Powering High-Quality Development: High-End Manufacturing, Human Capital Allocation, and Economic Growth

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Abstract: *By comparing the growth trajectories of East Asia and Latin America, this study finds that during industrialization, East Asian economies actively advanced their manufacturing sectors toward high-end production and achieved a higher relative density of high-skilled labor within this sector. In contrast, Latin American economies experienced a "low-end lock-in" in manufacturing, with high-skilled labor more heavily concentrated in the service sector. To provide a unified explanation of these patterns of industrial transformation and labor allocation, this paper develops a three-sector general equilibrium model that includes basic manufacturing (BM), high-end manufacturing (HM), and services, and incorporates labor heterogeneity. The model captures how, under different development thresholds for HM, the allocation of high-skilled labor across sectors leads to two distinct structural transformation paths: from BM to HM, or from BM to services. These paths, in turn, generate different trajectories of human capital accumulation and economic growth performance. Simulation analysis shows that dynamically adjusted industrial policies are more effective than static ones, and that combining education policy with industrial policy yields better outcomes than either policy alone. This study extends theoretical research on industrial structural transformation, highlights the importance of HM for latecomer economies, and offers theoretical underpinnings and decision-making insights for advancing new industrialization and deepening integration between industrial and talent chains.*

Keywords: *high-end manufacturing; human capital allocation; industrial structural transformation; proactive government*

JEL Classification Codes: F401

DOI: 10.19602/j.chinaeconomist.2026.01.02

1. Introduction

The global economic landscape reveals a critical insight: the rise of high-end manufacturing (HM), coupled with strategic allocation of high-skilled labor, is essential for latecomer economies

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to achieve transformative economic growth. As such, this advanced industrial sector serves as a powerful catalyst, driving less developed economies toward modernization, upgrading, and sustained long-term growth. A striking contrast emerges when comparing East Asian and Latin American economies. East Asian economies—such as Japan, South Korea, China's Taiwan region, and Singapore—have consistently increased the value-added share of their mid- to high-end technology manufacturing, often surpassing 50%, reflecting robust growth. In contrast, Latin American economies, including Mexico, Brazil, and Chile, typically remain below 40% and frequently experience stagnation or decline (see Figure 2). This divergence highlights the pivotal role of HM in economic transformation. Equally critical is the role of a skilled workforce. Does the supply of high-skilled labor effectively support HM? Our analysis of high-skilled labor density reveals a clear pattern: economies that escape the "middle-income trap" exhibit a higher concentration of high-skilled labor in HM and a lower density in services than those still trapped (see Figure 3). These observations prompt key questions: What drives the superior economic performance of economies with thriving HM and a greater share of skilled labor in this sector? How do HM, human capital allocation, and economic growth interrelate? And what role do government policies play in orchestrating industrial transformation and optimizing human capital allocation? Addressing these questions provides theoretical guidance and practical support for strategies, such as China's ambition to become a "manufacturing power" and integrate its industrial and talent ecosystems.

Extensive research has investigated the nexus of industrial structure and economic growth[1], yet significant gaps persist. Existing studies often fail to account for the stylized facts examined in this paper and offer limited insights for addressing China's current economic policy challenges. Much of the literature on structural transformation and economic growth focuses on how industrial-sector expansion drives labor out of agriculture, thereby promoting sustained regional growth (Lewis, 1954; Hao et al., 2020). However, these analyses typically rely on a binary agricultural-non-agricultural framework (Temple, 2005; Vollrath, 2009), neglecting the distinct roles of HM, BM, and services within a national economy. While some studies highlight manufacturing as a key driver for middle-income economies to achieve technological catch-up and efficiency gains (Rodrik, 2013, 2016; Cruz & Nayyar, 2017; Huang & Yang, 2022), and others examine trends, causes, impacts, and policy responses related to China's manufacturing share (Wu & Xu, 2021; Cai, 2021; Xiao & Sun, 2022; Lin & Xu, 2023), they lack a systematic analysis of HM's dominant role in exerting a stronger economic pull. This gap hinders a comprehensive understanding of industrial structural transformation in middle-income economies and limits guidance for addressing critical challenges, such as escaping the middle-income trap.

Second, the literature consistently underscores the pivotal role of human capital levels and structure in driving economic growth and productivity gains (Nelson & Phelps, 1966; Ding & Knight, 2011; Ciccone & Papaioannou, 2009; Kim & Lee, 2011). However, more profound insights into human capital allocation remain limited. A few studies explore its distribution across domains—such as productive versus non-productive activities (Murphy et al., 1991; Baumol, 1996),

[1] Extensive literature exists on industrial structural transformation; interested readers may consult Guo & Peng (2021) and Wang & Tang (2021) for detailed references.

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occupations (Hsieh et al., 2019), government-enterprise dynamics (Li & Yin, 2017), or technology-intensive versus knowledge-based industries (Li & Nan, 2019). Buera et al. (2022) further connect skill-biased technological progress to industrial shifts toward human capital-intensive sectors. Yet, a critical gap remains: none of these studies systematically explores how reallocating high-skilled labor across sectors influences both the trajectory of industrial upgrading and long-term growth.

Lastly, research on barriers to manufacturing development and policy solutions often focuses on broad factors, such as development strategies (Zhu et al., 2022), rising labor costs (Bai & Yu, 2019; Zhu & Wang, 2022), energy transitions (Jiang et al., 2023), and environmental policies (Sun et al., 2024). Some studies also address how financial frictions, contract enforcement, and policy biases toward firm size constrain manufacturing's scale effects (Shin & Zhou, 2007; Erosa & Cabrillana, 2008; Guner et al., 2008). However, there is a notable lack of detailed analysis on aligning human capital structure with the specific demands of HM development, a perspective critical for guiding effective industrial transformation.

Building on existing theories and empirical evidence, this study posits that, for developing economies, the role of manufacturing in economic growth stems not only from its share of GDP but, more critically, from its internal upgrading—particularly the pivotal role of HM. As the cornerstone of a "deep industrialization" pathway, HM enables economies to transcend the middle-income trap and achieve high-income status. We argue that the choice between industrial transformation pathways depends on the allocation of high-skilled labor between HM and services. To elucidate this mechanism, we introduce the concept of a technological development threshold for HM. Employing a framework that integrates stylized facts, theoretical modeling, and policy simulation, we analyze how the interplay between industrial structural change and human capital allocation shapes economic growth outcomes. We further simulate the effects of various policy interventions on these dynamics.

This study offers three main contributions: First, it theoretically differentiates the structural roles of HM and services in economic development. It explains why two transformation pathways—"deep industrialization" versus "premature servitization"—yield divergent growth trajectories, emphasizing the strategic importance of HM in overcoming the middle-income trap and sustaining long-term growth. Second, it introduces the concept of human capital allocation between manufacturing and services, examining its critical influence on the selection and success of industrial upgrading strategies. Significantly, this extends the literature on structural transformation by incorporating the human capital dimension into sectoral transition analysis. Third, this theoretical framework applies to evaluate the role of government policy—specifically, industrial and education policies—in fostering HM and human capital accumulation. Through policy simulations, it assesses the effectiveness of various interventions and provides actionable policy recommendations tailored to China's challenges in industrial development and talent allocation.

The paper is structured as follows: Section 2 presents cross-regional empirical evidence, comparing economies that have escaped the middle-income trap with those that have not, focusing on differences in industrial structure and human capital allocation, and introduces research hypotheses based on stylized facts. Section 3 develops a dynamic multi-sector general equilibrium model to analyze how the alignment of HM development and human capital allocation

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shapes structural transformation pathways and economic performance. Section 4 conducts policy simulations to evaluate the role of industrial and education policies in driving structural upgrading and growth. Section 5 concludes with a summary of findings and key policy implications.

2. Empirical Analysis

The economic disparities across economies at different developmental stages stem from their factor endowments and industrial structures, with human capital alignment playing a pivotal role (Lin, 2017). Since World War II, Latin American economies—such as Mexico, Brazil, Chile, and Peru—have often remained trapped in the "middle-income trap." In contrast, East Asian economies—such as Japan, South Korea, Singapore, and China's Taiwan region—have successfully overcome this challenge. Building on an analysis of factor endowment structures across industries, this section compares industrial structural transformation and human capital allocation across contrasting economic archetypes, laying the empirical foundation for the research hypotheses and theoretical model developed later in this paper.

2.1 Industrial Factor Endowment Structure

To enable more general comparisons and provide a robust basis for our theoretical model, this study first quantifies factor intensity across industries, highlighting their inherent differences. We then analyze industrial structural transformation and human capital allocation across economies with varying economic performance.

We categorize manufacturing into BM and HM based on the OECD's (2005) technological classification. HM encompasses medium-high-tech and high-tech sectors. In contrast, BM includes low-tech and medium-low-tech sectors[2]. The service sector is treated as a single entity, without distinguishing between producer and consumer services, for two reasons: first, our focus is on the critical role of HM in structural transformation and its impact on human capital allocation and economic performance; second, subdividing the service sector would unnecessarily complicate the model without altering the core findings[3].

Using WIOD data and benchmarking against the United States, we analyze the relative human capital intensity of BM (bm), services (ser), and high-tech manufacturing (htm) by calculating the average share of high-skilled labor and corresponding wage shares across these sectors (see Table 1). Let $i \in \{h, m, l\}$, where h, m, and l denote high-skilled, medium-skilled, and low-skilled labor, respectively, $j \in \{bm, hm, s\}$, bm, htm, and s represent the three sectors. The wage return for labor of skill i in sector j is denoted as $labs_{ij}$, while $labs_j$ represents the total labor wage return in sector j. Similarly, N_{ij} denotes the time input (measured in working hours) of labor with skill i in sector j, and N_j represents the total labor time input in sector j. The wage share of high-skilled labor in

[2] BM includes: Food, beverages and tobacco; Textiles and textile; Leather, leather and footwear; Wood and of wood and cork; Pulp, paper, paper, printing and publishing; Coke, refined petroleum and nuclear fuel; Rubber and plastics; Other non-metallic mineral; Basic metals and fabricated metal; Manufacturing nec, recycling; high-end manufacturing includes: Chemicals and chemical; Machinery, nec; Electrical and optical equipment; Transport equipment.

[3] Following Lin & Wang (2020), this study does not distinguish between producer and consumer services within the service sector, as such differentiation would not change the core mechanisms or conclusions of our research but would substantially increase model complexity. Accordingly, we adopt a streamlined model specification to maintain analytical clarity.

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sector j is expressed as $\frac{labs_{hj}}{labs_j}$, and the time input share of labor with skill i is $\frac{N_{hj}}{N_j}$. As shown in Table 1, high-tech manufacturing and services exhibit higher proportions of high-skilled labor than BM, confirming their classification as high-skilled, labor-intensive sectors. This provides strong empirical support for the model specifications developed later in the study.

TABLE 1. High-skilled labor density across industries

Sector	Share of wages earned by high-skilled labor $\left(\frac{labs_{hj}}{labs_j}\right)$	Share of labor hours contributed by high-skilled labor $\left(\frac{N_{hj}}{N_j}\right)$
BM	0.29	0.18
HM	0.45	0.31
Services	0.45	0.31

Notes: The share of wages earned by high-skilled labor $\frac{labs_{hj}}{labs_j}$ and the share of labor hours contributed by high-skilled labor $\frac{N_{hj}}{N_j}$ are calculated using WIOD data. Figures in Table 1 represent the arithmetic mean for each sector.

Source: WIOD (https://www.rug.nl/ggdc/valuechain/wiod/?lang=en).

2.2 Industrial Structural Transformation Pathways and Economic Growth

From 1950 to 1980, East Asian and Latin American economies experienced rapid growth during their middle-income phases. Structurally, both regions shifted from primary and secondary industries toward tertiary-dominated economies, ultimately becoming service-led. However, WIOD data from 1995-2009 reveal a subtle but critical difference: East Asian economies recorded an average manufacturing value-added share of 32.1%, compared to 26.5% for Latin American economies. Using the manufacturing value-added share as a key indicator of industrialization, this study compares the industrialization pathways of East Asian economies (Japan, South Korea, Singapore, and China's Taiwan region and Latin American economies (Argentina, Brazil, Chile, Mexico, Colombia, and Peru). As shown in Figure 1, during 1950-1980 East Asian economies steadily raised their manufacturing share of GDP alongside rising per capita income, while Latin American economies saw their shares stagnate, foreshadowing the latter's dual stagnation of industrialization and growth.

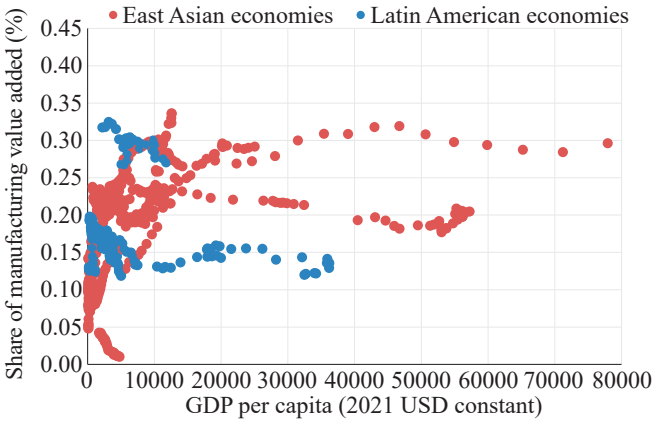


Fig. 1. Changes in manufacturing value-added share and per capita GDP in East Asian and Latin American economies

Source: Population and value-added data are sourced from the GGDC 10-Sector Database (https://www.rug.nl/ggdc/structuralchange/previous-sector-database/10-sector-2014). GDP data (purchasing power parity) are from PWT10.0 (https://www.rug.nl/ggdc/productivity/pwt/?lang=en), in 2021 US dollars.

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By disaggregating manufacturing into basic and mid- to high-end segments, this study reveals distinct industrial structural transformation pathways in East Asian and Latin American economies. Figure 2, based on the United Nations Industrial Development Organization's (UNIDO) Competitive Industrial Performance (CIP) index, illustrates the internal evolution of manufacturing in both regions from 1990 to 2021. Post-1990, Japan, South Korea, China's Taiwan region, and Singapore significantly increased their mid- to HM value-added shares. By 2021, Singapore's share exceeded 80%, with South Korea, Japan, and China's Taiwan region, surpassing 50%, positioning their manufacturing sectors among the world's most competitive. In contrast, Latin American economies experienced a "low-end lock-in," with stagnant or declining shares of mid- to HM. By 2021, except for Mexico, the mid-to-high-end manufacturing share in Latin American economies remained below 40%[4]. Combining these findings with the 1950-1980 industrialization pathways in Figure 1, this study highlights a clear divergence: East Asian economies achieved an internal manufacturing upgrade from basic to mid- to high-end manufacturing, driving a continuous rise in the latter's value-added share. Latin American economies, despite initiating industrialization, fell into "low-end lock-in," with their mid-to high-end manufacturing share stagnating or declining, contributing to broader economic growth stagnation.

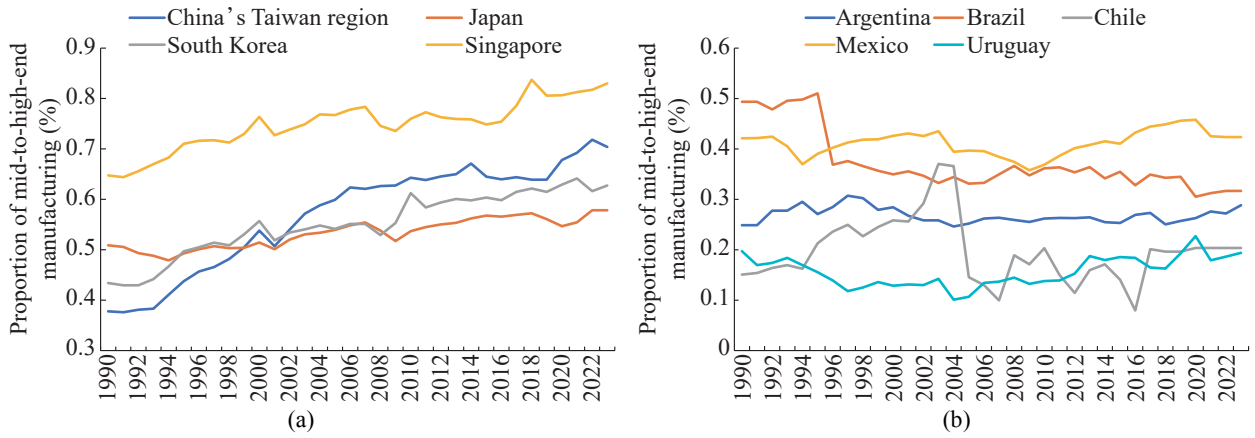


Fig. 2. Share of mid-to-high-end manufacturing value-added in East Asian and Latin American economies, 1990-2021 (%)

Source: Competitive Industrial Performance (CIP) index data (stat.unido.org), UNIDO.

2.3 Human Capital Allocation in Industrial Structural Transformation

To precisely gauge human capital allocation across different industries, this paper employs the concept of relative high-skilled labor density. This metric is defined as the ratio of an industry's high-skilled labor input share to the economy's total high-skilled labor share. It effectively measures the consistency between an industry's factor intensity and the economy's overall factor

[4] Chile's brief growth in mid-to-high-end manufacturing after the 1990s stemmed from the development of processing trade following neoliberal reforms. However, due to its reliance on mineral and agricultural product exports, the problem of a singular economic structure was not fundamentally improved. Compounded by widening income disparity, this led to Chile's manufacturing upgrading not being successful. Currently, industry constitutes approximately 10% of Chile's economy, with mid-to-high-end manufacturing comprising about 20% of its manufacturing output.

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endowment structure, thereby reflecting human capital allocation within that industry over a specific period. The particular calculation formula is as follows:

$$D_i=\frac{\frac{H_i}{H_i+L_i}}{\frac{H}{H+L}} \quad (1)$$

where $i\in\{bm, hm, s\}$ represents the industry, H denotes high-skilled labor, and L denotes low-skilled labor. A higher relative density of high-skilled labor indicates that an industry's high-skilled labor density is greater compared to the economy's overall high-skilled labor density, signifying that the sector attracts or allocates a larger proportion of high-skilled personnel. Conversely, a lower relative density suggests the industry attracts or allocates fewer high-skilled individuals.

To ensure the generalizability of our findings, this paper classifies economies into two categories—"Middle-Income Trap Escapers" (ME)[5] and "Middle-Income Trap Entrants" (MT)[6]—following the World Bank's income group classification standards and drawing on insights from Zhu & Ma (2020). Specifically, a middle-income economy is classified as an ME if it transitioned into the high-income group during the sample period; otherwise, it is categorized as an MT economy. Figure 3 illustrates the relative density of high-skilled labor in BM, HM, and services for both ME and MT economies. The figure reveals several key insights: (1) In BM, the relative density of high-skilled labor is mainly similar for both ME and MT economies, showing no significant disparity. (2) In HM, MT economies consistently exhibit a lower relative density of high-skilled labor compared to ME economies. Specifically, the relative density for MT economies ranges between 0.7 and 0.9, falling below 1 in 2009. Conversely, for ME economies, the relative density in HM ranges from 0.8 to 1.1, exceeding 1 in 2009. This indicates that economies with superior economic growth performance have a higher density of high-skilled labor in their HM sectors, where the proportion of high-skilled labor exceeds the national average. (3) Intriguingly, in the service sector, MT economies show a higher relative density of high-skilled labor than ME economies. The relative density of services in MT economies ranges from 1.4 to 1.8, while in ME economies it ranges from 0.9 to 1.2. This suggests that service sectors in economies trapped in the middle-income trap attract and allocate a disproportionately higher number of high-skilled individuals compared to other industries within those economies.

Industries exhibit distinct factor intensities, with HM and services being significantly more intensive in high-skilled human capital than BM. Economies with divergent development performance also display contrasting patterns of internal manufacturing upgrading and industrial structural transformation. East Asian economies, marked by superior growth, achieved internal manufacturing upgrading through a rising share of HM, following a transformation pathway from BM to HM to services. In contrast, Latin American economies are plagued by stagnant growth and "low-end lock-in" in manufacturing, with stagnant or declining HM shares. Consequently, this leads to a transformation pathway from BM directly to services. Correspondingly, high-skilled

[5] Including the United States, South Korea, Japan, and China's Taiwan region.
[6] Including Bulgaria, Romania, Brazil, India, Indonesia, Mexico, Russia, and Turkey.

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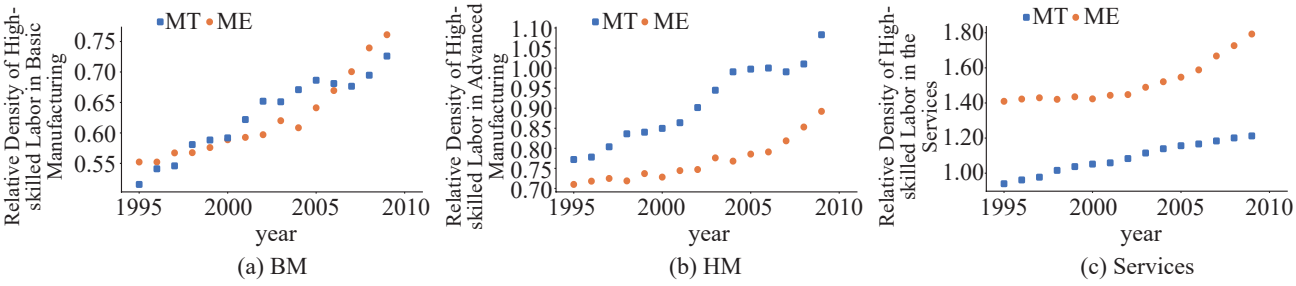


Fig. 3. Relative density of high-skilled labor across industries

Source: WIOD (https://www.rug.nl/ggdc/valuechain/wiod/?lang=en). ME denotes Middle-Income Trap Escapers, and MT denotes Middle-Income Trap Entrants.

labor allocation varies significantly: economies with stronger growth performance show a higher density of high-skilled labor in HM and a lower density in services compared to those with weaker performance. This pattern challenges the expectation that high-income economies, with larger service sectors and greater high-skilled labor pools, would have a higher proportion of high-skilled labor in services. This discrepancy also underscores the phenomenon this study seeks to illuminate and the questions it aims to answer: Why do economies that escape the middle-income trap exhibit a higher density of high-skilled labor in HM? And, given that both HM and service sectors are high-skilled labor-intensive, why do economies with robust HM and higher high-skilled labor density in this sector achieve superior growth?

Based on these industrial characteristics and transformation processes, we propose a central hypothesis: the divergence in growth performance between these economies hinges on the development of HM and the associated allocation of human capital, driven by industry endowment structure, technological characteristics, and industrial positioning. First, HM generates powerful effects, including scale economies, forward and backward linkages, investment and consumption pull, and employment multipliers (Ju et al., 2015; Rodrik, 2013, 2016; Szirmai & Verspagen, 2015; Su & Yao, 2017; Cruz & Nayyar, 2017). For latecomer economies, it is the most effective sector for technological catch-up and efficiency gains, serving as a key engine of growth. Second, from an input-output perspective, HM requires "servicification" inputs, driving demand for services and creating new human capital needs, which amplifies its economic pull (Zhang, 2015; Lin & Wang, 2020). Third, HM fosters "learning-by-doing" effects (Matsuyama, 1992). During the transition to a service economy, path-dependent production structures cultivate science- and professional-supplier-based capabilities essential for knowledge-intensive services (Cassini, 2023), thereby enhancing human capital accumulation and elevating high-skilled labor levels (Diao et al., 2019). Finally, given HM's demand for high-skilled labor, its allocation shapes industrial transformation pathways and economic growth. When the development threshold for HM is relatively low compared to the existing stock of high-skilled labor, this labor flows into HM, thereby propelling the industrial upgrading pathway from BM to HM and generating more robust and stable growth. Conversely, an excessively high development threshold results in high-skilled labor being diverted to services. This leads to the stagnation or contraction in HM, locks the economy into a BM-to-services transformation pathway, and ultimately constrains long-term growth potential.

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3. Theoretical Model and Mechanisms

Building on the heterogeneity of factor endowments and input-output relationships across industries, this study develops a dynamic general equilibrium model featuring three sectors: BM, HM, and services. Following the frameworks of Buera & Kaboski (2012b) and Lin & Wang (2020), the model departs from Lin & Wang (2020) by neither disaggregating the service sector nor incorporating monopolistic competition in producer services. Instead, the HM sector is characterized as a natural monopoly due to economies of scale and fixed costs. At the same time, all other markets — including both product and factor markets — are assumed to be perfectly competitive.

3.1 Model Setup

3.1.1 Economic environment

Each period, a continuum of N homogeneous households is born, living for two periods with no population growth, resulting in N young and N old households coexisting. Households consume manufactured goods (C_M) and service goods (C_S). The economy has two production factors: high-skilled and low-skilled labor.

3.1.2 Household preferences and endowments

Households' utility function follows a Stone-Geary form, where young households consume manufactured goods (e.g., automobiles, cosmetics) and old households consume services (e.g., healthcare, entertainment), as specified by:

$$U_t=log(C^t_{M,t})+\beta log(C^{t+1}_{S,t}+\theta_S),\ t=0,\ 1,\ 2\ldots \tag{2}$$

where $C^t_{M,t}$ denotes the manufactured goods consumed in period t by a household born in period t, and $C^{t+1}_{S,t}$ denotes the service goods consumed by the same household in period $t+1$. β is the utility discount factor. The lower time index t denotes the household's birth period, while the upper time index t denotes the time when consumption occurs. $\theta_S>0$ reflects the degree of subsistence in service consumption—indicating that service demand may be zero when income is low. Each household is endowed with one unit of continuous labor. In youth, households can allocate a fraction $\emptyset$ of their time to education. This investment in education turns them into high-skilled labor (H), while the remaining fraction ($1-\emptyset$) becomes low-skilled labor (L). In old age, high-skilled labor remains active, but low-skilled labor retires.

3.1.3 Production technology

The three sectors—BM, HM, and services—exhibit distinct factor intensities, consistent with empirical findings. HM and services are high-skilled BM, labor-intensive, while BM is low-skilled, labor-intensive. HM has the highest labor productivity for high-skilled labor, followed by BM and services.

The production function for BM is:

$$Y^t_{BM}=A^t_{BM}(L^t_{BM,t}+H^t_{BM,t-1}) \tag{3}$$

where A^t_{BM} denotes the labor productivity of the BM sector in period t, and $L^t_{BM,t}$ and $H^t_{BM,t-1}$ represent, respectively, the quantities of low-skilled labor born in period t and high-skilled labor

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born in period $t-1$ employed in BM in period t. Assuming that the relevant parameters ensure that wages for high-skilled labor are strictly higher than those for low-skilled labor, and that both types of labor have identical marginal products in this sector, then in market equilibrium, the BM sector employs only low-skilled labor.

The service sector's production function is:

$$Y_S^{t+1}=A_S^{t+1}H_{S,t}^{t+1} \tag{4}$$

where A_S^{t+1} denotes labor productivity in the service sector in period $t+1$, and $H_{S,t}^{t+1}$ is the quantity of high-skilled labor employed in the service sector in the same period.

HM, following the scale-effect production function in Buera & Kaboski (2012b) and the input-output structure in Lin & Wang (2020), is modeled with a concave production function that uses services as an intermediate input. The production function is specified as follows:

$$Y_{HM}^{t+1}=\begin{cases} A_{HM}^{t+1}\left(H_{HM,t}^{t+1}\right)^{\alpha} & I^{t+1}\geq Q_t \\ 0 & I^{t+1}<Q_t \end{cases} \tag{5}$$

where A_{HM}^{t+1} denotes labor productivity in HM in period $t+1$, and $H_{HM,t}^{t+1}$ denotes the quantity of high-skilled labor born and employed in period $t+1$. I^{t+1} represents the fixed entry cost. Due to the presence of fixed costs Q_t, average costs in HM are decreasing, implying increasing returns to scale. Assuming that TFP A_{HM}^{t} and fixed costs Q_t are sufficiently large, at most one firm can operate in equilibrium, making the sector a natural monopoly.

Although BM and HM differ in production technology and input structure, consumers care only about product functionality, not how goods are produced. As a result, consumption goods from both sectors are perfect substitutes for consumers, that is:

$$Y_M^t=Y_{BM}^t+Y_{HM}^t \tag{6}$$

In a market with perfect substitutes, the monopolistic firm in HM faces a limit pricing problem, where marginal production cost serves as the benchmark for product pricing. Ownership of the HM sector is evenly distributed among all old households, with profits correspondingly distributed equally into these households' incomes. Since households do not consume manufactured products in the second period of their life cycle, the consumers of high-end manufactured products produced in any given period are the newly born households in that period. If both types of manufacturing coexist, the consumption of a household born in period t during period t comprises high-end manufactured products produced by high-skilled labor born in period $t-1$ and basic manufactured products produced by low-skilled labor born in period t. Consumption in period $t+1$ consists of service products produced by high-skilled labor born in period t.

When simulating the theoretical model, parameter estimates are established as follows: This study adheres to a standard neoclassical discrete model, setting the discount factor β at 0.95. Drawing from Kongsamut et al. (2001), the Stone-Geary utility function parameter θ_S is set to 0.15 and adjusted based on industrial shares. TFP across all sectors is standardized at 1. Using the 2018 input-output table, the service sector's input share in HM is determined, setting the fixed service input Q_t in the HM production function at 0.15. Based on the income share outlined in Fact 1, the parameter for high-skilled labor input is set to 0.45.

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3.2 Market Equilibrium

In an economy with all three sectors, market equilibrium depends on the accumulation and allocation of high-skilled human capital. Market-clearing conditions yield the law of motion for the share of high-skilled labor $h_{HM,t}^{t+1}$ in HM relative to the total labor force born in period t:

$$\alpha\frac{A_{HM}^{t}}{A_{BM}^{t}}(h_{HM,t-1}^{t})^{\alpha}-h_{HM,t}^{t+1}=\alpha\frac{q^{t+1}}{A_{S}^{t+1}} \tag{7}$$

where q represents the per capita fixed cost in HM. The evolution of the share of low-skilled labor in BM $l_{M,t}^{t}$, as a proportion of the total labor force born in period t, follows the law of motion given by equation (7) amid $h_{HM,t}^{t+1}$.

$$A_{BM}^{t}l_{BM,t}^{t}+A_{HM}^{t}(h_{HM,t-1}^{t})^{\alpha}=\frac{1}{1+\beta}\left[A_{BM}^{t}+A_{BM}^{t}(1-\alpha)(h_{HM,t}^{t+1})^{\alpha}+\frac{A_{BM}^{t}}{A_{S}^{t+1}}\theta_{S}\right] \tag{8}$$

Assuming that labor productivity in all sectors is exogenously constant, the simulated equilibrium path for high-skilled labor in HM is shown in Figure 4. Due to the concave nature of the production function in HM, there are two steady-state equilibria for the share of high-skilled labor: a smaller, unstable steady-state h_{M}^{1} and a larger, stable h_{M}^{2}. Whether the initial share of high-skilled labor entering HM reaches a critical threshold—i.e., the development threshold—determines the economy's industrial transformation path. By comparing the initial share of high-skilled labor in HM to the thresholds h_{M}^{1} and h_{M}^{2}, three distinct scenarios emerge.

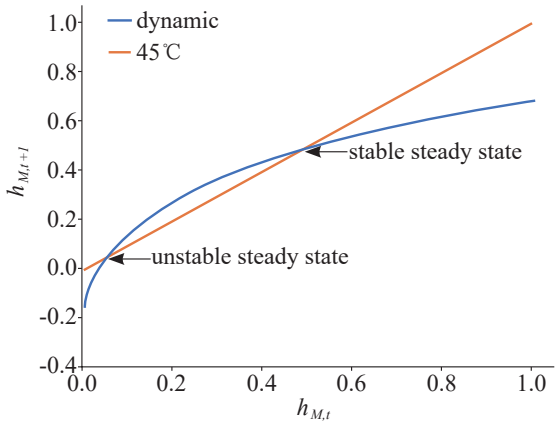


Fig. 4. Pathways of high-skilled labor dynamics in HM

Scenario 1: "gradual servitization" pathway. When the share of high-skilled labor in HM satisfies $h_{M}>h_{M}^{2}$, the sector exhibits a high proportion of high-skilled labor, reflecting robust growth and higher output levels. As income levels rise—given the higher income elasticity of demand for services—demand for services grows, prompting high-skilled labor to flow into the service sector to meet market needs. This results in a trend of manufacturing upgrading alongside a shift toward a service-dominated industrial structure. This pattern aligns with observations in the United States from 1950 to 2000, where the service sector's value-added share increased by 20%, driven by human capital-intensive services (Buera & Kaboski, 2012a), while the value-added share of manufacturing, particularly HM, remained stable or grew (Rodrik, 2016). However, this scenario is less relevant to the industrial upgrading and structural transformation stages of middle-income economies, the primary focus of this study, and is thus not explored in detail.

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Scenario 2: "deep industrialization" pathway. This pathway involves internal upgrading within manufacturing, from basic to HM. When the share of high-skilled labor in HM satisfies $h_M^1 < h_M < h_M^2$, it surpasses the development threshold. As the economy's high-skilled labor stock grows, HM leverages scale economies, leading to a steady increase in its high-skilled labor share until reaching a high steady-state value h_M^2. During this process, the manufacturing sector undergoes internal upgrading: the share of BM declines, while that of HM rises.

Assuming no exogenous technological progress, calculations show that at $t=0$, the high-skilled labor share $\emptyset_0$ satisfies:

$$\emptyset_0 > \emptyset^* \equiv \left(1-\frac{1}{1+\beta}\frac{1-\alpha}{\alpha}\right)h_M^1 + \frac{q^1}{A_S^1} + \frac{\beta}{1+\beta} \tag{9}$$

Under free market conditions, the share of high-skilled labor allocated to HM, relative to the total labor force of a given generation, exceeds h_M^1. The threshold for HM, $\emptyset^*$, is shaped by key factors: the TFP of the three sectors (A_{BM}, A_{HM}, and A_S), the fixed cost of HM development (Q), and the labor productivity parameter α of HM. A higher TFP in HM relative to BM, lower fixed costs, and a larger labor productivity parameter reduce the required high-skilled labor, thereby lowering the development threshold. Similarly, higher TFP in the service sector reduces its demand for high-skilled labor, enabling HM to attract more high-skilled labor and further lowering the threshold.

Figure 5 depicts the dynamic changes in labor shares across the three sectors over time under a manufacturing upgrading pathway. Initially, the share of high-skilled labor in HM rises significantly, while that in BM declines, reflecting a clear internal industrial upgrade.

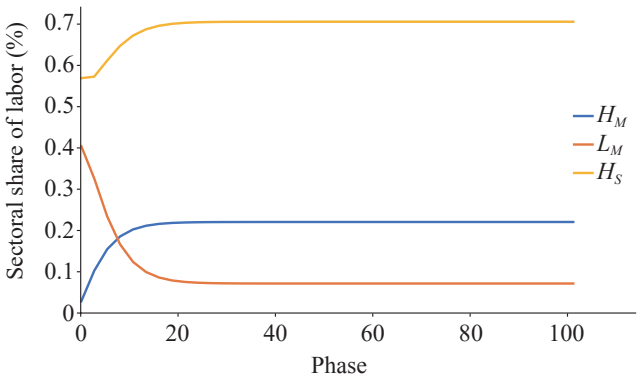


Fig. 5. Evolution of labor shares across sectors under deep industrialization

Given that labor quantities in each sector must be non-negative, the equilibrium existence requires the following parameter conditions:

$$\frac{1}{1+\beta}\left[A_{BM}^t + (1-\alpha)(h_M^2)^{\alpha} + \frac{A_{BM}^t}{A_S^{t+1}}\theta_S\right] < 1 \tag{10}$$

$$\frac{1}{1+\beta}\left[A_{BM}^t + (1-\alpha)(h_M^2)^{\alpha} + \frac{A_{BM}^t}{A_S^{t+1}}\theta_S\right] - a_{HM}^t h_M^2 \geq 0 \tag{11}$$

To ensure positive consumption of market services, the parameter condition is:

$$\frac{\beta}{1+\beta}\left(A_S^{t+1} + \frac{1-\alpha}{\alpha}h_M^2 A_S^{t+1} + \theta_S\right) - \theta_S > 0 \tag{12}$$

Scenario 3: "premature servitization" due to underdeveloped HM. When the share of high-

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skilled labor in HM satisfies $h_M < h_M^1$, the share of high-skilled labor endowment $\emptyset_0$ satisfies:

$$\emptyset_0 < \emptyset^* \equiv (1-\frac{1}{1+\beta}\frac{1-\alpha}{\alpha})h_M^1 + \frac{q^1}{A_S^1} + \frac{\beta}{1+\beta} \tag{13}$$

From the laws of motion for high-skilled labor in HM and labor in BM, the small production scale and low output of HM drive labor toward BM to meet household demand for manufactured goods. As the high-skilled labor stock declines in the next period, high-skilled labor shifts from HM to the service sector, causing HM to contract and eventually exit the economy. Consequently, the economy bypasses upgrading from basic to HM, instead transitioning directly from BM to services, with high-skilled labor concentrating in the service sector. This study terms the pathway "premature servitization."

Based on market-clearing conditions for manufactured and service products and labor markets, the equilibrium share of high-skilled labor $\emptyset^t$ in the economy is:

$$\emptyset^* = \frac{1}{1+\beta}(\beta - \frac{\theta_S}{A_S^1}) \tag{14}$$

If "premature servitization" occurs during structural transformation, can the economy revive HM, or will it remain "low-end locked"? As can be learned from the ratio of high-skilled labor $\emptyset_0$ required to reach the "deep industrialization" equilibrium, if the ultimate high-skilled labor share $\emptyset^{**} > \emptyset^*$, HM may re-emerge over time, enabling a structural shift from basic to HM. Conversely, if $\emptyset^{**} < \emptyset^*$, the absence of HM leads to "low-end lock-in," hindering internal manufacturing upgrading. This implies:

$$\emptyset^* - \emptyset^{**} = (1-\frac{1}{1+\beta}\frac{1-\alpha}{\alpha})h_M^1 + \frac{q^1+\theta_S}{A_S^1} \tag{15}$$

As noted, the discount factor β is set at 0.95, and the income share of human capital α in HM production, it is set to 0.45. From this, we derive:

$$(1-\frac{1}{1+\beta}\frac{1-\alpha}{\alpha})h_M^1 > 0 \tag{16}$$

Thus, the gap between the HM development threshold and the high-skilled labor share in the "premature servitization" scenario is positive. In an entirely market-driven economy, once trapped in this equilibrium, it cannot revive HM under free-market conditions, resulting in "low-end lock-in" and stagnant growth.

3.3 Comparison of Development Performance

The baseline theoretical model explores the diverse development pathways an economy may follow under varying preconditions. This section examines the impacts of two distinct pathways—"deep industrialization" and "premature servitization"—on social welfare and economic growth.

To better analyze economic growth, we incorporate exogenous Hicks-neutral technological progress into the model, reflected as an increase in TFP. To isolate the effects of non-balanced growth on sectoral scale and structural transformation, we assume a constant TFP growth rate across all sectors. Figure 6 illustrates the variations in human capital accumulation under different industrial structural transformation pathways.

Under the manufacturing upgrading pathway, the share of high-skilled labor is significantly higher than under the "premature servitization" pathway. This stems from HM's increasing demand for high-skilled labor and intermediate inputs, which drive service sector growth through vertical

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industrial linkages. The high human capital intensity of HM further promotes the accumulation of high-skilled labor and employment. Additionally, rising national income fuels greater demand for services and manufactured goods, amplifying the labor market's demand for high-skilled labor and accelerating endogenous accumulation. In contrast, since consumer preferences remain constant, technological progress alone does not drive significant growth in high-skilled labor levels in the "premature servitization" pathway. Under this pathway, services and BM develop slowly, with economic growth driven solely by technological progress, lacking enhancements in factor allocation or industrial structure. Consequently, the "deep industrialization" pathway—propelled by scale economies, vertical linkages, human capital demand, and technological progress—achieves a markedly faster rate of human capital accumulation than the "premature servitization" pathway, which relies solely on technological progress.

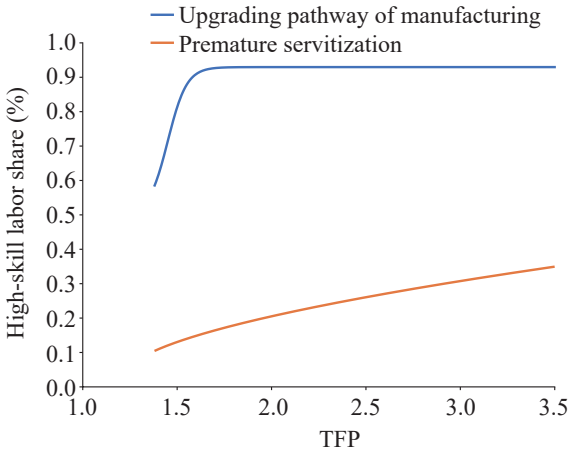


Fig. 6. High-skilled labor accumulation under two industrial structural transformation pathways

This section further compares the dynamic evolution of social welfare under the two distinct pathways. Figure 7 illustrates the utility growth trends for a representative household across these pathways. The manufacturing upgrading pathway consistently generates higher social welfare than the "premature servitization" pathway as TFP increases, with welfare rising more rapidly in the early stages. Several factors drive this: in the absence of exogenous technological progress and with a given share of high-skilled labor, HM' s scale economies boost economic output, enhance social welfare, and drive growth. Over the long term, HM's high human capital intensity sustains human capital accumulation and supports service-sector employment through vertical spillover effects. In contrast, under the "premature servitization" pathway, Hicks-neutral TFP growth, despite exogenous technological progress, fails to spur further accumulation of high-skilled labor or its flow into HM. This hinders the optimization of the industrial structure, leaving the economy without sustainable growth momentum.

Comparing human capital accumulation and economic growth under these pathways elucidates why, in the latter half of the twentieth century, East Asian economies—marked by intensive industrial transformation, continuous manufacturing upgrading, and labor shifts to higher-productivity sectors—achieved the fastest growth. Meanwhile, Latin American economies faced

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"premature de-industrialization," with high-skilled labor flowing to lower-productivity industries, resulting in stagnant growth and entrapment in the "middle-income trap."

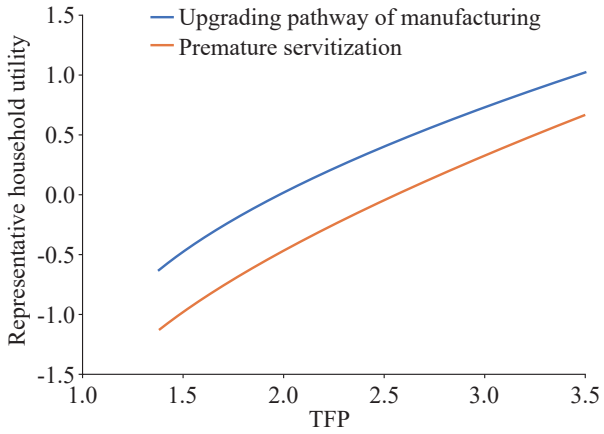


Fig. 7. Social welfare dynamics under two industrial structural transformation pathways

4. Policy Simulation: Industrial and Education Policies

For middle-income economies in the catch-up phase, high fixed costs and entry barriers in HM (Cai et al., 2010) hinder the natural progression toward advanced manufacturing, often resulting in "low-end lock-in" and labor-market mismatches. Government intervention is thus critical to guide development (Ye & Liu, 2020). This study simulates the economic effects of industrial and education policies, focusing on fiscal incentives or tax policies to promote industrial upgrading and HM development, and education policies to enhance human capital supply and optimize its allocation.

4.1 Industrial Policy

This study first explores the feasibility and impact of national policy preferences for HM when the initial stock of high-skilled labor falls below a critical threshold h_M^1. These preferences are funded through national taxation on individual income. Taxing fully competitive sectors, such as BM or services, would distort market interest rates, leading to intertemporal mismatches in factor allocation and reduced economic efficiency. To avoid these issues, this paper focuses solely on taxing individual income.

4.1.1 Impact of industrial policy: factor flows and industrial scale

The boundary between the manufacturing upgrading and premature servitization pathways is defined by:

$$\phi^*=\left(1-\frac{1}{1+\beta}\frac{1-\alpha}{\alpha}\right)h_M^1+\frac{q^1}{A_S^1}+\frac{\beta}{1+\beta} \tag{17}$$

A lower development threshold for HM enables middle-income economies to pursue industrial upgrading. An increase in the steady-state value h_M^2 results in a higher share of high-skilled labor in HM at equilibrium.

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In the absence of exogenous technological progress, lowering the threshold for HM development allows middle-income economies to follow an upgrading pathway. The share of high-skilled labor in HM rises over time, increasing significantly in the long-term, while the scale of BM contracts and low-skilled labor declines. The service sector's high-skilled labor share continues to grow but remains essentially unchanged in the long-term steady-state.

This aligns with economic intuition: first, taxing individual income reduces household welfare and demand for consumer goods, particularly for services, which redirects high-skilled labor toward manufacturing; second, subsidizing HM reduces the sector's effective demand for service intermediates and lowers its development threshold, thereby enabling middle-income economies to enter and upgrade. This stimulates the accumulation of high-skilled labor, leading to long-term expansion of both HM and services, while BM diminishes and eventually exits the economy.

4.1.2 Industrial policy goals: social welfare and economic growth

In the short term, implementing an industrial policy—specifically, preferences for HM—lowers consumer welfare relative to the transitional equilibrium in which HM exits the economy. However, welfare remains higher than in the "premature servitization" equilibrium, where the economy shifts too early toward services.

The government's objective in providing these policy preferences is to maximize household utility over time. It does so by promoting the accumulation of high-skilled labor and encouraging its reallocation into HM.

If the government announces tax credits and allowances at the beginning of each period, the lump-sum tax τ^t collected in period t satisfies:

$$\emptyset^{t-1}=(1-\frac{1}{1+\beta}\frac{1-\alpha}{\alpha})h_M^{1t}+\frac{q^t}{A_S^tP_S^t}-\frac{\tau^tN}{A_S^t}+\frac{\beta}{1+\beta}\text{, } t=1,2,3\ldots \quad (18)$$
$$\tau^t>0$$

where $\emptyset^{t-1}$ represents the high-skilled labor share chosen by households in period $t-1$, and h_M^{1t} is the threshold value in the law of motion for the high-skilled labor share in HM under the subsidy amount in period t, corresponding to the smaller positive solution of the following equation with respect to x:

$$\alpha\frac{a_{HM}^t}{A_{BM}^t}(x)^{\alpha}-x=\alpha\left(\frac{q^{t+1}}{A_S^{t+1}}-\frac{\tau^tN}{A_S^{t+1}P_S^{t+1}}\right) \quad (19)$$

If the government commits to fixed tax and subsidy levels from the first period and does not revise them until the policy is withdrawn, the lump-sum tax τ collected in each period satisfies:

$$\emptyset^0=(1-\frac{1}{1+\beta}\frac{1-\alpha}{\alpha})h_M^{11}+\frac{q^1}{A_S^1}-\frac{\tau N}{A_S^1P_S^1}+\frac{\beta}{1+\beta}\text{, } t=1,2,3\ldots \quad (20)$$

where $\emptyset^0$ is the exogenous share of high-skilled labor in the initial period, and h_M^{11} is the threshold value in the law of motion for the share of high-skilled labor in HM in period 1 under policy preferences, corresponding to the smaller positive solution of the following equation with respect to x:

$$\alpha\frac{a_{HM}^1}{A_{BM}^1}(x)^{\alpha}-x=\alpha\left(\frac{q^2}{A_S^2}-\frac{\tau^tN}{A_S^2P_S^2}\right) \quad (21)$$

As high-skilled labor accumulates, the share allocated to HM rises, reducing the subsidies

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required. Concurrently, the increasing proportion of high-skilled labor lowers wages and service product prices, yielding:

$$\tau > \tau^t, t=1, 2, 3\ldots \tag{22}$$

Thus, the initial subsidy policy effectively supports the sustained development of HM.

Based on the analysis, this paper proposes the following:

Proposition 1 (Manufacturing Subsidy Policy): When HM receives production allowances funded by personal income tax each period, the following effects emerge:

(1) Industrial Transformation and Upgrading Effect: In the early development stages, the threshold $\emptyset^*$ determining whether an economy follows the "premature servitization" or manufacturing upgrading pathway decreases, given by:

$$\emptyset^{***} \equiv (1-\frac{1}{1+\beta}\frac{1-\alpha}{\alpha})h_M^1+\frac{q^1}{A_S^1}-\frac{\tau N}{A_S^1 P_S^1}+\frac{\beta}{1+\beta} \tag{23}$$

This increases the likelihood of the manufacturing upgrading pathway and reduces the probability of "premature servitization."

(2) Social Welfare Effect: In the short term, taxing personal income reduces aggregate demand, lowering consumer welfare compared to the transitional equilibrium where HM exits under free market conditions. Over the long term, as high-skilled labor flows into HM, employment rises, internal manufacturing upgrades, and the high-skilled labor stock grows. This enables HM to develop independently, boosting economic efficiency and achieving higher social welfare than the "premature servitization" equilibrium.

(3) Optimal Industrial Policy: Dynamic preferential policy adjustments outperform fixed allowances. Governments should adopt flexible industrial policies, tailoring support to the development stage of HM and leveraging their role as a facilitating state until the sector scales sufficiently to overcome entry barriers.

This analysis shows that government support for HM, despite short term welfare costs, addresses market failures, lowers the upgrading threshold, and prevents "premature servitization." Historical examples from developed economies (e.g., the UK and the US) and successful catch-up economies (e.g., Japan and South Korea) highlight the extensive use of industrial policies (Chang, 2002; Rodrik, 2005). However, once human capital accumulation exceeds the HM threshold and the sector becomes self-sustaining, governments should shift policies to align with market dynamics and comparative advantages.

4.2 Education Policy

To address the challenge of high development thresholds for HM, where the initial accumulation of high-skilled labor is insufficient to meet sectoral demands, governments may implement education policies as a potential solution.

If the government intervenes directly in education investment to ensure that the share of high-skilled labor in each period $\emptyset_t'$ meets the equilibrium threshold $\emptyset^* > \emptyset_t' > \emptyset_t$, then in period $t+1$, some high-skilled labor flows into BM. This is derived from the equilibrium conditions:

$$(1-\emptyset_t')A_{BM}^t < \frac{1}{1+\beta}\frac{M_t^{t+1}+P_S^{t+1}\theta_S}{R^{t+1}} \tag{24}$$

$$\emptyset_t' A_S^{t+1} > \frac{\beta}{1+\beta}\frac{M_t^{t+1}+P_S^{t+1}\theta_S}{P_S^{t+1}}-\theta_S \tag{25}$$

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Since the high-skilled labor share is exogenous in the equilibrium model, $Y_M^t > (1-\emptyset_t')A_{BM}^t$, indicating that high-skilled labor in the economy flows into BM.

Unlike industrial policy, education policy impacts the economy indirectly. Relying solely on education policy to increase high-skilled labor during structural transformation may not effectively optimize the economic structure and could lead to short term mismatches in human capital. For instance, Latin American reforms under the Washington Consensus prioritized education investment and income distribution but faced a mismatch with unaligned industrial structures and economic environments. This resulted in an oversupply of human capital mismatched with the development stage, leading to "brain drain" and a shift of talent toward virtual sectors detached from the real economy, undermining sustainable economic growth. Thus, for middle-income economies, both the allocation and accumulation of human capital across industries are critical. Industrial and educational policies should work in tandem to guide industrial upgrading, align human capital with industrial structures, and avoid the waste of human resources.

5. Conclusions and Policy Implications

A comparative analysis of economies with varying growth trajectories reveals a clear pattern distinguishing those that escape the middle-income trap: first, they achieve internal industrial upgrading within manufacturing, leading to a higher share of HM; second, they allocate a higher relative density of high-skilled labor to this sector. This is because HM, compared to services, possesses unique attributes—scale economies, strong inter-industry linkages, and input-output dynamics. Unlike the service sector, HM specifically benefits from these distinct properties. These attributes enable HM to drive broader industrial growth and structural transformation, , create substantial employment for high-skilled labor, and through its inherent demand for human capital and "learning-by-doing" effects, act as a powerful engine for economic growth. Consequently, this drives broader industrial development, facilitating structural transformation and creating significant employment opportunities for high-skilled labor. Its high human capital intensity and "learning-by-doing" effects also position it as a key driver of economic growth. To model these dynamics, this study constructs a multi-sector general equilibrium model with heterogeneous labor, illustrating the interplay between industrial structure, human capital allocation, and economic growth. By analyzing the characteristics of BM, HM, and services, we show how varying HM development thresholds yield distinct high-skilled labor flows, leading to two distinct transformation pathways—"deep industrialization" and "premature servitization"—with divergent growth outcomes. Additionally, this paper evaluates the roles of industrial and education policies in shaping structural transformation and human capital allocation, emphasizing the importance of facilitating state intervention.

In China's current economic context, two critical trends stand out: First, declining manufacturing share. Notably, China's labor-intensive manufacturing advantage is waning, with manufacturing value-added dropping from 32.5% of GDP in 2006 to 27.7% in 2022. The sector also grapples with the challenge of being "large in scale but lacking in strength" amid its transition from low- to mid-end to high-end industries. Second, labor market imbalances: High-skilled labor is increasingly shifting toward non-manufacturing sectors, particularly the virtual economy. The *2020 University*

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Graduate Employment Report by Renmin University and ZPIN highlights that graduates with bachelor's degrees or higher prefer jobs in culture, media, internet/IT, business services, and finance over manufacturing. This "premature de-industrialization" and "excessive shift of capital and resources from the real to the virtual economy," coupled with rising youth unemployment, underscore the need to align industrial and human capital structures. To address the challenges posed by China's large yet underperforming manufacturing sector and structural labor-market mismatches, this study argues that solutions must tackle both industrial structure and human capital allocation. Thus, we propose a policy framework that prioritizes HM development to lower entry barriers while simultaneously guiding high-skilled labor into this sector. Key policy implications include:

(1) Promote HM and new industrialization: In September 2023, the National Meeting on Promoting New Industrialization identified new industrialization as vital for China's modernization and national strength. To overcome challenges such as weak manufacturing foundations and technological bottlenecks, policies should focus on strengthening HM, fostering strategic emerging industries, and integrating the digital and real economies. Developing HM in latecomer economies requires significant capital, advanced technology, robust supply chains, and innovative ecosystems. Given U.S. technological restrictions, comprehensive support for HM is critical to elevate China's position in global value chains.

(2) Align human capital with industrial structure. To drive economic growth, China must better match its talent pool to its industrial needs, ensuring tight integration between industrial and talent chains. Additionally, relying solely on education policies is less effective than combining them with industrial policies. While building a robust stock of high-skilled labor is essential, two strategies stand out. First, prioritize developing specialized skills—such as industrial mechanics, big data, and deep learning—to meet the demands of cutting-edge sectors like HM, the industrial internet, and artificial intelligence (Zhu, 2023). Second, guide high-skilled workers toward these industries by enhancing the income and social prestige of roles in basic research, skilled trades, and craftsmanship. This prevents talent from drifting away from manufacturing sectors, keeping high-skilled labor anchored in the real economy.

(3) Adapt industrial policies dynamically. Industrial policies must evolve in tandem with the manufacturing sector's development stage. Dynamic, flexible policies outperform rigid, static ones. Research shows that timely withdrawal of support policies can curb over-investment and boost corporate R&D efficiency, ultimately increasing TFP (Dai & Zheng, 2024). Thus, governments should calibrate support for HM, offering incentives in the early stages to overcome entry barriers. However, once the sector scales up and becomes self-sustaining—capable of attracting high-skilled labor independently, as modeled here—policymakers should phase out subsidies, allowing market forces to guide further growth.

References:

Bai X. J., Yu Q. R. How Does Labor Costs Affect China's Industrialization[J]. Finance & Trade Economics, 2019(8): 132-145.

中国知网 https://www.cnki.net

Baumol W. J. Entrepreneurship: Productive, Unproductive, and Destructive[J]. Journal of Business Venturing, 1996(1): 3-22.

Buera F. J., Kaboski J. P. Scale and the Origins of Structural Change[J]. Journal of Economic Theory, 2012(2): 684-712.

Buera F. J., Kaboski J. P. The Rise of the Service Economy[J]. American Economic Review, 2012(6): 2540-2569.

Buera F. J., Kaboski J. P., Rogerson R., Vizcaino J. I. Skill-Biased Structural Change[J]. Review of Economic Studies, 2022(2): 592-625.

Cai F. Productivity, Growth Momentum, and Manufacturing——How China Can Regain Its Resources Reallocative Efficiency[J]. China Industrial Economics, 2021(5): 5-18.

Cai Y. F., Wei H. K., Wei L. X. A Sensitivity Analysis of High-End Manufacturing Development to Composite Cost in China[J]. China Industrial Economics, 2010(1): 34-44.

Cassini L. J. Path-Dependent Productive Specialization: Should Prematurely Deindustrialized Countries Shift to a KIBS Export-Led Strategy?[J]. Structural Change and Economic Dynamics, 2023: 199-209.

Chang H. J. Breaking the Mould: An Institutionalist Political Economy Alternative to the Neo-Liberal Theory of the Market and the State[J]. Cambridge Journal of Economics, 2002(5): 539-559.

Ciccone A., Papaioannou E. Human Capital, the Structure of Production, and Growth[J]. Review of Economics and Statistics, 2009(1): 66-82.

Cruz M., Nayyar G. Manufacturing and Development: What Has Changed[M]. Washington D. C.: World Bank, 2017.

Dai H. W., Zheng L. C. The Impact of Industrial Policy Exit on Enterprise Investment and Production Efficiency[J]. Journal of Quantitative & Technological Economics, 2024(3): 68-88.

Diao X., McMillan M., Rodrik D. The Recent Growth Boom in Developing Economies: A Structural-Change Perspective[A]. In Nissanke M. and Ocampo J. A. eds., The Palgrave Handbook of Development Economics[C]. Cham: Palgrave Macmillan, 2019: 281-334.

Ding S., Knight J. Why Has China Grown So Fast? The Role of Physical and Human Capital Formation[J]. Oxford Bulletin of Economics and Statistics, 2011(2): 141-174.

Erosa A., Cabrillana H. On Finance as a Theory of TFP, Cross-Industry Productivity Differences, and Economic Rents[J]. International Economic Review, 2008(2): 437-473.

Guner N., Ventura G., Xu Y. J. Macroeconomic Implications of Size-Dependent Policies[J]. Review of Economic Dynamics, 2008(4): 721-744.

Guo K. S., Peng J. Z. The Manufacturing Sector's Strategic Position and Role in China's New Stage of Development[J]. Social Sciences in China, 2021(5): 128-149+207.

Hao T., Sun R., Tombe T., Zhu X. The Effect of Migration Policy on Growth, Structural Change, and Regional Inequality in China[J]. Journal of Monetary Economics, 2020: 112-134.

Hsieh C. T., Hurst E., Jones C. I., Klenow P. The Allocation of Talent and U.S. Economic Growth[J]. Econometrica, 2019(5): 1439-1474.

Huang Q. H., Yang H. T. Chinese "Domestic-International Differentials" in Manufacturing Value Added and Its Meaning of "De-Industrialization"[J]. China Industrial Economics, 2022(3): 20-37.

Jiang S. Z., Du H. F., Xu M. Z. Dual Transition of Energy and Industrial Structure under the Carbon Peaking and Neutrality Goals[J]. Journal of Quantitative & Technological Economics, 2024(2): 109-130.

Ju J., Lin J. Y., Wang Y. Endowment Structures, Industrial Dynamics, and Economic Growth[J]. Journal of Monetary Economics, 2015: 244-263.

Kim Y. J., Lee J. W. Technological Change, Human Capital Structure, and Multiple Growth Paths[J]. Japanese Economic Review, 2011(3): 305-330.

Kongsamut P., Rebelo S., Xie D. Beyond Balanced Growth[J]. Review of Economic Studies, 2001: 869-882.

Lewis W. Economic Development with Unlimited Supplies of Labour[J]. Manchester School, 1954(2): 139-191.

Li J., Nan Y. Decision-Making Under Misallocation of Human Capital: Giving Priority to Industrial Restructuring of R&D? [J]. Economic Research Journal, 2019(8): 152-166.

Li S. G., Yin H. Government-Enterprise Talent Allocation and Economic Growth: An Empirical Study Based on China's City Data[J]. Economic Research Journal, 2017(4): 78-91.

中国知网 https://www.cnki.net

Lin C., Xu X. Y. Income Distribution, Baumol's Cost Disease, and Manufacturing Share[J]. Journal of Quantitative & Technological Economics, 2023(5): 202-224.

Lin J. Y., Wang Y. Structural Change, Industrial Upgrading, and Middle-Income Trap[J]. Journal of Industry, Competition and Trade, 2020: 359-394.

Lin Y. F. New Structural Economics, Viability and New Theoretical Insights[J]. Wuhan University Journal (Philosophy & Social Science), 2017(6): 5-15.

Matsuyama K. J. Agricultural Productivity, Comparative Advantage, and Economic Growth[J]. Journal of Economic Theory, 1992(2): 317-334.

Murphy K. M., Shleifer A., Vishny R. W. The Allocation of Talent: Implications for Growth[J]. Quarterly Journal of Economics, 1991(2): 503-530.

Nelson R. R., Phelps E. S. Investment in Humans, Technological Diffusion, and Economic Growth[J]. American Economic Review, 1966(1/2): 69-75.

Rodrik D. Growth Strategies[J]. Handbook of Economic Growth, 2005(1): 967-1014.

Rodrik D. Premature Deindustrialization[J]. Journal of Economic Growth, 2016: 1-33.

Rodrik D. Unconditional Convergence in Manufacturing[J]. Quarterly Journal of Economics, 2013(1): 165-204.

Shin S. J., Zhou J. When Is Educational Specialization Heterogeneity Related to Creativity in Research and Development Teams? Transformational Leadership as A Moderator[J]. Journal of Applied Psychology, 2007(6): 1709-1721.

Su D., Yao Y. Manufacturing as the Key Engine of Economic Growth for Middle-Income Economies[J]. Journal of the Asia Pacific Economy, 2017(1): 47-70.

Sun X. H., Zhang J. N., Li J. X. Market-Based Environmental Regulation and the Path of Transformation and Upgrading of Manufacturing Enterprises: Microscopic Evidence From Emissions Trading[J/Ol]. Journal of Quantitative & Technological Economics, 2024(1): 90-109.

Szirmai A., Verspagen B. Manufacturing and Economic Growth in Developing Countries, 1950-2005[J]. Structural Change and Economic Dynamics, 2015: 46-59.

Temple J. Dual Economy Models: A Primer for Growth Economists[J]. Manchester School, 2005(4): 435-478.

Vollrath D. How Important Are Dual Economy Effects for Aggregate Productivity?[J]. Journal of Economic Growth, 2009(2): 325-334.

Wang Y., Tang X. M. Research on Structural Transformation and Industrial Upgrading in New Structural Economics: Quantitative Facts and Theoretical Progress[J]. Economic Review, 2021(1): 3-17.

Wu D., Xu Z. Leading the High-Quality Development of Manufacturing Industry with New Momentum[J]. Journal of Zhongnan University of Economics and Law, 2021(5): 123-134.

Xiao H. W., Sun L. Path Selection of Maintaining the Share of Manufacturing Basically Stable under the Perspective of Economic Security[J]. Economic Review Journal, 2022(1): 52-59.

Ye X. S., Liu J. The Impact of Government Support and Market-Oriented Reforms on Manufacturing Technology Progress[J]. Economic Research Journal, 2020(5): 83-98.

Zhang C. C. The Multiplier of Local Employment: Impact of Manufacturing Employment on Service Employment[J]. The Journal of World Economy, 2015(6): 70-87.

Zheng S. L., Tao R., Yang W. B. The Impact of ChatGPT's New Generation Artificial Intelligence Technology on Industry Impact and Transformation[J]. Review of Industrial Economics, 2024(1): 5-20.

Zhu L. Deep Integration of Artificial Intelligence and Manufacturing: Connotate and Path[J]. Rural Finance Research, 2023(8): 60-69.

Zhu L., Ma J. Q. Research on Income Standard Classification and Measurement: Comments on the Middle-Income Trap and the Development Stage of China[J]. Journal of Macro-Quality Research, 2020(4): 84-102.

Zhu L., Qiu S., Wu Z. W. Development Ideas, Industrial Structural Changes, and Economic Growth: a Case Study of HongKong SAR and Singapore[J]. Contemporary Finance & Economics, 2022(3): 3-15.

Zhu L., Wang Y. Research on the Impact of Labor Costs on Manufacturing Enterprise Upgrading Modes[J]. Wuhan University Journal (Philosophy & Social Science), 2022(2): 118-132.

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