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Research article

Factors influencing the transition of China's economic growth momentum

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Abstract: Driven by factors such as structural economic shifts, technological breakthroughs, policy changes, and global economic transformations, China's economic growth drivers have continuously evolved. We constructed a panel dataset encompassing 31 provinces in China from 2002 to 2021 and utilized both panel data models and panel quantile models to delve into the underlying factors driving this transition. We further investigated the varying impacts of these factors across different temporal and geographical contexts based on the stage analysis and spatial cluster analysis. The findings revealed that capital accumulation, digital economy, and technological innovation were the major drivers shaping China's economic growth momentum transition, exhibiting significant heterogeneity across different quantile levels. Additionally, we observed heterogeneity in the influencing factors across temporal periods and regions.

Keywords: economic growth; momentum transition; influencing factors; disparities in stage; regional disparities

JEL Codes: C51, O10

1. Introduction

The process of economic growth momentum transition and its influencing factors exhibit variations across times and spaces. Given that economic transformation is a dynamic process, the driving forces behind economic growth evolve over time, leading to differences in these driving factors. With the deployment of national dynamic transformation policies and the implementation of local regulations, both the economic structure and the structure of economic growth momentum

undergo changes. Furthermore, changes in economic factors over time contribute to shifts in the driving forces of economic growth. For instance, in the 1980s and 1990s, China's economic growth relied significantly on demographic dividends, with population-related factors being the predominant driving forces (Taketoshi, 2020). However, following the market reforms in the economic system, the capital-driven characteristics of China's economic growth became more prominent (Fang, 2018; Ye et al., 2021). The development of modern technology, especially in the digital economy, has gradually revealed itself as the driving force of the economy (Li et al., 2023; Xu et al., 2023). Regional economic disparities contribute to differences in economic growth momentum transition across regions. Disparities in resource endowments, industrial structures, and developmental levels among eastern, central, and western regions create significant variations (Xu et al., 2023). Regional disparities in breakthrough points, key areas, and stage tasks for economic growth momentum transition are substantial. Different regions possess diverse conditions in terms of the technological foundation, energy efficiency levels, and environmental capacity for achieving economic growth momentum transition. Looking at economic clusters, there are notable differences in the development of various economic circles, such as the Yangtze River Delta and the Pearl River Delta (Liu et al., 2023). Coastal cities can leverage their proximity to the sea for momentum transition, while non-coastal economic circles must rely on alternative technologies. We aimed to provide theoretical analysis for the transition by investigating the influencing factors during the process of economic growth momentum transition. Therefore, a comprehensive understanding of the influencing factors of economic growth momentum transition holds significant importance.

Economic growth, as the core significance in the field of economics, has always been the focus of scholars' research. Many scholars have conducted extensive and in-depth studies on the influencing factors of economic growth. Existing research mainly focuses on the following four aspects. First, studies on the impact of human capital on economic growth. In the past, economic growth has largely benefited from the demographic dividend (Fang, 2018; Ye et al., 2021). First, the abundance of labor resources has provided enterprises with cost advantages and more choices, thus promoting the development of industries (Amirul et al., 2022). Second, with the increase in population base, the consumption market has expanded, providing enterprises with broader market space, driving consumption upgrading and industrial upgrading (Amirul et al., 2022). Moreover, the demographic dividend has brought about an increase in talent reserves, providing a continuous source of power for technological innovation and industrial upgrading, and promoting sustained economic growth (Xu et al., 2023). Finally, capital accumulation is accelerated under the promotion of the demographic dividend, providing more financial support for economic development, promoting infrastructure construction and regional economic development (Jayasuriya, 2012; Singh, 2015; Cruz and Ahmed, 2018). However, with the continuous development of the economy, the marginal utility of demographic dividend factors for economic development is significantly decreasing. Human capital gradually replaces demographic dividend factors as influencing factors of economic development and drivers of economic kinetic energy transformation. Human capital directly promotes the improvement of production efficiency and innovation capabilities by enhancing labor skills and knowledge levels (Xu et al., 2023). High-skilled labor can adapt to technological changes and industrial upgrading more quickly, thus driving economic growth towards higher quality and more sustainable directions. In addition, human capital indirectly promotes the optimization of economic structure and the rational allocation of resources by influencing the supply and demand relationship and wage levels in the labor market (Xu et al., 2023). With the improvement of skill levels, the matching efficiency of the labor

market is improved, and enterprises can more efficiently find labor suitable for their own development needs, achieving optimal resource allocation.

Second, studies on the impact of technological level on economic growth. Technological innovation can improve production efficiency, promote the transformation of industries towards green and sustainable development by improving production processes, optimizing resource allocation, reducing energy consumption, and reducing waste emissions (Huang et al., 2019). In addition, technological progress is a key force driving industrial upgrading, leading enterprises to move from low value-added to high value-added links by introducing new technologies, developing new products, and providing new services, thereby enhancing the competitiveness of the overall industry chain (Zhou et al., 2021; Zou, 2024). Against the backdrop of economic globalization, technological level is an embodiment of international competitiveness (Carlsson and Taymaz, 1993). A country's innovation capability and technological level directly affect its status and influence in the international market. The rise of high-tech industries and the improvement of technological innovation capabilities cannot only drive economic growth but also create a large number of high-skilled employment opportunities, attracting foreign investment and technological cooperation (Li et al., 2019).

Third, studies on the impact of physical capital on economic growth. The impact of physical capital on economic growth is profound and specific. Initially, as the foundation of production activities, the accumulation of physical capital directly promotes the expansion of production scale and the improvement of production efficiency (Duan et al., 2023). Enterprises purchasing advanced production equipment and building infrastructure cannot only improve product quality but also reduce production costs, thereby enhancing market competitiveness. Second, the investment of physical capital drives technological innovation and industrial upgrading (Huang et al., 2019). In order to maintain competitiveness, enterprises will continuously invest funds in research and development, develop new technologies and products, and promote the development of industries to a higher level. In addition, the optimal allocation of physical capital helps to achieve the rational utilization of resources and the maximization of economic benefits. By improving capital use efficiency and optimizing investment structure, it can promote the adjustment of economic structure and the optimal allocation of resources, providing continuous driving force for economic growth (Xu and Li, 2023). However, the impact of physical capital on economic growth is not unilateral. Economic growth will also promote the accumulation of physical capital (Shvets, 2024). With the development of the economy, enterprise profits increase, and there are more funds for investment and production, further promoting the accumulation of physical capital. This virtuous cycle provides a solid foundation for economic growth.

Fourth, studies on the impact of the ecological environment on economic growth. The impact of the ecological environment on economic growth is profound and dual. First, a healthy ecological environment is an important support for economic growth (Albitar and Hussainey, 2023). Clean water resources, fertile soil, and suitable climatic conditions provide basic conditions for resource-based industries such as agriculture and forestry, directly promoting the abundance and quality of agricultural and forestry products, and contributing to the material basis of economic growth. Second, a good ecological environment has a significant driving effect on the development of tourism and service industries (Guinot et al., 2023). Beautiful natural landscapes and pleasant environments attract a large number of tourists, driving the prosperity of the tourism industry and further promoting the development of related service industries, providing new growth points for economic growth. However, the deterioration of the ecological environment may also have a negative impact on economic growth

(Krasnoselskaya and Timiryanova, 2023). For example, problems such as water scarcity, land degradation, and air pollution may lead to resource shortages, rising production costs, and increased costs for ecological environment restoration, thus restricting economic growth. In addition, environmental pollution and ecological damage may also cause damage to residents' health and social well-being, reducing labor productivity and consumer confidence (Idowu, 2023).

The existing literature on the influencing factors of economic growth is quite extensive, providing rich theoretical support and empirical evidence for understanding economic growth. However, the transformation of economic growth momentum, as a key process, has not yet been fully explored. This complex and dynamic process involves the transition and coexistence of old and new driving forces during economic growth, reflecting the inherent dynamism and sustainability of economic growth. Based on this, we focus on the transformation of economic growth momentum, aiming to explore the influencing factors and their heterogeneity. Through a panel data linear benchmark regression model, this article will reveal the mode of action of various factors on the transformation of economic growth momentum. Furthermore, considering the heterogeneous characteristics of economic growth momentum transformation at different stages of development, we introduce a quantile regression model to conduct an in-depth analysis of the influencing factors of economic growth momentum transformation at different quantiles. In addition, considering the possible differences in the transformation of economic growth momentum in different regions and time periods, this article adopts a comparative research method to explore the effects of various influencing factors in different contexts.

The remainder of the paper is organized as follows. Section 2 provides an introduction to the model, variables and data utilized in this study. Section 3 analyzes the impact of the influential factors on the transformation of economic growth momentum. Section 4 investigates the heterogeneity of these influential factors in relation to economic growth momentum transformation, considering different periods and regions. Last, Section 5 presents the conclusion and implications of the study.

2. Model, variable and data

2.1. Baseline regression model

Starting from the sources of economic growth, we identify the influencing factors of the transformation of economic growth momentum, focusing on the elemental sources of economic growth momentum. In China, land, labor, capital, technology, and data are considered as the major production factors. However, considering China's reality, although land is a production factor, its marketization level is not high due to state ownership. Additionally, based on the characteristics of China's economic growth since the reform and opening-up, the major sources of economic growth have primarily been driven by labor and capital. With the establishment and improvement of a market economy system, the role of innovation in driving the economy has become more significant. Therefore, we consider labor, capital, technology, and data as the four key elements in its model. The paths of momentum transformation primarily encompass three avenues: Enhancing the efficiency of traditional factors such as labor and capital, the emergence of new factors that form new business models and subsequently generate new momentum, and the full integration of various factors leading to improved factor allocation efficiency (Wen & Xu, 2023). Based on this analysis, this paper incorporates labor and capital as the two core explanatory variables in the classical economic growth model to investigate their contributions to economic growth. The impact of innovation on the transformation of economic

growth momentum can manifest in both direct and indirect ways. In terms of direct effects, innovation is directly included as an explanatory variable to analyze its influence on momentum transformation through quantitative analysis. Indirectly, innovation encompasses a range of elements, including institutional and technological innovation. The relationship between energy consumption and economic growth is a comprehensive outcome of various factors such as institutional innovation, technological innovation, and optimal resource allocation. Therefore, energy consumption is selected as one of the influencing factors of momentum transformation. With the advancement of information technology, especially digital technology, new and powerful momentum has been provided for the transformation of growth drivers. Therefore, we incorporate the data element into the analysis. When including data elements in the model, it is crucial to consider their multifaceted impacts. The development of the digital economy is driven by both market forces and policies. Different provinces exhibit variations in their approaches to leveraging new factors and technologies to drive economic growth. Consequently, we select the digital economy search index as a metric to assess market drivers and government attention to momentum transformation as a measure of policy drivers.

The panel data linear regression mod'l utilizes economic growth data from China's 31 provinces over the period of 2002–2021 to reveal how various influencing factors interact with economic growth momentum. Furthermore, the panel data model controls for individual heterogeneity and considers temporal variations, enabling a more accurate identification of the factors that impact the transformation of economic growth momentum. The baseline regression model used in this paper is presented in Equation 1.

$$trans_{it} = \alpha_0 + \alpha_1 * labor_{it} + \alpha_2 * capital_{it} + \alpha_3 * energy_{it} + \alpha_4 * government_{it} + \alpha_5 * digital_{it} + \alpha_6 * inno_{it} + \mu_t + \sigma_i + \varepsilon_{it} \quad (1)$$

In Equation (1), $trans_{it}$ denotes the economic growth momentum transition index for province i at time period t; $labor_{it}$ is the size of the labor force in province i at time t; $capital_{it}$ signifies the capital stock of province i at time t; $energy_{it}$ indicates the level of energy consumption in province i at time t; $government_{it}$ represents the government's attention on economic growth momentum transition in province i at time t; $digital_{it}$ denotes the level of the digital economy in province i at time t; $inno_{it}$ is the technological innovation level of province i at time t; the $\alpha_i (i = 1,2,3,4,5,6)$ are the corresponding regression coefficients for each influencing factor; μ_t is time-fixed effects; and σ_i is individual-fixed effects; and ε_{it} is the random interference term.

2.2. Variable and data

We focus on examining the influencing factors of China's economic growth momentum transformation, utilizing data from 31 provinces as the research subjects. Due to the consideration of data integrity and availability, Hong Kong, Macao, and Taiwan are excluded from the sample. The time frame selected for this study spans from 2002 to 2021. The choice of 2002 as the starting point for the research sample is grounded in two major aspects. First, it corresponds to the phase of China's economic reform. China's economic reform is initiated in 1978, exhibiting a certain degree of staging. The first stage, from 1978 to 1984, marked the initial rollout and local experimentation, notably with the introduction of the household contract responsibility system in rural areas. The second stage, from 1984 to 1992, witnessed a exploration of "planned commodity economy" with a shift in focus from rural to urban areas. The third stage, from 1992 to 2000, was characterized by the initial establishment

of a socialist market economy system with a focus on institutional innovation. The fourth stage, from 2001 to 2011, saw the improvement of market-oriented institutions, while the fifth stage, beginning in 2012, represents a period of deepening of reforms. Throughout these stages, the mechanisms of market action varied. Although China proposed the establishment of a socialist market economy system in 1992, it was a period of exploration and establishment, with many mechanisms inevitably influenced by previous systems. In fact, it was after 2001 that the market gradually emerged as a significant mechanism in the economy. Additionally, the selection is also motivated by shifts in the global economic landscape. The nearly two-year-long global economic crisis that began in 2008, originating from the subprime mortgage crisis in the United States, significantly altered the global economic landscape. This crisis underscored the pivotal role of financial services in supporting the real economy, prompting many countries to initiate economic strategies such as the "reindustrialization movement", thereby altering the determinants of economic growth. To explore the dynamics of these influencing factors on China's economic momentum both pre- and post-crisis, it is imperative to encompass two distinct temporal segments. Hence, we adopt 2002 as the starting point and designates 2021 as the latest endpoint for the sample, taking into account data availability. The data sources are primarily the National Bureau of Statistics, Wind Database, EPS Database, Baidu Index official website, and the government work reports of the 31 provinces.

The variables involved in the model include the index of economic growth momentum transformation as the dependent variable, and six explanatory variables: labor, capital, energy consumption, technological innovation, digital economy, and the government's attention to economic growth momentum transformation. Table 1 presents the measurement and data sources of these variables.

Table 1. Variable description.

Type	Variable	Symbol	Measurement	Source
Dependent Variable	Economic Growth Momentum	Trans	Economic Growth Momentum Index Measured by Multi-Indicator Comprehensive Evaluation Method	Wen & Xu (2023)
Explanatory Variables	Labor	labor	Direct count of employed individuals	National Bureau of Statistics
	Capital	capital	Capital Stock calculated using the Perpetual Inventory Method	WIND database, EPS database, Provincial Statistical Yearbooks
	Energy Consumption	energy	Energy Consumption per GDP	SRIT DRCNET
	Technological Innovation	inno	Number of Patent Applications Granted	National Bureau of Statistics
	Digital Economy	digital	Digital Economy Search Index calculated using Baidu Index	Baidu Index
	Government Attention	government	Using textual analysis to assess government focus on economic momentum transformation	Provincial Government Work Reports

Calculation instructions for some variables requiring additional measurement are as follows. Research has emphasized the old and new momentum of economic growth, with Wen and Xu (2023) contending that these momentums coexist, albeit with differences in their dominant over time. For instance, during the early stages of industrial development, economic growth is primarily driven by labor inputs, indicative of labor-centric growth. As capitalism evolves, monopolistic capital emerges at a certain stage, leading to capital-centric growth. Technologically-driven growth becomes prominent with technological advancements reaching a certain threshold. Researchers have evaluated the transformation of economic growth momentum by distinguishing between new and old ones based on their dominant factors. However, these factors exhibit correlations, and the principle of non-repetition or omission is not fully met. In contrast, Wen and Xu (2023) constructed an index to measure the level of economic growth momentum transition, focusing on the operational aspects of the national economy. For these reasons, we adopt the measurement approach proposed by Wen and Xu (2023) to assess the level of economic growth driver momentum. First, it designs the indicator system focused on various aspects of the national economy, considering the significance, scientific rigor, and feasibility of the indicators. Subsequently, it standardizes the data used and employs the entropy method to assign weights to the indicators when compiling dimensional indices from the raw data. Finally, it utilizes the analytic hierarchy process (AHP) given that the economic growth momentum transition involves both objective impacts from different dimensions and subjective influences resulting from organizational behaviors.

Second, the digital economy search index is determined by selecting six keywords closely related to the digital economy. These keywords include digital economy, industrial internet, cross-border e-commerce, digital currency, digital trade, and cybersecurity. The Baidu Index for these keywords is then crawled from the official website and aggregated to obtain the annual digital economy index for each province. Last, to measure the government's focus on economic growth momentum transformation, government work reports for the period 2002–2021 are downloaded from the official websites of the provincial governments of China's 31 provinces. By reviewing these reports, relevant keywords are selected and a keyword dictionary is constructed, focusing on terms such as momentum transformation, industrial structure, industrial structure, economic structure, consumption, investment, exports, foreign investment, foreign direct investment, foreign trade, expanding domestic demand, labor-intensive industries, economic growth, high-quality development, innovation-driven, high-tech, key core technologies, information technology, financial technology, cross-border data flows, digital trade, digital economy, digital currency, digital infrastructure, intelligent manufacturing, blockchain, smart cities, and digitization. The government's focus is then measured by calculating the frequency of these keywords relative to the overall word count in the work reports.

2.3. Descriptive statistics

The descriptive statistical results based on the collected data are presented in Table 2.

Upon observing the coefficient of variation in Table 2, it becomes evident that there exist varying degrees of disparities in the data regarding the transformation of economic growth momentum and its influencing factors among different provincial regions. Notably, the coefficient of variation for technological innovation, energy consumption, and the digital economy are relatively high, at 2.104, 1.753, and 1.353, respectively. This indicates that the distribution of sample data for these three variables is uneven, with significant provincial variations. In contrast, the coefficient of variation for

the transformation of economic growth momentum exhibits the smallest value of 0.360, indicating that the performance of various provinces in this aspect is relatively similar, with some differences but not entirely significant.

Table 2. Descriptive statistics.

Statistics	Mean	Standard deviation	Min	Max	Skewness	Kurtosis	Coefficient of variation
trans	47.265	17.010	18.801	95.208	0.835	2.913	0.360
labor	2.415	1.661	0.079	7.486	0.668	2.582	0.688
capital	4.101	4.018	0.069	29.94	2.223	9.947	0.980
energy	1.622	2.844	0.016	22.92	5.339	34.36	1.753
government	0.008	0.003	0.000	0.023	−0.138	5.132	0.375
digital	1.465	1.982	0.000	13.19	2.164	8.498	1.353
inno	39.68	83.48	0.007	872.2	4.895	35.22	2.104

Examining the skewness coefficients in Table 2 reveals that most of the skewness coefficients for the transformation of economic growth momentum and its influencing factors across China's 31 provincial regions are greater than 0. This suggests that the sample data distributions mostly exhibit a certain degree of peakedness. Notably, the skewness coefficient for energy consumption is the highest, reaching 5.339, indicating a particularly pronounced right skewness in the distribution of this variable's samples. This could be due to exceptionally high values in energy consumption in some provinces, leading to a rightward skew in the overall distribution. These abnormally high values may originate from regions with a concentration of energy-intensive industries or from unusual increases in energy consumption in certain provinces during specific periods. On the other hand, the skewness coefficient for the government's focus on the transformation of economic growth momentum is the smallest, at −0.138, indicating a slight left skewness in the distribution of this variable's samples. This suggests that while a few provinces have relatively high levels of government focus on the transformation of economic growth momentum, the majority of provinces have relatively low levels of focus.

Observing the kurtosis coefficients in Table 2 further reveals that all the Kurtosis coefficients for the transformation of economic growth momentum and its influencing factors across China's 31 provincial regions are greater than 0. This indicates that the sample data distributions all exhibit a certain degree of peakedness. Notably, the sample kurtosis coefficient for technological innovation is the highest, reaching 35.22. This suggests that the values of the technological innovation variable in certain provinces may be extremely outliers, resulting in a distinct peaked shape in the overall distribution. This could be due to significant progress in technological innovation in some provinces, while others lag behind, leading to a pronounced peaked distribution. In contrast, the sample Kurtosis coefficient for labor force is the lowest, at 2.582, indicating a slightly peaked distribution for labor force samples, which suggests that the labor force numbers across provinces are relatively uniform.

The correlation coefficients based on the collected data are presented in Table 3.

As shown in Table 3, the level of Economic Growth Momentum Transition exhibits certain linear correlations with various influencing factors. It demonstrates a positive linear correlation with technological innovation, a negative linear correlation with energy consumption, and a weak positive linear correlation with government focus on economic growth. There is a strong correlation between digitization and both capital (0.719) and innovation (0.731), indicating a strong positive relationship

between digitization and these two variables. There is a high degree of positive linear correlation between capital and innovation.

Table 3. Correlation analysis.

	trans	labor	capital	energy	government	digital	inno
trans	1.000						
labor	**0.298**	1.000					
capital	**0.436**	0.723	1.000				
energy	**−0.221**	−0.600	−0.608	1.000			
government	**0.091**	0.326	0.234	−0.176	1.000		
digital	**0.253**	0.297	0.719	−0.305	0.126	1.000	
inno	**0.566**	0.653	**0.945**	−0.595	0.183	0.731	1.000

3. Impact analysis of testing

3.1. Full-sample regression analysis

To control for the influence of unobservable factors related to time and province on the transformation of economic growth momentum, we employ time-fixed effects and province-fixed effects. In terms of parameter estimation, the least squares method is adopted. Table 4 presents the empirical results of identifying the influencing factors of the transformation of economic growth momentum from 2002 to 2021. Specifically, columns (1) to (6) exhibit regression results where economic growth momentum is the explained variable, and labor, capital, energy consumption, government's focus on economic growth momentum transformation, digital economy, and technological innovation are added as explanatory variables step by step.

Table 4. Full-sample regression results.

Variable	(1) trans	(2) trans	(3) trans	(4) trans	(5) trans	(6) trans
labor	−3.664*	−3.535	−1.623	−1.700	−1.470	0.632
	(2.211)	(2.172)	(2.583)	(2.571)	(2.593)	(2.606)
capital		−7.931***	−6.885***	−7.012***	−5.545***	−6.805***
		(1.784)	(1.927)	(1.943)	(2.059)	(1.944)
energy			0.480**	0.475*	0.205	0.287
			(0.244)	(0.245)	(0.282)	(0.284)
government				−0.929	−0.988	−0.867
				(0.983)	(0.973)	(0.939)
digital					4.245**	5.183***
					(1.955)	(1.983)
inno						5.223***
						(0.845)
Constant	49.296***	56.750***	53.920***	54.831***	50.897***	38.354***

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Variable	(1) trans	(2) trans	(3) trans	(4) trans	(5) trans	(6) trans
	(1.248)	(2.070)	(2.797)	(3.027)	(3.448)	(3.770)
Time Fixed	YES	YES	YES	YES	YES	YES
Province Fixed	YES	YES	YES	YES	YES	YES
Observations	620	620	620	620	620	620
R-squared	0.900	0.903	0.904	0.904	0.905	0.912

Note: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

In the context of full-sample regression analysis, capital, digital economy, and technological innovation emerge as key factors influencing the transformation of economic growth momentum in China. First, capital has a significant negative impact on the transformation of economic growth momentum. With a coefficient of −6.805, the effect of capital on economic growth momentum transformation is statistically significant at the 1% level. This indicates that, under constant other conditions, an increase in capital by one unit would lead to an average decrease of 6.805% in the degree of economic growth momentum transformation, suggesting that capital suppresses the transformation of economic growth momentum in China. Second, the digital economy exerts a significant positive influence on the transformation of economic growth momentum. With a coefficient of 5.183, the effect of the digital economy on economic growth momentum transformation is statistically significant at the 1% level. This suggests that, under constant other conditions, an increase in the digital economy by one unit would result in an average increase of 5.183% in the degree of economic growth momentum transformation, indicating that the digital economy promotes the transformation of economic growth momentum in China. Moreover, technological innovation also has a significant positive impact on the transformation of economic growth momentum. With a coefficient of 5.223, the effect of technological innovation on economic growth momentum transformation is statistically significant at the 1% level. This implies that, under constant other conditions, an increase in technological innovation by one unit would lead to an average increase of 5.223% in the degree of economic growth momentum transformation, suggesting that technological innovation also contributes to the transformation of economic growth momentum in China.

In the pursuit of rapid economic growth, capital may become overly concentrated in traditional industries and low-end manufacturing, leading to resource misallocation and overcapacity (Wu and Lin, 2020; Chen and Lin, 2021). This undoubtedly hinders the transition of the economy towards high-tech industries. As a new economic format based on digital technology and data resources, the digital economy offers China new development opportunities. It can enhance production efficiency, reduce transaction costs, create new business forms and models, and promote innovation and entrepreneurship, thereby strengthening economic vitality and competitiveness (Li et al., 2023; Xu and Li, 2023). Technological innovation, another crucial driver of economic growth, injects new vitality into the transformation of economic growth momentum through technological advancements that drive efficiency improvements, cost reductions, and the development of new products and services (Huang et al., 2019; Gholami et al., 2023). Therefore, in promoting the transformation of China's economic growth momentum, it is essential to pay attention to the rationality of capital allocation while fully leveraging the important role of the digital economy and technological innovation.

The possible reasons for the insignificant impact of labor on economic growth momentum transition are as follows. First, changes in the demographic structure have affected the dynamics of the

labor market. As China gradually enters an aging society, the proportion of the working-age population has begun to decline, and the growth rate of labor supply has slowed down, which can be known in results of the seventh national census. Moreover, with the improvement of the level of education, more young people choose to enter higher education, delaying their entry into the labor market and further reducing the supply of the labor market. These factors have led to labor's role in economic growth becoming less significant than before (Liu et al., 2022). Second, technological progress and capital deepening have altered the dynamic structure of economic growth. During this period, the Chinese economy has undergone a transition from relying on labor-intensive industries to technology-intensive industries. With the widespread application of technologies such as automation and informatization, the role of capital and technology in economic growth has become increasingly prominent, while the role of labor has relatively weakened. Furthermore, the process of capital deepening has also accelerated this trend, as companies are more inclined to increase production efficiency through increased capital investment and technological advancements rather than simply increasing labor input (Luo et al., 2023).

The impact of the government's focus on economic growth momentum on the transformation of economic growth momentum may be constrained by various factors. First, the formulation and implementation of policies often require a certain amount of time and process, and the effectiveness of policies may also be uncertain due to various factors (Guan et al., 2021). Therefore, even if the government pays certain attention and support to the transformation of economic growth momentum, it may not immediately show a significant impact. Second, there may be deviations between policy objectives and actual implementation (Sager & Gofen, 2022). For example, the government may hope to promote the transformation of economic growth momentum through a certain policy, but the actual situation may be that the policy has not achieved the expected effect or the effect is not obvious. This may lead to a low correlation between the government's focus on economic growth momentum and the transformation of economic growth momentum. Apart from the government's focus on economic growth momentum, other factors such as technological progress and industrial structure optimization also have significant impacts on the transformation of economic growth momentum (Luo et al., 2023). If the role of these factors is more prominent, then the government's focus on economic growth momentum may appear relatively less important.

To verify the reliability of the influencing factors of economic growth momentum transformation, this paper conducted a robustness analysis. First, we narrowed down the sample period to 2003–2020. Second, given the potential influence of marketization level and import-export trade volume on economic growth momentum transformation, we included these two variables in the regression model.

Table 5. Robustness check.

Variable	(1) Narrow down the sample period to 2003–2020.	(2) Include marketization into the regression model.	(3) Include import-export trade volume into the regression model.
	trans	trans	trans
labor	1.512	0.546	2.578
	(3.102)	(2.620)	(2.797)
capital	−6.284**	−6.828***	−7.571***
	(2.463)	(1.947)	(1.944)

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Variable	(1) Narrow down the sample period to 2003–2020.	(2) Include marketization into the regression model.	(3) Include import-export trade volume into the regression model.
	trans	trans	trans
energy	0.338	0.326	0.355
	(0.314)	(0.292)	(0.284)
government	0.099	−0.870	−1.025
	(1.164)	(0.941)	(0.940)
digital	5.456**	4.899**	3.737*
	(2.279)	(2.068)	(2.078)
inno	5.301***	5.335***	4.995***
	(0.937)	(0.871)	(0.820)
market		−0.445	
		(1.200)	
trade			2.067***
			(0.704)
Constant	36.290***	39.166***	4.335
	(4.427)	(4.392)	(12.458)
Observations	558	618	620
R-squared	0.911	0.912	0.913

Note: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

The results indicate that the above models did not alter the impact of various factors on the economic growth momentum transformation, demonstrating a certain degree of robustness in the empirical findings of this paper.

3.2. Quantile regression analysis

The transition of economic growth momentum is complex, with factors playing different roles across stages, systems and policies. The impact of these factors changes dynamically based on conditions. For example, during China's reform and opening-up, the labor force drove economic growth. However, as the system matured and labor approached saturation, the large labor pool limited efficiency gains. This phenomenon is not limited to labor, with other factors such as capital and technology showing similar patterns. The roles of these factors in economic growth can vary significantly across stages. Therefore, when analyzing and identifying the influencing factors of economic growth momentum transformation, it is imperative to adopt a comprehensive and dynamic perspective. In quantile regression models, the conditional expectations of economic growth momentum transition at different percentiles (e.g., 0.25, 0.5, and 0.75) can be estimated. This estimation is achieved by minimizing weighted absolute residuals to determine the regression parameters. The advantage of this method over traditional average regression models lies in its ability to finely characterize the data's heterogeneity, rather than focusing solely on overall averages. Through quantile regression, we can understand the factors influencing economic growth momentum transition across different percentiles. For instance, when examining lower percentiles (e.g., 0.25), we analyze the factors influencing economic growth momentum transition in regions where it lags behind;

conversely, when exploring higher percentiles (e.g., 0.75), we investigate the factors contributing to exceptional economic growth momentum transition in regions where it performs well. Table 6 presents the regression results at key quantile levels (0.1, 0.25, 0.5, 0.75, and 0.9) of economic growth momentum transformation from 2002 to 2021.

Table 6. Quantile regression results.

Variable	(1)	(2)	(3)	(4)	(5)
	0.1	0.25	0.5	0.75	0.9
labor	2.352	1.360	−0.413	−1.843	−2.537
	(4.609)	(3.465)	(2.390)	(3.183)	(3.919)
capital	−6.697**	−7.476***	−8.869***	−9.992***	−10.538***
	(2.708)	(2.036)	(1.406)	(1.870)	(2.302)
energy	0.717	0.612*	0.424*	0.272	0.198
	(0.437)	(0.329)	(0.227)	(0.302)	(0.372)
government	−1.960	−1.635	−1.054	−0.585	−0.357
	(1.651)	(1.241)	(0.855)	(1.140)	(1.404)
digital	2.363*	2.107**	1.649**	1.280	1.101
	(1.419)	(1.067)	(0.735)	(0.980)	(1.207)
inno	3.321***	3.676***	4.309***	4.821***	5.069***
	(1.215)	(0.914)	(0.631)	(0.839)	(1.033)
Observations	620	620	620	620	620

Note: Robust standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

As shown in Table 6, the influencing factors of China's economic growth momentum transformation exhibit heterogeneity across different quantile levels of economic growth momentum. Specifically, as indicated in columns (1) to (3) of Table 6, capital, digital economy, and technological innovation all have significant impacts on economic growth momentum transformation at the 10% significance level, suggesting that at the quantile levels of 0.1, 0.25, and 0.5, the factors influencing China's economic growth momentum transformation are capital, digital economy, and technological innovation. On the other hand, as shown in columns (4) and (5) of Table 6, the impacts of capital and technological innovation on economic growth momentum transformation are significant at the 1% significance level, indicating that at the quantile levels of 0.75 and 0.9, the influencing factors are capital and technological innovation.

Overall, both capital and innovative technologies play significant roles in the process of economic growth momentum transformation. The digital economy and energy consumption intensity, however, exhibit only significant promoting effects at certain quantile levels of economic momentum transformation, and both primarily function at lower levels of economic growth momentum transformation. This suggests that the driving effects of the digital economy and energy consumption intensity on economic growth are primarily evident in the initial stages. As the level of economic growth momentum transformation increases, their roles may relatively weaken, giving way to other factors such as capital and innovative technologies.

The digital economy significantly drives economic growth momentum transition in early stages, enhancing productivity, optimizing resources, and upgrading industries through digital technologies. However, as the level of economic growth momentum transition rises, the impact of the digital

economy may gradually weaken. This is due to diminishing marginal effects as the digital economy matures and technology becomes widely applied, limiting further growth potential (Jiao & Sun, 2021). Additionally, as the level of economic growth momentum transition increases, capital accumulation and innovative technologies gradually become more prominent (Lu & Zhu, 2022). Capital accumulation can provide the necessary material foundation and financial support for economic growth momentum transition, especially in driving large-scale projects, infrastructure development, and the advancement of high-tech industries. Furthermore, through continuous technological innovation and upgrades, new market demands and industrial opportunities can be created, thereby facilitating higher-quality economic development.

4. Heterogeneity analysis

4.1. Temporal heterogeneity analysis

When economic growth momentum transformation is impacted by major events or undergoes changes in economic structure, there may be differences in the influencing factors. As the economic structure evolves, there are also differences in the factors influencing momentum transformation. Combining the research of Wen and Xu (2023) on China's economic growth momentum, it can be observed that structural changes in economic growth momentum transformation mainly occur at two time points. One is the impact of the 2008 global financial crisis, which led to a transformation of the global economy from a virtual economy to a real economy, thereby altering the structure of factors influencing economic growth momentum. Against the backdrop of the global financial crisis, the driving forces of China's economic growth also underwent corresponding changes. The other time point is 2014, when China's economic growth began to slow down from the end of 2012, and China entered the stage of a "New Normal" economy starting from 2013. To promote sustained and stable economic development in China, especially since the 18th National Congress of the Communist Party of China, a series of high-quality development policies have been implemented, resulting in corresponding changes in the influencing factors of China's economic momentum transformation. Furthermore, starting from 2013, the rapid development of information technology, digital communications, and other technologies has contributed to the continuous growth of economic growth momentum. Based on this, 2014 became another key point for China's momentum transformation. We divide the full sample into two pairs of samples using 2008 and 2014 as the breakpoints. To control the impact of unobservable factors such as time and province on economic growth momentum transformation, we control for time-fixed effects and province-fixed effects. The regression results for different time periods are presented in Table 7.

Table 7 demonstrates the heterogeneity in influencing factors on China's economic growth momentum transformation both pre and post the financial crisis and the transition to the "New Normal" phase of the Chinese economy. Prior to the financial crisis, the predominant factor impacting China's economic growth momentum transformation was the government's emphasis on this transformation. However, following the crisis, the influencing factors shifted towards labor, capital, the digital economy, and technological innovation. The impact coefficient of the government's focus on economic growth momentum transformation was −2.184 before the financial crisis, signifying a 2.184% average decrease in economic growth momentum transformation for each additional unit of government focus. Subsequent to the financial crisis, the impact coefficients of labor, capital, the digital economy, and technological

innovation on economic growth momentum transformation were 7.779, −4.447, 8.729, and 2.616, respectively, all of which passed significance tests. These outcomes suggest that post-financial crisis, key factors influencing China's economic growth momentum transformation included labor, capital, the digital economy, and technological innovation.

Table 7. Results of temporal heterogeneity regression.

Variable	(1) Before the Financial Crisis (2008)	(2) After the Financial Crisis (2008)	(3) Before the "New Normal" stage in the Economy (2014)	(4) After the "New Normal" stage in the Economy (2014)
labor	−10.484	7.779**	−8.080**	−0.835
	(9.141)	(3.874)	(3.967)	(5.594)
capital	−6.795	−4.447*	−2.703	−8.680**
	(7.015)	(2.403)	(3.079)	(3.468)
energy	−0.196	0.380	−0.047	−0.063
	(0.590)	(0.530)	(0.331)	(1.413)
government	−2.184**	−0.114	−1.103	0.292
	(1.092)	(1.504)	(1.086)	(1.480)
digital	−8.339	8.729***	−11.222**	3.710
	(11.211)	(2.707)	(5.395)	(3.652)
inno	1.390	2.616**	3.607***	2.719
	(2.025)	(1.082)	(1.220)	(2.093)
Constant	56.833***	32.266***	51.608***	47.576***
	(5.863)	(6.675)	(4.064)	(11.554)
Time Fixed	YES	YES	YES	YES
Province Fixed	YES	YES	YES	YES
Observations	217	403	372	248
R-squared	0.936	0.938	0.914	0.967

Note: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Preceding the transition of China's economy into the "New Normal" phase, major influencers of economic growth momentum transformation were predominantly labor, the digital economy, and technological innovation. However, upon entering the "New Normal" phase, labor capital emerged as the primary influencing factor. Before this transition, the impact coefficients of labor, the digital economy, and technological innovation on economic growth momentum transformation were −8.080, −11.222, and 3.607, respectively, indicating their primary roles. Following the entry into the "New Normal" phase, the impact coefficient of capital on economic growth momentum transformation was −8.680, significant at the 5% level, signifying capital as the primary factor influencing China's economic growth momentum transformation.

4.2. Spatial heterogeneity analysis

Due to the varying degrees of economic growth momentum transformation across regions and their corresponding influencing factors, we employ the K-MEANS clustering method to analyze the

31 provinces and municipalities based on their economic growth momentum transformation levels. The data utilized for the clustering analysis is the averages of the economic growth momentum transformation in 31 provinces of China, spanning from 2002 to 2021. The major reasons for selecting this data are as follows: First, average data can depict the overall situation of economic growth momentum transformation levels across provinces. By computing the mean of multi-year data for each province, it mitigates the impact of short-term fluctuations and outliers, yielding a relatively stable value. This value can represent the province's average level of economic growth momentum transformation over an extended period. Second, average data aids in simplifying the dataset. Given that clustering analysis involves processing extensive data, utilizing average data helps reduce the dimensionality and complexity of the dataset. The results of the K-MEANS clustering analysis are presented in Table 8.

Table 8. K-MEANS clustering of 31 provinces by economic growth momentum transition.

Type	Province
First Category	Beijing, Guangdong, Jiangsu, Shandong, Shanghai, Tianjin, Zhejiang (7)
Second Category	Anhui, Fujian, Gansu, Guizhou, Hainan, Hebei, Henan, Heilongjiang, Hubei, Hunan, Jilin, Guangxi (12)
Third Category	Jiangxi, Liaoning, Yunnan, Chongqing, Qinghai, Shanxi, Shaanxi, Sichuan, Tibet, Xinjiang, Inner Mongolia, Ningxia (12)

Based on the degree of economic growth momentum transformation, the 31 provinces and municipalities in China can be categorized into three groups. The first group exhibits a relatively high level of economic growth momentum transformation, primarily located in coastal regions with advantageous geographical positions and resource endowments. As economically developed areas, they not only possess a well-established market economy system but also demonstrate strong innovation capabilities, advanced technology, and optimized industrial structures. The second group demonstrates a moderate level of economic growth momentum transformation, with regions primarily distributed in the central part of the country, while some, such as Guangxi, Guizhou, and Gansu, are located in the western region. These provinces and municipalities have made some progress in economic growth momentum transformation but lag behind the first group. The third group exhibits a relatively low level of economic growth momentum transformation, with regions concentrated in economically backward areas that may face issues such as resource scarcity, inferior infrastructure, and brain drain.

Based on the clustering results of the provinces, this study divides the sample into three sub-samples to investigate the heterogeneity of influencing factors across different spatial economic growth momentum transformations. To control for the impact of unobservable time and provincial factors on economic growth momentum transformation, we include time-fixed effects and province-fixed effects. Table 9 presents the results of the heterogeneity analysis of influencing factors for different categories of economic growth momentum transformation from 2002 to 2021. Specifically, columns (1) to (3) show the regression results for the first, second, and third groups, respectively.

Table 9. Results of spatial heterogeneity regression.

Variable	(1) First Category	(2) Second Category	(3) Third Category
labor	2.156	−0.553	8.679*
	(6.219)	(5.671)	(4.635)
capital	−3.401	−7.943**	−8.778***
	(3.812)	(3.413)	(3.196)
energy	12.904*	−0.162	0.674**
	(6.654)	(1.289)	(0.322)
government	−2.030	−1.451	0.293
	(1.977)	(1.695)	(1.402)
digital	6.263	4.876	2.308
	(5.221)	(4.229)	(2.915)
inno	2.863	7.795***	6.166***
	(1.972)	(1.336)	(1.255)
Constant	53.227***	31.115***	29.308***
	(13.539)	(5.677)	(3.946)
Time Fixed	YES	YES	YES
Province Fixed	YES	YES	YES
Observations	140	240	240
R-squared	0.823	0.745	0.727

Note: Robust standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Different regions with varying degrees of economic growth momentum transition exhibit heterogeneity in the factors influencing the transition. From the results in Column (1) of Table 9, it is evident that in the first category of regions, the coefficient of energy consumption on the economic growth momentum transition is 12.904, significantly positive at the 10% significance level. This suggests that, for regions with a high degree of economic growth momentum transition, energy consumption is a major influencing factor. In Column (2) of Table 9, for the second category of regions, the coefficient of capital on economic growth momentum transition is −7.943, significantly negative at the 5% significance level. The coefficient of technological innovation is 7.795, significantly positive at the 1% significance level. This indicates that, for regions with a relatively high degree of economic growth momentum transition, capital and technological innovation are the major influencing factors. In Column (3) of Table 9, for the third category of regions, the coefficient of labor on economic growth momentum transition is 8.679, significantly positive at the 10% significance level. The coefficient of capital is −8.778, significantly negative at the 1% significance level. The coefficient of energy consumption is 0.674, significantly positive at the 5% significance level. The coefficient of technological innovation is 6.166, significantly positive at the 1% significance level. These results indicate that, for regions where the degree of economic growth momentum transition needs improvement, the major influencing factors include labor, capital, energy consumption, and technological innovation. In conclusion, factors influencing the economic growth momentum transition exhibit heterogeneity across regions with different degrees of economic growth momentum transition.

Regions with low economic growth momentum transformation tend to experience significant suppression of this transformation by capital. This can be attributed to several reasons. First, their industrial structures are often outdated, relying heavily on high-energy and high-pollution industries (Peng et al., 2023). Excessive capital investment in these traditional industries hinders the development of emerging industries and technological innovation, leading to inefficient resource allocation and impeding momentum transformation. These regions may lack an optimal investment environment, with insufficient innovation incentives and risk control mechanisms (Wen & Xu, 2023). This drives capital towards low-risk, stable-return industries, limiting the growth of emerging industries and technological innovation, further suppressing momentum transformation. Finally, institutional and policy shortcomings may hinder momentum transformation. For instance, a lack of tax incentives, financing support, or innovation subsidies may prevent enterprises from investing in technological innovation and industrial upgrading, reducing capital's effectiveness in driving momentum transformation (Papamichail et al., 2023).

The impact of technological innovation on economic growth momentum transformation differs among regions. In regions with low momentum transformation, technological innovation has significant potential to upgrade traditional industries, improve efficiency, reduce costs, and enhance competitiveness, thus promoting momentum transformation (Xu and Li, 2022). However, in regions with high momentum transformation, the impact of technological innovation is less significant as they already possess high innovation capabilities. These regions now require greater focus on institutional, management, and other reforms to achieve high-quality economic development (Han et al., 2022).

4.3. Time and regional heterogeneity analysis

In sub-sections 4.1 and 4.2, we investigate heterogeneous factors affecting the transition of economic growth momentum in different periods and regions. This subsection further explores the heterogeneity of factors influencing the transition of economic growth momentum in different regions during distinct time periods. Accordingly, we examine the heterogeneous impact factors in different regions after the financial crisis and before and after the introduction of the "New Normal" in the economy. The estimation results are presented in Tables 10 and 11.

Table 10 presents the parameter estimation results of the sample formed by the cross-grouping of the financial crisis and spatial classification. Columns (1) and (2) exhibit the regression results before and after the financial crisis for the first category of regions, respectively. Columns (3) and (4) display the corresponding results for the second category of regions before and after the crisis, respectively. Finally, columns (5) and (6) show the results for the third category.

Table 10 presents the parameter estimation results of the sample formed by the cross-grouping of the financial crisis and spatial classification. Columns (1) to (2) exhibit the regression results before and after the financial crisis for the first category of regions with varying degrees of economic growth momentum transition. Columns (3) to (4) display the corresponding results for the second category of regions, while columns (5) to (6) show the results for the third category.

According to Table 10, there is heterogeneity in the factors affecting economic growth momentum conversion for regions with different degrees of economic growth momentum conversion before and after the financial crisis. From the results in Table 10 column (1) to column (2), it can be seen that in the first type of region, before the financial crisis, the regression coefficient of capital to economic growth momentum index is 73.034 and passes the significance test; after the financial crisis, the

regression coefficient of capital to economic growth momentum index is −14.846, and the regression coefficient of energy consumption to economic growth momentum index is 32.416, both of which pass the significance test. This indicates that the financial crisis has had a significant impact on the economic growth momentum conversion of the first type of region. Before the financial crisis, capital was the main driving force of economic growth momentum, while after the financial crisis, the influence of capital weakened, and energy consumption became an important factor driving economic growth momentum.

Table 10. Results of spatial heterogeneity regression before and after the financial crisis.

Variable	(1) First Category		(2) Second Category		(3) Third Category	
	Before	After	Before	After	Before	After
labor	1.491	11.022	−4.406	−11.369	−25.063	7.892
	(19.856)	(11.463)	(32.396)	(8.067)	(18.057)	(6.628)
capital	73.034**	−14.846*	−12.682	−2.679	−8.271	−0.469
	(34.527)	(7.919)	(15.863)	(5.187)	(7.092)	(3.811)
energy	−4.841	32.416**	2.087	2.931	−0.557	0.854
	(14.105)	(13.288)	(4.422)	(2.420)	(0.816)	(0.691)
government	−3.672	1.866	−1.265	−3.886*	−2.453	−0.638
	(2.741)	(3.043)	(2.163)	(2.340)	(1.537)	(2.016)
digital	−1.269	2.129	−14.355	17.797***	−22.429*	1.397
	(23.337)	(7.213)	(36.722)	(4.517)	(13.201)	(4.468)
inno	−4.410	3.846	3.060	8.345***	1.585	2.293
	(6.949)	(3.797)	(5.445)	(2.380)	(2.731)	(1.420)
Constant	8.652	55.053**	45.246*	16.149	45.959***	28.630***
	(50.876)	(23.824)	(24.155)	(10.167)	(4.873)	(6.489)
Observations	49	91	84	156	84	156
R-squared	0.887	0.871	0.785	0.852	0.850	0.804

Note: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

From the results in Table 10 column (3) to column (4), it can be seen that before the financial crisis, the regression coefficients of the factors affecting economic growth momentum conversion for the second type of region did not pass the significance test; after the financial crisis, the regression coefficients of government, digital economy, and technological innovation to the economic growth momentum index are −3.886, 17.797, and 8.345 respectively, all of which pass the significance test. This indicates that after the financial crisis, the roles of government, digital economy, and technological innovation in promoting economic growth momentum conversion have been strengthened in the second type of region.

From the results in Table 10 column (5) to column (6), it can be seen that in the third type of region, before the financial crisis, the regression coefficient of digital economy to economic growth momentum index is −22.429, significantly negative at the 1% significance level, indicating that digital economy is the main factor affecting economic growth momentum conversion. This suggests that some new technologies may face significant difficulties in integrating into the economic driver. In addition, it may also imply that there may be institutional costs incurred by the government in

guiding these new technologies, which together lead to their negative impact on economic growth momentum (Luis-Alberto et al., 2013; Li and Rao, 2023; Liu et al., 2023). After the financial crisis, the regression coefficients of the factors affecting economic growth momentum conversion for the third type of region did not pass the significance test. This indicates that the financial crisis has had a complex impact on the economic growth momentum conversion of these regions, causing the original influencing factors to lose significance after the crisis.

Table 11 presents the parameter estimation results of the sample formed by the cross-grouping of the "New Normal" stage and spatial classification. Specifically, Columns (1)–(2) of Table 11 show the regression results for the first category of regions (e.g., developed regions) before and after the "New Normal" stage; Columns (3)–(4) present results for the second category of regions (e.g., developing regions); and Columns (5)–(6) display results for the third category of regions (e.g., underdeveloped regions).

Table 11. Results of spatial heterogeneity regression before and after the "new normal" stage.

Variable	(1)		(2)		(3)	
	First Category		Second Category		Third Category	
	Before	After	Before	After	Before	After
labor	−3.279	15.765	2.618	−8.906	−8.973*	−13.621
	(13.199)	(10.501)	(8.033)	(9.305)	(5.229)	(12.700)
capital	12.586**	0.696	−10.154*	−7.458	−11.720***	−8.832
	(5.682)	(7.121)	(5.792)	(6.443)	(3.586)	(5.375)
energy	−12.641	9.630	−0.549	2.851	−0.140	−2.379
	(8.666)	(9.851)	(1.927)	(5.658)	(0.389)	(1.788)
government	−3.834	0.756	0.489	−1.464	−1.768	−0.206
	(2.778)	(2.219)	(2.023)	(2.460)	(1.415)	(2.438)
digital	−32.665***	12.456**	0.178	3.028	−1.367	6.361
	(9.602)	(5.264)	(15.538)	(10.182)	(8.095)	(6.947)
inno	5.703*	2.945	5.786***	5.230	2.954**	2.135
	(3.226)	(3.748)	(1.746)	(3.426)	(1.384)	(2.619)
Constant	65.288***	18.354	36.404***	40.102**	40.725***	41.892***
	(16.775)	(30.749)	(7.435)	(15.542)	(2.880)	(12.461)
Observations	84	56	144	96	144	96
R-squared	0.857	0.963	0.695	0.923	0.801	0.863

Note: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Based on the results in Table 11, it can be observed that there is heterogeneity in the impact factors of economic growth momentum conversion among regions with different degrees of economic growth momentum conversion before and after China's economy entered the "New Normal" stage.

The results in columns (1) to (2) of Table 11 indicate that in the first category of regions, prior to China's economy entering the "New Normal" stage, capital, digital economy, and technological innovation have regression coefficients of 12.586, −32.665, and 5.703, respectively, all passing significance tests. This suggests that capital, digital economy, and technological innovation are the primary influencing factors. After China's economy entered the "New Normal" stage, the regression coefficient of the digital economy on the economic growth momentum index is 12.456, significantly

negative at the 5% level of significance, indicating that in the first category of regions, the digital economy inhibits the conversion of economic growth momentum, although the inhibitory effect is somewhat weakened. This may be due to the fact that in economically developed regions, the traditional economic system is relatively mature, and the digital economy, as an emerging force, may initially compete with traditional industries, thereby inhibiting the conversion of economic growth momentum (Yang, 2023; Xia et al., 2024). However, over time, the integration of the digital economy and traditional economy gradually occurs, leading to the formation of new business models and growth points, which may alleviate the inhibitory effect. The results in columns (3) to (4) of Table 11 show that in the second category of regions, before China's economy entered the "New Normal" stage, capital and technological innovation have regression coefficients of −10.154 and 5.786, respectively, both passing significance tests; after China's economy entered the "New Normal" stage, none of the influencing factors in the second category of regions passed significance tests. Additionally, the results in columns (5) to (6) of Table 11 reveal that in the third category of regions, prior to China's economy entering the "New Normal" stage, labor, capital, and technological innovation have regression coefficients of −8.973, −11.720, and 2.954, respectively, all passing significance tests; after China's economy entered the "New Normal" stage, none of the influencing factors in the third category of regions passed significance tests. These findings indicate that for regions with moderate to low levels of economic growth momentum conversion, prior to China's economy entering the "New Normal" stage, capital and technological innovation will significantly affect the level of economic growth momentum conversion, with the former having a negative effect and the latter a positive effect; after China's economy entered the "New Normal" stage, the effects of these influencing factors on the conversion of economic growth momentum have all weakened.

5. Conclusions and discussions

We examine the factors influencing the economic growth momentum transition in 31 Chinese provinces from 2002 to 2021 using panel data linear regression models and quantile regression models. The specific contents are as follows:

First, theoretical analysis is conducted to identify the factors influencing the economic growth momentum transition in China, and the main factors affecting the economic growth momentum transition in China are identified using the full sample. Starting from the sources of economic growth, this study determines the influencing factors of the economic growth momentum transition and constructs a panel data linear regression model. The results of the model show that capital, digital economy, and technological innovation are the major factors influencing the economic growth momentum transition in China. Considering that the roles of these factors may vary at different stages of the economic growth momentum transition, we further employ panel data quantile regression models to explore the effects of various influencing factors on the degree of economic growth momentum transition at different quantile levels. The research results indicate significant heterogeneity in the degree and manner of the effects of various influencing factors at different stages of the economic growth momentum transition.

Second, we investigate the heterogeneity in the effects of the factors influencing the degree of economic growth momentum transition during different periods. Considering that the economic growth momentum transition may be influenced by the external economic environment, this study conducts an in-depth analysis of the key nodes of structural changes in China's economic growth

momentum transition, especially the global financial crisis in 2008 and China's entry into the "New Normal" development stage in 2014. Using these two time points as nodes and splitting the full sample into different subsamples, a panel data linear regression model is constructed for comparative analysis. The research results show that the effects and degrees of the factors influencing the economic growth momentum transition in China have undergone significant changes before and after the financial crisis and the "New Normal", indicating pronounced heterogeneity.

Third, we explore the heterogeneity in the effects of the factors influencing the degree of economic growth momentum transition under different time periods and spatial interaction effects. Based on the degree of economic growth driver transformation, we employ the K-Means method to classify the 31 Chinese provinces into three categories and combines different time periods and spatial classifications to form multiple cross-sectional samples. Subsequently, a panel data linear regression model is used to analyze each cross-sectional sample, and the regression results are compared and analyzed. The research results show significant heterogeneity in the influencing factors across regions with different degrees of economic growth driver transformation. Furthermore, the effects and degrees of the factors influencing the economic growth momentum transition also exhibit heterogeneity under different time periods and regional classifications.

To enhance the transition of economic growth momentum, the government may consider implementing a series of strategic recommendations. First, targeted tax incentives should be introduced for key sectors such as manufacturing, technological innovation, and green development. The government can award grants and subsidies to enterprises that have achieved remarkable results. Organize regular bank-enterprise matching activities would facilitate cooperation between financial institutions and enterprises, fostering information exchange and cooperation. The establishment of an information sharing platform can enhance financing efficiency by matching the financing needs of enterprises with the credit policies of financial institutions. Additionally, a dedicated financing platform for innovative projects could effectively match capital with innovative ventures, showcasing projects from various regions to attract investors' interest. The platform can also provide services such as project evaluation and financing scheme design to help investors assess risks and returns.

Second, establish a special fund and annually increase its budget by at least a designated amount to support national-level science and technology projects. Formulate key research and development plans targeting fields such as artificial intelligence, 5G communication, and quantum technology, attracting top domestic and international research teams. An evaluation system for scientific and technological achievements should be established, rewarding projects that achieve significant breakthroughs. To tackle critical technological challenges, a core technology research team should be formed. Additionally, establish cooperation mechanisms with internationally renowned scientific research institutions, introducing advanced foreign technologies and further innovating upon them. Core technology application demonstration projects should be launched to promote the practical application of these technologies. Promote close collaboration between universities, research institutions, and enterprises for joint technology research and development, as well as achievement transformation. A database of industry-university-research cooperation projects should be established to regularly disseminate project information and facilitate supply-demand matching. An information sharing platform should be launched to enhance information exchange and resource sharing. Furthermore, encourage universities, research institutions, and enterprises to jointly establish laboratories for resource sharing and complementary advantages, making these laboratories accessible to small and medium-sized enterprises for technology research and testing services.

When implementing regional cooperation mechanisms, it's crucial to draw on successful domestic and international models, incorporate the unique characteristics and needs of China's diverse regions, and establish multi-level cooperation platforms. For example, establishing a provincial-level regional cooperation committee can facilitate the alignment of development plans and policies across regions, encouraging resource sharing and capitalizing on complementary strengths. Moreover, fostering collaboration between cities and counties can be strengthened, promoting the emergence of distinct regional industrial clusters and innovation hubs through synergies in industry, technology, talent exchange, and other initiatives. In terms of enhancing fiscal transfer payments to less developed regions, it is essential to tailor specific payment standards and ratios based on the fiscal capacities and expenditures of each area. For regions experiencing economic challenges, both central and provincial governments can create dedicated poverty alleviation funds to support infrastructure development, industrial expansion, and social advancement. Additionally, optimizing the tax structure, implementing preferential tax policies for underdeveloped areas, easing their financial burden, and stimulating their growth potential are all viable strategies.

Use of AI tools declaration

The authors declare that they have not used Artificial Intelligence tools in the creation of this article.

Conflict of interest

All authors declare no conflicts of interest in this paper.

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