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Article

The Moderating Effect and Equity Enhancement Path of Income Distribution Policy in the Context of the Digital Economy

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Abstract: The rapid and pervasive development of the digital economy has fundamentally reshaped the traditional patterns of global income distribution. While technological progress and digital transformation have significantly improved overall production efficiency and created novel economic opportunities, they have simultaneously exacerbated distributional imbalances. These disparities primarily stem from the emergence of data monopolies, profound skill differentiation among the workforce, and the disproportionate wealth concentration driven by platform effects. This paper comprehensively analyzes the multidimensional mechanisms through which the digital economy influences income distribution dynamics. Specifically, it discusses the critical moderating effects of data rights confirmation and targeted skill training programs on primary distribution, emphasizing the need to empower workers in the digital age. Furthermore, it evaluates the role of digital taxation frameworks and robust social security mechanisms in optimizing secondary distribution. Additionally, the study proposes a strategic path to improve societal equity, which includes the systematic coordination of resource allocations and the comprehensive optimization of the overarching governance system. The research indicates that proactive institutional innovation is essential to balance data revenue sharing, effectively bridge the widening digital divide, and ultimately achieve a sustainable equilibrium between economic efficiency and social equity. By addressing these structural challenges, this study provides vital policy guidance for fostering inclusive development and ensuring that the dividends of the digital economy are shared more equitably across all segments of society.

Keywords: digital economy; income distribution; public policy; social equity; digital divide

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1. Introduction

1.1. Research Background

With the deep integration of globalization and informatization, the digital economy has emerged as a significant driver of economic development [1]. Supported by rapid advancements in technologies such as big data, artificial intelligence, and cloud computing, the digital economy is transforming traditional production methods and industrial structures while also reshaping the model of social income distribution.

In this context, income disparity has become increasingly evident. The uneven distribution of technological benefits and the rapid growth of the platform economy have allowed some individuals to gain advantages from the digital economy, while others face risks of marginalization. The unclear ownership of data, as a new factor of production, and the imperfections in income distribution mechanisms exacerbate issues related to monopolistic practices and wealth imbalances [2, 3]. Comprehensive studies on the

income distribution within the digital economy and the regulatory impacts of relevant policies are of significant practical importance.

1.2. Research Significance

Studying the multidimensional influence mechanism of the digital economy on income distribution contributes to a comprehensive understanding of the changes in distribution patterns brought about by technological progress and industrial transformation. This research aims to explore methods for optimizing market mechanisms and refining tools for government policy to enhance social equity by analyzing the regulatory effects of income distribution policies [4, 5]. Furthermore, it proposes innovative institutional approaches to improve income distribution equity, address emerging challenges in the development of the digital economy, and promote sustainable societal development.

Beyond providing a theoretical foundation for strengthening income distribution policies in the digital era, this study also aims to help various sectors of society recognize the dual impact of the digital economy on efficiency and fairness [6, 7]. This understanding is expected to further support the inclusive and healthy growth of the digital economy.

2. Multi-Dimensional Influence Mechanism of Digital Economy on Income Distribution

2.1. Data and Labor Market

2.1.1. Production Attribute of Data Elements: The Transformation from Resources to Assets

In the traditional economy, data primarily existed as a supplementary "resource" within the production process. The advancement of the digital economy has facilitated the transformation of data into an independent "asset": on one hand, the non-competitive nature of data allows it to be utilized repeatedly in production, generating value-added products such as user profiles and market forecasts through algorithms, which become key sources of enterprise competitiveness. On the other hand, the replicability of data reduces costs and leads to an increasing trend in its marginal income [8].

This transformation has a direct impact on income distribution: enterprises possessing large volumes of data gain excess profits through data monopolies, while ordinary users, as the initial contributors of data, are unable to share in the resulting income due to the absence of data property rights and bargaining power, thereby widening income disparities. The distribution of income derived from data assets becomes concentrated among a small group of technology and capital holders, further exacerbating imbalances in distribution [9].

2.1.2. Labor Market Segmentation: Skill-Biased Technology Change

The widespread adoption of digital technology represents a shift favoring skilled workers, as digital tools such as artificial intelligence and big data analysis complement high-skill workers while substituting low-skill workers. This dynamic creates a division in the workforce: individuals with advanced digital skills can enhance production efficiency and achieve higher wages through technological advantages. For instance, in the skill premium formula $W_s = W_0 + \theta \cdot S$, an increase in digital skill level S results in a greater wage increment determined by the skill premium coefficient θ. Conversely, low-skill workers, including those in traditional manufacturing and basic service roles, face the risk of automation replacing their jobs. Even when employed, their wage growth significantly lags behind that of high-skilled workers.

Jobs within the gig economy, such as online customer service and delivery roles, have emerged as a result of the digital economy. However, these positions are predominantly low-skilled and often lack social security and stable income, thereby exacerbating income inequality within the labor market. In the era of the digital economy, disparities in digital

skills have become a key factor contributing to the unequal distribution of income, commonly referred to as the "digital divide."

2.2. The Distribution Effect of Platform Economy

2.2.1. Income Volatility in the Gig Economy

The gig economy operates through platforms that match supply and demand, but the income structure is inherently subject to fluctuations. Workers' earnings are influenced by the volume of orders (R), which vary depending on factors such as time periods, geographic locations, and platform algorithms. During low-demand periods, workers may face a lack of orders, while high-demand periods can lead to a surge in activity [10]. Additionally, the dynamic adjustment of service types and subsidy policies, combined with variable costs (C) such as transportation and equipment, often contribute to the platform extraction rate (r), which subsequently impacts actual revenue ($\pi = (1 - r) \cdot \mathcal{R} - C$).

A significant concern is that gig workers are predominantly classified as independent contractors, which means they lack fixed salaries, social security, and other essential protections [11]. Income instability introduces risks, further widening the disparity in income distribution compared to individuals with stable employment.

2.2.2. Data Monopoly and Profit Concentration

In the platform economy, data serves as a core competitive resource. Leading platforms act as barriers by accumulating extensive data, such as user behavior and consumption preferences, over extended periods. This creates significant challenges for new entrants to access data of comparable quality or to offer alternative services. Such monopolistic control over data contributes to increased market dominance. Leveraging these data advantages, dominant platforms can optimize services and pricing strategies with precision, thereby capturing greater market share and generating substantial profits. In the distribution of these profits, platform companies maintain a dominant position, while users, who contribute data, and small- and medium-sized businesses receive only a minimal portion. This dynamic results in a disproportionate allocation of earnings, with a limited number of platform enterprises benefiting significantly, further intensifying disparities in profit distribution [12].

3. The Analysis of the Adjustment Effect of Income Distribution Policy

3.1. Primary Distribution: The Optimization Path of Market Mechanism

3.1.1. Data Element Right Confirmation and Income Distribution

For ensuring equity in the primary distribution of data elements, the focus lies in defining property rights and establishing clear rules for revenue division. Currently, most data are centralized under platform enterprises, leading to a disproportionate share of revenue favoring these platforms. By confirming the rights associated with data elements, the ownership of original data by users and the usufruct of processed data by platforms can be delineated [13]. This approach creates a multi-rights system involving users, platforms, and society.

Building on this foundation, revenue allocation can be structured based on the contribution of data [14]. Users may receive basic revenue for owning the original data (V_L), while platforms generate value-added revenue through data processing and technological inputs (V_D). The allocation weight (λ) can be determined through market negotiations or established industry standards, such as the formula ($S = \lambda \cdot V_D + (1 - \lambda) \cdot V_L$). This mechanism not only enhances the efficiency of data utilization by platforms but also allows ordinary users to share in the revenue generated from data assets, thereby reducing disparities in the primary distribution.

3.1.2. Skills Training and Digital Literacy Enhancement

In response to the differentiation in market demand caused by skill-biased technological advancements within the digital economy, policies targeting primary distribution focus on enhancing the digital literacy of workers with lower skill levels. This

aims to improve their competitiveness through structured skills training programs. The essence of such training lies in converting public input ($H_{t+1} = H_t + \delta \cdot E$) into the human capital stock (δ) of workers. The efficiency of this conversion is represented by δ. By offering targeted courses, such as basic programming and intelligent equipment operation, the ability gap between workers with varying skill levels can be narrowed more effectively.

Fundamental digital skills enable workers with lower qualifications to complement digital technologies more effectively, reducing their risk of replacement and aligning their wages with their improved skill levels. This gradual reduction in the skill premium gap contributes to adjustments in primary distribution, enhancing overall market capacity [15]. Such measures not only boost productivity but also mitigate income disparities stemming from skill differences, thereby achieving a balance between efficiency and equity.

3.2. Secondary Distribution: System Innovation

3.2.1. Design of Digital Tax Collection Mechanism

The trans-regional and data-driven nature of the digital economy presents challenges for the tax system in effectively encompassing the profits of platform enterprises, resulting in tax base erosion and imbalanced distribution. Innovations in digital tax collection mechanisms should prioritize the principle of "location of value creation," utilizing the platform's digital service income (such as advertising and data transactions) as the tax base. Formula $\mathrm{T} = \tau \cdot \mathrm{R_D}$ can be applied to achieve precise tax collection, where τ represents the differentiated tax rate, and $\mathrm{R_D}$ denotes digital service income.

First, it is recommended to adopt a progressive tax rate structure, where larger platforms are subject to higher τ, to mitigate the excessive profits derived from data monopolies. Simultaneously, lower tax rates or exemptions should be implemented for small and medium-sized digital enterprises to sustain market dynamism [5]. Second, the establishment of a coordinated mechanism for digital taxation across regions is proposed to prevent double taxation and ensure that platform enterprises bear a fair tax burden on a global scale. Third, revenues generated from digital taxes can be allocated to public services, such as digital infrastructure development and skill enhancement initiatives. This approach not only addresses income disparities but also redirects a portion of monopoly profits toward societal welfare through secondary distribution.

3.2.2. Transfer Payment and Social Security

In the digital economy, individuals engaged in gig work and those with limited skills often experience unstable income and insufficient social security. Strengthening mechanisms for secondary distribution through transfer payments and innovations in the social security system is essential [16].

For transfer payments, a "directional precision" approach can be adopted, channeling financial resources to regions and sectors significantly affected by the digital divide. This is represented in the formula $P_{t+1} = P_t - \gamma \cdot T$ (where P denotes the poverty rate, T represents the scale of transfer payments, and γ indicates policy sensitivity). Increasing investment in T and enhancing γ can contribute to reducing poverty rates among affected populations [17]. Simplifying subsidy application procedures and accurately identifying eligible recipients are effective strategies.

In terms of social security, it is important to move beyond the traditional model tied to formal employment relationships. This includes extending industrial injury and medical insurance coverage to gig workers and establishing appropriate financing mechanisms. Additionally, providing unemployment assistance and re-employment training subsidies to workers displaced by technological advancements can be beneficial. By constructing a comprehensive social security framework, income fluctuations caused by the digital economy can be mitigated, enabling broader access to developmental benefits and narrowing wealth disparities.

4. The Institutional Innovation Path of Improving Equity

4.1. Distribution Synergy Mechanism

4.1.1. Fair Distribution of Data Element Income

The equitable distribution of data element income relies on the coordination of primary, secondary, and tertiary distributions. In the primary distribution, the market plays a dominant role, with pricing determined by data contribution. Users participate in market transactions with original data ownership to earn basic income ($\pi_1 = \alpha \cdot D$, where α is the unit data market price, and D represents the data volume). Platforms generate value-added income through technical processing and operations, with the ratio between the two parties determined through market negotiation to prevent unilateral monopolies by platforms. In the secondary distribution, the government regulates through taxation, imposing a digital tax on the value-added benefits of platform data in proportion ($\pi_2 = \pi_1 - T$, where T is the tax payable). The tax revenue is allocated to the construction of public data infrastructure, indirectly benefiting data contributors.

Through the involvement of social forces, tertiary distribution encourages platform enterprises to allocate a portion of their data income to digital inclusion initiatives via public welfare foundations ($\pi_3 = \pi_2 - \beta \cdot \pi_2$, where β represents the donation ratio). These initiatives may include supporting data skills training or promoting the safeguarding of data-related interests. The interconnected nature of tertiary distribution ensures market efficiency while addressing imbalances in primary distribution through government and social mechanisms, thereby fostering broader sharing of data income.

4.1.2. Bridging the Digital Divide

The core of the digital divide lies in the disparity between groups in accessing digital infrastructure and acquiring digital skills. Solutions can be approached from two perspectives: "investment" and "empowerment." At the infrastructure level, increasing investment (I) in digital infrastructure in rural and remote areas can enhance network coverage and speed. This relationship can be expressed through formula $C = 1 - e^{-\rho \cdot I}$: as investment (I) increases, the marginal effect coefficient (ρ) rises, bringing coverage (C) closer to 1, thereby gradually closing the "access gap."

In terms of skills empowerment, it is recommended to provide free digital skills training for the elderly and individuals with lower levels of education, with courses focusing on practical topics such as smartphone usage and accessing online services. Efforts should also be made to integrate public services across both online and offline platforms, including government services and medical education. Additionally, establishing a digital literacy evaluation system is essential to connect training outcomes with employment assistance. This approach enables individuals to not only utilize digital tools but also enhance their income through them, thereby addressing income disparities rooted in differences in technical proficiency.

4.2. Optimization of Governance System

4.2.1. Legal Protection of Data Property Rights

The ambiguity surrounding data property rights represents a significant challenge to achieving balanced distribution, necessitating legal clarification of these boundaries. A structured framework of "hierarchical confirmation of rights" is essential: individuals retain ownership of original data and possess the authority to determine the scope of its collection and usage, including providing explicit informed consent; platform enterprises are entitled to utilize and derive benefits from processed data, contingent upon providing reasonable compensation to individuals; public data is designated as state-owned and accessible to the public [18].

The impact of legal clarity can be measured using the property right clarity index ($I_P = \Sigma \frac{n}{i=1} W_i \cdot (1 - C_i)$): greater legal precision reduces costs associated with disagreements (C_i) in data-related activities and enhances the clarity of property rights (I_P). Furthermore, it is crucial to establish mechanisms that ensure accountability for improper handling of data, including administrative measures and civil remedies for

unauthorized actions. This guarantees that individuals can secure benefits through a robust legal framework.

4.2.2. Algorithm Transparency Supervision

An algorithmic black box often results in unequal outcomes, such as imbalances in gig-economy job allocation and variations in pricing strategies. To address this, enhancing transparency through supervision is essential [14]. Specific measures include requiring platforms to disclose the core logic of their algorithms, such as order allocation rules and methods for calculating commission rates, as well as clarifying key parameters that influence earnings, such as user ratings and the weighting of service duration. Establishing a third-party algorithm review mechanism can help regularly assess whether algorithms exhibit biases against specific groups, with tools like the fairness index $F - 1 - \frac{|\ D_{group1} - D_{group2}\ |}{D_{group1} + D_{group2}}$ used to monitor and ensure that deviations remain within acceptable limits. Additionally, creating feedback channels allows workers or users to challenge algorithmic outcomes, with platforms obligated to provide explanations and make adjustments within a defined timeframe. Transparency supervision can mitigate deviations caused by algorithmic inefficiencies and foster fairer competition among market participants.

5. Conclusions and Policy Suggestions

5.1. Core Conclusion

While improving production efficiency, the digital economy exerts a complex and multidimensional influence on income distribution. On the one hand, the transformation of data factors from "resources" into "assets," together with skill-biased technological change, has widened the income gap between high-skilled and low-skilled workers. On the other hand, the gig-based model of the platform economy has increased income volatility. At the same time, data monopolies channel profits toward a small number of large enterprises, further intensifying distributional imbalance.

The regulatory effect of existing income distribution policies shows clear differentiation. In primary distribution, optimizing market mechanisms can help narrow the gap related to data factor rights confirmation and skills training. However, unresolved issues such as unclear property rights and low conversion efficiency still require attention. In secondary distribution, the implementation of digital taxation and targeted transfer payments can help regulate monopoly profits and protect lower-income groups. At the same time, difficulties in cross-regional tax collection and assistance delivery must be addressed.

Institutional innovation is central to improving equity. Strengthening the legal protection of data property rights and enhancing oversight of algorithmic transparency can mitigate unequal distribution at the governance level, while cooperative mechanisms in tertiary distribution can promote broader sharing of data-related income. Overall, the distributive effects of the digital economy are not determined by technology itself; with well-designed policies, a dynamic balance between efficiency and equity can be achieved.

5.2. Policy Recommendations

In view of the persistent problems of income distribution in the digital economy, coordinated efforts are needed in three areas: market mechanisms, public regulation, and governance systems.

First, market rules for data factors should be improved. It is necessary to accelerate the establishment of a classified data property rights system, clarify the distribution of returns among users, platforms, and society, and develop a data trading market in which prices are formed through market mechanisms. Public data sharing should be promoted to lower the threshold for data use by small and medium-sized entities and reduce monopolistic effects. Second, protection for disadvantaged groups should be strengthened. The coverage of digital skills training should be expanded, with practical courses targeted at low-skilled workers and rural populations, thereby improving the

efficiency of human capital transformation. Gig workers should be incorporated into the social security system, and a contribution mechanism jointly supported by platforms, individuals, and the government should be established to reduce the risks associated with income volatility. Third, adjustment instruments and governance capacity should be optimized. A differentiated digital tax can be introduced, with progressive tax rates applied to large platforms, and the resulting revenue directed toward digital infrastructure and skills training. In addition, a fairness review system should be established, platforms should disclose their core allocation rules, third-party agencies should assess the risk of algorithmic bias, and distortions in allocation caused by excessive algorithmic control should be addressed at the source.

The implementation of these measures will help promote the development of the digital economy, enhance the equitable sharing of its benefits across society, and support inclusive growth.

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