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Understanding the Slowing of China's Economic Growth: An Empirical Examination of the Effects of Opening-up

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Abstract: Understanding the factors behind the slowdown in China's economic growth since the early 21st century is crucial. This study uses a linear regression model to analyze the impact of Opening-up on economic growth, employing provincial-level panel data from the National Bureau of Statistics of China (NBS) for 1997-2023. Robustness is tested by including variables such as total imports and exports at the business unit's location, gross regional product, and total imports and exports at domestic destinations and sources in RMB. The study also examines heterogeneity across regions, time periods, trade types, and economic sectors. Key findings include: 1) A positive correlation between Opening-up and economic growth; 2) Variation in the impact of Opening-up based on region, time, trade type, and sector; 3) External shocks can weaken the benefits of Opening-up; 4) The economic slowdown is partly due to uneven regional development, external shocks, high reliance on imports, and insufficient industrial restructuring.

Keywords: Opening-up, Economic Growth, Regression Analysis, Heterogeneity Analysis, China.

1. Introduction

Since the Reform and Opening-up policy was launched in 1978, China has witnessed a staggering annual GDP growth rate of 10% over a span of 30 years. Particularly between 1992 and 2011, the economy grew robustly, with annual rates fluctuating between 7.7% and 14.2%. In 1952, China's GDP stood at just 67.91 billion yuan, with a per capita figure of 119 yuan. After 26 years of progressive development, these numbers rose to 367.87 billion yuan and 385 yuan respectively by 1978. By 2020, the GDP had surged to 101,356.7 billion yuan, and per capita GDP had climbed to 7,182.8 yuan, securing China's position as the world's second-largest economy. Over the past three decades, China's exceptional economic rise is evident in the continual increase in both total GDP and per capita income, the strengthening of national power, the enhancement of living standards, and the deepening of its Opening-up to the global economy.

Since 2012, China's economic growth has seen a marked deceleration. The GDP growth rate sharply declined from 9.6% in 2011 to 7.9% in 2012, garnering significant domestic concern. This downward trajectory persisted, with growth falling below 6% by 2016 and further decreasing to 5.2% by 2023. Although China has yet to attain developed country status, the pace of its GDP growth has substantially slowed. The nation is now transitioning from a period of rapid development to a 'new normal' characterized by high-quality growth, which encompasses the overlapping phases of

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adjusting the growth rate, undergoing structural reforms, and absorbing the effects of previous stimulus policies. Concurrently, China faces economic pressures from changing expectations and inadequate effective demand. Additionally, the intensifying trends of anti-globalization, trade protectionism, and rising geopolitical risks have introduced greater complexity and uncertainty to the external challenges confronting China's economic growth.

What factors have led to the significant decline in China's economic growth rate since the early 21st century? What are the key influences driving this trend? What future developments are expected in China's economic trajectory? Given the current domestic and international conditions, how should China navigate its path towards becoming a modern socialist strong country and achieving its second centennial objective? This study aims to empirically analyze the impact of Opening-up on China's economic growth, utilizing macroeconomic data from 1997 to 2023 and a one-dimensional linear regression model. To provide a thorough understanding of China's economic landscape, the analysis will include robustness tests and heterogeneity assessments to ensure comprehensive and accurate conclusions.

2. Literature review

Research related to this study examines the impact of Opening-up on economic growth. Si Lijuan and Yang Fuqiang and Wei Wei et al. emphasize regional variations in these effects [1-2]. Qu Yue et al. found that foreign trade has increasingly stimulated growth in sectors such as education and healthcare, but has had slower effects on technology and manufacturing, with negative impacts in agriculture, finance, and retail [3]. Quan Shengyue used spatial panel analysis to demonstrate that foreign investments and trade positively affect regional economies, though the export-processing model limits export growth while amplifying the impact of imports [4]. Xing Shenglong and Xu Xiaoliang analyzed the long-term effects of Opening-up on regional growth using Cobb-Douglas production functions [5-6].

The literature indicates that the influence of Opening-up on economic growth is not uniform and varies with different openness conditions and regional characteristics. Additional studies provide varied perspectives on this relationship. Li Zhen examined the spatial efficiency relationship between Opening-up and economic growth, including the moderating effects [7]. Shi Honglian et al. and Wu Shaojiang analyzed the nonlinear dynamics of trade openness, finding that it promotes growth at lower levels but inhibits it at higher levels, considering factors such as capital deepening, capacity utilization, and absorptive capacity [8-9].

Based on the reviewed literature, this study makes four key contributions: First, it examines China's economic deceleration since the 2000s from the perspective of Opening-up, offering fresh insights into the country's economic slowdown. Second, it applies rigorous statistical techniques, including empirical analysis, robustness checks, and heterogeneity analysis across various regions, time periods, trade types, and economic sectors to assess the impact of Opening-up on economic growth. Third, it utilizes a comprehensive dataset covering 31 Chinese provinces, municipalities, and autonomous regions, ensuring the analysis is both extensive and current. Finally, given the complex global context and China's ambitions for modernization and achieving its centenary goals, this study provides valuable theoretical and practical insights. It also offers lessons for other developing nations and aims to deepen the understanding of economic theory.

3. Developments in China's Opening-up Since Reform

Figure 1 illustrates the trend in China's total import and export volumes since the onset of its Reform and Opening-up policy in 1978. Initially, before the 21st century, the increase in trade volumes was not pronounced. However, after China's accession to the WTO in 2001, there has been a significant

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rise in trade volumes, indicating a broadening of its opening-up measures. Recently, from 2021 to 2023, the growth rate of imports and exports has markedly slowed, a trend attributed to the global economic recovery challenges in the post-pandemic period and limited domestic demand. At the beginning of the 21st century, China saw sustained high-speed growth in trade volumes, but from 2018 to 2020, growth rates were depressed due to US-China trade tensions and the impact of COVID-19. Notably, in 2008, China's trade volumes fell sharply, but this decline was quickly reversed due to China's prompt macroeconomic response, including the "Four Trillion Yuan plan," which mitigated the effects of the US subprime mortgage crisis.

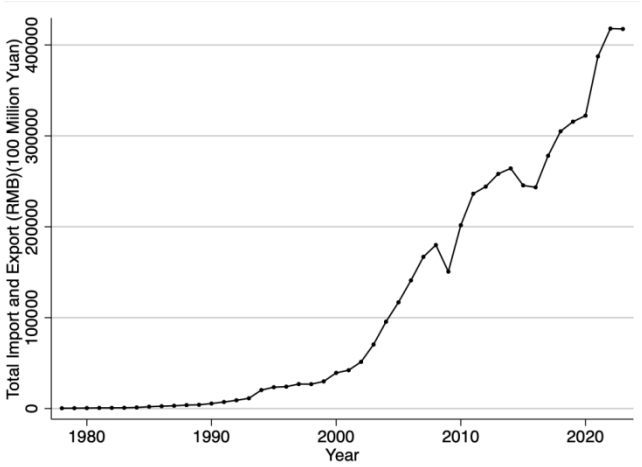

Figure 1: Overview of China's cumulative import and export trends following the Reform and Opening-up.

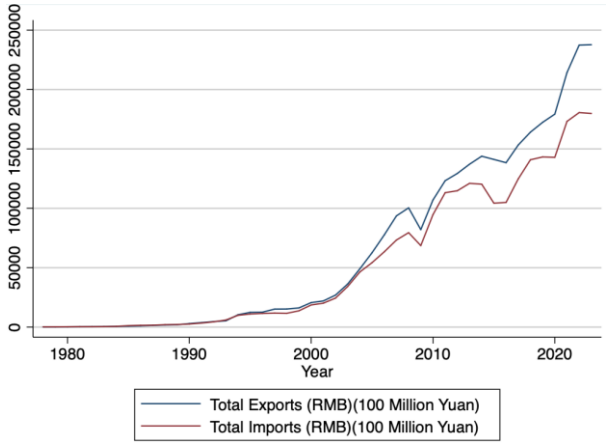

Figure 2: Evolution of China's import and export volumes individually since the Reform and Opening-up.

Figure 2 illustrates the trend in China's total imports and exports since the onset of the Reform and Opening-up. Throughout the 21st century, both import and export volumes have risen notably, with exports overtaking imports after 2004 and the gap expanding. This creates a distinct trumpet-shaped pattern in the data. Regarding growth rates, from 2018 to 2020, there was a noticeable deceleration, particularly in imports, which saw minimal growth compared to exports. This slowdown was largely due to trade tensions with the United States and the impact of the COVID-19 pandemic, which primarily affected import levels. The imposition of high tariffs and other trade barriers significantly impacted imports, while exports remained relatively stable due to strong international

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demand beyond the US market. From 2021 to 2023, both imports and exports experienced near-zero growth rates, largely due to rising trade protectionism, unilateral actions, and fluctuations in global commodity prices. Notably, in addition to the sharp decline in trade volumes during the 2008 US subprime mortgage crisis, there was also a significant drop in 2014-2016, with imports experiencing a more extended and severe decline. This persistent stagnation can be attributed to weakened domestic and international demand, diminishing traditional manufacturing strengths, and the ongoing decrease in commodity prices.

4. Research Design

4.1. Variable Selection

This study focuses on economic growth, measured by Gross Regional Product per capita, as the main dependent variable. The key independent variable is Opening-up, assessed through Total Exports and Imports to and from Domestic Destinations and Sources. To ensure robustness, the analysis includes Gross Regional Product, Total Imports and Exports at Business Units, and Total Exports and Imports at Domestic Destinations and Sources, all in RMB. The study also examines trade heterogeneity using Total Exports from Domestic Sources and Total Imports to Domestic Destinations, and analyzes industry-specific impacts through Value Added in Primary, Secondary, and Tertiary Industries.

4.2. Data Sources

The empirical analysis in this study focuses on 31 provinces, municipalities, and autonomous regions within China, covering the period from 1997 to 2023. The data utilized for this analysis are sourced from the National Bureau of Statistics of China. Descriptive statistics for the study are presented in Table 1.

Table 1: Descriptive Statistical Analysis.

Variable	Obs	Mean	Std.Dev.	Min	Max
Total Exports and Imports to and from Domestic Destinations and Sources (thousands of dollars)	837	9.25E+07	1.99E+08	90300	1.50E+09
Gross Regional Product per capita (yuan per person)	837	36910.23	33021.52	2250	200278
Regional Gross Domestic Product (billion yuan)	837	16355.52	20469.5	77.2	135673
Total Amount of Imports and Exports at the Location of the Business Unit (in thousands of dollars)	837	9.26E+07	1.86E+08	92910	1.30E+09
Total Exports from Domestic Sources (thousands of dollars)	837	5.08E+07	1.18E+08	22770	8.80E+08
Total Imports to Domestic Destinations (thousands of dollars)	837	4.17E+07	8.46E+07	20000	5.70E+08
Value Added of Primary Industry (billion yuan)	837	1387.671	1345.831	28.4	6506.2
Value Added of Secondary Industry (billion yuan)	837	6891.473	8733.21	16.9	56909.7
Value Added of Tertiary Industry (billion yuan)	837	8076.389	11017.33	31.9	75695.2

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4.3. Model Design

The research model in this paper is a one-way linear regression as follows:

$$Y = \alpha X + \beta + \varepsilon \quad (1)$$

In this model, Y denotes the dependent variable for economic growth, X represents the primary explanatory variable for openness, and ε stands for the error term.

5. Empirical Analysis

5.1. Correlation Analysis

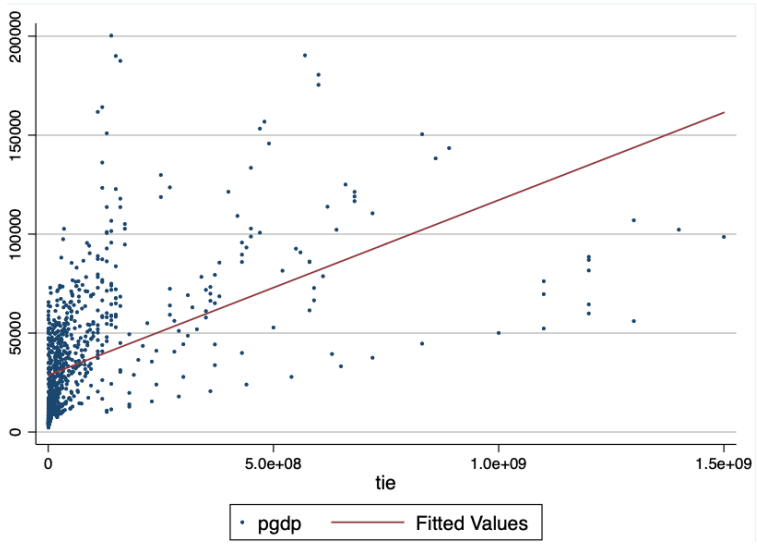

Figure 3: Correlation Between Gross Regional Product per Capita and Total Exports and Imports to and from Domestic Destinations and Sources.

Figure 3 shows the relationship between Gross Regional Product per capita and Total Exports and Imports to and from Domestic Destinations and Sources. Here, pgdp stands for Gross Regional Product per capita (in yuan), and TIE represents Total Exports and Imports (in thousands of dollars). The figure reveals a general positive trend between Gross Regional Product per capita and Total Exports and Imports, though significant regional differences are evident. Many Chinese regions exhibit low levels of outward openness, limiting the impact of openness on economic growth. Further regression analysis will be conducted to confirm this relationship.

5.2. Benchmark Regression

Table 2 presents the primary regression findings for the impact of Total Exports and Imports from and to Domestic Destinations and Sources. The core model indicates an estimated coefficient of 0.7221 for the explanatory variable, which is statistically significant at the 1% level. These results preliminarily suggest that Total Exports and Imports have a generally positive effect on Gross Regional Product per capita. This effect is attributed to how increased openness has integrated China into the global value chain, leading to market expansion, capital inflow, technological advancements, and industrial growth, all contributing to economic development.

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Table 2: Results of Benchmark Regression and Robustness Testing.

	y	y	y	y
x	0.7221***	0.8068***	0.6963***	0.7625***
	(66.0910)	(76.3763)	(69.1293)	(59.1414)
_cons	-1.9919***	-4.5411***	-1.5459***	-9.4421***
	(-10.3172)	(-23.2338)	(-8.6859)	(-28.0705)
N	837	837	837	837
R2	0.8853	0.8814	0.8940	0.8689

5.3. Robustness Tests

To verify the robustness of the primary regression results, this study conducts a robustness check by using alternative indicators for openness and economic growth. Specifically, it substitutes Total Exports and Imports to and from Domestic Destinations and Sources with Total Imports and Exports at the Business Unit Location. Additionally, Gross Regional Product per capita is replaced with Gross Regional Product, and Total Exports and Imports are measured in Thousands of U.S. Dollars rather than RMB. Results from Models 2, 3, and 4 in Table 2 confirm that the positive effect of openness on economic growth remains significant, supporting the robustness of the original findings.

5.4. Heterogeneity Analysis

5.4.1. Regional Heterogeneity Analysis

To examine the spatial effects of opening up on economic growth, this study classifies China into four regions—eastern, central, western, and northeastern—based on the 2011 classification by the National Bureau of Statistics. Table 3 displays the regression results for the impact of opening up on per capita regional GDP, with coefficients of 0.7542, 0.7121, 0.6696, and 0.5529, respectively, all significant at the 1% level.

The results show that while opening up benefits all regions, the impact varies. The eastern coastal regions experience the greatest economic boost, followed by the central Yangtze River region. The western regions have a moderate effect, and the northeastern regions see the least benefit. This variation suggests that the eastern and central regions have gained more from opening up, whereas the western and northeastern regions have seen less impact. The overall slowdown in China's economic growth is partly due to the reduced effect of openness in the western and northeastern regions and the diminishing benefits in the central and eastern regions, exacerbated by a global trend toward anti-globalization since the 21st century.

Table 3: Analysis of Regional Differences.

	Eastern	Central	Western	Northeastern
	y	y	y	y
x	0.7542***	0.7121***	0.6696***	0.5529***
	(51.9434)	(59.8693)	(32.8087)	(13.8370)
_cons	-3.3273***	-1.8327***	-0.4909	0.7170
	(-11.4830)	(-9.1062)	(-1.5138)	(1.0651)
N	270	162	324	81
R2	0.9234	0.9635	0.8459	0.9678

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5.4.2. Temporal Heterogeneity Analysis

This paper examines the effect of opening up on China's economic growth by dividing the sample period into four phases, focusing on China's WTO accession in 2001, the U.S. subprime mortgage crisis in 2008, and the U.S.-China trade tensions in 2018. Table 4 presents regression results for these periods, with coefficients of 0.3010, 0.5142, 0.3756, and 0.2428, all significant at the 1% level.

The analysis shows that opening up has positively influenced China's economic growth throughout these periods. The most significant impact occurred after China joined the WTO, enhancing growth through global value chain integration. However, the global downturn during the U.S. subprime crisis reduced the positive effects of openness. The strongest influence of openness on economic growth was observed between China's WTO entry and the U.S. subprime crisis. The effects before China joined the WTO and after the global crisis were similar but less significant. Even without WTO membership, opening up would still have positively impacted economic growth, though to a lesser degree. The current trade conflicts with the U.S. further highlight the severe negative effects of trade disputes on economic performance. Therefore, the U.S. subprime mortgage crisis and U.S.-China trade tensions have significantly contributed to the slowdown in China's economic growth since the early 21st century.

Table 4: Analysis of Temporal Variations.

	1997-2001	2001-2008	2008-2018	2018-2023
	y	y	y	y
x	0.3010***	0.5142***	0.3756***	0.2428***
	(12.2591)	(35.4187)	(15.8923)	(10.9281)
_cons	4.2993***	1.1832***	4.0196***	6.8580***
	(11.5583)	(4.8884)	(9.7168)	(17.1271)
N	155	186	341	155
R2	0.6784	0.9242	0.6026	0.5573

5.4.3. Trade Heterogeneity Analysis

This section examines trade heterogeneity by categorizing international trade into imports and exports. Table 5, Models (1) and (2) present the effects of Total Exports from Domestic Sources and Total Imports to Domestic Destinations on Gross Regional Product per capita. The estimated coefficients for these variables are 0.7186 and 0.6604, respectively, with both results achieving significance at the 1% level.

The findings in Table 5 indicate that while both exports and imports positively influence economic growth, exports have a stronger positive effect compared to imports. The trade tensions between the U.S. and China, particularly the U.S. restrictions on Chinese imports such as high-end chips and soybeans, have significantly affected China's import levels. This restriction has further weakened the already limited positive impact of imports on economic growth, contributing to a slowdown in China's economic progress.

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Table 5: Analysis of Trade and Industry Heterogeneity.

	Exports	Imports	Primary Sector of Industry	Secondary Sector of Industry	Tertiary Sector of Industry
	y	y	y	y	y
x	0.7186***	0.6604***	0.5392***	0.8009***	0.8767***
	(60.1271)	(53.1977)	(56.6516)	(76.4378)	(72.6565)
_cons	-1.4496***	-0.4179**	-2.3899***	-5.3460***	-6.5106***
	(-7.1609)	(-2.0167)	(-9.8830)	(-26.4122)	(-30.2637)
N	837	837	837	837	837
R2	0.8630	0.8355	0.8005	0.8795	0.8751

5.4.4. Analysis of Industry Heterogeneity

This paper categorizes GDP into Value Added of Primary Industry, Value Added of Secondary Industry, and Value Added of Tertiary Industry according to national economic industry classifications to examine industry-specific heterogeneity. Table 5, Models (3), (4), and (5) detail the effects of Total Exports and Imports on these industry sectors, with the coefficients for the explanatory variables being 0.5392, 0.8009, and 0.8767 respectively. All coefficients are significant at the 1% level.

The results indicate that Opening-up positively influences all three sectors, with the most pronounced effect on the Tertiary Industry, followed by the Secondary Industry, and the least effect on the Primary Industry.

From this, it can be deduced that the slowdown in China's economic growth is due to two main factors. First, the impact of Opening-up on the Primary Industry has been relatively limited. Second, the shift in focus from manufacturing to services, driven by advancements in technologies such as artificial intelligence, the internet, and blockchain, has reduced the advantage of China's manufacturing sector as the "world's factory." Additionally, the contribution of the service sector to GDP has only recently surpassed 50%. Despite the strong impact of Opening-up on the Tertiary Industry, it has not been sufficient to maintain the high growth rates observed previously.

6. Conclusions

Based on the findings, this study indicates that China's Opening-up policy has generally expanded since 1997, despite facing various fluctuations due to external shocks. The disparity between China's total imports and exports has notably increased in the 21st century, with external shocks exerting a greater effect on imports. There is a positive association between China's Opening-up and economic growth. Regionally, Opening-up has a more significant impact on economic growth in the eastern and central regions, while its effect is comparatively weaker in the western and northeastern areas. Additionally, the positive influence of Opening-up on economic growth has been moderated by the U.S. subprime mortgage crisis and U.S.-China trade tensions, whereas China's WTO membership amplified this effect. Both exports and imports contribute positively to economic growth, though imports have a lesser impact. The positive effect of Opening-up on Value Added is most pronounced in the Tertiary Industry, followed by the Secondary and Primary Industries. The slowdown in China's economic growth can be attributed to uneven regional development, external shocks, high dependency on imports, and insufficient industrial restructuring.

The study suggests five key implications: (1) Continue Expanding Opening-up: The government should maintain its commitment to high-level Opening-up and further enhance related policies. (2) Promote Regional Coordination: Foster balanced regional development and integrate land-sea and

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east-west strategies. (3) Strengthen International Relations: Improve international dialogue, reduce trade conflicts, and address global issues collectively. (4) Boost Domestic Consumption: Enhance domestic demand and reduce external market dependence, while advancing innovation and developing key technologies to strengthen economic growth. (5) Advance Agricultural and Industrial Modernization: Support agricultural modernization and technological advancements, and drive the transformation and expansion of the manufacturing and service sectors.

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