Research in Economics and Management
ISSN 2470-4407 (Print) ISSN 2470-4393 (Online)
Vol. 10, No. 2, 2025
www.scholink.org/ojs/index.php/rem

Original Paper

AIUnlimited Labor Supply Theory: Reshaping the Pattern of Labor Income Distribution

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Received: September 27, 2025 Accepted: October 10, 2025 Online Published: October 23, 2025
doi:10.22158/rem.v10n2p216 URL: http://dx.doi.org/10.22158/rem.v10n2p216

Abstract

Traditional economics takes the scarcity of labor resources as its core assumption, which makes it difficult to adapt to the disruptive impact of AI on the labor market. This article aims to make up for this deficiency, clarify the concept of "AI infinite labor" for the first time, break through traditional assumptions, and construct a systematic theoretical framework for AI infinite labor supply. The study adopts rigorous model setting and derivation methods, focusing on in-depth analysis of the impact of AI on economic growth, income distribution, and production consumption balance. The results show that AI unlimited labor supply can not only significantly drive economic growth, but also profoundly reshape the income distribution pattern, while having complex and far-reaching effects on the production consumption balance. Based on the above research findings, this article proposes targeted solutions for policy makers, such as "AI benefit redistribution" and "skill training for low skilled groups", to help the economy achieve efficient, fair, and sustainable development in the AI era.

Keywords

AI unlimited labor supply, income distribution, Production consumption balance, economic growth

1. Introduction

The extensive penetration of artificial intelligence throughout production, service and distribution sectors is bringing about a fundamental transformation in the essential attributes of labor and the supply mechanisms of production factors. Unlike traditional mechanical automation, which only replaces routine manual work without overcoming physical limitations on human labor, industrial artificial intelligence and generative AI possess scalable, replicable and geographically flexible labor characteristics. Once trained, intelligent models can be rapidly deployed across different locations to continuously generate standardized production and service outputs; their supply is constrained merely by computing power, rather than demographic endowments, working hours or geographical boundaries. This new labor form spawned by artificial intelligence profoundly reshapes the operational logic of factor markets, and delivers pronounced structural shocks to patterns of factor income distribution, the evolution trajectory of employment, and the general equilibrium system of the macroeconomy.

More disruptively, AI has completely broken the physical boundaries of labor supply: a trained industrial AI model can be deployed to factories worldwide within 24 hours, and its “labor supply” is only constrained by computing power, with no need to consider attendance, training, or geographical limitations. This “nearly unlimited labor supply” is challenging the century-old foundation of economics. Since Solow (1956) proposed the neoclassical growth model, “labor scarcity” has always been a cornerstone of economic theory—from Lucas (1988)’s human capital accumulation theory to Acemoglu (2002)’s analysis of skill-biased technological change, all implicitly assume that labor supply is limited by physical factors such as population and time. However, AI exhibits the characteristics of “extremely low replication costs, unlimited supply, and stable marginal efficiency,” which has completely reconstructed traditional logic and given rise to multiple practical paradoxes: On the distribution side, the proportion of labor remuneration in China's manufacturing industry continues to decline, and Yale scholar Restrepo predicts that the proportion of labor income may approach zero in the AGI era; On the employment side, the educational threshold for new AI positions is high, and there is significant pressure to replace low skilled groups; Macroscopically, the contradiction between AI driven production expansion and limited consumption by low skilled individuals contradicts the logic of economic growth.

Against this backdrop, this study focuses on three core research questions: First, what are the definition, characteristics, and theoretical assumptions of AI unlimited labor, and what are its essential differences from traditional heterogeneous labor? Second, after introducing this factor, how is the four-factor production function (AI-high-skilled labor-low-skilled labor-capital) reconstructed, and what is the mechanism by which AI affects wage structure and income inequality? Third, how does AI disrupt the production-consumption balance, and how can structural contradictions be resolved through theoretical and policy measures? The innovations of this study lie in: constructing a theoretical framework of AI unlimited labor to fill the gap in traditional theories, revealing the evolutionary laws of factor distribution through the four-factor production function, and finally proposing targeted solutions such as the redistribution of computing power dividends and skill training for low-skilled groups, thereby providing theoretical and practical support for achieving a balance between efficiency and equity in the AI era.

The potential innovations of this study are as follows: First, it for the first time constructs a theoretical framework of AI unlimited labor supply, challenging the traditional assumption of “labor scarcity” and filling the gap in existing economic growth theories and labor economics in explaining new phenomena in the digital age. This framework clearly defines the definition, characteristics, assumptions, and prerequisites of AI unlimited labor, makes an essential comparison with traditional labor, and expands the understanding of labor to include AI unlimited labor. Second, it develops a production function model integrating AI unlimited labor, revealing the role of AI unlimited labor in the changes in the wage structure of heterogeneous labor, the widening of income inequality, and the dynamic evolution of the production-consumption balance, and draws conclusions with theoretical and practical significance. Third, addressing issues such as the innovation of economic growth drivers, the reshaping of income distribution patterns, and the complex factors affecting the production-consumption balance, it proposes solutions (e.g., “redistribution of AI benefits” and “skill training for low-skilled groups”) for policymakers’ reference, provides strategic guidance for enterprises to realize “collaborative allocation of AI and human resources,” and offers targeted and operable suggestions to help the economy achieve a balance between high-efficiency growth and social equity in the AI era.

2. Literature Review

In the field of economic research, labor income distribution has always occupied a core position and remains a key topic of long-term concern and discussion among scholars. In recent years, with the rapid development of artificial intelligence (AI) technology, the innovative concept of “AI-driven unlimited labor supply” has gradually entered public discourse. Its potential far-reaching impacts on labor income distribution have attracted widespread attention, necessitating further in-depth research and analysis.

Tracing the evolution of economic theory, early classical economic growth theories laid a solid foundation for subsequent studies. Solow (1956) developed a growth model that pioneeringly identified capital accumulation and technological progress as key drivers of economic growth. Although this model emerged before the advent of AI and did not directly address AI-related content, its profound insights into the relationship between economic growth and factor inputs—particularly the link between educational investment and growth, and the importance of technological progress—provided a critical cornerstone for later scholars to understand economic operating mechanisms. Subsequently, Romer (1986) emphasized the externality of knowledge and the central role of increasing returns in long-term economic growth, while Lucas (1988) proposed an endogenous growth theory that highlighted the significance of human capital accumulation. These two frameworks greatly enriched the system of economic growth theory. While they did not directly explore the domain of AI unlimited labor supply, they offered robust theoretical support for subsequent investigations into the complex interactions between technology and labor in economic operations, inspiring later researchers to examine the relationship between economic growth and labor from diverse factor perspectives.

Entering the 21st century, AI technology gradually demonstrated its transformative potential. Economists have astutely grasped its potentially far - reaching effects across economic aspects, resulting in the progressive deepening of research in relevant fields. Barro and Sala-i-Martin (1995) focused on the impacts of traditional production factors and macroeconomic policies on economic growth; Aghion and Howitt (1998) proposed an endogenous growth theory that placed technological innovation at the core of economic growth and constructed a dynamic analytical framework, providing a solid theoretical basis for academic exploration of technology-driven economic development models. their findings offered important references for subsequent discussions on the direction of policy adjustments in the AI era. Nevertheless, constrained by the context of their time, their research failed to fully anticipate the transformative impact of the new factor of "AI unlimited labor supply" on economic growth paths and the structure of labor income distribution, inevitably leaving certain theoretical limitations.

In recent years, with the all-round penetration of AI technology in the economic sphere, academic research on the relationship between AI, the labor market, and income distribution has flourished. some scholars examined AI's impact on the employment structure (Autor & Dorn, 2013; Frey & Osborne, 2017), pointing out that with the development of AI technology, routine and rule-based jobs face heightened displacement risks, while demand for high-skill, creative jobs may increase—driving significant changes in the employment structure (Goos et al., 2014;Acemoglu&Restrepo 2019). Acemoglu and Restrepo (2018) further delved into this area, revealing the complex substitution and complementarity relationships between technology and labor. This finding offered key insights for subsequent explorations of the intrinsic link between AI unlimited labor supply and labor income distribution, prompting scholars to examine AI's impacts on the labor market from the perspective of more complex interactive relationships.

In both domestic and international academic circles, numerous scholars have actively engaged in research on the relationship between AI and the economy. Domestic Chinese scholars, in particular, have conducted extensive and in-depth explorations in this field. Cao and Zhou (2018) focused on analyzing AI's role in enhancing productivity and driving economic growth, while thoroughly investigating its impacts on labor employment and whether it exacerbates income inequality—providing a multi-dimensional perspective for comprehensively understanding AI's economic effects. Cai and Chen (2019) pointed out that in the process of AI and automation development, the combined effects of the substitution effect and suppression effect are expected to keep total employment basically stable, but the employment structure will inevitably face structural shocks: middle-skill jobs are vulnerable to substitution, leading to polarization of the employment structure. At the same time, the labor share in primary distribution will decline, with groups in substituted industries who have low educational attainment, poor skills, and older ages suffering the most severe losses—further widening income inequality. Guo (2019) found that advancements in AI services or extended technologies drive the mobility of production factors across industrial sectors; the direction of this mobility depends on differences in AI output elasticity and the substitution elasticity between AI and traditional production methods across sectors, a process that also profoundly affects changes in the labor income share. Jin et al. (2020) demonstrated through empirical research that AI application can significantly increase firms' labor income share. Zhu and Liu (2020) explored the impact of AI technological change on income distribution from a theoretical perspective, noting that the data bias of AI leverages data advantages to foster a "winner-takes-all" market structure, further widening income gaps between digital platform firms and within firms themselves. Wang and Chang (2021) analyzed AI's impacts on the labor market, arguing that AI exerts complex dual effects: on one hand, it displaces certain jobs, reducing employment levels and labor compensation; on the other hand, it creates new jobs, increases labor demand, and raises workers' incomes.

In summary, existing research has achieved notable progress in areas such as economic growth theory, and AI's impacts on the labor market and income distribution. However, most current studies treat AI as a tool for improving efficiency, focusing primarily on its displacement and creation effects. With the continuous development of AI technology and the widespread adoption of AI robots, AI is gradually evolving into a new type of labor. It not only transforms traditional work methods but also creates new jobs—such as machine learning engineers and data analysts. For example, manufacturing assembly lines and customer service industries have widely adopted industrial robots and chatbots, and the application of these technologies is driving the labor market toward high-skill sectors. Against this backdrop, this study pioneeringly introduces AI directly into the model as a new type of unlimited labor, conducting an in-depth analysis of its impacts on income distribution and the mechanisms underlying production-consumption balance. Special attention is paid to the mechanism through which AI unlimited labor supply affects the income distribution of heterogeneous labor (e.g., high-skilled vs. low-skilled labor), aiming to provide new insights and a unique perspective for research in this field, fill the gap in existing research regarding the in-depth exploration of the characteristics of AI labor, and advance research at the intersection of AI and economics.

3. The Theory of AI Unlimited Labor Supply

3.1 Definition and Core Characteristics of AI Unlimited Labor

BIunlimited labor is a new form of labor driven by cutting-edge artificial intelligence technology. Distinct from traditional "efficiency-enhancing tools," it essentially combines virtual programs with independent labor capabilities (e.g., intelligent algorithms) and physical carriers (e.g., industrial robots), enabling it to participate in economic production beyond physical constraints (an extension of Romer's (1986) knowledge capital theory, which regards AI as a new type of knowledge-intensive labor). Its core characteristics manifest in five key breakthroughs:

First, unlimited quantity: Through algorithm replication and cloud deployment, AI labor can achieve unlimited expansion at near-zero marginal cost. For instance, a single intelligent quality inspection system can serve thousands of production lines worldwide simultaneously, completely breaking free from constraints imposed by population size and geography.

Second, continuous working hours: Unrestricted by physical fatigue, AI labor can operate 24 hours a day. A typical example is intelligent logistics sorting robots, whose daily working hours are three times that of human workers.

Third, high precision and stability: where data algorithms enable nanometer-level operational accuracy (such as in AI lithography machines) with extremely low error rates, far surpassing the variability of human labor.

Fourth, self-learning capability: Powered by machine learning algorithms, AI can dynamically optimize its work methods in real time. For example, industrial robots can automatically adjust processing parameters based on variations in raw materials to adapt to dynamic changes in task complexity.

Fifth, substitution-complementarity duality: AI can replace humans in repetitive tasks (e.g., data entry) and high-risk operations (e.g., high-altitude work), while also collaborating with high-skilled labor (e.g., AI assisting lawyers in reviewing legal documents). This forms a dual relationship of "substituting for low-skilled labor and complementing high-skilled labor."

3.2 Theoretical Assumptions and Prerequisites for AI Unlimited Labor Supply

The realization of AI unlimited labor supply relies on three core prerequisites, none of which can be omitted:

First, the assumption of continuous technological progress: AI must possess the ability to handle complex economic tasks, which depends on breakthroughs in algorithm innovation (e.g., Transformer architecture), hardware upgrades (e.g., increased GPU computing power), and cross-domain adaptation technologies. Without these, AI would be confined to simple labor and unable to function as "general-purpose labor." For example, AI surgical robots require deep integration of image recognition algorithms and medical knowledge; technological stagnation would prevent them from addressing complex surgical scenarios.

Second, the assumption of computing power and data support: Sufficient computing power (e.g., server clusters in data centers) serves as the physical foundation for AI operation, while massive structured data (e.g., manufacturing production data, service industry user behavior data) acts as the "nutrient" for AI's learning and evolution. This aligns with the logic of "technology matching factor foundations" in Acemoglu's (2002) theory of skill-biased technological change. Without computing power and data, AI labor would be left without essential inputs to drive its capability evolution.

Third, the assumption of institutional and policy guarantees: Policies are needed to clarify the responsibility attribution of AI labor (e.g., liability division for autonomous driving accidents), data security standards (e.g., user privacy protection), and market access criteria, thereby preventing technological abuse and social risks. For instance, the regulatory framework for "high-risk AI" in the European Union's Artificial Intelligence Act provides an institutional boundary for the orderly application of AI labor.

3.3 Core Differences from Traditional Labor Supply Theory

Traditional labor supply theory is rooted in the premise of "labor scarcity," whereas the theory of AI unlimited labor supply completely breaks this assumption, resulting in three fundamental differences:

First, subversion of theoretical assumptions: In traditional theory, labor supply is constrained by population growth and physical limits, with an upward-sloping supply curve (wage increases only lead to limited growth in supply). For example, Japan's aging population causes labor shortages, and even wage hikes cannot fill the gap. In contrast, the supply curve of AI labor is nearly horizontal—it can be supplied infinitely at a given cost, constrained only by computing power and free from population or physical limitations.

Second, reconstruction of the production function: Traditional production functions (e.g., the Cobb-Douglas function) treat labor as a scarce factor with "diminishing marginal returns." The integration of AI unlimited labor, however, requires incorporating a "knowledge-intensive unlimited factor" into the production function, highlighting increasing returns to scale. The collaboration between AI, capital, and high-skilled labor can drive output growth far exceeding the growth of factor inputs—for example, the combination of AI and robots in smart factories increases production capacity fivefold compared to traditional factories.

Third, adjustment of factor distribution: In traditional distribution, the income share of labor and capital remains relatively stable. In the AI era, however, high-skilled labor (e.g., AI algorithm engineers) gains a significantly larger income share by collaborating with AI to create high value . Low-skilled labor, by contrast, faces a declining income share due to substitution, forming a new distribution pattern characterized by a "widening skill premium."

3.4 Comparative Analysis of Key Dimensions Between AI and Traditional Labor Supply

Table 1 systematically compares AI unlimited labor supply and traditional labor supply across core dimensions, with additional insights into their differences in application scenarios, cost structure, scalability, and innovation potential:

Application scenarios: Traditional labor supply is concentrated in fields requiring direct human operation, judgment, and emotional interaction (e.g., education, medical care). AI unlimited labor supply excels at tasks with high repetition, large datasets, and clear rules (e.g., data analysis, automated manufacturing).

Cost structure: Traditional labor costs include wages, benefits, and training, and tend to rise over time. AI unlimited labor costs are primarily incurred during initial R&D and deployment, with relatively low operational costs in later stages that can be further reduced through scale effects.

Scalability: Traditional labor supply is constrained by geography, culture, and language, making cross-border expansion difficult. AI unlimited labor supply enables global deployment, quickly adapting to different languages and cultural environments to achieve seamless cross-border collaboration.

Innovation potential: Innovation in traditional labor supply stems mainly from individual skill improvement and experience accumulation. AI unlimited labor supply, through continuous learning algorithms and big data analysis, constantly spawns new application scenarios and business models, driving industrial upgrading and transformation.

Table 1. Comparison Between AI Unlimited Labor Supply and Traditional Labor Supply

Comparative DImension	Traditional Labor Supply	AI Unlimited Labor Supply
Definition	Scarce labor resource constrained by population and physiology	New knowledge-intensive labor capable of unlimited participation in production
Quantity Characteristics	Slow growth, constrained by population size	Near-zero marginal cost replication, nearly unlimited quantity
Working Hours	8–10 hours per day, requiring rest	24-hour continuous operation, no physical fatigue constraints
Precision and Stability	Easy to be interfered by human factors, with a relatively high error rate	Algorithmic control, extremely low error rate, high stability
Learning Capability	Skill acquisition takes months to years, slow adaptation	Real-time data learning, hour-level adaptation to new tasks
Theoretical Assumptions	Labor scarcity, diminishing marginal returns	Breaks the scarcity assumption, dependent on technology, computing power, and institutional guarantees
Economic Growth Model	Relies on increased labor quantity and human capital accumulation	Relies on AI technological innovation, computing power enhancement, and data utilization
Factor Distribution Pattern	Relatively stable income shares of labor and capital	Income growth for high-skilled labor; low-skilled labor faces substitution risks

In summary, the theory of AI infinite labor supply is not a supplement to traditional theories, but a comprehensive reform of the essence of labor, the structure of production functions, and the logic of factor allocation. Its core significance lies in providing theoretical support for balancing economic growth and social equity in the AI era, while also providing analytical ideas for resolving the practical contradiction between "technological substitution and employment security".

4. Construction and Analysis of the AI Unlimited Labor Supply Model

This section constructs and analyzes the AI unlimited labor supply model from five aspects: model specification, model derivation, the impact of AI unlimited labor supply on the wages of high- and low-skilled labor, the impact of AI unlimited labor on income distribution, and the analysis of total consumption and production-consumption balance.

4.1 Model Specification

To deeply explore the mechanism by which AI unlimited labor supply affects economic growth, this study develops a comprehensive production function model that integrates key factors: AI unlimited labor (L_{AI}), high-skilled labor (L_H), low-skilled labor (L_L), and capital (K). The production function is specified as:

$$Y = AK^{\alpha}L_H^{\beta_H}(L_L + L_{AI})^{\beta_L} \tag{1}$$

In this model:

Y denotes total output, capturing the final result of economic activities.

A represents generalized technological progress driven by AI, which permeates sectors like healthcare, finance, and manufacturing, transforming production via innovation and policy support.

Capital (K) includes both physical assets (e.g., factories, machinery) and human capital accumulated through education/training.

L_H signifies high-skilled labor, which performs complex, high-value tasks using specialized knowledge and innovation.

L_L represents traditional low-skilled labor, engaged in routine, repetitive work. Labor is classified by substitutability with AI: workers who complement AI to enhance productivity are “high-skilled,” while those replaceable by AI are “low-skilled.”

L_{AI} is AI-powered labor with near-unlimited supply. Currently, AI cannot fully substitute high-skilled labor but can infinitely replace low-skilled labor; future substitutability for high-skilled roles remains uncertain (this study assumes no substitution for high-skilled labor).

Parameters α, β_H, and β_L denote output elasticities of capital, high-skilled labor, and the composite of low-skilled and AI labor, respectively. They satisfy $\alpha + \beta_H + \beta_L = 1$, implying constant returns to scale—total output scales proportionally with equal proportional increases in all inputs. This assumption simplifies analysis and aligns with real-world production trends (e.g., Solow-type models use similar assumptions to study structural change in developing economies).

Combining L_L and L_{AI} into one term reflects economic intuition: AI labor substitutes for low-skilled labor (with L_{AI} reducing demand for L_L) while complementing high-skilled labor (high-skilled workers use AI to boost aggregate productivity, as seen in smart manufacturing where engineers and AI-powered robots collaboratively optimize production).

4.2 Model Derivation

Under perfect competition, firms maximize profits, leading to the profit function:

$$\pi = AK^{\alpha}L_H^{\beta_H}(L_L + L_{AI})^{\beta_L} - w_H L_H - w_L L_L - p_{AI}L_{AI} - rK \tag{2}$$

Where:

w_H = wage of high-skilled labor,

w_L = wage of low-skilled labor,

p_{AI} = cost of AI labor (marginal cost is near-zero, so p_{AI} reflects average R&D/maintenance costs),

r = capital rental rate.

To maximize profits, take partial derivatives of π with respect to L_H, L_L, L_{AI}, and K, and set them to zero:

$$\frac{\partial \pi}{\partial L_H} = \beta_H AK^{\alpha}L_H^{\beta_H - 1}(L_L + L_{AI})^{\beta_L} - w_H = 0 \tag{3}$$

$$\frac{\partial \pi}{\partial L_L} = \beta_L AK^{\alpha}L_H^{\beta_H}(L_L + L_{AI})^{\beta_L - 1} - w_L = 0 \tag{4}$$

$$\frac{\partial \pi}{\partial L_{AI}} = \beta_L AK^{\alpha}L_H^{\beta_H}(L_L + L_{AI})^{\beta_L - 1} - p_{AI} = 0 \tag{5}$$

$$\frac{\partial \pi}{\partial K} = \alpha AK^{\alpha - 1}L_H^{\beta_H}(L_L + L_{AI})^{\beta_L} - r = 0 \tag{6}$$

Solving these:

From Equation (3), the wage for high-skilled labor is:

$$w_H = \beta_H AK^{\alpha}L_H^{\beta_H - 1}(L_L + L_{AI})^{\beta_L} \tag{7}$$

w_H depends on technology (A), capital (K), high-skilled labor input (L_H), and the composite of low-skilled/AI labor ($L_L + L_{AI}$).

From Equation (4), the wage for low-skilled labor is:

$$w_L = \beta_L AK^{\alpha}L_H^{\beta_H}(L_L + L_{AI})^{\beta_L - 1} \tag{8}$$

From Equation (5), the "price" of AI labor (its effective return in production) is:

$$p_{AI} = \beta_L AK^{\alpha}L_H^{\beta_H}(L_L + L_{AI})^{\beta_L - 1} \tag{9}$$

These derivations clarify the interdependence of factor prices, laying groundwork for analyzing factor market dynamics.

Impact of AI Unlimited Labor on High- and Low-Skilled Wages

To analyze how L_{AI} affects wages, take partial derivatives:

High-Skilled Wages (w_H) with Respect to L_{AI}:

$$\frac{\partial w_H}{\partial L_{AI}} = \beta_H \beta_L A K^{\alpha} L_H^{\beta_H - 1} (L_L + L_{AI})^{\beta_L - 1} \tag{10}$$

Since $\beta_H, \beta_L, A, K^{\alpha}, L_H^{\beta_H - 1}, (L_L + L_{AI})^{\beta_L - 1} > 0$ (given $\beta_H, \beta_L \in (0,1)$ and $L_H, L_L, L_{AI} > 0$), $\frac{\partial w_H}{\partial L_{AI}} > 0$.

Interpretation: Increasing L_{AI} raises high-skilled wages. For example, in fintech, AI-powered data analysis boosts high-skilled analysts' productivity (e.g., generative AI increases U.S. worker hourly productivity by 33%, per recent studies), creating complementarity between AI and high-skilled labor that elevates marginal product and wages.

Low-Skilled Wages (w_L) with Respect to L_{AI}:

$$\frac{\partial w_L}{\partial L_{AI}} = \beta_L (\beta_L - 1) A K^{\alpha} L_H^{\beta_H} (L_L + L_{AI})^{\beta_L - 2} \tag{11}$$

Since $\beta_L - 1 < 0$ (and other terms are positive), $\frac{\partial w_L}{\partial L_{AI}} < 0$.

Interpretation: Increasing L_{AI} reduces low-skilled wages. As AI infinitely substitutes for low-skilled labor, their wages decline and may eventually lead to unemployment.

This divergence highlights labor market polarization: high-skilled labor benefits from AI complementarity, while low-skilled labor suffers from substitution. Policymakers must address this via skills training to facilitate low-to-high-skilled transitions.

Impact on Income Distribution

To measure the high-to-low-skilled wage gap, define the wage ratio $\frac{w_H}{w_L}$:

$$\frac{w_H}{w_L} = \frac{\beta_H A K^{\alpha} L_H^{\beta_H - 1} (L_L + L_{AI})^{\beta_L}}{\beta_L A K^{\alpha} L_H^{\beta_H} (L_L + L_{AI})^{\beta_L - 1}} \tag{12}$$

Simplifying:

$$\frac{w_H}{w_L} = \frac{\beta_H}{\beta_L} \cdot \frac{1}{L_H} \cdot (L_L + L_{AI}) \tag{13}$$

As L_{AI} increases, $\frac{w_H}{w_L}$ rises—income inequality widens. High-skilled labor leverages AI to create value (e.g., using AI for innovation), while low-skilled labor faces reduced employment and stagnant wages.

Widening inequality risks social unrest and economic inefficiency (e.g., imbalanced consumption). From an employment perspective, AI concentrates opportunities in high-skilled sectors (e.g., AI-driven logistics eliminates low-skilled sorting jobs but creates high-skilled AI maintenance roles), deepening labor market polarization.

4.3 Production-Consumption Balance

Let total consumption $C = C_H + C_L$, where C_H (high-skilled consumption) rises and C_L (low-skilled consumption) falls with AI-driven wage changes. The product market equilibrium condition is:

$$AK^{\alpha}L_H^{\beta_H}(L_L + L_{AI})^{\beta_L} = C_H + C_L + I + G \tag{14}$$

Substituting C_H, C_L (linked to w_H, w_L) into this equation yields a complex relationship between L_H, L_L, L_{AI}, K. Define L_{AI}^* as the level of L_{AI} that balances production and consumption:

If $L_{AI} < L_{AI}^*$: Production < Consumption (shortage), so firms expand, increasing factor demand and stimulating growth.

If $L_{AI} > L_{AI}^*$: Production > Consumption (surplus), so firms contract, reducing factor demand and slowing growth.

Further mathematical analysis reveals how L_{AI}^* varies with parameters like A, α, β_H, and β_L, elucidating the dynamic interplay of AI labor and macroeconomic balance.

This framework advances understanding of AI's role in growth, distribution, and macro stability, providing insights for policy and firm strategy in the AI era.

5. Research Conclusions and Policy Recommendations

5.1 Core Research Conclusions

This study constructs the theory of AI unlimited labor supply and conducts an in-depth analysis of AI's mechanism of action in the economic system, yielding the following core conclusions:

In terms of economic growth drivers, AI unlimited labor supply reshapes the model of economic growth. When integrated into the production function, AI collaborates with high-skilled labor, low-skilled labor, and capital to become a new growth engine. As AI technology advances and AI labor input increases, total output rises, and the structure of factor inputs and production efficiency are optimized—this not only drives steady economic growth but also has achieved notable results in smart manufacturing, such as the establishment of intelligent automated production lines, optimization of production management processes, intelligent quality control, and efficient supply chain management. Empirical studies indicate that the application of AI technology exerts a significant positive impact on average wage levels; particularly in high-skill industries, workers' incomes have increased markedly. However, the substitution effect of AI technology on low-skilled labor has led to a decline in the incomes of this group, thereby exacerbating income inequality and labor market polarization. Such polarization may trigger socioeconomic issues, including intensified social class conflicts and imbalanced consumption structures.

In terms of production-consumption balance, AI transforms the production function and industrial structure on the production side, while influencing the income and consumption capacity of labor with different skill levels (and thus changing the consumption structure) on the consumption side. The production-consumption balance is shaped by multiple factors, including AI labor supply, technological progress, income distribution, and industrial structure, and exhibits different supply-demand states at various development stages.

5.2 Policy Recommendations

Based on the above conclusions, the following policy recommendations are proposed to promote sustainable economic development:

5.2.1 For Innovating Economic Growth Drivers

Governments should increase financial support for AI R&D, encourage universities and research institutions to conduct research on cutting-edge AI technologies, and advance the in-depth integration of AI with the real economy. They should also guide enterprises to increase investment in AI technology and high-skilled labor, optimize the industrial structure, and enhance the overall production efficiency of the economy.

5.2.2 For Reshaping the Income Distribution Pattern

First, it is essential to strengthen vocational skills training and build skill-upgrading platforms for low-skilled labor, helping them transition to high-skill fields to mitigate the employment shocks and challenges brought by AI development. Second, governments should improve tax and welfare policies to regulate excessively high incomes, safeguard the basic livelihoods of low-income groups, narrow income gaps, and maintain social stability.

5.2.3 For Maintaining Production-Consumption Balance

Given the complex factors influencing production-consumption balance, governments need to establish a dynamic monitoring mechanism to closely track the impacts of changes in AI labor supply, technological progress, income distribution, and industrial structure on this balance. Based on the supply-demand state at different stages, they should formulate targeted fiscal and monetary policies. For instance, when production exceeds consumption, expansionary fiscal policies such as tax cuts and increased government spending can be adopted to boost consumption and effectively absorb excess production capacity. Conversely, if consumption outpaces production, enterprises should be incentivized to expand capacity, and resources should be rationally allocated to the production sector to ensure steady economic operation.

Acknowledgements

This article has received funding from the Guangdong Provincial Philosophy and Social Sciences Planning Project (GD23XYJ77), the Ministry of Education's Humanities and Social Sciences Research Youth Project (23YGC790197),, and the Shantou University Research Start up Fund Project (STF23007).

References

Acemoglu, D., & Autor, D. H. (2011). Skills, tasks and technologies: Implications for employment and earnings. *Handbook of Labor Economics* (Vol. 4, pp. 1043–1171). Elsevier.

Acemoglu, D., & Restrepo, P. (2018). The race between man and machine: Implications of technology for growth, factor shares, and employment. *American Economic Review*, *108*(6), 1488–1542.

Acemoglu, D., & Restrepo, P. (2019). Automation and new tasks: How technology displaces and reinstates labor. *Journal of Economic Perspectives*, *33*(2), 3–30.

Barro, R. J., & Sala-i-Martin, X. (1995). *Economic growth*. McGraw-Hill.

Cai, Y. Z., & Chen, N. (2019). Artificial intelligence and high-quality growth and high-quality employment under the new technological revolution. *Journal of Quantitative and Technical Economics*, *36*(5), 3–22.

Cao, J., & Zhou, Y. L. (2018). Research progress on the economic impacts of artificial intelligence. *Economic Dynamics*, (1), 103–115.

Frey, C. B., & Osborne, M. A. (2017). The future of employment: How susceptible are jobs to computerisation? *Technological Forecasting and Social Change*, *114*, 254–280.

Goos, M., Manning, A., & Salomons, A. (2014). Explaining job polarization: Routine-biased technological change and offshoring. *American Economic Review*, *104*(8), 2509–2526.

Guo, K. M. (2019). Artificial intelligence development, industrial structure transformation and upgrading, and changes in labor income share. *Management World*, *35*(7), 60–77.

Jin, C. F., Wu, Y., Chi, R. Y., et al. (2020). Does artificial intelligence increase enterprises' labor income share? *Scientific Research*, *38*(1), 54–62.

Lucas, R. E. (1988). On the mechanics of economic development. *Journal of Monetary Economics*, *22*(1), 3–42.

Romer, P. M. (1986). Increasing returns and long-run growth. *Journal of Political Economy*, *94*(5), 1002–1037.

Solow, R. M. (1956). A contribution to the theory of economic growth. *Quarterly Journal of Economics*, *70*(1), 65–94.

Wang, J., & Chang, H. (2021). Research progress on the impact of artificial intelligence on the labor market. *Economic Dynamics*, (8), 146–160.

Zhu, Q., & Liu, H. Y. (2020). Research on the income distribution effect of artificial intelligence technological change: Frontier progress and review. *Chinese Journal of Population Science*, (2), 111–125.