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FINANCIAL OPENNESS AND ECONOMIC GROWTH IN CHINA: THRESHOLD EFFECTS OF FINANCIAL DEVELOPMENT ACROSS URBAN AGGLOMERATIONS

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Abstract

This study examines how financial development (FD) conditions the effect of financial openness (FO) on economic growth across China's three major urban agglomerations: Jing-Jin-Ji, the Yangtze River Delta, and the Pearl River Delta. Using a balanced panel of 10 provinces, municipalities, and special administrative regions from 1995 to 2022, the analysis applies Hansen's panel threshold regression model, with real per capita GDP growth as the outcome and an FD index constructed through principal component analysis as the threshold variable. The estimates identify two FD thresholds, 0.7328 and 1.0401, which divide the FO–growth relationship into three regimes. Financial openness promotes economic growth in all regimes, but its effect is strongest at moderate levels of financial development. Specifically, the estimated FO coefficients are 2.622 when FD is at or below 0.7328, 3.869 when FD lies between 0.7328 and 1.0401, and 2.068 when FD exceeds 1.0401. These results indicate diminishing returns to openness once financial systems become highly developed. Trade openness, fixed-asset investment, and inflation are also positively associated with growth, whereas the effect of higher-education graduates is negative but statistically insignificant. Robustness checks using additional bootstrap replications, nonlinear interaction terms, winsorization, and alternative variable transformations confirm the double-threshold structure and the stronger growth effect within the moderate-FD regime. The findings show that the benefits of financial integration depend on domestic financial maturity. Accordingly, policymakers should pursue region-specific reforms that deepen financial capacity in less-developed areas while containing over-financialization and strengthening regulation in advanced urban economies.

Keywords: Financial Openness, Financial Development, Economic Growth, Threshold Regression, China's Urban Agglomeration Regions
JEL classification: E1, E6, F31, G2

1. Introduction

Since 1978, China has undergone a profound economic transformation, evolving from a protectionist stance to an open-door policy that has fundamentally reshaped its financial landscape. This transition, characterized by increasing financial openness (FO) and rapid financial development (FD), is particularly evident in key urban agglomerations such as the Pearl River Delta, Yangtze River Delta, and Jing-Jin-Ji regions. These clusters, highlighted during the 19th National Congress of the Communist Party in 2017 (Wu, 2021) and projected to evolve into world-class city clusters by 2035 (Qian, 2021), contributed 43% of China's total GDP in 2024, underscoring their critical role in national economic stability and growth (National Bureau of Statistics of China, 2025; Beijing-Tianjin-Hebei Collaborative Development Joint Office, 2025; Beijing-Tianjin-Hebei Collaborative Development Joint Office, 2026; Guangdong Academy of Social Sciences, 2025). Against this backdrop, financial openness—defined as the extent to which domestic financial markets integrate with global markets—has emerged as a key driver of economic performance by attracting foreign capital, fostering competition, and enabling efficient resource allocation (Klein & Olivei, 2005; Henry, 2007). At the same time, FD, which encompasses the sophistication of financial markets and institutions in

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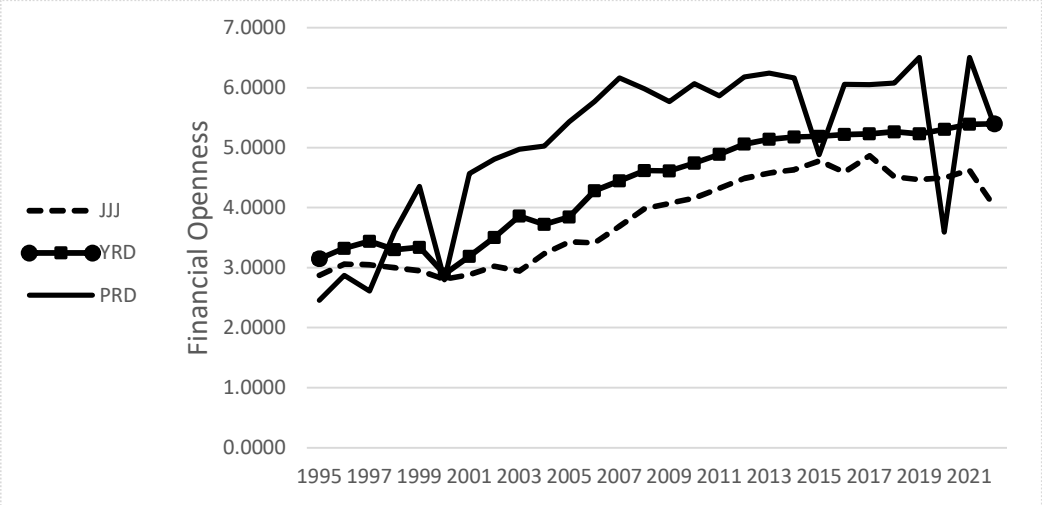
mobilizing savings and channelling investments (King & Levine, 1993; Levine, 2005), plays a crucial role in determining whether financial liberalization yields positive outcomes.

As shown in Figure 1, financial openness (represented by FDI inflows) has steadily increased across all three major Chinese urban regions since the mid-1990s. The Pearl River Delta (PRD) has consistently maintained the highest level of openness but with considerable volatility, reflecting its deep global integration and sensitivity to external shocks. The Yangtze River Delta (YRD) shows a stable and sustained increase, indicating a strong institutional environment. Meanwhile, the Jing-Jin-Ji (JJJ) region has experienced more gradual growth in openness, suggesting room for policy-driven financial liberalization. These trends offer strong support for the threshold regression findings, where regional financial openness interacts significantly with financial development to influence economic growth.

Figure 1

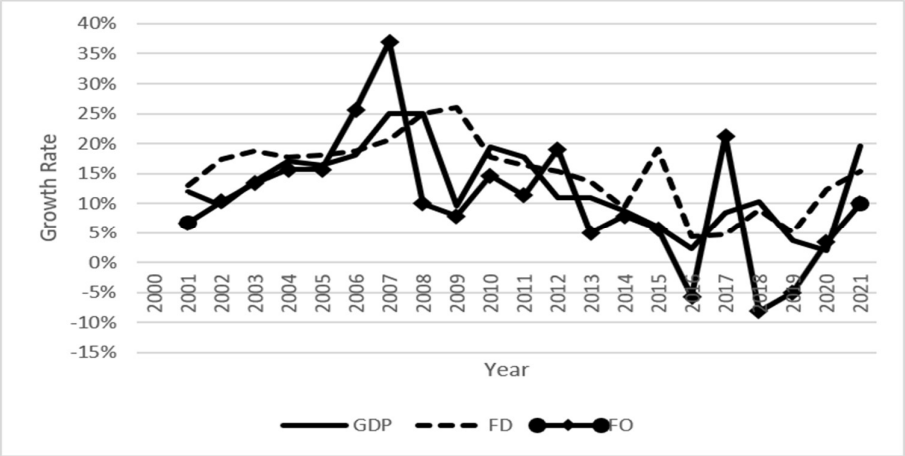
Evolution of Financial Openness in Three Chinese Urban Agglomerations (1995-2022)



Taking the average of financial openness (represented by FDI-inflow), financial development (represented by deposits in financial institutions), and economic growth levels across these three economic regions in China (as shown in Figure 2), the trends from 2001 to 2021 moving in same direction at most of time. However, during the period from 2012 to 2018, there were significant deviations in the degrees of financial openness and financial development from economic growth. This raises the question of whether there are threshold values of financial development during these years, indicating that the impact of financial openness on economic growth in these three regions undergoes changes.

Figure 2

The Year-on-Year Average Growth Rates of GDP, FD, and FO in the Three Regions (2000-2021)



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Although previous research has examined these factors individually, many studies have assumed linear relationships or focused on national or provincial levels (Chinn & Ito, 2006; Estrada et al., 2015), leaving a critical gap in our understanding of how FO and FD interact within China's dynamic urban agglomerations.

This study addresses that gap by exploring the nonlinear and interactive impacts of FO and FD on economic growth in China's major urban clusters. The central research questions are: How does FO influence economic growth in these regions? How does the level of FD moderate this relationship? And what is the critical threshold at which financial openness transitions from being beneficial to potentially destabilizing? By answering these questions, the study aims to (1) examine the nonlinear effects of financial openness on economic growth, (2) identify the threshold level of financial development that delineates distinct regimes in this relationship, and (3) provide empirical evidence to inform region-specific financial policies.

The significance of this research is multifaceted. Theoretically, it enriches the literature by integrating the nonlinear dynamics between financial openness and economic growth with the moderating influence of financial development, thereby challenging traditional linear models and extending established theories such as the Theory of Endogenous Growth (Romer, 1986; Lucas, 1988) and the Financial Liberalization Hypothesis (McKinnon, 1973; Shaw, 1973). Practically, the findings offer policymakers critical insights for designing tailored financial strategies that maximize the benefits of global financial integration while mitigating potential risks, particularly in regions with varying levels of financial maturity. Methodologically, the study employs Hansen's (1999) threshold regression model, an innovative approach that effectively captures regional heterogeneity and the regime-dependent effects of FO on per capita GDP, thereby enhancing the robustness of the empirical analysis.

By addressing these research objectives and questions, this study not only fills an important gap in ascertaining the interplay between FO, FD and growth in China's urban agglomerations but also provides a comprehensive framework for guiding sustainable regional economic policies. The remainder of the study contains the relevant research, details the methodology, presents the empirical findings, discusses policy implications, and suggests guidance for future research.

2. Literature Review

2.1 Theoretical Review

The nexus among financial openness and growth has attracted extensive debate in the research. Financial openness is defined as the level to which a country's financial markets are integrated with global markets, while economic growth is quantified by the rise in output or GDP. However, research shows that the benefits of FO on growth are not automatic; they depend largely on the level of domestic FD. Financial development encompasses the strength, depth, and efficiency of financial institutions and markets, which are essential for mobilizing savings, allocating capital efficiently, and managing risks.

Several economic theories support the idea that FD moderates the effects of FO on growth. Endogenous Growth Theory (Romer, 1986; Lucas, 1988) argues that economic prosperity is driven by variables such as innovation and human capital, which can be enhanced by the inflow of foreign capital and technology through financial openness. However, this positive effect is more likely to materialize in nations with state of art financial markets. Similarly, the Financial Liberalization Hypothesis (McKinnon, 1973; Shaw, 1973) suggests that removing financial restrictions improves capital efficiency and spurs growth, but only when a strong domestic financial structure is in place. In addition, Threshold Theory (Hansen, 1999) posits that the impacts of FO on growth are nonlinear; there exists a critical level of financial development, below which openness might even lead to instability rather than growth. Finally, the established link between financial development and growth (Levine, 2005; King & Levine, 1993) further implies that without sufficient financial depth and robustness, the advantages of financial openness may not be fully realized.

2.2 Empirical Review

Research on financial openness and economic growth has increasingly highlighted its positive contributions, particularly with the progression of global financial integration. Many researchers argue that financial openness facilitates growth. Edison et al. (2002) identified three main ways in which global financial integration contributes to economic expansion:

First, financial openness will make the financial system more competitive and transparent by allowing financial institutions to share risks and reduce domestic capital costs. For instance, it helps lower loan interest rates and the cost of equity, supporting high-return investment and higher economic production. Second, financial openness can encourage international capital flows, allowing developing nations with relatively high marginal productivity to receive investment subsidies while still meeting the development fund needs of capital-inflow countries. Third, financial openness allows foreign banks with advanced financial practices to enter the market, introducing advanced risk management techniques, innovative financial instruments, and services. This, in turn, strengthens the domestic financial system, enhances the performance of financial institutions, and indirectly increases investment returns and economic growth (Yang et al., 2020). This perspective on the contribution of financial openness in fostering growth aligns with the findings of other scholars, including Xie (2017), Tao and Xie (2017), Yu and Qayyum (2023), Sahoo and Sethi (2023) and Salifu et al. (2024).

Beside above studies, research also shows a non-linear nexus between FO and growth: McKinnon and Pill (1996) analysed the frequent occurrence of financial problems in developing countries in the 1980s, attributing these crises to the implementation of financial openness policies, which significantly destabilized their economies, leading to adverse effects on economic growth. Obstfeld (2009) said financial openness is not a cure-all and can even be harmful if not managed carefully. Evidence shows its benefits are more likely when introduced gradually, supported by strong external balances and reserves. It should also work alongside domestic policies and reforms that promote stability and growth. Kose et al. (2009) research indicates that an economy needs to meet a specific level before fully experiencing the positive effects of financial openness, such as supporting economic growth and reducing financial risks. They noted that nations boasting advanced financial systems and strong institutional quality tend to experience a more significant positive impact from financial openness on their growth. The primary objective of studying the threshold effect of financial openness is to determine when it augment growth and when it may have negative consequences.

Meanwhile, Chen and Quang (2014) crafted a panel threshold model, identifying crucial external conditions for financial openness to affect economic growth. They highlighted these conditions in areas like economic development, institutions, financial progress, and government spending, which play a role in how FO impacts growth along various levels of financial development. Additionally, Yang and Chen (2015), in their analysis across 69 global countries (regions) found that capital account openness significantly affects cross-border investments, with its impact closely related to a country's (region's) financial development level. Similarly, Guo and Peng (2016), examining both national and provincial levels in China and established a notable threshold effect of financial openness on growth. The same perspectives also can be found by the studies of (Liang, 2020; Karim et al., 2021; Nam et al., 2024).

Likewise, several other researchers have posited that the connection between foreign direct investment (FDI) and economic growth may follow a nonlinear pattern (Kose et al., 2009; Hayat & Tahir, 2020; Yang et al., 2020; Ibbagui, 2020). In a threshold regression analysis focused on Sub-Saharan Africa (SSA), Ibbagui (2020) examined how six factors—inflation, initial income, population growth, trade openness, financial market development, and human capital—moderate the FDI—growth relationship. The findings suggest that the direct effect of FDI on economic expansion can be inconsistent and unclear; however, FDI's growth-enhancing impact emerges more distinctly once these variables reach certain threshold values.

Similarly, Osei and Kim (2020) examined how increasing FD impacts the effectiveness of FDI on growth. It found that while FD generally enhances growth, its further expansion beyond a certain point does not significantly enhance this effect. The study revealed that the positive influence of FDI on growth becomes negligible when the ratio of private sector credit to GDP exceeds 95.6%.

Recent studies have highlighted the significance of threshold effects in shaping how FDI influences economic performance. For example, Nguyen (2022) finds that FDI exerts a positive impact on growth both before and after critical levels of financial development—specifically 85.64% for the banking sector and 21.95% for the stock market. Notably, the effect of FDI strengthens once financial development surpasses these thresholds. In a related vein, Yeboua (2021) emphasizes that institutional quality plays a pivotal role in

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maximizing FDI's contribution to economic growth among African nations. The study identifies various institutional benchmarks—ranging from 25% for bureaucracy quality to 65% for government stability—above which FDI substantially promotes growth. Below these benchmarks, FDI's influence may be neutral or even detrimental. These findings collectively underscore that both financial development and institutional robustness must reach certain thresholds for FDI to generate consistently positive outcomes.

Conversely, the research by Law et al. (2018) found that financial development has a threshold effect in the financial openness-growth relationship. They showed that for developing economies, financial openness only positively affects growth when financial development surpasses a certain threshold (e.g., private credit-to-GDP ratio of 40%). Below this level, financial liberalization leads to financial fragility and crises rather than economic benefits.

An and Yeh (2021) examined how FDI affects growth by focusing on the role of financial system maturity in emerging and developing Asian countries during 1996-2017. They identified two critical thresholds. Their analysis showed that FDI positively influences economic growth only when financial development is within a specific intermediate range; beyond this range, particularly at very high levels of financial development, the growth benefits of FDI tend to decrease. These findings contribute to our understanding of the complex, nonlinear interaction among FDI, financial development, and economic growth, and provide valuable benchmarks for

2.3 Research Gap

Given above discussion about research studies conducted in various context by using diverse methodologies indicate that such type of research in three major urban economic agglomeration regions of China have been overlooked. Moreover, the mixed findings of existing studies instigate for further comprehensive research to re explore the intricate linkages between FO and growth through FD by using threshold regression approach. By filling these gaps, the study intends to provide nuanced insights and policy recommendations to carefully manage the financial liberalization and FD policies to ensure the stable growth in these and other regions of China and similar emerging countries.

3. Methodology

3.1 Sources of Data and the Sample Period

China categorizes its cities into three tiers: municipalities, prefecture-level cities, and county-level cities. Notably, Beijing, Shanghai, Tianjin, and Chongqing are directly governed by the central government (Zhang et al., 2012); in this study, the term "city" specifically refers to these municipalities. Following China's accession to the WTO in 2001 and its subsequent financial liberalization, we compiled panel data from 10 provinces, municipalities, and Special Administrative Regions (SARs) for the period 1995-2022. Data were drawn from the China City Statistical Yearbook, China Financial Yearbook, Provincial Statistical Yearbook, Hong Kong and Macao SAR Yearbook, the China Economic Network, and the National Bureau of Statistics. The selection of our sample, variables, model, and time frame was guided by data availability, theoretical rationale, and prior research.

3.2 Model and Variables

The data is first checked through descriptive statistics to check the normality of data and then coefficient of correlation is estimated to check the association and multi co-linearity between the variables. Afterward, Variance inflation factor is also applied to check the multi co-linearity. Initially, our research model also includes the variable of government expenditure, but due to the high multi collinearity problems, we decide to drop this variable. So, after checking the Variance inflation factor, stationary tests are applied to check the order of integration along with applying the Kao cointegration tests. Later on the existence of threshold is confirmed and then coefficients are estimated by using Hansen (1999)'s pioneered threshold regression model. The models to be estimated is given in equation 3.1 to 3.3.

$$\mathrm{PGDPGR}_{it} = \alpha_0 + \beta_1 FO_{it} + \beta_2 FD_{it} + \beta_3 TEI_{it} + \beta_4 FAI_{it} + \beta_5 TG_{it} + \beta_6 IR_{it} + \varepsilon_{it} \qquad 3.1$$

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where $i$signifies various provinces or municipalities included in the data set, t represents the time-series dimension for each observation $(t, =, 1 \ldots T)FO_c$is financial openness, $FD_c$is financial development, $TEI_c$is total exports and imports, $FAI_c$is fixed asset investment, $TG_c$is the total graduates for High Education, and $IR_c$is Inflation rate. The term $\alpha_0$represents a distinct fixed effect, while $\epsilon_c$follows an independent and identical distribution with constant variance $\sigma^2$and zero mean.

Furthermore, by considering FD as the threshold variable, the static threshold regression model adopted is shown in equation 3.2:

$$PGDP_{it} = \alpha_0 + \beta_1 FO_{it} \cdot I(FD_{it} \leq \gamma) + \beta_2 FO_{it} \cdot I(FD_{it} > \gamma) + \beta_3 TEI_{it} + \beta_4 FAI_{it} + \beta_5 TG_{it} + \beta_6 IR_{it} + \varepsilon_{it} \quad 3.2$$

For the robustness check, referring the method of Tan et al. (2024) along with Hansen (1999), this research includes the squared term of $FO^2$by interacting FD to examine the non-linear connection among FO and growth, and how this relationship is moderated/regulated by FD, The following equation 3.3 shows this consideration. If the square term of FO multiplied by FD coefficient $(\beta_4)$is significant, it means a nonlinear influence of FO to economic growth depending on FD. And $\beta_1$and $\beta_2$show the FO's and FD's direct effect to economic growth respectively, $\beta_3$captures the linear interaction of FO with FD, while $\beta_4$measures FO's curved interaction with FD.

$$PGDP_{it} = \alpha_0 + \beta_1 FO_{it} + \beta_2 FD_{it} + \beta_3 FO_{it} * FD_{it} + \beta_4 {FO_{it}}^2 FD_{it} + \beta_5 TEI_{it} + \beta_6 FAI_{it} + \beta_7 TG_{it} + \beta_8 IR_{it} + \varepsilon_{it} \quad 3.3$$

By performing the formula 3.1, 3.2 and 3.3, this study intends to analyse how financial openness (FO) influences economic growth via financial development in the three key urban areas of China. The study first develops the indices for financial development by applying principal component analysis and then uses these indices to research the impacts of FO on growth through FD. Various indicators are used to develop the index of FD as shown in Table 1.

Table 1

Details of Variables, Notation and Data Source

Variable	Notation	Description	Source
Financial Development	FD	Index developed through principal component analysis by using LFIN (the total loans in the financial system), SFM (securities fund management), and GP (Gross premiums)	China City Statistical Yearbook
Financial Openness	FO	Proxy by foreign direct investment logarithmic transformation	China Financial Yearbook
Economic Growth	PGDPGR	Real Per capita GDP growth rate	Provincial Statistical Yearbook
Trade Volume	TEI	Sum of exports and Imports Logarithmic transformation	China City Statistical Yearbook, the China Financial Yearbook, the Provincial Statistical Yearbook
Domestic investment	FAI	fixed asset investment, Logarithmic transformation	
Human capital	TG	Total graduates for High Education, Logarithmic transformation	
Inflation	IR	Inflation rate	

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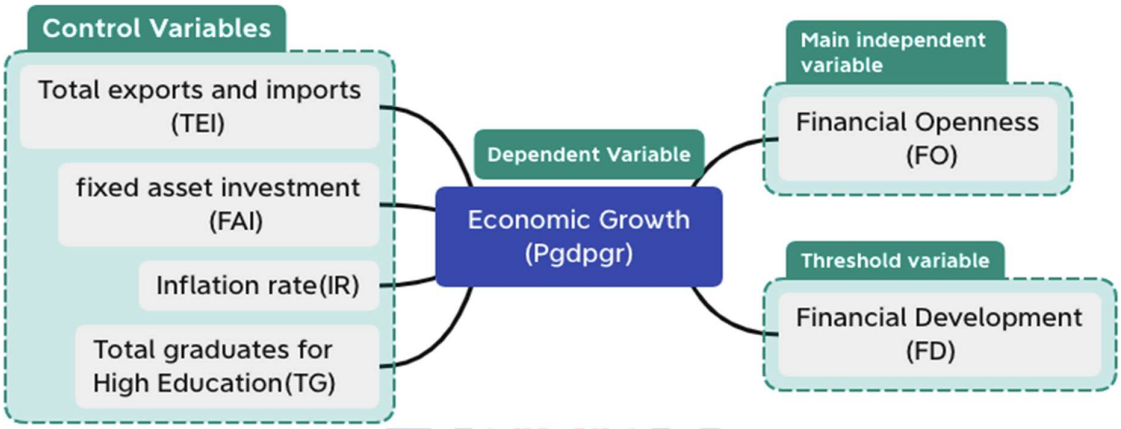
3.3 Conceptual Framework

Figure 3 demonstrates the conceptual Framework of this research. It shows that the dependent variable is Economic growth whereas the variable of interest is financial openness, threshold variable is financial development and control variables are trade volume, inflation rate, and total graduates for High Education. The FO is expected to exert different effects on growth during various regimes of FD. TEI, IR, TG are expected to demonstrate direct nexus with economic growth.

Figure 3

Conceptual Framework



3.4 Hypothesis

1. There is nonlinear nexus among FO and growth.
2. This intricate relationship between financial openness and economic growth occurs through financial development.
3. The impacts of financial openness on economic growth are different during various levels of financial development.

4. Results Discussion

4.1 Descriptive Statistics

Table 2 exhibits the results of descriptive statistics providing key insights into the distribution and properties of the variables incorporated in the research. With 280 observations for each variable, the dataset appears balanced. The mean and standard deviation values indicate the central tendency and dispersion of each variable. For instance, the average of PGDPGR is 10.911, with a SD of 11.224, suggesting medium variation in economic output across observations. Financial openness (FO) has a average of 4.429 and a comparatively less SD of 2.152, showing less differences in financial openness levels among regions. Similarly, financial development (FD) has a average of 0 and a SD of 1.642, pointing that some economies have highly developed financial systems while others lag behind.

Examining the minimum and maximum values reveals interesting patterns. FO ranges from -4.841 to 9.992, highlighting both highly open and financially restrictive economies. FD ranges from -4.18 to 2.624, indicating varying degrees of financial sector maturity. Total exports and imports (InTEI) and fixed asset investment (InFAI) also exhibit variation, with values 3.12-9.489 and 1.855-9.187 respectively. Total graduates for High Education (InTG) varies widely from -1.772 to 4.16, reflecting disparities in human capital development. Meanwhile, the inflation rate (InIR) ranges from 96 to 118.7, with a standard deviation of 3.731.

The skewness and kurtosis values provide additional insights into data distribution. PGDPGR (0.23) shows positive skewness, indicating that while most observations are concentrated around lower values, a few extreme values significantly increase the mean. InIR (1.66) is also positively skewed, suggesting occasional inflation spikes. On the other hand, FD (-0.412), FO (-0.39), InTEI (-0.315) InFAI(-0.381) and InTG (-0.695) are slightly negatively skewed, meaning that most observations are clustered at higher values with a few lower extreme values. The kurtosis values for PGDPGR (11.362) and FO (7.151) suggest that these distributions

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have fat tails, meaning extreme values occur more frequently than in a normal distribution. They are leptokurtic. Meanwhile, InTEI (1.909), InFAI(2.797)and FD (2.237) have relatively normal distributions, with kurtosis values close to 3. 7.15. Overall, the descriptive statistics indicate significant variation in economic growth and financial openness, and inflation rate across observations. The presence of extreme values in some variables, particularly PGDPGR, FO and InIR, suggests the need for robustness checks in regression analysis, such as trimming outliers or applying transformations. The stable inflation rate and diverse trade reflect differences in economic structures across regions. These insights can guide further econometric modelling and policy recommendations.

Table 2

Descriptive Statistics

Variables	Obs	Mean	Std. Dev.	Min	Max	p1	p99	Skew.	Kurt.
PGDPGR	280	10.911	11.224	-54.186	68.997	-20.463	51.493	.23	11.362
FO	280	4.429	2.152	-4.841	9.992	-3.817	9.983	-.39	7.151
FD	280	0	1.642	-4.18	2.627	-4.038	2.535	-.412	2.237
InTEI	280	6.803	1.76	3.12	9.489	3.277	9.455	-.315	1.909
InFAI	280	6.41	1.595	1.855	9.187	1.995	9.05	-.381	2.797
InTG	280	2.076	1.361	-1.772	4.16	-1.514	4.071	-.695	2.988
IR	280	103.07	3.731	96	118.7	96.73	116.6	1.66	6.599

4.2 Unit Root Test Results

The results of the unit root test are shown in Table 3. The results demonstrate that financial development, FDI, enrolment ratio in higher education, and interest rate are stationary at level. However, GDP per capita, total exports and imports, inflation rate, and exchange rate are stationary at first difference.

Table 3

Results of IPS Unit Root

Variable	t-state at level	p-value	t-state at 1st differ	p-value	conclusion
FO	-2.058	0.021			I(0)
FD	-2.300	0.002			I(0)
PGDPGR	-2.209	0.005			I(0)
InTEI	-1.702	0.205	-2.370	0.001	I(1)
InFAI	-1.413	0.563	-2.438	0.000	I(1)
InTG	-1.452	0.511	-2.524	0.000	I(1)
IR	-1.890	0.072			I(0)

4.3 Variance Inflation Factor for Multicollinearity

In order to lower the multicollinearity, we take the first difference of InTEI and InFAI, Table 4 shows VIF values of all the variables are less than 10; confirming the unavailability of multicollinearity among the variables.

Table 4

Variance Inflation Factor

Variable	VIF	1/VIF
FD	4.63	0.216177
InTG	2.92	0.342219
FO	2.11	0.474277
DInFAI	1.42	0.705915
DInTEI	1.15	0.872877
IR	1.12	0.895925
Mean VIF	2.22	

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4.4 Coefficient of Correlation

Table 5 depicts the results of coefficient of correlation. It shows that there is mild positive association between per capita GDP growth rate and financial openness, trade volumes, fixed asset investment and total graduates for higher education. However, financial development is negatively and weakly associated with per capita GDP growth rate. It means the variables are free form multicollinearity problem.

Table 5

Matrix of Correlations

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(1) PGDPGR	1.000						
(2) FO	0.036	1.000					
(3) FD	-0.075	0.665	1.000				
(4) DlnTEI	0.434	-0.095	-0.160	1.000			
(5) DlnFAI	0.511	-0.038	-0.119	0.316	1.000		
(6) lnTG	0.243	0.297	0.700	0.041	0.227	1.000	
(7) IR	0.302	-0.116	-0.163	0.152	0.253	0.049	1.000

4.5 Kao Cointegration Test

Table 6 demonstrates the findings of Kao cointegration test. The results demonstrate that all five statistics are significant, indicating the presence of strong cointegration among the variables.

Table 6

Kao Cointegration Test

Test	Statistic	P-value
Modified Dickey-Fuller t	-17.3340	0.0000
Dickey-Fuller t	-8.4813	0.0000
Augmented Dickey-Fuller t	-4.8583	0.0000
Unadjusted modified Dickey-Fuller t	-18.9365	0.0000
Unadjusted Dickey-Fuller t	-8.6165	0.0000

Note. Kernel: Bartlett 1.70 (Neway-West). Lags: Number of panels=10. Number of periods=25.
Source: Author's calculation.

4.6 Linear Regression

By conducting the formula 3.1, we got the result of linear regression between per capita GDP growth rate and other variables (Table 7), the result shows financial openness has a mild positive impact to per capita GDP growth rate, while financial development shows a negative impact to per capita GDP growth rate, 1% increase of financial development will cause 2.462% decrease of per capita GDP growth rate, this founding is align with Bijlsma et al. (2018), Ductor & Grechyna (2015), and Law & Singh (2014), they all supported the 'too much finance' hypothesis, and suggested that excessive financial development can lead to economic volatility and negatively impact growth, particularly when the financial sector grows disproportionately compared to the real sector. Four control variables all positively impact on economic growth, among them, the fixed asset investment contributes the largest share with the coefficient 19.458, followed by the total export and import (18.14). The p-values of all variables' coefficient are all significant at 1%.

Table 7

Linear Regression

PGDPGR	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
FO	1.134	0.318	3.57	0.000	0.508	1.76	***
FD	-2.462	0.623	-3.95	0.000	-3.689	-1.235	***
DlnTEI	18.14	3.324	5.46	0.000	11.594	24.686	***
DlnFAI	19.458	4.05	4.80	0.000	11.483	27.433	***
lnTG	2.697	0.582	4.64	0.000	1.552	3.842	***

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IR	0.45	0.161	2.80	0.005	0.134	0.767	***
Constant	-50.857	16.344	-3.11	0.002	-83.039	-18.674	***
Mean dependent var	10.050				SD dependent var	9.900	
R-squared	0.425				Number of obs	270	
F-test	32.442				Prob > F	0.000	
Akaike crit. (AIC)	1867.609				Bayesian crit. (BIC)	1892.798	

Note. *** p < .01, ** p < .05, * p < .1.

4.7 Existence of Threshold Results

After conducting the panel threshold regression with bootstrap 500 times, the results presented in Table 8, 9 and Table 11 confirm the existence of threshold effects in the relationship between financial development (FD) and economic growth, indicating that the impact of financial openness (FO) on economic growth varies depending on the level of FD. Table 8 identifies two threshold values for FD: 0.7328 and 1.0401, suggesting that the nexus among FO and growth is nonlinear and operates in three distinct regimes. The confidence intervals for both thresholds are relatively narrow, indicating a precise estimation of these threshold points.

Table 9 further supports the presence of threshold effects by testing whether a single or double threshold model provides a better fit. The F-statistic for the single threshold model is 13.05, with a p-value of 0.232, which is not significant. However, the double threshold model reports an F-statistic of 11.33, with a p-value of 0.064, indicating the existence of double threshold effect at the 10% significance level. It suggests that the double threshold model provides a fit and accurately captures the nonlinear impact of FO on growth along with various values of FD.

Table 8

Existence of Threshold Results

Model	Threshold	Lower	Upper
Th-1	1.0401	0.8772	1.0528
Th-2	1.0401	0.7131	1.0528
Th-2	0.7328	0.5582	0.7518

Source: Author's calculation.

Table 9

Existence of Threshold Results

Threshold	dRSS	MSE	Fstat	Prob	Crit10	Crit5	Crit1
Single	1.38e+04	56.7855	13.05	0.232	19.007	24.992	33.893
Double	1.32e+04	54.2555	11.33	0.064	9.502	12.003	19.984

Source: Author's calculation.

4.8 The Results of Threshold Regression

Table 11 threshold regression results show that, except for the negative impact of the higher education graduates (InTG) (-0.982508) on economic growth in the China's three major regions, all other variables have a positive effect on economic growth. The impact of FO on InGDP depends on the level of FD, revealing a nonlinear relationship. When FD is low (FD ≤ 0.7328), FO positively and strongly boosts economic growth (coefficient = 2.622026, p = 0.000), likely due to underdeveloped financial institutions and inefficient capital allocation. As FD moves into a moderate range (0.7328 < FD ≤ 1.0401), the promoting effect of FO on the economy reaches the highest level (coefficient = 3.86917), suggesting that as financial markets are developed enough to efficiently allocate foreign capital, facilitate investment, and support productivity growth. In this range, financial openness enhances economic performance by allowing better access to foreign capital and encouraging financial sector competition and efficiency. In environments where FD is high (FD > 1.0401), the effect of FO's influence on economic growth weakens slightly, but still positive and significant (coefficient = 2.067968), indicating the returns start to diminish, perhaps due to inefficiencies, over-complexity or saturation in financial development. These findings support earlier studies of Arcand et al. (2015) and Law &

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Singh (2014), which suggest that FD contributes to growth till certain level, after which it can become counterproductive.

As it shown in Table 10, among these three major economic regions in China, the Yangtze River Delta (YRD) had the highest level of financial development in average from 1995 to 2022, the figure is 0.1079, followed by The Jing-Jin-Ji region with the figure is -0.1216, with the Pearl River Delta (PRD) ranking the last, the figure is -0.1674. The YRD reached its optimal FD level the earliest, with FD surpassing the threshold of 0.7328 after 2010, where a 1% rise of FO led to 3.869% economic growth. The Jing-Jin-Ji region surpassed the threshold of 0.7328 in 2013, followed by the PRD regions in 2015. In the Yangtze River Delta, Shanghai is the first one, whose FD reached the optimal level in 2007, and also the first one, whose FD entered the diminishing-return stage of FO to economic growth in 2009, where a 1% increase of FO contributed to 2.068% economic growth. In the Jing-Jin-Ji region, Beijing is the first one, whose FD reached the optimal level in 2008, and also the first one, whose FD entered the diminishing-return stage of FO to economic growth in 2010. In PRD, Hong Kong is the first one, whose FD reached the optimal level in 2006, and the first one, whose FD entered the diminishing-return stage of FO to economic growth in 2007. Throughout the observation period, Macao's FD still has not reached the threshold of 0.7328 by 2022, so Macao's financial openness (FO) had a moderate positive impact on economic growth, where a 1% rise in FO led to 2.622% economic growth. Till 2022, all three regions, their FD in average, have entered the diminishing-return stage of FO to economic growth in 2009, where a 1% increase of FO contributed to 2.068% economic growth, as the PRD is the last region that entered this stage in 2017.

Table 10

FD for Three Regions

Year	JJJ	YRD	PRD	Year	JJJ	YRD	PRD
1995	-2.4982	-2.4598	-1.8182	2010	0.4741	0.7894	0.0345
1996	-2.3297	-2.0960	-1.7042	2011	0.5143	0.8939	0.2101
1997	-2.0317	-1.8906	-1.5021	2012	0.6046	0.9231	0.2428
1998	-1.9282	-1.7444	-1.2208	2013	0.7878	1.0989	0.5541
1999	-1.8848	-1.5344	-1.1666	2014	0.9641	1.2416	0.6736
2000	-1.6745	-1.3013	-1.0396	2015	1.2322	1.4682	0.9142
2001	-1.5617	-1.1719	-1.0096	2016	1.2335	1.5574	0.8949
2002	-1.2058	-0.9566	-1.0235	2017	1.2957	1.6066	1.0605
2003	-0.9650	-0.7354	-0.9274	2018	1.3641	1.6550	1.0661
2004	-0.8534	-0.4707	-0.7904	2019	1.4162	1.7330	1.2218
2005	-0.7863	-0.6496	-0.7321	2020	1.5163	1.8383	1.2540
2006	-0.5564	-0.2003	-0.5546	2021	1.5874	2.0351	1.3601
2007	-0.0937	0.2431	-0.2692	2022	1.6184	2.0837	1.2638
2008	0.0523	0.4104	-0.1871	**Average**	**-0.1216**	**0.1079**	**-0.1674**
2009	0.3035	0.6297	-0.0618				

The regression results also reveal the impacts of several control variables on economic growth. Trade openness (DInTEI) also exhibits a significant strong positive nexus with growth, with a parameter of 18.53594 (p-value = 0.000). This result implies that trade liberalization significantly enhances economic growth. This finding is consistent with Sahoo and Sethi (2023); Beck and Levine (2004); Narayan and Narayan (2013), who emphasizes that both direct and indirect effects of trade openness are significant, supporting its importance in enhancing regional economic development.

Similarly, Fixed assets investment (InFAI), representing physical capital investment, exhibits a significant and strong positive effect on growth in this study. These results match with previous research. For instance, Beck and Levine (2004) find that domestic investment, strengthens the ability of economies to sustain growth. Their study emphasizes that higher levels of infrastructure investment correlate with faster GDP growth rates, as investment facilitates improved productivity and economic efficiency. Scholars such as

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Kar et al. (2011) and Ibrahim and Alagidede (2018) also hold the same view regarding to the positive influence of domestic investment to economic growth.

On the other hand, the coefficient for inflation rate (IR) is 0.697084, and also strong statistically significant (p-value = 0.000). This suggests that moderate inflation rates does have a positive impact on economic growth within the observed period, which aligns with the findings in the literature, such as Evans and Hnatkovska (2014), shown that stabilize inflation, which is critical for sustaining long-term economic growth. Lower inflation volatility supports investment and reduces the risk for foreign investors.

A particularly notable result is the negative relationship between higher education graduates (InTG) and economic growth, with a coefficient of -0.982508 but statistically insignificant (p-value = 0.211). This can be explained by the analysis proposed by scholars Junxu & Yajun (2021). According to them, the three major regions' advantage is so pronounced that it attracts graduates from universities all over China, however, the spillover effect on talent attraction in the surrounding areas of these three regions is limited. While the overall higher education graduates in these major regions have been increasing annually, due to disparities in development levels, these three major regions in China still exerts a significant suction effect on talent from surrounding regions, leading to a certain degree of talent wastage and also due to the high living cost in these regions.

The overall model fit, and statistical tests confirm the robustness of these results. The Rho value (0.33605131) suggests that a significant portion of the variation in economic growth is due to country-specific factors, while the F-statistic (26.41) with a p-value of 0.000 confirms the strong overall significance of the model. This indicates that the included variables effectively explain variations in economic growth across the dataset.

Table 11

Results of Threshold Regression

Depen Var: PGDPGR	Coefficient	Std.err.	t	P_value	[95% conf. interval]	
DlnTEI	18.53594	3.332133	5.56	0.000	11.97369	25.0982
DlnFAI	18.71115	3.847381	4.86	0.000	11.13418	26.28812
lnTG	-0.982508	0.782942	-1.25	0.211	-2.524421	0.559407
IR	0.697084	0.172199	4.05	0.000	0.357959	1.03621
_cot#c.FO	2.622026	0.482836	5.43	0.000	1.671136	3.57292
	3.86917	0.624479	6.20	0.000	2.639332	5.09901
	2.067968	0.485574	4.26	0.000	1.111687	3.02425
_cons	-74.4579	17.71679	-4.20	0.000	-109.349	-39.5667
sigma_u	5.1790863					
sigma_e	7.2797692					
rho	0.33605131					
F test that all u_i=0	F(9,243)=3.15			Prob>F=0.0013		

5. Robustness Check

To ensure the robustness of the panel threshold regression findings, a series of validation tests were conducted using three complementary approaches. First, the model was re-estimated with an increased number of bootstrap replications—from 500 to 1,000—to verify the stability of threshold estimates. The results remained unchanged, confirming the consistency and reliability of the identified double-threshold structure. Second, a nonlinear specification was introduced by including both the square term of financial openness (FO^2) and its interaction with financial development (FD) in a linear regression model. The coefficient of FO^2 was negative and statistically significant (-0.054, p = 0.013), while FO remained strongly positive (1.529, p = 0.000), lending support to the threshold regression's core finding of a nonlinear relationship. Third, to address potential distributional concerns due to leptokurtosis in key variables (e.g., PGDPGR, FO, and IR), several transformations were applied: an inverse hyperbolic sine (IHS) transformation and Winsorization for PGDPGR, logarithmic transformation and Winsorization for IR, and Winsorization for

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FO. Using this transformed dataset, the panel threshold regression was re-estimated and again identified two statistically significant thresholds (bootstrap p = 0.070). Across low, moderate, and high FD regimes, the effect of FO on economic growth remained positive and significant, with the strongest effect observed at the moderate level of FD—thereby reaffirming the inverted-U pattern identified in the main results. Collectively, these robustness checks strongly validate the reliability and internal consistency of the study's core empirical findings. All these results for robustness check, please refer to the Appendices of this paper if needed.

6. Policy Implications

The findings of this study carry several critical policy implications for fostering balanced and sustainable economic growth through financial openness and development across China's major urban agglomerations:

First, prioritize optimal financial development thresholds. The results highlight a nonlinear relationship where the marginal effect of financial openness (FO) on economic growth is maximized when financial development (FD) is at a moderate level ($0.7328 < FD \leq 1.0401$). This suggests that policy efforts should not merely aim at expanding financial systems indefinitely, but rather at achieving an optimal level of FD to enhance the effectiveness of FO in driving growth.

Second, avoid over-financialization. In regions where FD surpasses the upper threshold (> 1.0401), the positive impact of FO on growth diminishes, indicating diminishing marginal returns. Policymakers should remain cautious of over-financialization, which could lead to inefficiencies, misallocation of capital, and increased systemic risk. Regulatory frameworks should thus be designed to maintain financial development within a balanced range.

Third, regionally tailored financial reforms. The three major economic regions—YRD, Jing-Jin-Ji, and PRD—have reached different stages of financial development. Hence, regional differentiation in financial policy is vital. For instance, regions that have yet to reach the optimal FD threshold (e.g., Macao) should focus on deepening and strengthening their financial infrastructure, while advanced regions (e.g., Shanghai, Hong Kong) should focus on maintaining financial stability and enhancing governance to avoid regressions into diminishing returns.

Fourth, enhance financial openness responsibly. As FO consistently shows a positive and significant impact on growth across all FD regimes, maintaining a degree of openness is economically beneficial. However, this openness must be complemented by well-developed domestic financial institutions to absorb and allocate capital flows effectively. Capital market liberalization must proceed hand-in-hand with prudent regulatory oversight and institutional strengthening.

Fifth, integrated urban financial strategies. Given that urban agglomerations are at different stages of development and openness, coordinated regional financial development strategies can help balance disparities. Inter-regional financial cooperation—especially among leading cities like Shanghai, Beijing, and Hong Kong—could be instrumental in lifting lagging areas through knowledge spillovers, institutional learning, and harmonized regulation.

Sixth, promote inclusive and sustainable financial growth. The moderate FD regime not only brings about the highest growth impact from FO but also offers a sustainable trajectory. Policies aimed at inclusive financial development: supporting SMEs, green finance, and financial literacy, can ensure that the gains from FO translate into broad-based, long-term economic resilience.

7. Conclusion

This study uncovers the nuanced and nonlinear relationship between financial openness (FO), financial development (FD), and economic growth across China's three leading urban agglomeration regions—Jing-Jin-Ji, the Yangtze River Delta (YRD), and the Pearl River Delta (PRD)—from 1995 to 2022. By applying a panel threshold regression approach, we find robust evidence of double threshold effects in FD, suggesting that the growth-enhancing role of FO is conditional on a region's level of financial development. Specifically, FO contributes most significantly to economic growth when FD is at a moderate level, with diminishing returns observed as FD becomes excessively high. This nonlinear pattern reveals that while financial openness

is a vital driver of economic expansion, its efficacy is significantly shaped by the depth and maturity of financial systems.

Our findings have important implications for both regional development strategies and national economic planning. Rather than a one-size-fits-all policy, a staged and regionally customized approach to financial reform is crucial. Cities and regions should prioritize building foundational financial infrastructure before aggressively liberalizing their financial sectors. For advanced regions, refining financial oversight and preventing over-financialization are key to sustaining long-term growth.

In conclusion, the interplay between FO and FD must be carefully managed to unlock their full potential. The path to inclusive and sustainable economic growth lies not only in opening doors to global finance but also in ensuring those doors are supported by strong, well-regulated domestic financial institutions.

"These findings underscore the critical role of financial development in shaping the influence of FO, even if the precise number of thresholds remains statistically tentative."

Author's Contributions

All authors participated in ideation, development, and writing the manuscript. All authors read and approved the final manuscript.

Conflict of Interest Statement

The authors declare that there is no conflict of interest regarding the publication of this article.

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Informed Consent

Informed consent was obtained from all participants prior to data collection. Participants were informed about the purpose of the study, the voluntary nature of their participation, and their right to withdraw at any time without any consequences. The confidentiality and anonymity of respondents were guaranteed throughout the research process.

Data Availability

The datasets generated and analysed during the current study are available from the corresponding author upon reasonable request. The authors are committed to transparency and will provide detailed methodological information and analysis protocols upon request.

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