1)} \right),
 \end{aligned}$$

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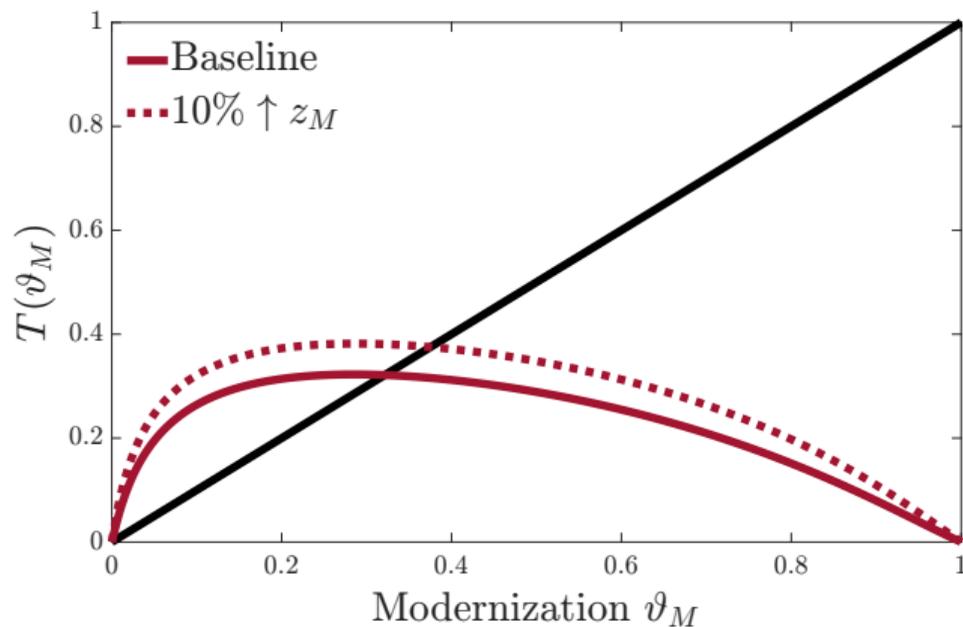
μ_M and $T'(\vartheta_M)$

$$\begin{aligned}\mu_M &= \frac{1}{1 - T'(\vartheta_M)} = \frac{1}{1 - \left(\frac{f_\kappa(\kappa^*)\kappa^*}{F_\kappa(\kappa^*)} \left(\frac{\partial \log y}{\partial \log \vartheta_M} + \frac{\partial \log \kappa^*}{\partial \log P_M/P_T} \frac{\partial \log P_M/P_T}{\partial \log \vartheta_M} \right) + (1 - \zeta) \frac{\partial \log P_M/P_S}{\partial \log \vartheta_M} \right)} \\ T'(\vartheta_M) &= \frac{f_\kappa(\kappa^*)\kappa^*}{F_\kappa(\kappa^*)} h_M(\vartheta_M) \left(\tau + \frac{\tau(1 - \phi)}{\sigma - 1} + \frac{1 + \tau\phi}{F_\kappa(\kappa^*)(\sigma - 1)} \right) \\ &\quad + \frac{f_\kappa(\kappa^*)\kappa^*}{F_\kappa(\kappa^*)} \phi \frac{y - \kappa^*}{\kappa^*} \frac{\vartheta_M}{F_\kappa(\kappa^*)} \frac{1}{\sigma - 1} \frac{1 + \tau\phi}{1 + \tau\phi(1 - \vartheta_M)} \\ &\quad + (\zeta - 1) \left(1 - \frac{\vartheta_M}{F_\kappa(\kappa^*)} \right) \frac{1}{\sigma - 1} \frac{1 + \tau\phi}{1 + \tau\phi(1 - \vartheta_M)}\end{aligned}$$

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Visualization: Amplification (or Dampening) Under Heterogeneity

Figure: Amplification in the Case of Worker Heterogeneity



Structural Parameters

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Parameter	Description	Value	Target Moment	Moment Value
ε_1	Inverse scale param. of $F(\kappa)$	0.68	Logit coef: $\frac{\partial \log \frac{\Pr[\text{Modern shopping}_i]}{1 - \Pr[\text{Modern shopping}_i]}}{\partial \log y_i}$	0.68
σ_h	Dispersion of $\log h$	0.67	$\text{SD}(\log y_{it}^w)$	0.67
σ_s	Dispersion of $\log s$	0.68	$\text{SD}(\log y_{it}^T)$	0.89
σ_u	Dispersion of $\log u$	0.43	$\text{SD}(\Delta \log y_{it}^T)$	0.40
ρ	Correlation of $\log h, \log s$	0.0376	$\Pr[\text{WT trans.} \mid \log y_{it}^w]$ probit coef	0.056
ϕ	Cobb-Douglas weight of services	0.63	Service share of wage bill	0.63
ω_M	Preference weight for M	0.90	Modern share Modern shopping	0.90
ε_0	Location parameter of $F(\kappa)$	1.49	Unconditional $\Pr[\text{Modern shopping}]$	0.70
τ_{rt}	Labor market friction	rt -specific	Modern service wage premium	
$\tilde{z}_{X,rt}$	Effective prod. in X	rt -specific	Average wage	
$z_{M,rt}$	Technology in M	rt -specific	Modern share of service emp.	
Parameter	Description	Value	Source	
z_T	Technology in T	1.0	Normalization	
ζ	M - T elasticity of substitution	3.97	Feng et al. (2024)	
σ	Cross-variety elasticity of sub.	5.02	Peters (2022)	

Regional Tariff Reduction (Dix-Carneiro and Kovak, 2017)

- Dix-Carneiro and Kovak (2017) construct regional tariff reduction RTR_r as a shift-share:

$$RTR_r = - \sum_i \beta_{ri} d \log(1 + \tau_i)$$

- β_{ri} = weight of industry i in region r labor market
- τ_i = tariff on industry i
 - Take cumulative changes from 1991 to 2000

Trade Shock First Stage

Table: First Stage of 2SLS IV Regression: Trade Shock

	Log income shock
Tariff shock (DK17)	-3.702*** [-4.491,-2.913]
Observations	409
State FE	Yes
Lag Controls	Yes

Note: 95% CI from robust standard errors in brackets. Log income is in 2000, the first Census year post-trade liberalization. Regression controls for 1991 modern employment share, log income, and modern wage premium. Microregions are weighted by 1991 population. For details on construction of the tariff shock, see Dix-Carneiro and Kovak (2017).

Mean tariff shock = 0.082, SD=0.053 \implies One SD more import competition \rightarrow -0.2 log income shock

Heterogeneous Responses to Income Shock

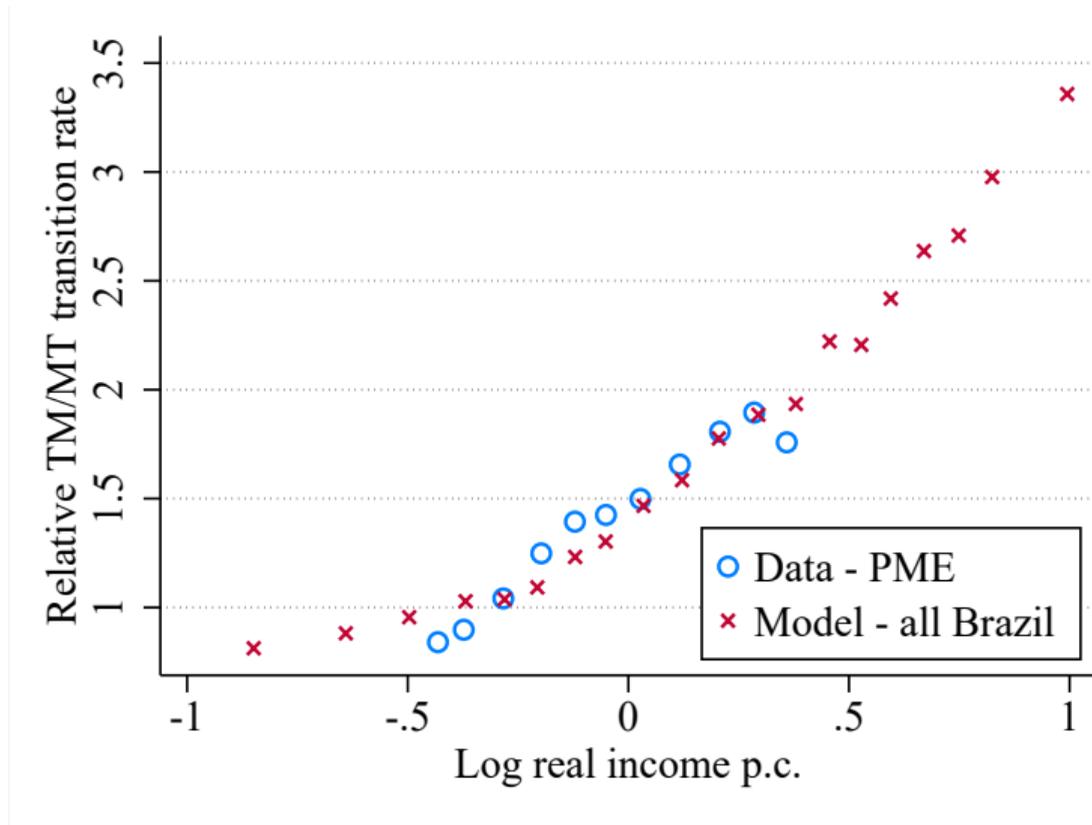
Table: Response to Income Shock with Heterogeneity by Initial Modern Share

	Modern share of service emp.	Modern wage premium in services
Log income shock	0.172*** [0.109,0.236]	-0.259** [-0.465,-0.053]
Lagged modern share \times Log income shock	-0.336*** [-0.544,-0.127]	1.249*** [0.528,1.970]
Observations	389	389
State FE	Yes	Yes
Lag Controls	Yes	Yes
Log Income IV	Tariff shock	Tariff shock
1st Stage F-Stat	17.8	17.8

Note: 95% CI from robust standard errors in brackets. Log income shock is instrumented change in log income from 1991 to 2000. Regression controls for 1991 modern employment share, log income, and modern wage premium. Microregions are weighted by 1991 population. For details on construction of the tariff shock, see Dix-Carneiro and Kovak (2017).

- Shock has weaker effect on modern share, stronger effect on premium, where modern share is initially high
 - Consistent with less elastic labor supply to modern sector when modern share is high

Untargeted Moment: Relative Worker Flows (PME)

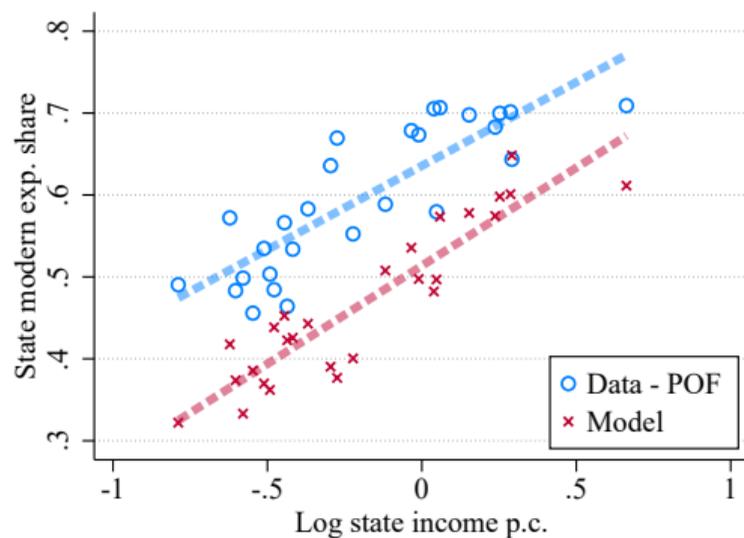


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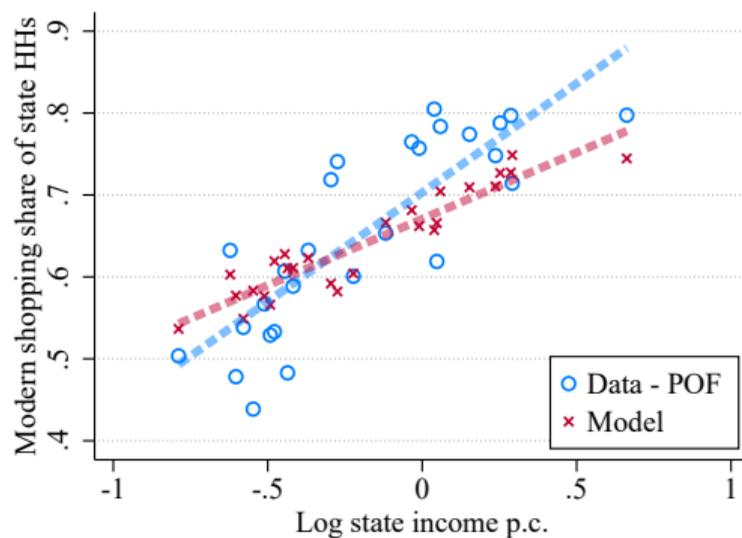
Untargeted Moment: State-Level Modern Expenditure Share (POF)

Figure: State-Level Engel Curves: Model vs. Data (POF)

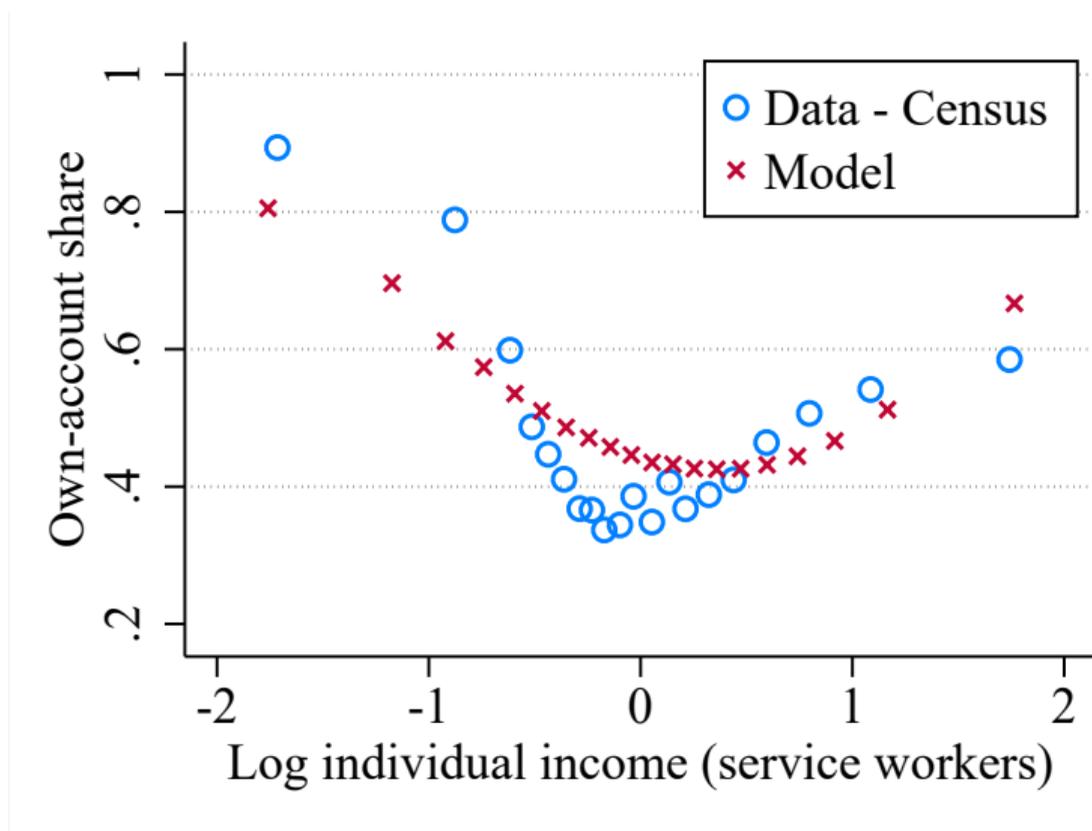
(a) Modern Expenditure Share



(b) Modern Shopping Extensive Margin



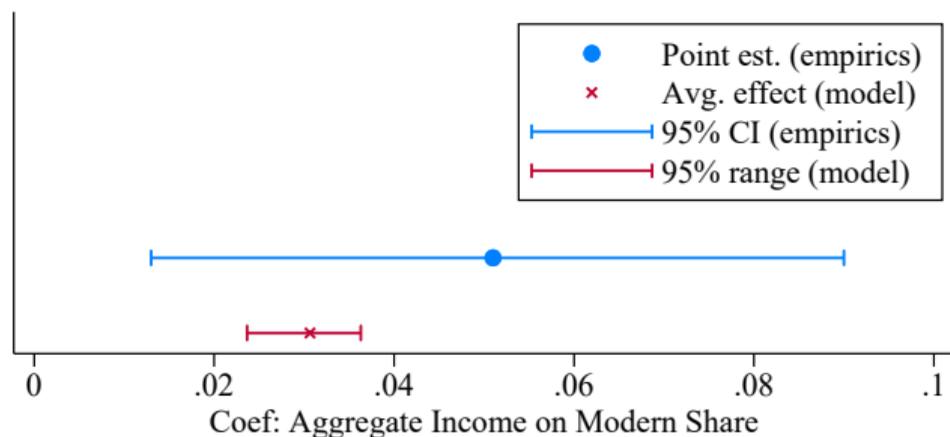
Untargeted Moment: Traditional Employment vs. Income



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Model Validation: Response to Trade-Induced Income Shock

Figure: Impact of Aggregate Income on Modern Service Share: Model vs. Data



Note: “Empirics” displays point estimate and 95% CI from using Dix-Carneiro and Kovak (2017) trade shock as an IV for local income to estimate local aggregate income’s effect on the modern share of service employment. The equivalent effect in the model is $\frac{d \log \ell_M}{d \log \bar{z}_X} / \frac{d \log e_G}{d \log \bar{z}_X}$. Figure presents the average and the range between the 2.5% and 97.5% percentile of the distribution of microregion-level effects.

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