

The Differential Impact of Aging on Structural Change: Insights from Cross-Country Analysis Based on Income Levels

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Work in Progress

ABSTRACT

This paper examines the **heterogeneous effects of population aging on sectoral employment reallocation across countries at varying stages of economic development**. Using an unbalanced panel dataset of 59 countries spanning 1960–2018, we estimate a panel fixed-effects model in which the old-age dependency ratio serves as the primary explanatory variable for employment shares across agriculture, manufacturing, and services. To rationalize the empirical findings, we develop an extended **overlapping generations (OLG) model incorporating hierarchical consumption preferences differentiated by age cohort, building on the non-homothetic utility frameworks** of Matsuyama (2002) and Foellmi and Zweimüller (2008). The model generates **age-specific demand structures in which older cohorts systematically shift consumption expenditure toward services**, particularly health-related services, inducing labor reallocation away from industry. Empirical results confirm that aging accelerates tertiarization — **the expansion of service-sector employment share** — **most prominently in high-income economies**, consistent with the demand-side channel of structural transformation. In **low-income countries, however, binding income constraints prevent full materialization of preference-driven sectoral reallocation, resulting in persistent agricultural employment retention**. Middle-income countries exhibit ambiguous dynamics, suggestive of a structural transformation puzzle. These findings highlight that the demographic transition interacts with the level of economic development to shape the trajectory of deindustrialization and de-agriculturalization, with important implications for development policy and long-run labor productivity growth.

BACKGROUND AND MOTIVATION

- **Structural transformation is key to economic development.** An increase in the employment share of a particular sector typically signals growth in economic activities, production, and labor productivity.
- The reallocation of resources **from low-productivity to high-productivity sectors** (Fan et al., 2003).
- Aging reshapes labor market dynamics and **sectoral shifts**.
- **De-agriculturalization and deindustrialization driven by income and preferences**, e.g., Rodrik (2013, 2016) and Świecki (2017).
- Previous studies e.g., Siliverstovs et al. (2011); Cravino et al. (2022); Herrendorf et al. (2022) highlight **aging's effect on services**.
- Focus on countries at **varying income levels**.

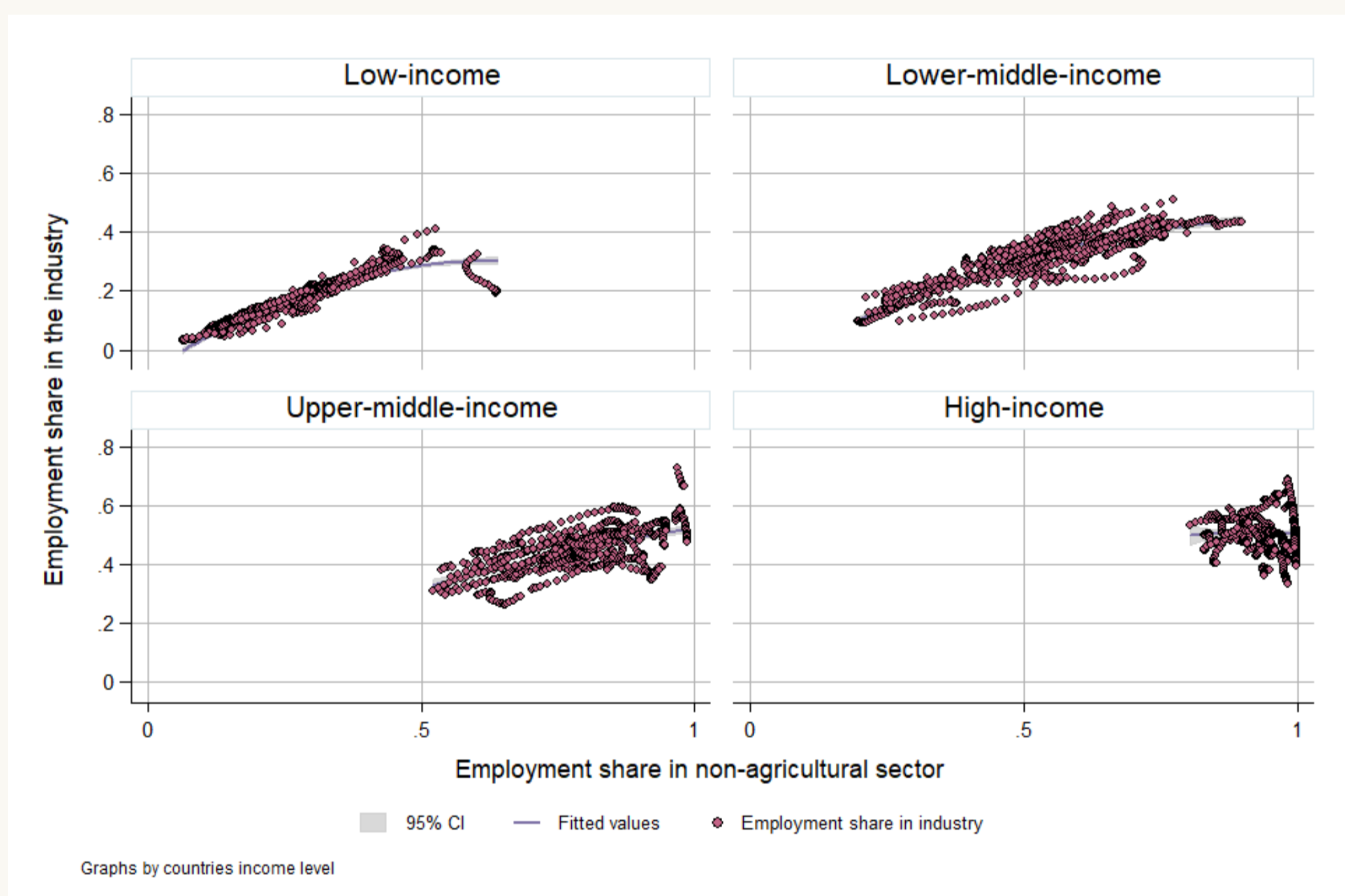
DATA & IDENTIFICATION

59 Countries 1960–2018 Unbalanced Panel

- **Sources:** Extended ETD (Africa, Asia, Latin America), World Bank, WGI, LUIS (8 European countries)
- **Sectors:** Agriculture · Industry · Services

$$share_{i,m,t} = \alpha + \beta_1 OADR_{i,t} + \beta_2 share_{i,m,t-1} + \beta_3 Y_{i,t} + \beta_4 Ysq_{i,t} + \beta_5 X_{i,t} + \mu_i + \lambda_t + \varepsilon_{i,t}$$

AGING REDUCES INDUSTRY VS. SERVICES SHARE



Source: Authors' calculation.

KEY REGRESSION RESULTS

Dep. var.: sectoral employment share. OADR = old-age dependency ratio.

	Agri	Industry	Services
High-income			
OADR	-0.004***	-0.004***	+0.008***
Middle-income			
OADR	-0.003	+0.002	+0.002
Low-income			
OADR	+0.106*	-0.095**	-0.011

***p<0.01, **p<0.05, *p<0.1. Controls: ln GDP p.c., human capital, trade, gov. spending. R² ≈ 0.94–0.97. Country + year FE.

FINDINGS BY INCOME LEVEL

High-income — **Strong shift away from agriculture and industry toward services.** Aging accelerates service-sector growth via hierarchical preferences. Demand for health and personal services rises with age and is fulfilled at high income levels.

Middle-income — **The Puzzle:** Coefficients are statistically insignificant for all sectors. Competing forces — preference shifts toward services vs. binding income constraints — appear to cancel out.

Low-income — **Aging increases agricultural employment and reduces industry share.** Income is too low to afford age-related services; older workers remain in subsistence agriculture.

THEORETICAL FRAMEWORK

Extended **Overlapping Generations (OLG)** model with **hierarchical consumption preferences** ranked by age, building on Matsuyama (2002) and Foellmi & Zweimüller (2008).

- Overlapping generations economy with $I \in \mathbb{N}$ production sectors; each produces a consumption good using only labour.
- Each agent lives for at most two periods: young and old.
- Consumption goods are ranked by preference; rankings may differ between young and old.

Budget constraints:

$$\sum_{i=1}^I p_{i,t} c_{i,t}^y + s_t = w_t \quad (\text{young, period } t)$$

$$\sum_{i=1}^I p_{i,t+1} c_{i,t+1}^o = \frac{R_{t+1}}{\pi} s_t \quad (\text{old, } \pi \in (0, 1] \text{ survive})$$

Priority rankings via bijective functions:

$$\sigma_y : \text{Index}_Q \rightarrow \text{Permutation}(\text{Index}_Q) \quad (\text{young})$$

$$\sigma_o : \text{Index}_Q \rightarrow \text{Permutation}(\text{Index}_Q) \quad (\text{old})$$

Four-sector example (agri, manu, non-health serv., health serv.):

$$\sigma_y(1) = 1, \sigma_y(2) = 2, \sigma_y(3) = 3, \sigma_y(4) = 4$$

$$\sigma_o(1) = 1, \sigma_o(2) = 3, \sigma_o(3) = 4, \sigma_o(4) = 2$$

Utility weight and Quadratic utility:

$$\xi_j(i) = \sigma_j(i)^{-\gamma}, \quad \gamma > 0 \quad (\text{lower rank} \Rightarrow \text{higher weight})$$

$$u_i(c_{i,t}^j) = \mu_i c_{i,t}^j - \frac{1}{2}(c_{i,t}^j)^2, \quad \mu_i \geq 0$$

$$\sum_{i=1}^I \xi_j(i) u_i(c_{i,t}^j) \quad \text{for } j \in \{y, o\}. \quad (\text{Each life stage weighted sum utility})$$

Lifetime optimisation:

$$\max \left\{ \sum_{i=1}^I \xi_y(i) u_i(c_{i,t}^y) + \pi \beta \sum_{i=1}^I \xi_o(i) u_i(c_{i,t+1}^o) \right\}$$

Optimal consumption (FOCs):

$$c_{i,t}^y = \max\{0, \mu_i - \lambda_t p_{i,t} \sigma_y(i)^\gamma\}$$

$$c_{i,t+1}^o = \max\left\{0, \mu_i - \frac{\lambda_t}{\beta R_{t+1}} p_{i,t+1} \sigma_o(i)^\gamma\right\}$$

Total savings of the young must equal the total interest income received by the old:

$$s_t L_t = \frac{R_t}{\pi} s_{t-1} \cdot \pi L_{t-1} \Rightarrow s_t = \frac{R_t}{1+n} s_{t-1} \Rightarrow s_t = \frac{\prod_{\tau=0}^t R_\tau}{(1+n)^t} s_{-1}$$

Linear production: $Q_{i,t} = A_{i,t} l_{i,t} L_t$. Labour clearing: $\sum_i l_{i,t} = 1$. Goods clearing: $Y_{i,t} = c_{i,t}^y L_t + c_{i,t}^o \pi L_{t-1}$.

Equilibrium labour share in sector i :

$$l_{i,t} = \frac{1}{A_{i,t}} \left[\max\left\{0, \mu_i - \lambda_t \frac{A_{i,t}}{A_{i,t}} \sigma_y(i)^\gamma\right\} + \frac{\pi}{1+n} \max\left\{0, \mu_i - \frac{\lambda_t}{\beta R_{t+1}} \frac{A_{i,t}}{A_{i,t}} \sigma_o(i)^\gamma\right\} \right]$$

- $\sigma_y(i)^\gamma \uparrow \Rightarrow$ the number of ranks the young give to a certain good i is high, which indicates less priority in their consumption \Rightarrow **less labour** to sector i
- $\sigma_o(i)^\gamma \uparrow \Rightarrow$ means the number of ranks the old give to a certain good i is high, which indicates less priority in their consumption \Rightarrow **less labour** to sector i
- $\pi \uparrow$ or $n \downarrow$: more weight to the aging situation and preference for goods consumed by the old \Rightarrow labour shifts toward health/services
- $\mu_i = 0$: economy chooses not to eat good i at all \Rightarrow no labor reallocate to that sector i

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