Research on China's Industrial Structure Upgrading and Unemployment

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Abstract. China's rapid economic growth has been accompanied by efforts transition from labor-intensive to technology-driven industries, as exemplified by the "Made in China 2025" (MIC, 2025) initiative. Although this transition aims to enhance economic value, it has also led to significant social challenges, particularly the displacement of low-skilled workers and increasing unemployment due to automation. This study examines the impact of China's industrial upgrading on unemployment, highlighting skill mismatch and the resulting socioeconomic issues. It proposes that slowing the pace of industrial transition and implementing targeted retraining programs could mitigate these adverse effects and ensure a more balanced and sustainable development trajectory.

Keywords: Industrial upgrading, economic growth, unemployment, labor-intensive, technology-driven

1 Introduction

1.1 Motivation

Since the 2010s, China has emerged as the world's second-largest economy in terms of nominal GDP and the largest in terms of purchasing power parity[15]. Facing trends in economic development and manufacturing competition from lower-wage countries such as Vietnam, China initiated "Made in China 2025" (2015), targeting the country's transition from low-end labor-intensive industries to high-value-added technology-intensive industries. However, with the advent of technology, a series of social issues have arisen. Automation and the use of advanced robotics lead to the displacement of labor. Moreover, workers engaged in low-skilled manufacturing jobs find it difficult to transition to these new industries without significant retraining. This skill mismatch has contributed to higher unemployment rates and wealth disparities in recent years[3]. Although MIC 2025 reflects China's determination of technological development, social problems present huge challenges in the process of industrial structure upgrading. Therefore, I am motivated to delve into the issues of industrial structure upgrading and unemployment in this paper.

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Furthermore, I consider China's industrial upgrading matters to the world as a major player in the global economy. China's economic situation affects global trade, investment flows, and overall economic stability. Moreover, in the context of the global economic downturn and the US-China trade war, the shift in China's industrial structure is no longer a macro issue but is closely related to every citizen. The inconsistency between the pace of industrial upgrading and adaptation of the labor market underscores a critical issue: China's labor force struggles to keep pace with the rapid evolution of industries. This problem is crucial to China's economic development because, for China's economy to move steadily upward, we should consider the realities of the population and not merely pursue efficient industrial upgrading. Otherwise, it may lead to negative social consequences as the former Great Leap Forward caused.

1.2 Background

The global landscape of economic development has evolved significantly, where the specialization of the international division of industries continuously deepens, the revolution in information technology, and the perfection of the world trade system have been closely linked to the economic development of all countries. Particularly notable is the dynamic of cooperation and competition between China and Western countries, which has emerged as a driver in propelling industrial structure upgrades within China[18]. The experience of industrial structure upgrading in developed Western nations offers insightful lessons for China, shedding light on potential pathways for economic advancement.

By 2010, China's GDP surpassed that of Japan, becoming the second-largest economy in the world[15]. According to the World Bank classifications, China has entered the middle-income bracket. However, with this status comes the challenge of avoiding the "middle-income trap," a scenario that countries such as Mexico and Brazil have encountered. Drawing inspiration from the economic tracks of Japan and the "Four Asian Tigers," which successfully transitioned from middle- to high-income economies, China recognizes the necessity of industrial structure enhancement[6]. The push for upgrading stems from both the subjective and objective factors. Subjectively, the traditional reliance on a labor-intensive manufacturing model, underpinned by low-cost labor, is no longer sustainable. Developed countries increasingly constrain this model in terms of industrial value creation. Therefore, China is compelled to shift towards industries with higher added value, fostering technological efficiency and innovation to revitalize economic growth[6]. Objectively, challenges such as stricter import technology standards, escalating domestic labor costs, and intensified competition from countries with lower labor costs necessitate departure from the low-cost development approach[18].

Moreover, China's employment situation has become increasingly severe. The official urban unemployment rate has seen a steady increase, rising from 3.1% in 2003 to 5.5% in 2022[13]. However, these figures likely underrepresent the actual unemployment situation, as they do not account for special circumstances such as flexible employment. China's actual unemployment situation far exceeds the official figures. One of the main pressures on employment comes from the displacement of surplus labor

from rural areas to urban centers, particularly in labor-intensive industries. Meanwhile, compared to developed countries, there is a significant discrepancy between China's industrial structure and the labor force structure, with the labor force structure lagging behind changes in the industrial structure. Looking ahead, the tertiary sector is anticipated to be a major avenue for employment absorption. However, in comparison to developed nations, China's service sector remains underdeveloped in terms of both output and employment contributions and policy interventions are needed to solve this problem[16].

1.3 Research Question

Research question: In this research, I will (1) delve into the effects of industrial structure upgrading on the unemployment situation and (2) analyze what solutions should be employed to solve the problems caused by rapid industrial structure upgrading, considering China's demographic realities.

My hypothesis is that as the industrial structure upgrading process unfolds, the overall unemployment rate in labor-intensive industries increases to a positive value while that in technology-intensive industries decreases and remains negative. The unemployed population in labor-intensive industries cannot be covered by the population employed in technology-intensive industries. This problem should be eliminated by slowing the pace of rapid industrial upgrading and using policy measures such as providing re-education services, and enhancing redistribution policies such as imposing property taxes to suppress the wealth gap and advance welfare benefits.

1.4 Literature Review

The existing study of industrial upgrading and its implications for unemployment rates constitute a significant aspect of my research, and they can be categorized into distinct yet correlated themes.

1. Correlation Between Industrial and Employment Structures: Research by Huang (2021) underscores a pronounced correlation between industrial and employment structures[7]. As the industrial structure undergoes optimization, adjustments within the employment structure occur concurrently. However, the pace of optimization in the industrial structure struggles to align with that of the employment structure's adjustment, potentially precipitating structural unemployment issues. Various scholars offer insights into structural unemployment from different vantage points, each attributing it to the nuances of industrial restructuring.
2. Contributing Factors to Structural Unemployment: Du (2024) identifies several factors contributing to structural unemployment, including industrial restructuring, workforce quality, employment outlooks, and asymmetries in labor market information[3]. These elements collectively foster a considerable degree of structural unemployment, thus highlighting the multifaceted nature of this challenge.
3. Mismatch in Labor Market Dynamics: The discourse extends to labor shifts from primary and secondary sectors and their inadequacy in meeting the skill demands of

the burgeoning tertiary sector in China, as detailed by Gu and Tian (2023)[5]. Ma (2021) discussed the disconnect between the structure of higher education majors and the rapid pace of industrial restructuring[10]. Liu (2022) points to a shortfall in skilled and technical workers necessary for supporting industrial structure upgrading[9]. Furthermore, the relocation of labor-intensive industries from coastal regions engenders regional labor shortages, thereby exerting additional pressure on industrial upgrading and migration within these areas, as analyzed by Zhao and Liu (2023)[8]. Employing Marx's theory on the organic composition of capital, Yu and Liu (2011) interpret structural unemployment, specifically highlighting the discord between the skills and knowledge of university graduates and the needs of the industrial structure[19].

These studies collectively highlight the complex relationship between China's industrial structural transformation and unemployment. Nonetheless, there is a gap in adopting a global perspective to devise solutions.

My Research Approach: Addressing this gap, my study aims to blend horizontal analysis (a comparative study across three main industrial structures of Western countries) with vertical analysis (evaluating employment changes in China over the past decade). This dual approach aims to incorporate advanced international experiences in industrial upgrading to facilitate the analysis of the relationship between China's industrial upgrading and unemployment, as well as possible solutions.

2 Methodology and Data Source

2.1 Methodology

2.1.1 Employment Growth Rate Calculation.

The employment growth rate for labor-intensive manufacturing industries is calculated using the following methodology: Initially, compute the net change in employment for each year within the eight designated labor-intensive manufacturing sectors:

- Processing of Food from Agricultural Products
- Manufacture of Foods
- Manufacture of Textile
- Manufacture of Textile Wearing Apparel
- Manufacture of Leather, Fur, Feather and Related Products and Footwear
- Manufacture of Furniture
- Manufacture of Paper and Paper Products
- Construction

Subsequently, this net change is divided by the total number of individuals employed in the respective industry in the preceding year, which yields the annual employment growth rate for each sector. A weighted average of these rates was then calculated to establish a comprehensive annual employment growth rate for the entire labor-intensive manufacturing sector. This methodology is consistently applied to determine the annual employment growth rates for the labor-intensive and high-end service sectors.

To test my hypothesis, the employment growth rate has a strong correlation with the unemployment rate. My research assumes that the labor force size in each industry remains relatively constant. Therefore, a positive employment growth rate denotes an expansion in the industry's employed workforce, which correlates with a decline in the unemployment rate, assuming labor force stability. Conversely, a negative employment growth rate, indicative of a contracting workforce, leads to an increase in the unemployment rate, assuming labor force stability.

2.1.2 Comparative Analysis Methodology.

This study investigates the influence of industrial upgrading on unemployment rates by using a comparative analysis method that integrates both cross-sectional and longitudinal perspectives. Cross-sectionally, my study contrasts the industrial structures, disparities, and tracks of development between China and the United States. Longitudinal comparisons track the changes within different industry sectors over time. This comparative analysis aimed to explore the complexities of the central issues, enhance the scope of the study, and facilitate more nuanced and comprehensive conclusions.

2.2 Data Source

I primarily relied on datasets from the China Labor Statistical Yearbooks published by the National Bureau of Statistics of China (NBS of China) from the year 2011 to 2023[13]. The data resources of this book were mainly obtained from state and department reporting systems, administration records, and sampling surveys.

The main advantages of these datasets include their authority and comprehensive coverage. The data cover a wide range of labor-related statistics, including employment rates, wage trends, and industry-specific labor metrics, etc. This comprehensive coverage enables a detailed analysis of labor market trends over time. Additionally, being systematically collected and published by the government, its official source imposes credibility and makes it a trusted resource for researchers, policymakers, and businesses. However, these datasets may have reporting biases, as they could be selectively reported or inaccurately represented to meet certain administrative goals or portray labor market conditions in a more favorable light, especially in the aspects of informal employment, undocumented workers, and emerging industries, which add difficulties to research.

The datasets used for the analysis are as follows:

1. GROSS DOMESTIC PRODUCT AND COMPOSITION, which includes the respective compositions of three major domestic industries: primary industry, secondary industry, and tertiary industry from the year 2012 to 2022.
2. URBAN REGISTERED UNEMPLOYMENT AND UNEMPLOYMENT RATE AT THE YEAR-END, which includes the national unemployment rate from the year 2012 to 2022.
3. EMPLOYMENT AND TOTAL WAGES IN URBAN NON-PRIVATE UNITS BY SECTOR (2011 - 2023), for which I collect 8 representative sectors in labor-intensive manufacturing industries, including Processing of Food from Agricultural

Products, Manufacture of Foods, Manufacture of Textile, Manufacture of Textile Wearing Apparel, and Manufacture of Leather, Fur, Feather and Related Products and Footwear, Manufacture of Furniture, Manufacture of Paper and Paper Products and Construction. I also collected eight representative sectors in both labor- and technology-intensive service industries, including transport, storage and post, information transmission, software and information technology, wholesale and retail trades, hotels and catering services, financial intermediation, real estate, education, and health and social services. These sectors are considered representative and can be a good estimate of the entire industry because they comprise over 50% of the total industry's output value.

3 Empirical Research

3.1 Effect of Industrial Structure Upgrading on Unemployment Rate

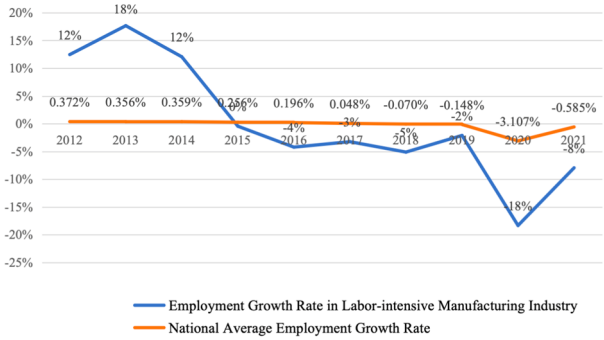

Fig. 1. Comparison of the Labor-intensive Manufacturing Industry and National Average Employment Growth Rate.

Figure 1 shows a comparative analysis of the employment growth rates between the labor-intensive manufacturing industry and the national average in China. Throughout the entire period, the national average employment growth rate remained very low, close to 0%, and became slightly negative in 2021, indicating a steady trend in the national labor force change, which aligns with our assumption of a relatively constant labor force size. For labor-intensive manufacturing, from 2012 to 2014, there is an increasing trend in the employment growth rate, which is far higher than the national average. However, in 2015, there was a notable decline in the growth rate of labor-intensive manufacturing industries, which dropped below the national average and continued to fall until it reached its lowest point in 2020.

As analyzed in the Methods section, the employment growth rate has a strong correlation with the unemployment rate. Therefore, we can infer that the decline in employment growth rates from 2015 onwards could be indicative of industrial structure changes impacting labor-intensive manufacturing industries more significantly than the national average level, leading to a higher unemployment rate in labor-intensive manufacturing industries than the national average, which supports my hypothesis. This

trend underscores the adverse effects of rapid industrial upgrading on employment situations, especially in labor-intensive sectors compared with broader national metrics.

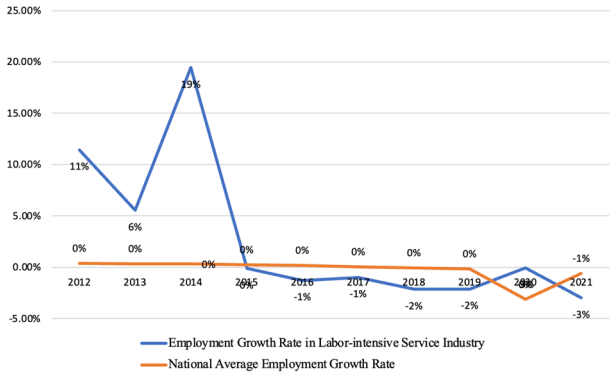

Fig. 2. Comparison of the Labor-intensive Service Industry and National Average Employment Growth Rate.

Figure 2 provides a comparative analysis of the employment growth rates between the labor-intensive service industry and the national average in China. The employment growth rate in the labor-intensive service industry exhibits a highly volatile pattern, dropping sharply from approximately 20% to 0% from the year 2014, to 2015 following the spike in 2014 and then remaining negative below the national level.

The overall employment stagnation in the labor-intensive service industry compared with the national level after 2015 could indicate that industrial upgrading process imposes a negative effect on employment growth. To correlate with the unemployment rate, this trend indicates an increasing unemployment rate after 2015 above the national average value, which aligns with my hypothesis that industrial upgrading can lead to increased unemployment in labor-intensive industries even if these industries are in the tertiary sector.

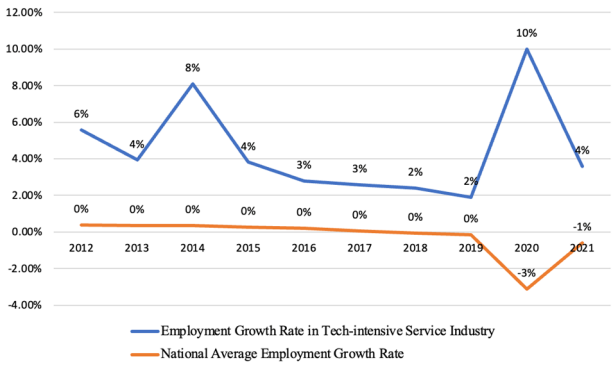

Fig. 3. Comparison of the Tech-intensive Service Industry and National Average Employment Growth Rate.

Figure 3 provides a comparative analysis of the employment growth rates between the high-end service industry and the national average in China. The employment growth rate for the high-end service industry is consistently higher than the national level, showing intermittent spikes, with significant increases in 2014 and 2020, reaching 8% and 10%, respectively.

The fluctuations in the high-end service industry's employment growth rate, particularly the sharp increases, could imply that during periods of industrial upgrading, this technology-intensive sector has absorbed labor more effectively than labor-intensive industries. This observation supports the hypothesis that technology-intensive sectors have a decreasing unemployment rate as opposed to labor-intensive industries.

3.2 Solutions

3.2.1 Upgrading of Labor Force Structure.

As proved in the previous section, industrial structure upgrading leads to a positively large unemployment rate in labor-intensive industries and a negative unemployment rate in technology-intensive industries. One intuition is to calculate the gap between the workforce transitioning from labor-intensive to technology-intensive industries, which overlooks the critical factor of skill mismatch. It is essential to recognize that individuals who have previously worked in labor-intensive industries may face challenges in adapting to the higher skill requirements of technology-intensive sectors. This disparity in skills highlights the importance of investing in labor training programs to bridge the gap and facilitate smoother transitions for workers[18].

The process of industrial upgrading, driven by advancements in technology and efficiency, necessitates a substantial increase in the workforce's human capital content [6]. Empirical research corroborates the positive impact of augmenting human capital content on the various facets of employment. Notably, increasing human capital has been shown to stimulate overall employment growth and facilitate the upgrading of employment structures by aligning skill sets with evolving industry demands[6].

Through a comparative analysis, it can be observed that the impact of the transformation of the U.S. manufacturing sector on unemployment and the corresponding responses of the U.S. government hold significant implications for China. As illustrated in Table 1, during the 1970s and 1980s, the U.S. manufacturing industry began to decline comprehensively. The value added by manufacturing to GDP decreased from 26.9% in 1957 to 17.1%, while the contribution of related service industries to GDP saw a notable increase. Amid the shocks of structural and cyclical adjustments, the U.S. experienced a reduction of 1.75 million manufacturing jobs nationwide, leading to severe unemployment issues[4]. During this phase of structural transformation, it was particularly challenging for workers to find reemployment without the relevant knowledge or skills from other industries. For instance, in Massachusetts in 1975, the average duration of unemployment for employees of a chemical plant was nearly 60 weeks[2].

To address the issue of unemployment resulting from structural adjustments, the U.S. enacted the Manpower Development and Training Act (MDTA) in 1962[11]. This Act primarily aimed to combat rising unemployment, especially structural unemployment caused by technological changes such as automation. It marked the first

comprehensive employment training program provided by the U.S. federal government for displaced workers, offering services such as classroom and on-the-job training, benefiting a total of 140,000 individuals. However, the Act's nationwide scope proved too broad and failed to accommodate local conditions, as unemployment rates continued to rise in the 1970s[2]. In 1973, the U.S. introduced the Job Training Partnership Act (JTPA), which differed from earlier policies in three key ways: first, it delegated greater responsibility to state governments for planning, allowing for more targeted employment training; second, it fostered greater interaction between businesses and employees through the establishment of industry associations; third, it concentrated resources on training and job placement services[1]. This policy provided employment placement assistance to 84% of program participants, with over 80% receiving job counseling and more than 60% obtaining job search assistance. Clearly, this was a relatively successful policy. In 1998, the U.S. passed the Workforce Investment Act (WIA), which categorized reemployment individuals into groups—adults, youth, and dislocated workers—and provided them with relevant skills training (Workforce Investment Act, 1998).

Table 1. Value Added by Industry Group in Current Dollars as a Percentage of Gross Domestic Product for Selected Years[17].

	1947	1957	1967	1977	1987
Gross domestic product	100.0	100.0	100.0	100.0	100.0
Private industries	87.5	87.4	85.8	85.6	86.1
Agriculture, forestry, fishing, and hunting	8.2	4.0	2.7	2.5	1.7
Mining	2.3	2.3	1.4	2.1	1.5
Utilities	1.4	1.9	2.0	2.3	2.6
Construction	3.7	4.7	4.6	4.6	4.6
Manufacturing	25.6	26.9	25.2	21.6	17.1
Durable goods	13.0	16.1	15.4	13.1	10.2
Nondurable goods	12.6	10.9	9.8	8.5	6.9
Wholesale trade	6.3	6.2	6.5	6.6	6.0
Retail trade	9.4	7.9	7.8	7.8	7.4
Transportation and warehousing	6.0	5.0	4.0	3.8	3.2
Information	2.5	2.9	3.2	3.5	3.9
Finance, insurance, real estate, rental, and leasing	10.4	13.1	14.2	15.0	17.7
Professional and business services	3.7	4.5	5.3	6.0	8.7
Educational services, health care, and social assiatance	1.9	2.4	3.4	4.6	6.0
Arts, entertainment, recreation, accommodation, and food services	3.2	2.7	2.8	2.9	3.2
Other services, except government	3.0	2.8	2.7	2.3	2.4
Government	12.5	12.6	14.2	14.4	13.9
Addenda:					
Private goods-producing industries	39.8	38.0	34.0	30.9	24.9
Private services-producing industries	47.8	49.4	51.8	54.7	61.2

It can be observed that in response to reemployment policies during economic structural transformation, the United States focused on two core concepts: training and segmentation. Training requires local regions to provide adult education platforms, offering reemployment individuals access to knowledge at relatively low costs. Segmentation involves tailoring training programs to local conditions and targeting specific groups, which necessitates joint efforts from both local and central governments. During the U.S. economic transformation, policies addressing unemployment in labor-intensive industries often lagged, typically being enacted only after significant unemployment had occurred. This offers valuable lessons for us. If China can proactively implement relevant reemployment policies and targeted training for the unemployed during its economic transition, it will be able to effectively address potential unemployment issues.

Therefore, by increasing the quality of labor training, the government can effectively promote the upgrading of the skill structure among workers. This entails providing comprehensive training programs that equip individuals with the technical skills, digital literacy, and problem-solving abilities demanded by modern industries. To address the challenge of re-employment for laid-off workers, skill training is important(Zhang, 2019). By providing tailored programs that cater to the specific needs and aptitudes of displaced workers, the government can enhance their employability and facilitate successful transition to new opportunities.

3.2.2 Redistribution to Narrow the Wealth Gap.

The Gini coefficient announced by China in 2022 was 0.467. It is generally considered that a Gini coefficient between 0.4 and 0.5 indicates a large disparity in income distribution among residents, signifying a substantial wealth gap in Chinese society[12]. Worse still, under the pressure of unemployment resulting from the upgrading of the industrial structure, the problem of a huge wealth gap is exacerbated. Therefore, measures to improve the redistribution system emerges as particularly crucial. Workers in labor-intensive industries face unemployment risks due to mismatched skills, hindering their smooth transition to the high-end manufacturing and service sectors. The inevitable rise in labor costs in China has driven the relocation of labor-intensive manufacturing industries, leading workers in these industries to seek employment opportunities in labor-intensive service industries (owing to skill mismatch)[19]. However, despite the rapid development of high-end manufacturing, Figure 2 illustrates that the growth of labor-intensive service industries' employment is not promising. This inadequacy in the secondary distribution reflects China's inability to stimulate the overall growth of the service industry.

The rapid development of high-end manufacturing industries in China, such as modern automobile manufacturing, aircraft manufacturing, semiconductor manufacturing, and innovative drug manufacturing, has increased the personal wealth of participants. However, owing to limited participation, the income growth of workers in large labor-intensive industries is not significant, exacerbating the wealth gap[14]. In theory, the development of manufacturing should promote the expansion of the service industry, and with the development of industries, there are more consumers, workers' incomes increase, and more funds flow into the service industry, thereby increasing the

proportion of the service industry in the GDP. However, the premise of this transition is that society can ensure that the unemployed do not starve to death through sufficient taxation and social security systems as well as policies such as personal bankruptcy systems to alleviate the concerns of entrepreneurs.

Drawing lessons from the experience of Western countries such as the United States, the practice of early property taxation is worth considering. Property taxes help to compress the prices of fixed assets, reducing the overall cost to society. By increasing property taxes in secondary distribution, stable social security can be provided, reducing the expected cost of survival for industrial workers, stimulating service consumption, and promoting the development of emerging service industries. According to data from the Bureau of Economic Analysis (2000), the proportion of GDP of tertiary industry in the United States increased by only 2.6 percentage points from 1970 to 1980, but from 1980 to 1990, this proportion increased by 6.4 percentage points. This period coincided with the tilt of US policy towards medium- and high-end manufacturing and high-tech industries and explosive growth in information technology. Thus, China should prioritize narrowing the wealth gap through property taxation, improving welfare benefits, and ardently developing the service sector. This strategy could facilitate the transition of workers from labor-intensive manufacturing to more viable roles in the labor-intensive service sector.

4 Conclusion

Several key findings and recommendations can be drawn based on the analysis presented in the previous sections. The acceleration of industrial structure upgrading in China has brought about shifts in employment patterns and exacerbated the unemployment problem. The labor force, particularly that from labor-intensive sectors, faces considerable challenges in transitioning to the emerging technology-intensive sectors, as shown in the figures. However, the solution does not lie in merely slowing down the pace of industrial upgrading but in implementing strategic measures to mitigate its adverse effects. Two solutions are suggested in this study. The first is the emergent implementation of workforce reskilling practices to meet the demands of new industries. Second, an enhancement in the redistribution of property taxation to facilitates fairer redistribution of wealth. By reflecting on the U.S. experience, where property taxation contributes to societal equity and stability, China can similarly leverage fiscal policy to manage its wealth gap while fostering a conducive environment for service industry growth.

To conclude, China's industrial structure upgrading is both a testament to its remarkable economic progress and a reflection of the critical socioeconomic balances that must be achieved. To progress into China's next phase of economic development while avoiding the pitfalls of past rapid industrial transitions, a mix of policy reforms targeting people's welfare is essential. These endeavors will not only chart the course of China's economic future but will also provide a blueprint for other nations grappling with similar challenges in the global landscape of the 21st century.

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