ISSN: 2710-0723

Research on the Impact of Market-Based Allocation of Data Elements on Urban-Rural Integration

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Abstract

Focusing on the core relationship between the market-based allocation of data elements and urban-rural integration, this study explores both theoretical and empirical dimensions. Theoretically, data elements establish an enabling mechanism of "factor mobility-industrial synergy-income equilibrium" by breaking down urban-rural information barriers, optimizing resource allocation efficiency, and fostering new digital economy models: market-based data reduces the cost of factor circulation between urban and rural areas, driving the downward flow of production factors such as capital and technology to rural regions;Digital technology deeply integrates with agriculture and rural services, restructuring urban-rural industrial value chains; data-enabled new employment forms and income channels help narrow the urban-rural income gap. Empirically, using interprovincial panel data with a two-way fixed effects model and mediation analysis, we find that market-based allocation of data elements significantly and positively impacts urban-rural integration through the mediating pathways of industrial upgrading and improved factor allocation efficiency.Heterogeneity analysis indicates that the enabling effect is more pronounced in regions with well-developed digital infrastructure and higher marketization levels. This research provides theoretical support and empirical references for leveraging data factor marketization reforms to address the urban-rural dual structure and promote high-quality integrated urban-rural development.

Keywords

Data Elements; Market-Based Allocation; Urban-Rural Integration.

1. Introduction

1.1. Significance of the Study

This study holds significant theoretical value for enriching the research framework on factor marketization and integrated urban-rural development, offering multidimensional theoretical innovation and supplementation to urban-rural relations research in the digital economy era. First, it breaks through the traditional analytical framework focused on conventional production factors like land, labor, and capital, systematically incorporating data elements-the core production factor of the digital economy era-into the analysis of integrated urban-rural development, achieving an innovative expansion of research perspectives.Traditional urban-rural relationship theories primarily revolve around the urban-rural flow and allocation efficiency of conventional factors, struggling to fully explain the new characteristics and patterns of urban-rural integration under the backdrop of widespread digital technology adoption. This study, however, centers on the interactive relationship between data elements and urban-rural integration. It not only expands the conceptual boundaries of production factors within urban-rural relationship theory-extending the scope of production factor

ISSN: 2710-0723

research from material and human factors to non-material and technological factors-but also constructs an analytical framework linking digital factors to urban-rural integration. This provides a novel theoretical perspective for explaining the dynamic evolution logic and driving mechanisms of urban-rural integration in the digital era, filling explanatory gaps in traditional theories within the digital economy context.Second, by systematically constructing a three-stage enabling mechanism-"factor flow-industrial synergy-income equilibrium"-it clearly deconstructs the intrinsic logical chain through which the market-based allocation of data elements influences urban-rural integration. This effectively addresses the existing research gap in the lack of in-depth, systematic exploration of the theoretical mechanisms by which digital elements empower urban-rural integration.Current research predominantly remains at the level of qualitatively describing the positive effects of data elements on urban-rural integration or conducting fragmented analyses of the impact effects at specific stages. It has failed to form a complete theoretical logical loop and lacks a step-by-step mechanism analysis of key issues such as how data elements break down urban-rural barriers through market-based allocation, how they transmit to the industrial level, and ultimately how they influence urban-rural income distribution.This study clarifies the core functions of data factor marketization in reducing information asymmetry and optimizing resource allocation efficiency. It further bridges the intermediate link of industrial synergy development, ultimately anchoring in the goal-oriented approach of urban-rural income equilibrium. This forms a complete theoretical chain of "factors – industries – income," making the intrinsic mechanism of data factors empowering urban-rural integration clearer and more tangible. It provides a referenceable mechanism analysis paradigm for subsequent related research.Finally, this study empirically tests the mediating effects of industrial structure upgrading and factor allocation efficiency. This not only validates the theoretical mechanism's rationality but also enriches theoretical research on the transmission pathways through which factor marketization influences regional coordinated development. Existing studies on factor marketization and regional coordinated development often focus on analyzing the direct impacts of single or composite factor marketization, with insufficient exploration of intermediate transmission pathways-particularly lacking targeted research on digital factor transmission pathways.This study clarifies that industrial structure upgrading serves as the core vehicle through which data factor marketization empowers urban-rural integration-data factors drive agricultural digital transformation and promote coordinated industrial upgrading by facilitating urban-rural industrial division of labor and collaboration, thereby advancing urban-rural integration. Simultaneously, it confirms the optimizing role of factor allocation efficiency-data marketization reduces the cost of factor circulation between urban and rural areas, promotes the efficient flow of factors such as capital, technology, and talent to rural areas, enhances overall factor allocation efficiency, and provides fundamental support for urban-rural integration.These findings expand the theoretical understanding of factor marketization transmission pathways, offering new theoretical insights into the driving mechanisms of coordinated regional development in the digital economy era while opening fresh perspectives for subsequent research in related fields.

At the practical level, this study offers targeted and actionable policy recommendations for advancing high-quality urban-rural integration through data marketization reforms. It holds significant practical value for addressing the challenges of unbalanced and inadequate urban-rural development and accelerating the modernization of agriculture and rural areas.On one hand, against the backdrop of persistent urban-rural dualism in China, longstanding information barriers and impediments to factor mobility between urban and rural areas severely constrain resource allocation efficiency and regional coordination. Leveraging its characteristics of cross-temporal/spatial accessibility, low-cost transmission, and high liquidity, the marketization of data elements has emerged as a new driver for dismantling urban-rural

ISSN: 2710-0723

development barriers and reshaping resource allocation patterns. The core findings of this study provide scientific grounds for government departments to formulate precise and effective data element marketization policies:Regarding digital infrastructure development, it can help extend 5G networks, IoT, and big data centers to counties and rural areas, prioritizing solutions for rural challenges like uneven network coverage, slow speeds, and high costs. Establishing unified urban-rural digital platforms enables real-time sharing of agricultural production, market demand, and public service information, fundamentally reducing information asymmetry between urban and rural areas.Regarding data circulation mechanisms, it can provide guidance for standardizing the entire process management of data collection, storage, trading, and security. This involves clarifying data property rights, transaction rules, and revenue distribution mechanisms to encourage urban and rural entities to participate in data market transactions. It promotes the flow of high-quality urban data resources to rural areas while activating the value of rural-specific data elements, forming a favorable two-way circulation pattern for urban-rural data elements. This, in turn, drives the downward flow and aggregation of traditional production factors like capital, technology, and talent into rural areas, injecting sustained momentum into rural revitalization.For regions with advanced digital infrastructure and high marketization, such as eastern coastal areas, efforts should focus on deeply integrating data marketization with high-end agriculture and rural digital economy industrial parks to establish exemplary models of integrated urban-rural development. For central and western regions with relatively weaker digital infrastructure, priority should be given to increasing investment in digital infrastructure and improving foundational systems for data markets to gradually unlock the enabling effects of data elements.For rural areas with unique resource endowments, pilot programs can be launched to empower distinctive sectors like specialty agricultural products and rural cultural tourism, fostering a digital development model characterized by "one county, one industry; one village, one product."Differentiated policy design can effectively avoid the ineffectiveness of one-size-fits-all approaches, fully leverage the comparative advantages of each region, promote synchronous improvement in urban-rural integration across different areas, thereby narrowing regional development gaps and fostering coordinated regional development nationwide. This provides solid practical support for achieving high-quality integrated urban-rural development, comprehensively advancing rural revitalization, and accelerating the building of a modern socialist powerhouse.

1.2. Theoretical Implications

This study not only enriches the theoretical framework of factor marketization and urban-rural integration but also offers multidimensional theoretical innovation and extended value for research on coordinated regional development in the digital economy era, providing significant theoretical insights. First, by incorporating the data factor system into the urban-rural integration analytical framework, it expands the theoretical system of urban-rural integration, breaking the long-standing analytical inertia of traditional research confined to material and human factors such as land, labor, and capital.Traditional urban-rural relationship theories, largely developed under industrialization and industrial economy contexts, struggle to explain the driving mechanisms of urban-rural integration that align with the new characteristics of the digital economy era-such as the spatiotemporal nature of urban-rural interactions, the low-cost nature of factor flows, and the digital transformation of development models.This study explicitly defines data elements as a new core driver of urban-rural integration. It systematically clarifies the unique attributes of data elements-non-rivalry, non-excludability, and cross-spatial mobility-and delves into the intrinsic logic of how data elements overcome physical spatial constraints between urban and rural areas, reduce information asymmetry costs, and reshape the allocation patterns of urban-rural factors.This research not only expands the scope and definition of production factors within urban-rural relations theory-extending the study of production factors from traditional physical elements to the digital realm-but also

ISSN: 2710-0723

constructs a novel theoretical framework: "Digital Factors – Urban-Rural Interaction – Integrated Development." This framework fills a theoretical gap in explaining the digital transformation of urban-rural integration, providing a new theoretical paradigm for future research.

This study innovates the research perspective on how factor marketization influences regional development, enriching theoretical research on factor allocation efficiency. Existing studies on factor marketization predominantly focus on the direct impacts of traditional factor marketization on economic growth and regional coordination, while lacking in-depth exploration of the market allocation of new factors represented by data. Particularly absent is systematic analysis of its connection to urban-rural integration.By adopting the market-based allocation of data elements as the core explanatory variable, this study reveals the unique role of data elements in driving urban-rural integration. Unlike traditional factors, data elements can transmit value without physical spatial migration, enabling efficient information and resource matching across urban-rural geographical barriers. This characteristic positions the market-based allocation of data elements as a distinctive force for dismantling the urban-rural dual structure.Furthermore, by examining how data factor marketization optimizes urban-rural factor combinations and enhances overall factor allocation efficiency, this study expands the application scenarios of factor marketization theory. It extends research on factor allocation efficiency from the single-region level to the urban-rural interaction level, enriching the theoretical dimensions of how factor marketization influences coordinated regional development. This provides a new theoretical perspective for understanding the operational mechanisms of new factors in regional development.

1.3. Relevance

This study maintains strong relevance to academic research trends, national policy orientations, and practical development needs, reflecting the organic unity of theoretical exploration and realistic response. In terms of academic relevance, it closely aligns with the frontier direction of factor marketization and urban-rural integration research. While existing studies have preliminarily examined the impact of digital elements on regional development, most focus on single-factor analysis or macro-level descriptions, lacking in-depth integration of data element marketization and urban-rural integration mechanisms. This study addresses the academic call to explore the interaction between new production factors and urban-rural relations, constructing a systematic analytical framework to connect fragmented research findings. This contributes to advancing cross-disciplinary research in the digital economy and urban-rural development.

In terms of policy relevance, the research directly aligns with the national strategy of data element marketization reform and high-quality urban-rural integration. As the "reform and tackling year" for data work deepens, promoting the market-oriented allocation of data elements to empower urban-rural integration has become a key policy focus. The study concentrates on key policy directions including data infrastructure development, data circulation mechanism enhancement, and industrial digital transformation. This provides academic support for implementing initiatives like the "Data Element ×" action and public data development and utilization, facilitating the translation of policy objectives into tangible development outcomes.

In terms of practical relevance, it accurately responds to the realistic demands of breaking the urban-rural dual structure and narrowing development gaps. In practice, problems such as unsmooth urban-rural factor flow and unbalanced industrial development still exist, while data elements have shown unique advantages in optimizing resource allocation and promoting factor flow. This study explores leveraging the multiplier effect of data elements through marketization, directly addressing practical pain points in integrated urban-rural development.

ISSN: 2710-0723

It provides actionable solutions for promoting two-way factor flows, upgrading rural industries, and narrowing urban-rural income gaps, thereby enhancing the research's practical guidance value.

2. Literature Review

Academic research on urban-rural integration, factor market allocation, and the economic impact of data elements has been extensive, yet significant gaps remain. Studies on urban-rural integration predominantly focus on the flow and allocation of traditional factors like land and labor, establishing mature analytical frameworks [1]. However, they exhibit insufficient attention to new production factors in the digital era, making it difficult to explain emerging characteristics of urban-rural integration.Regarding the relationship between factor market allocation and urban-rural integration, existing research confirms that traditional factor marketization positively impacts urban-rural integration with regional heterogeneity. However, it overlooks the role of data factor market allocation, and analyses of transmission mechanisms remain fragmented.

Research on the economic effects of data elements, while focusing on areas like economic growth and industrial upgrading and confirming their positive contribution to high-quality development [2], mostly lacks in-depth analysis of the market-based allocation mechanisms for data elements. The relationship between data elements and urban-rural integration is often described qualitatively, lacking systematic theoretical mechanism construction and robust empirical testing. Research on transmission pathways and heterogeneity characteristics is particularly insufficient.

Accordingly, this paper's marginal contributions are: First, incorporating the market-based allocation of data elements into the urban-rural integration analytical framework, thereby overcoming limitations of traditional research. Second, constructing a three-stage enabling mechanism-"factor mobility-industrial synergy-income equilibrium"-to fill gaps in mechanism analysis. Third, conducting empirical tests based on interprovincial panel data to clarify its impact effects, transmission pathways, and heterogeneity, providing references for policy formulation.

3. Theoretical Analysis and Hypotheses

The market-based allocation of data elements empowers urban-rural integration through the "factormobility-industrial synergy-income equilibrium" mechanism. Its core logic is as follows: market-based data allocation reduces urban-rural information asymmetry and factor circulation costs, facilitating the downward flow of capital, technology, and other factors to rural areas and resolving bottlenecks in factor mobility; factor agglomeration further drives agricultural digital transformation and urban-rural industrial division of labor and collaboration, achieving industrial synergy and upgrading; industrial upgrading generates new employment forms and income channels, helping to narrow the urban-rural income gap.Based on this, we propose Hypothesis H1: The market-based allocation of data elements has a significant positive impact on urban-rural integration. Concurrently, industrial structure upgrading and factor allocation efficiency may serve as mediating factors (H2, H3); digital infrastructure and marketization levels will amplify this enabling effect (H4).

3.1. Theoretical Foundations and Historical Evolution

This study's theoretical foundation stems from the convergence of urban-rural relations theory, factor allocation theory, and digital economy theory [3]. Regarding urban-rural relations, Lewis's dual economy theory and the Todaro model established the analytical basis for traditional factor flows between urban and rural areas. Meanwhile, new economic geography

ISSN: 2710-0723

theory emphasizes the driving role of factor agglomeration and spatial linkages in urban-rural integration, providing theoretical reference for the cross-spatial empowerment of data elements.Factor allocation theory indicates that marketization is the core pathway to enhancing factor allocation efficiency, supporting the analysis of the operational logic behind the market-based allocation of data factors ([4]). Digital economy theory reveals the unique attributes of data factors-non-rivalry and high liquidity-enriching the theoretical framework of factor allocation.

Historically, urban-rural integration has evolved from "traditional factor-driven" to "digital factor-enabled" development. In the traditional phase, integration primarily relied on unidirectional flows of factors like land and labor, significantly constrained by geographical barriers and information silos.With the widespread adoption of digital technologies, data has gradually emerged as a new core production factor. The market-based allocation of data has broken through the temporal and spatial constraints of traditional factor flows[5] . Particularly against the backdrop of advancing market-oriented reforms for data, a two-way circulation pattern of urban-rural data has gradually taken shape. This has propelled the evolution of urban-rural integration from "resource complementarity" to "value co-creation," providing a practical foundation for data to empower urban-rural integration.

3.2. Mechanisms of Action and Research Hypotheses

The market-based allocation of data elements empowers urban-rural integration through three core pathways: First, the factor mobility pathway, where data marketization reduces urban-rural information asymmetry and transaction costs, removes barriers to the flow of capital, technology, and other factors into rural areas, and optimizes the allocation of factors across the entire region. Second, the industrial synergy pathway, where data deeply integrates with agriculture and rural services, driving agricultural digital transformation and urban-rural industrial division of labor and collaboration, thereby achieving industrial structure upgrading.Third, the income equalization pathway: industrial upgrading generates new forms of employment like rural digital jobs, broadening farmers' income channels and narrowing the urban-rural income gap. Based on this, we propose the following hypotheses: H1: The market-based allocation of data elements has a significant positive impact on urban-rural integration; H2: Industrial structure upgrading mediates this relationship; H3: Factor allocation efficiency mediates this relationship; H4: The sophistication of digital infrastructure and regional marketization positively moderate the aforementioned enabling effects.

4. Research Design

This study adopts a "theoretical mechanism-path analysis-case validation" framework, focusing on the core issue of how market-based allocation of data elements empowers urban-rural integration. Theoretically, it systematically clarifies the connotations of core concepts and deepens the intrinsic logic of the three-stage mechanism: "factor mobility-industrial synergy-income equilibrium." Pathologically, it identifies three differentiated empowerment pathways-digital infrastructure-leading, solid industrial foundation-driven, and distinctive resource – driven - tailored to regional development disparities. Case selection balances regional disparities across eastern, central, and western China, choosing three representative areas: Deqing, Zhejiang (advanced digital infrastructure), Meishan, Sichuan (prominent agricultural industry), and Qiannan, Guizhou (specialty cultural tourism empowerment). By examining their practices in market-based allocation of data elements, this study analyzes implementation outcomes and critical enabling conditions under different pathways, providing empirical support for the theoretical mechanisms.

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5. Theoretical Mechanisms

The core mechanism through which market-based allocation of data elements empowers urban-rural integration can be summarized as a "three-stage progression" logic: First, the element flow activation mechanism. Data marketization builds unified urban-rural information platforms to reduce information asymmetry and transaction costs, breaking geographical constraints and promoting efficient two-way flow of capital, technology, and other elements. This addresses the bottlenecks of rural element outflow and urban element underflow. Second, the industrial synergy upgrade mechanism.Deep integration of data with agriculture and rural services drives intelligent agricultural production and digitalized distribution, establishing a nested value chain model of "urban R&D + rural production + comprehensive marketing" to achieve industrial synergy between urban and rural areas. Third, the income equilibrium guarantee mechanism. Industrial upgrading fosters new business models like rural e-commerce, broadening farmers' income channels. Simultaneously, it promotes public service data sharing, indirectly narrowing the urban-rural development gap and solidifying the foundation for integrated development.

5.1. Direct Impact of Market-Based Allocation of Data Factors on Urban-Rural Integration

The market-based allocation of data elements exerts a significant direct enabling effect on urban-rural integration, primarily due to its unique capacity to dismantle barriers to urban-rural development. By establishing unified urban-rural data sharing platforms, this approach substantially reduces information asymmetry and transaction costs for factor flows between urban and rural areas, overcoming geographical constraints on their interaction. On one hand, it helps rural areas precisely align with urban market demands, technological resources, and capital supply, alleviating the outflow of high-quality rural factors. On the other hand, it provides an efficient channel for the downward flow of urban factors, extending urban digital technologies and management expertise to rural areas. Simultaneously, the digital public service models spurred by market-based data allocation accelerate the sharing of high-quality public resources like education and healthcare across urban and rural areas, directly narrowing the gap in public services and solidifying the foundation for urban-rural integration.

5.2. Indirect Impacts of Market-Based Allocation of Data Factors on Urban-Rural Integration

The market-based allocation of data as an economic factor indirectly promotes urban-rural integration through intermediate pathways such as industrial synergy and employment expansion. At the industrial level, the deep integration of data with agriculture and rural services drives the intelligent transformation of agricultural production and the digital upgrade of agricultural product distribution. This establishes an industrial synergy model featuring "urban R&D and design + rural production and processing + comprehensive digital marketing," fostering deep embedding within urban-rural industrial value chains and strengthening economic linkages between urban and rural areas.At the employment and income level, industrial digital transformation spurs new business models like rural e-commerce, digital cultural tourism, and remote services, creating numerous flexible job opportunities and broadening income channels for farmers. Simultaneously, data empowerment enhances rural human capital, facilitating the shift of rural labor toward high-value-added sectors. By narrowing income disparities and fostering urban-rural economic linkage, this indirectly elevates the level of urban-rural integration.

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6. Conclusion and Recommendations

Research findings indicate that the market-based allocation of data elements serves as a core new driver for empowering urban-rural integration, operating through a dual logic of "direct barrier removal + indirect pathway transmission." Direct impacts manifest in resolving urban-rural information asymmetry, facilitating two-way factor flows, and promoting public service sharing. Indirect effects are realized through industrial synergy upgrades and employment-income growth, with this enabling effect varying based on digital infrastructure levels and regional development endowments.Case studies like Deqing, Zhejiang, validate the effectiveness of market-based data allocation tailored to regional characteristics, offering replicable models for integrated urban-rural development.

Policy recommendations should focus on three key directions: First, strengthen the foundation of digital infrastructure by extending 5G and big data platforms to rural areas, establishing a unified urban-rural data sharing system, breaking down data circulation barriers, and refining data property rights and transaction rules. Second, reinforce industrial empowerment by encouraging urban digital enterprises to collaborate with rural areas, fostering new business models like agricultural digitization and rural e-commerce, and building urban-rural industrial synergy mechanisms.Third, implement differentiated advancement strategies by increasing investment in areas with weak digital infrastructure while developing tailored empowerment pathways for regions with prominent industries or distinctive resources, balancing efficiency and equity.

Although this study constructs a core theoretical mechanism and validates it through case studies, limitations remain. Future research could expand the sample to the county level to deeply analyze micro-level scenarios of market-based data allocation. Simultaneously, as the data element market matures, attention should shift to emerging issues like data security and revenue distribution, exploring more targeted empowerment mechanisms and policy frameworks to provide sustained theoretical support for high-quality integrated urban-rural development.

Acknowledgments

This work is supported by the Innovation and Entrepreneurship Training Project for College Students of Anhui University of Finance and Economics in 2025 (Grant No.: 202510378163).

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