

## Research Article

# Does Shanghai International Financial Center Promote RMB Internationalization?

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The construction of the Shanghai International Financial Center was completed in 2020, which signaled the new age of financial reforms in China. The Shanghai International Financial Center plays a significant part in the progress of RMB internationalization. However, empirical proof of the impacts remains few. So, we conducted an empirical analysis to determine if the Shanghai International Financial Center promoted RMB internationalization effectively. To obtain robust results, we conducted regressions with Newey–West standard errors, Cochrane–Orcutt estimation, and Prais–Winsten estimation. We observed that the Shanghai International Financial Center has significant positive effects on RMB internationalization by expanding financial scale and activity. The findings give adequate evidence to support the theories advanced in prior research, and the methodology and indicators used in the study may serve as a guide for future research. We made several policy discussions of the findings regarding the continued expansion of the offshore market and capital liberalization within Shanghai.

## 1. Introduction

In 2009, the Chinese government announced its plan to elevate Shanghai to the International Financial Center (IFC) status to pioneer international renminbi (RMB) trade settlement and financial market reforms. The Shanghai Pilot Free Trade Zone (FTZ) was established in 2013 and has played a critical role in furthering the RMB's internationalization and financial reforms. Shanghai IFC's construction was completed in 2020.

The GDP of Shanghai reached 3.87 trillion yuan in 2020, in which the output of the financial industry increased by 716.63 billion yuan or 25.32 percent of the total tertiary industrial output. Financial services have developed into one of the most vital sectors of Shanghai's economy. The highly developed financial market in Shanghai plays a significant role in financial reforms. In 2020, Shanghai was placed third in the world in the Global Financial Centers Index for the first time.

With China's economy and trade expanding, the RMB's use in global markets rose considerably. The status of the Dollar is deteriorating, particularly in the aftermath of the

subprime mortgage crisis in 2007–2008, and the global monetary system is progressively shifting toward a leaderless and multipolar currency system (B. J. Cohen [1] and B. Eichengreen [2]). China began promoting RMB internationalization in response to the shifting worldwide financial architecture to alleviate the challenges associated with the reliance on the Dollar [3].

RMB internationalization began in 2009, with the announcement in 2018 of pilot programs enabling the use of the RMB in cross-border trade settlement. As the world's largest exporter and second-largest importer, China has the potential to expand the RMB's use in global markets due to the volume of trade. The RMB was adopted as a composition currency for the Special Drawing Rights (SDR) in 2016, accounting for 10.92 percent of the total. According to the 2019 BIS Triennial Central Bank Survey, global RMB usage increased from 0.1 percent to 4.3 percent, boosting the currency's ranking from 29th to eighth. China has made headway toward the internationalization of the RMB, although its global use remains limited in comparison with the USD, ERO, and JPY.

Shanghai IFC plays the role of the pilot zone for RMB cross-border settlement for trade and capital liberalization. So Shanghai IFC must give credible experiences in policy formulation and implementation to advance financial reforms and RMB internationalization in China. Thus, it is critical to determine if the Shanghai IFC is capable of promoting RMB internationalization. However, there are few studies devoted to this critical subject.

Numerous studies have been conducted on the RMB's potential as an international currency since 2010. Multiple studies proposed that China's massive economy and cross-border trade will result in the RMB emerging as a new worldwide currency (B. J. Cohen [1]; Wu et al. [4]; Chen and Peng [5]; J.-W. Lee [6]). Eichengreen and Kawai [7] noted that significant progress had been made on RMB settlements for trade and RMB-denominated bond issuance. T. Ito [8] stated that the RMB's weight in the private and public sectors had increased significantly. McNally and Gruin [9] argued that China adopted a unique mode of monetary governance, which may result in the RMB gaining a more significant market share in the global markets. However, the road to internationalization for RMB will be bumpy [10], and capital liberalization is necessary for the currency's further expansion (J.-W. Lee [6]; Eichengreen and Kawai [7]; T. Ito [8]).

Shanghai IFC was highlighted multiple times in these studies and was viewed as an effective technique to promote the worldwide use of RMB. However, in comparison with Hong Kong's offshore market, the Shanghai IFC primarily serves as an onshore market, which may hinder capital liberalization and weaken the contribution to RMB internationalization [11]. Zhao and Wang [12] and Huang et al. [11] conducted empirical analyses of the effects of Shanghai FTZ (a critical component of Shanghai IFC) on international RMB use. They discovered that the effects were not substantial, contrary to earlier theoretical research. Pan et al. [13] discovered that Shanghai IFC plays an increasing role in global markets and contributes to the internationalization of the RMB.

The findings of Zhao and Wang [12] and Huang et al. [11] are unsurprising, given the difficulty of observing the effects of Shanghai IFC's comprehensive policies over a one- or two-year period and the data sample size. Additionally, these researches concentrated on the Shanghai FTZ, distinct from the IFC. Pan et al. [13] gave some reasonable results on the subject, but indirectly. In 2020, the construction of the Shanghai IFC was completed, and policies and markets would have been stable and effective. We feel that the moment has come to examine whether Shanghai IFC aided in the progress of RMB internationalization during the last decade.

We conducted an empirical analysis using RMB data spanning 2012 to 2021. We began the study by looking at previous studies, in which we discovered the fundamental theories that would support the corresponding analysis. In the theoretical analysis section, we identified cross-border trade settlements and cross-border investment and finance as the primary factors of RMB internationalization. We examined the impact of the Shanghai IFC on these two

variables. We used financial scale and activity to quantify the Shanghai IFC's characteristics, and RMB cross-border settlements for general trade and RMB cross-border direct investment were used to quantify the determinants of RMB internationalization. We applied regressions with Newey–West standard errors, Cochrane–Orcutt estimation, and Prais–Winsten estimation to conduct the analysis. The results indicated that the establishment of the Shanghai IFC had a significant effect on RMB internationalization. Our research addressed the unresolved question from prior studies and provided empirical evidence and discussions for future policy formulation and implementation.

## 2. Theoretical Foundation

### 2.1. *The Determinants of Currency Internationalization.*

Numerous research studies have been conducted on the determinants of currency internationalization. Strange and Cohen [14] offered six roles for “fully developed” international currency, based on the fundamental argument about currency's functions such as medium of exchange, store of value, and unit of account, in both the private and official sectors. P. Krugman [15] examined the Dollar's international role in light of the previous theory and proposed that a country's importance in the global market and the self-reinforcement of the international currency's usefulness were two determinants of the Dollar's internationalization, laying the groundwork for subsequent research. Bacchetta and Van Wincoop [16] discovered that the exporting country with a larger market share and more varied goods tends to possess greater power in using its currency in the settlements for trade, which is consistent with P. Krugman's [15] findings.

Chinn and Frankel [17] identified four determinants of currency internationalization: (a) output and trade patterns, (b) the country's financial markets, (c) currency confidence, and (d) network externalities. These determinants were utilized in part or entirely in empirical studies on currency internationalization (J.-W. Lee [6]; Goldberg and Tille [18]; He et al. [19]; Cui et al. [10]). Chen and Peng [5] classified variables into three categories: ancestry, acceptability, and availability, covering more specific indicators, such as economic size, trade volume, stock market capitalization, and currency volatility. Some studies included macro- and microeconomic indicators to validate the primary factors of the choice of invoicing currency, which is considered a form of currency internationalization (Goldberg and Tille [18]; Batten and Szilagyi [20]; W. Chung [21]; Li et al. [22]).

H. Chey [23] classified the determinants of currency internationalization into two categories: economic and political. Economic considerations are primarily concerned with currency confidence and convenience, which are mostly consistent with the determinants identified by Chinn and Frankel [17] and comparable studies. Political issues influence currency internationalization in both direct and indirect ways. Politics either has an indirect effect on currency internationalization through improving economic conditions or has an immediate effect on currency internationalization without affecting economic factors.

*2.2. The IFC's Effect on Currency Internationalization.* The financial market is a critical factor in determining a currency's international use, and a large, liquid, open, and deep financial market helps a currency achieve international status [17]. Numerous studies have established that a well-developed financial system considerably boosts the currency's global market power, and a deep and liquid financial market attracts international investors, hence expanding the currency's use [24]. According to some research, the Chinese financial market still needs further progress toward the creation of an effective financial system (Chen and Peng [5]; J.-W. Lee [6]; Huang et al. [11]; T. Ito [8]).

Offshore markets play essential roles in the progress of currency internationalization. He and McCauley [25] discovered that offshore markets contribute to the currency's recognition and adoption by facilitating trade settlement, investment, and finance outside the country, which benefits the capital account liberalization process. They also suggested that offshore markets could have an effect on the domestic economy's financial stability. Y. Cheung [26] proposed that offshore markets could enhance the currency's convenience and confidence. The effectiveness of offshore markets should be evaluated in light of several factors, including the economy's size and trade volume, the financial market's structure, capital account openness, and economic and political stability. There are two RMB markets in China: the offshore market in Hong Kong and the onshore market in Shanghai, which are connected via the Shanghai-Hong Kong Connect [8]. Since July 2021, Shanghai has also begun to organize RMB offshore trading, which will enable Shanghai to contribute more to the internationalization of the RMB as a domestic offshore market.

In 2008, the Chinese government announced the establishment of five pilot cities (including Shanghai) to test RMB-based trade settlement with foreign counterparties, and the plan to build the Shanghai IFC in 2019 to expedite financial reforms. Chen and Peng [5] suggested that these actions might strengthen the currency's ancestry and acceptability and boost RMB internationalization. Zhao and Wang [12] concentrated on the effects of the Shanghai FTZ and found it effectively promotes the use of RMB in theory, but the empirical findings were insignificant. Huang et al. [11] discovered that the rates of RMB onshore and offshore markets are pretty close, implying that the contribution of the Shanghai FTZ is negligible. Pan et al. [13] discovered that China's financial centers (including the Shanghai International Financial Center) are becoming increasingly important in global financial markets, and Chinese financial service firms can leverage financial infrastructure and networks to expand the use of the RMB in financial transactions.

### 3. Theoretical Analysis

In previous research, the IFC was seen as an efficient technique to encourage the international use of a currency. Specifically, a well-constructed IFC could provide superior financial markets and network externalities and attract foreign institutions and investors. In traditional economics,

foreign currency has six roles in the economy, including the medium of exchange, store of value, and unit of account, both in private and official use. Shanghai IFC may expand the RMB's functions of medium of exchange and unit of account through RMB cross-border settlement for trade and RMB cross-border investment and financing.

*3.1. RMB Cross-Border Settlement for Trade.* With the continuous rise of China's economy, the size of China's foreign trade kept expanding. This boosted the demand for RMB as the settlement currency. In 2009, as the IFC, Shanghai was designated as one of four cities in China that performs trials of RMB settlement of cross-border trade. In 2013, Shanghai launched the first FTZ in mainland China, in which both foreign and domestic funds are all settled in RMB. These initiatives strengthened the pricing function of RMB, fostered the development of RMB trade settlement, and widened the RMB adoption by neighboring nations. In Shanghai FTZ, RMB takes the lead in realizing the opening-up of the capital account and later realizing the convertibility of capital. The establishment of Shanghai FTZ is a milestone in RMB internationalization.

According to the data released by the People's Bank of China, after establishing the Shanghai FTZ in 2013, the amount of RMB cross-border settlement of trade surged dramatically, reaching 4.63 trillion yuan in 2013, soaring 57.48 percent year-on-year. In 2019, RMB cross-border trade settlement climbed to 6.04 trillion yuan. In 2020, notwithstanding the impact of COVID-19, RMB cross-border trade settlement reached 4.29 trillion yuan.

*3.2. RMB Cross-Border Investment and Financing.* In 2020, the construction of the Shanghai IFC was completed. Shanghai gathered various financial trading platforms and established reliable financial market infrastructures that support the issuance, transaction, and risk management of RMB financial assets, strengthen the RMB's payment and pricing functions and promote RMB investment and financing internationalization. According to World Federation of Exchanges data, Shanghai Stock Exchange became the world's third-largest exchange at the end of 2020.

With the establishment of RQFII, the Shanghai-Hong Kong Stock Connect, Bond Connect, and SGE International, foreign investors are increasingly entering China's financial markets, expanding RMB cross-border investment channels and enhancing RMB internationalization. According to China's National Bureau of Statistics, direct investment in RMB increased significantly following 2014. In 2020, RMB cross-border direct investment reached 2.23 trillion yuan, up to 112.58 percent from 2014 levels, with foreign direct investment increasing to 1.65 trillion yuan and outward direct investment increasing to 0.58 trillion yuan.

In RMB cross-border financing, issuers of Panda Bonds increased their diversification, while foreign entities increased their participation as issuers. Panda Bonds were issued in Shanghai by some countries, most notably

those along the Belt and Road, such as Russia and Poland. By the end of 2020, foreign governments, international development institutions, financial institutions, and non-financial institutions had issued Panda Bonds worth 1 trillion yuan, an increase of 20.24 billion yuan from 2019. The expansion of RMB bonds and its share in the global bond market were facilitated by the continued development of Panda Bonds, which increased the breadth and depth of China's bond market and facilitated the deep interactions between the domestic and global financial markets.

## 4. Empirical Analysis

**4.1. Variables and Data.** The scale and activity of the financial markets provide insight into the characteristics of the Shanghai IFC. The greater the financial scale and activity, the more advanced the IFC is and the greater the influence it may have on the global financial market. We chose Shanghai deposits in RMB and foreign currencies (*SDrfc*) as the financial scale indicator because it reflects Shanghai's attractiveness to domestic and foreign capitals. Given that a sizable portion of financial transactions in Shanghai takes place on the Shanghai Stock Exchange, including domestic and foreign investments, it is reasonable to use the Shanghai Stock Exchange's trading volume (*SEtrade*) as a proxy for financial activity.

The proportion of RMB in COFER (Currency Composition of Official Foreign Exchange Reserves) and RMB cross-border settlements of general trade were previously used to quantify the internationalization characteristics of the RMB. Since 2016, RMB reserves have been included in COFER, but their share remains small, limiting the amount of data available for our research. So we chose the scale of RMB cross-border general trade settlements (*CBtrade*) as a proxy for RMB internationalization. We chose the scale of RMB cross-border direct investment (*DInvest*) as the indicator to capture the characteristics of RMB cross-border investment and financing.

We used monthly data from January 2012 to November 2021 for this study. The data mainly comes from China's National Bureau of Statistics, the People's Bank of China, and the CSMAR Database. To obtain a stationary data sample, we took the logarithms of each variable. We used linear interpolation to fill in the missing values. The results of descriptive statistics of the data sample are shown in Table 1.

### 4.2. Regression Model

**4.2.1. Structural Change Test.** The stability of model coefficients has an effect on the fitting results in time series analysis. If the data sample exhibits obvious structural changes; that is, if the observed values differ significantly across time periods and the corresponding linear regression coefficients differ significantly, the fitting results will have significant errors, reducing the model's accuracy. It is easy to see from the time series lines of each variable that the structure of *SDrfc* has a noticeable difference around January

TABLE 1: Descriptive statistics.

Variable	Observation	Mean	Std. Dev.	Min	Max
<i>CBtrade</i>	119	8.4051	0.3199	7.1577	8.9848
<i>DInvest</i>	119	7.1795	0.9608	4.7875	8.6634
<i>SDrfc</i>	119	4.6213	0.3198	4.0388	5.1476
<i>SEtrade</i>	119	10.5690	0.7070	9.1133	12.2079

2015 (as indicated by the vertical line in Figure 1), implying that the *SDrfc* data sample may have structural changes. The development of Shanghai IFC entered a new era with the establishment of the Shanghai FTZ in September 2013 and the Shanghai-Hong Kong Stock Connect in November 2014. With policies having a lagged effect, it is reasonable to hypothesize that the data structure may have changed after December 2014.

To assess structural change in the research, we used both the Chow test and a dummy variable. We chose January 2015 as the cut-off point based on the time series line and introduced the dummy variable  $D$  and its interaction with *SDrfc*, denoted by  $DSDrfc$ .  $D$  is defined as:

$$D_t = \begin{cases} 1, & \text{after January 2015 (including),} \\ 0, & \text{others.} \end{cases} \quad (1)$$

We obtained an F-value of 48.91 in the Chow test, an F-value of 69.18, and a  $P$  value of 0.00 in the dummy variables test using robust standard errors in the regression of *CBtrade*. The results indicate that at the 1% level of significance, the null hypothesis of "no structural change" can be strongly rejected. The regression results for *DInvest* are consistent with those for *CBtrade*. As a result, we believe that the *SDrfc* data sample's structure changed after January 2015.

**4.2.2. Lagged Variables.** As indicated by the time series lines, the trend of *SEtrade* lagged behind that of *CBtrade* and *DInvest*. Because stock trading on the Shanghai Stock Exchange is unlikely to have a significant effect on RMB cross-border settlement or direct investment in the near future, it is reasonable to incorporate lagged variables into economic models.

To determine the optimal lags for *SEtrade*, we used the AIC (Akaike Information Criterion) and BIC (Bayesian Information Criterion). We calculated AIC and BIC separately for first to sixth order lags and discovered that the third-order lagged variable is optimal for *CBtrade* regressions, and the fifth-order lagged variable is optimal for *DInvest* regressions. As a result, we obtained the following regression models:

$$\begin{aligned} CBtrade_t &= \beta_1 SDrfc_t + \beta_2 SEtrade_t + \beta_3 SEtrade_{t-3} \\ &\quad + \beta_4 D_t + \beta_5 D_t \times SDrfc_t + \beta_0 + \varepsilon_t, \\ DInvest_t &= \beta_1 SDrfc_t + \beta_2 SEtrade_t + \beta_3 SEtrade_{t-5} \\ &\quad + \beta_4 D_t + \beta_5 D_t \times SDrfc_t + \beta_0 + \varepsilon_t, \end{aligned} \quad (2)$$

where  $\beta_1$ ,  $\beta_2$ ,  $\beta_3$ ,  $\beta_4$ , and  $\beta_5$  are the coefficients,  $\beta_0$  is the intercept, and  $\varepsilon_t$  is the residual error.





FIGURE 1: Time-series line of data sample.

TABLE 2: Summary of results.

Panel A: RMB cross-border settlement of trade				
	OLS	HAC	CO	PW
$SDrfc_t$	3.9084*** (0.4288)	3.9084*** (0.4623)	3.5475*** (0.7358)	3.8380*** (0.6429)
$SEtrade_t$	0.1397*** (0.0343)	0.1397*** (0.0358)	0.1697*** (0.0388)	0.1669*** (0.0386)
$SEtrade_{t-3}$	0.1377*** (0.0362)	0.1377*** (0.0363)	0.0626 (0.0392)	0.0650* (0.0390)
$D_t$	14.2158*** (1.8478)	14.2158*** (1.8896)	13.0964*** (3.2133)	14.3384*** (2.8250)
$D_t \times SDrfc_t$	-3.4645*** (0.4345)	-3.4645*** (0.4471)	-3.1703*** (0.7539)	-3.4624*** (0.6623)
Constant	-10.8777*** (1.7380)	-10.8777*** (1.8770)	-8.9371*** (3.0040)	-10.1673*** (2.5946)
F-value	55.96	71.84	18.68	67.48
R-square	0.7178	0.7178	0.4615	0.7541
Observation	116	116	115	116
Panel B: RMB cross-border direct investment				
	OLS	HAC	CO	PW
$SDrfc_t$	8.9337*** (1.0550)	8.9337*** (0.7466)	9.6198*** (1.5065)	9.4082*** (1.4021)
$SEtrade_t$	0.0203 (0.0723)	0.0203 (0.0806)	0.1212 (0.0859)	0.1211 (0.0854)
$SEtrade_{t-5}$	0.2577*** (0.0774)	0.2577** (0.1069)	0.1692* (0.0894)	0.1663* (0.0884)
$D_t$	29.25841*** (4.5196)	29.25841*** (3.3460)	32.2873*** (6.5053)	31.3810*** (6.0610)
$D_t \times SDrfc_t$	-6.9411*** (1.0634)	-6.9411*** (0.7671)	-7.6572*** (1.5293)	-7.4437*** (1.4246)
Constant	-34.1685*** (4.3076)	-34.1685*** (2.9672)	-37.1947*** (6.2092)	-36.2667*** (5.7262)
F-value	131.58	131.58	61.80	62.89
R-square	0.8590	0.8590	0.7428	0.7443
Observation	114	114	113	114

Note.\*\*\*, \*\*, and \* denote significance at 1%, 5%, and 10%, respectively, and the standard errors of each coefficient are enclosed in parentheses.

4.2.3. *Research Method.* To test the significance of the effects, we primarily used regression models. We tested the economic model’s heteroskedasticity and autocorrelation. The heteroskedasticity test was conducted using the White and Breusch–Pagan tests. In the regression of *CBtrade*, we obtained a *P* value of 24.83 percent in the White test and 83.74 percent in the Breusch–Pagan test, indicating that no evidence of heteroskedasticity in the regression model. To test the autocorrelation of the error term, we used the Breusch–Godfrey LM test and the Durbin–Watson test. We

obtained a *P* value of 0.00 for the Breusch–Godfrey LM test and a *d*-statistic of 1.22 for the *CBtrade* regression, indicating significant autocorrelation. The regression results for *DInvest* are consistent with the results mentioned previously, so we will not display the details of these results.

To address the autocorrelation of the error term in the regression model, we performed regressions separately using Newey–West standard errors (HAC), Cochrane–Orcutt estimation (CO), and Prais–Winsten estimation (PW). Standard error estimations are revised in the HAC

TABLE 3: Summary of robustness test results.

	(1)			(2)		
	HAC	CO	PW	HAC	CO	PW
$SDrfc_t$	4.32*** (0.65)	4.21*** (0.91)	4.37*** (0.80)	8.22*** (0.84)	8.43*** (1.30)	8.45*** (1.22)
$SEtrade_t$	0.26*** (0.05)	0.25*** (0.05)	0.25*** (0.05)	0.03 (0.08)	0.08 (0.08)	0.08 (0.08)
$SEtrade_{t-3,5}$	0.13** (0.06)	0.06 (0.05)	0.06 (0.05)	0.20* (0.11)	0.15* (0.08)	0.15* (0.08)
F-value	47.02	17.08	33.37	166.52	71.05	72.23
R-square	0.67	0.44	0.60	0.84	0.77	0.77
Observation	116	115	116	114	113	114

Note.\*\*\*, \*\*, and \* denote significance at 1%, 5%, and 10%, respectively, and the standard errors of each coefficient are enclosed in parentheses.

regression to account for autocorrelation effects while leaving the regression coefficients unchanged. The feasible generalized least squares (FGLS) regressions, including CO and PW estimations, employ an iterative procedure to eliminate autocorrelation and obtain robust results.

**4.3. Results.** The regression results (Table 2) indicate that the independent variables have a significant positive correlation with the dependent variables  $SDrfc$  and  $SEtrade$ , indicating that Shanghai's deposits in RMB and foreign currencies and the trading volume of the Shanghai Stock Exchange both have a positive effect on RMB internationalization. As illustrated in panel A of Table 2, the Shanghai IFC's financial scale (as measured by  $SDrfc$ ) and financial activity (as measured by  $SEtrade$ ) significantly boost RMB cross-border trade settlement. These effects are also reflected in RMB cross-border direct investment (as illustrated in panel B of Table 2). However, the difference is that financial activity exhibits a clear hysteresis effect on RMB cross-border direct investment, as only the coefficients of the lagged  $SEtrade$  are significant.

The results suggest that the expansion of financial scale and activity in Shanghai has benefited both RMB cross-border settlements in general trade and direct investment, implying that the Shanghai IFC promoted RMB internationalization.

**4.4. Robustness Test.** Under the current account, cross-border trades include trades in goods and services. Given that RMB cross-border settlement of goods trade accounts for approximately 75% of total RMB cross-border settlement in trade, we used the indicator in place of  $CBtrade$ . The regression results (see column (1) of Table 3) indicate that  $SDrfc$  and  $SEtrade$  are positively correlated with the independent variable.

Under the capital account, the direct investment includes ODI (Outward Direct Investment) and FDI (Foreign Direct Investment). Because FDI accounts for 75% of RMB cross-border direct investment, we chose FDI to replace  $DInvest$ . According to the regression results (see column (2) of Table 3), we discovered that  $SDrfc$  and lagged  $SEtrade$  have a significant positive correlation with FDI. The robustness test results are consistent with the main findings, demonstrating the robustness of our empirical results.

## 5. Concluding Remarks

Based on the theoretical analysis of the effect of Shanghai IFC on RMB internationalization, we conducted an empirical analysis to determine whether the construction of Shanghai IFC benefits the process of RMB internationalization. We found that Shanghai IFC's financial size, scale, and activity can effectively boost RMB cross-border trade settlement and RMB cross-border direct investment, implying that Shanghai IFC has a sizable impact on RMB internationalization.

Our research addressed a critical question that remained unresolved in previous studies and provided reasonable empirical evidence for related theoretical findings. The theoretical analysis established a more precise framework for subsequent research, and the methods and indicators employed in the study serve as a helpful reference for subsequent empirical analysis on related topics. Our findings established the efficiency of the Shanghai IFC in the process of RMB internationalization, implying that it would be prudent to replicate the policies and practices of the Shanghai IFC in additional cities throughout China. Additionally, the suggestions we make below may aid in the development of policy and practice at the Shanghai IFC.

Based on our findings, we believe that further development of the Shanghai IFC is necessary and beneficial for RMB internationalization. We propose that in the future, policymakers and supervisors should prioritize accelerating the development of Shanghai's offshore RMB market, enhancing the multilayered capital market, and strengthening financial regulation in order to avert systemic financial risk.

An RMB offshore market in Shanghai could contribute to the further opening of China's financial market by enhancing the RMB's two-way circulation mechanism between onshore and offshore markets, providing a more active market for RMB securities, and increasing the currency's international use. Shanghai's offshore market will be well connected to the onshore market, which could help Shanghai establish itself as a global center for RMB foreign exchange transactions, cross-border settlements, and cross-border investment.

Shanghai has established a fully functional IFC and a multitiered capital market. However, compared with some mature international financial centers, such as London and Hong Kong, the Shanghai IFC still requires improvement.

A sophisticated registration-based initial public offering (IPO) system should be adequately implemented on the Shanghai Stock Exchange to optimize capital market functions. Appropriate financial innovations should be encouraged to upgrade the financial market's activity, and capital liberalization should be enhanced to attract more foreign investors.

Increased financial scale and activity also expose the market to increased systemic financial risk. Thus, as the RMB internationalizes, the supervisor should take more effective measures to avoid systemic financial risk, such as strengthening the macro prudential regulatory system, enhancing the monitoring and supervision of cross-border capital flows, and implementing countercyclical financial market adjustment.

Additionally, there are some obvious limitations to this research. Due to the data sample's limitations, we did not use the RMB internationalization index or create a development index for the Shanghai IFC. To obtain more precise empirical results, we intend to collect additional data in the future and select appropriate methods for developing sophisticated indexes to assess the degree of RMB internationalization and the Shanghai International Financial Center. Besides that, the mechanism by which the Shanghai IFC influences RMB internationalization is still unknown in theory. With the establishment of an offshore market in Shanghai, the issue will become more complex. Thus, additional theoretical research is required to elucidate this issue.

## Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

## Conflicts of Interest

The authors declare that they have no conflicts of interest.

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