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The Spillover Channel of the Federal Reserve's Quantitative Easing on China's Long-term Interest Rates under Capital Account Liberalisation

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Backgroud &Motivation

- The spillover effect of the Fed's quantitative easing on other economies has been the focus of academia. For a long time, as China has a relatively strict capital flow management, and the spillover effect of Fed quantitative easing on China mainly focuses on the real economic channels such as trade and investment (Liu and Zhai, 2011; Sheng Xia, 2013; Zhang et al. 2015; Sun et al. 2016), with little evidence of the effectiveness of financial channels through empirical data. In the discussion of the financial channel (Blanchard et al., 2015; Bruno and Shin, 2015), foreign empirical studies have deliberately excluded Chinese data, and domestic studies on the spillover effects of the Federal Reserve's monetary policy on China after financial liberalisation have mostly used macro-financial models to simulate it (Zhang Liqing and Zhong Xi, 2020), lacking empirical support.

Backgroud &Motivation

- After the opening of the "bond pass" in 2019, the scale and proportion of foreign investors' holdings of China's government bonds have rapidly increased. The financial channels of spillover from the Fed's quantitative easing to China may emerge as the scale of capital flows under China's portfolio investment increases after the new round of financial opening.

- Three rounds of quantitative easing after the 2008 financial crisis all occurred before the opening of China's bond market, while the quantitative easing under the Covid-19 epidemic occurs after the opening of China's bond market. Thereby, we have the opportunity to study the changes in the spillover effects of the Fed's quantitative easing on China before and after the opening of the bond market.

Backgroud &Motivation

- Question:
- Against the background of a new round of financial opening in China and unlimited quantitative easing by the Federal Reserve, have the spillover effects and spillover channels of the Federal Reserve's monetary policy on China's long-term interest rates changed?
- Has the opening up of the capital account become a key factor affecting the spillover effect, and has the increase in exchange rate flexibility eased the spillover from the Fed's monetary policy to China's long-term interest rates?
- In this paper, we will take the Fed's quantitative easing under these two big shocks(financial crisis and the epidemic) as an example to measure the changes in the spillover effects of Fed’s QE on China's long-term Treasury yields in different periods and screen the spillover channels to determine whether the financial channels of the Fed's QE on China's long-term interest rate spillover after the opening of the bond market are visible and whether the increased exchange rate flexibility can weaken the spillover from the financial channels.

Backgroud &Motivation

- Long-term Treasury yields are the benchmark for pricing in a country's bond market, and also the main intermediary for the transmission of quantitative easing (Bernanke, 2010), and an important variable affecting the independence of monetary policy.
- Research on the spillover effects of the Fed's monetary policy on China's long-term interest rates and the channels of spillover will influence the policy choices of China's monetary authorities in response to the Fed's policy spillover, and will also provide a reference for the pace of China's capital account opening.
- In addition, under the massive capital flows brought about by quantitative easing, the validity of the "The Impossible Trinity" has been challenged empirically (Passari and Rey, 2015), and the research in this paper will also provide a new empirical basis for theoretical exploration of macro finance under open conditions.

In the aftermath of the 2008 financial crisis, a large empirical literature has focused on whether exchange rate floating under quantitative easing can weaken the impact of the Federal Reserve's monetary policy on policy rates in other countries. Although the discussion has not reached consensus, the literature has argued that the presence of financial channels affects the safeguard of monetary policy independence from exchange rate floating.

Studies by Hofmann and Takats (2015) and Han and Wei (2016) also suggest that exchange rate floating does not weaken the transmission of the Fed's monetary policy to the home country's policy rate. Zhang and Zhong (2020) construct a two-country DSGE model that includes banking and financial frictions, arguing that the financial channel transmits faster than the real economy channel under the global financial integration, a floating exchange rate regime does not insulate against shocks from the global financial cycle nor does it guarantee monetary policy independence. Georgiadis and Zhu (2019) demonstrate the validity of the triadic paradox based on cross-country panel data for 47 economies from 2002-2018, where both capital controls and exchange rate floating can reduce the sensitivity of domestic policy rates to the Fed's policy rate; it also demonstrates that the presence of financial channels reduces the degree of monetary policy independence available to the home monetary authority under a flexible exchange rate regime.R. Ahmed (2020) argues that the previous literature weakens the impact of intermediate exchange rate policies such as managed floating exchange rate regimes, proposes a continuous measure of exchange rate flexibility, and empirically verifies that the spillover effect of Fed monetary policy on the domestic policy rates typically increases with exchange rate stability.

With the difficulty in reaching agreement on the spillover of the Fed's monetary policy to policy rates of other economies, some scholars have focused their research on the spillover of the Fed's monetary policy to long-term interest rates in other economies. The empirical research sample is dominated by small open economies and the vast majority of the literature observes spillovers from the Fed's monetary policy to long-term Treasury yields in small open economies and that financial openness and capital flows weaken the monetary authority's control over long-term interest rates and exchange rate floats do not mitigate this spillover effect, but little literature identifies specific channels of spillovers.

Miyajima et al. (2014) find that unconventional US monetary policy reduces the Treasury yields and stimulates domestic credit through a panel VAR model with a sample of small open Asian economies; financial openness does not mitigate the control of short-term policy rates by the home monetary authority, but weakens its control over long-term rates. Jain-Chandra and Unsal (2012) use a dynamic factor model and SVAR models to demonstrate that long-term interest rates in open Asian economies are mainly driven by global factors and that monetary policy transmission, as represented by the short-term policy rate, remains effective, but that a surge in capital inflows weakens the effectiveness of domestic monetary policy transmission. In terms of the relationship between exchange rate elasticity and spillovers, Obstfeld (2015) shows that the spillovers from the Fed's monetary policy to long-term interest rates across economies are not affected by exchange rate elasticity. Kharroubi and Zampolli (2016) even find that the more elastic the exchange rate of a sample country is, the more its long-term interest rate is affected by the base country's monetary policy. Albagli et al. (2019) examine the spillover and spillover channels of the Fed's monetary policy on long-term interest rates in other countries through high-frequency data identification, testing for the existence of information and financial channels, but their study sample is also mainly small and open economies.

Contribution of this paper

This paper systematically compares the spillover channels of the Fed's monetary policy on long-term interest rates in other countries based on the historical literature, and examines the changes in the spillover effects and spillover channels of the Fed's quantitative easing on China's long-term interest rates during the capital account liberalisation, using Chinese Treasury yields of major maturities from 2006 to 2021 as a sample.

The innovations of this paper

- identifies the spillover channels of the Fed's monetary policy on China's long-term interest rates from an empirical perspective, and finds that the spillover channels of the Fed's monetary policy on China's long-term interest rates during the new round of quantitative easing are mainly financial channels.

- Based on an affine term structure model containing risk factors (Adrian et al., 2013) decomposing Chinese 10-year Treasury yields into risk-neutral rates and risk premia, this paper describes for the first time the impact of the Fed's monetary policy on China's long-term interest rate implied risk-neutral rates and risk premia.

- This paper determines that the main channel of spillover from the Fed's monetary policy information to China's long-term interest rates during this round of quantitative easing is the financial channel, rather than the information channel generated by the cycle synchronisation under the epidemic shock.

Contribution of this paper

The innovations of this paper

- Unlike most of the domestic literature, which still constructs VAR models through specific policy variables or uses event studies to measure policy shocks, this paper uses high-frequency data identification to quantify the policy information released at each Fed meeting during the quantitative easing period, and constructs regression models to measure the policy spillover effect using this variable.

- finds through empirical data that in the financial channel, an increase in exchange rate floatation mitigates the spillover to our risk-neutral interest rate and enhances the spillover to the risk premium. During the quantitative easing process during the current epidemic, increased exchange rate flexibility did not, on the whole, significantly mitigate the spillover from the Fed's policy message to China's long-term interest rate.

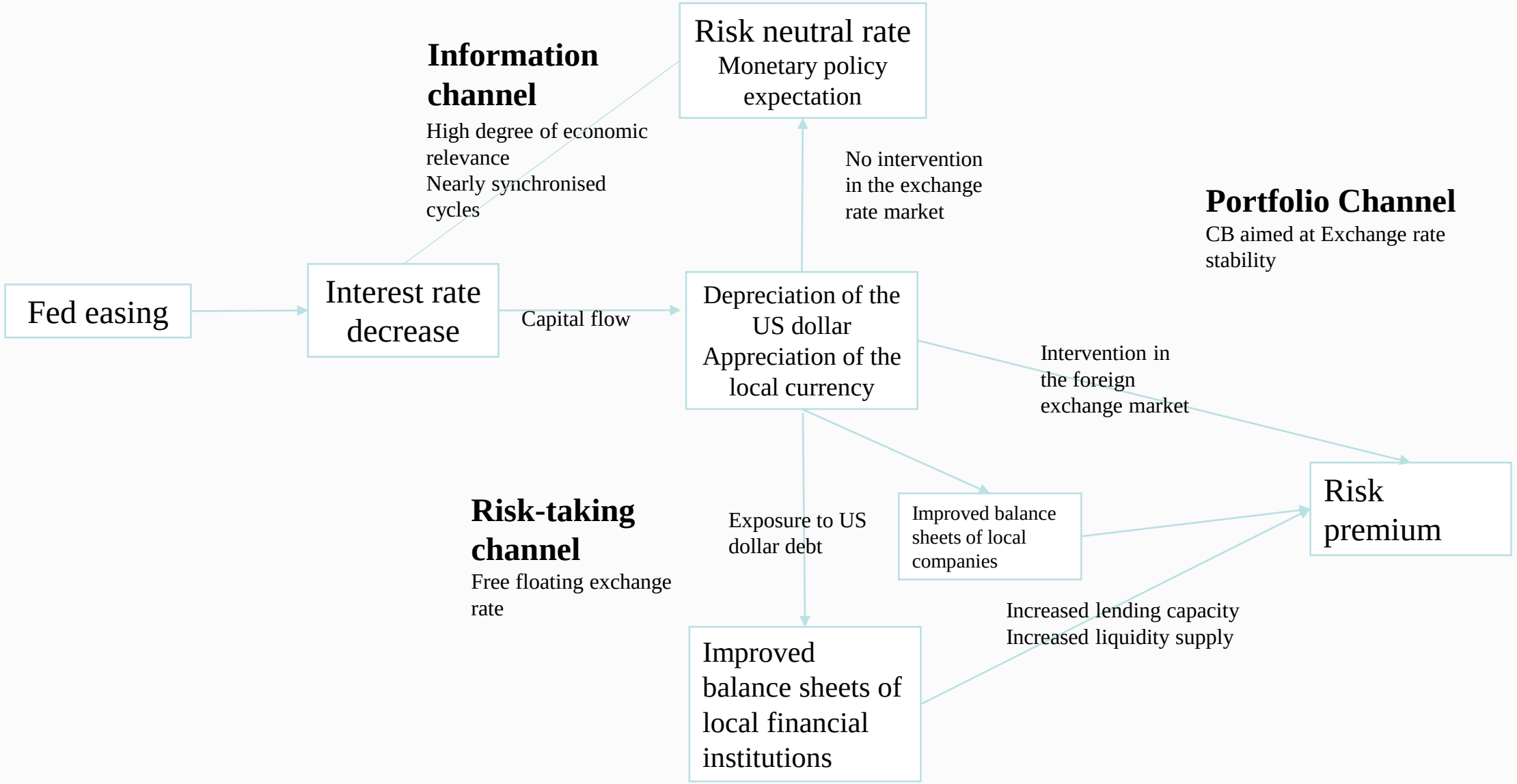
- uses a non-linear LP-VAR model to verify that as the degree of capital account opening and foreign investors' participation in China's treasury market increase, the short-term shocks to China's long-term interest rates from the Fed's monetary policy increase significantly, but the shocks are not strong and sustainable enough to affect China's monetary policy independence for the time being.

The Fed's spillover channel to international long-term interest rates

- Main spillover channels

- Financial Channel
- Asset Portfolio Channel（Blanchard et al.，2015；Albagli et al.，2019）
- Risk-taking Channel（Bruno & Shin，2015）
- Difference: whether the central bank is targeting exchange rate stability or not, risk premium adjustment is only one part of the risk-taking channel

- Information Channel


Risk neutral rate
Monetary policy expectation
Information channel
High degree of economic relevance
Nearly synchronised cycles
No intervention in the exchange rate market
Portfolio Channel
CB aimed at Exchange rate stability
Fed easing
Interest rate decrease
Capital flow
Depreciation of the US dollar
Appreciation of the local currency
Intervention in the foreign exchange market
Risk premium
Risk-taking channel
Free floating exchange rate
Exposure to US dollar debt
Improved balance sheets of local companies
Increased lending capacity
Increased liquidity supply
Improved balance sheets of local financial institutions

The Fed's spillover channel to international long-term interest rates

- Channel identification

- Financial Channel
- Asset Portfolio Channel： risk-neutral rate, risk premium
- Risk-taking Channel： risk premium
- Whether the central bank aims for exchange rate stability and what regulatory effect the exchange rate plays

- Information Channel
- Risk neutral rate： Impact of other macro information variables on risk-neutral interest rates

The Fed's spillover channel to international long-term interest rates

- Yield decomposition

$$y^h = RN^h + TP^h$$

In this paper, we decompose the long-term Treasury yield y^h into the risk-neutral rate RN^h (monetary policy expectations) and the risk premium TP^h.

Based on the affine term structure model with risk factors proposed by Adrian et al. (2013), with reference to the approach of Albagli et al. (2019).

Unlike the traditional three-factor interest rate term structure, Adrian et al.'s (2013) model introduces a risk factor.

Albagli et al. (2019) define the difference between the model-predicted bond yield $\widehat{y_t^n}$ and the risk-neutral rate $\tilde{y}_t^n$ as the risk premium (TP), which this paper argues is implicit in the model setting and ignores the real information in the transactions. Due to the availability of transaction data, the risk premium TP is defined as the difference between the return on a real transaction and the risk-neutral rate calculated by the model, i.e. $TP_t^n = y_t^n - \tilde{y}_t^n$.

- **Model and variable selection**

$$\Delta y_{D,t}^{h} = a_{year}^{h} + \alpha_{month}^{h} + \beta_1^h MP_t^{US} + \beta_2^h MP_t^{D} + \sum_n \gamma_{n,us} S_{n,t}^{US} + \sum_n \gamma_{n,D} S_{n,t}^{D} + \varepsilon_t^h$$

$$MP_t^i = \begin{cases} y_{i,t+1}^{2Y} - y_{i.t-1}^{2Y}, & t \text{ is the period of announcement of monetary policy changes or interest rate meetings in economy } i \\ 0, & \text{others} \end{cases}$$

$$S_{n,t}^i = \begin{cases} y_{i,t+1}^{2Y} - y_{i,t-1}^{2Y}, & t \text{ is the publication date of macro indicator n for economy i} \\ 0, & \text{others} \end{cases}$$

- The use of high frequency identification (HFI) monetary policy surprise was first introduced by Cook & Hahn (1989) and Kuttner (2001). In the aftermath of the 2008 financial crisis, as central banks in major developed economies triggered the zero interest rate floor and introduced unconventional monetary policies such as quantitative easing, a growing body of literature discarded the original benchmark interest rate change indicator and adopted the method to measure changes in monetary policy, and the interest rate indicator chosen was no longer limited to the implied rate of return on forward federal funds rate contracts (Gertler & Karadi 2015; Stedman, 2019**; Albagli et al, 2019**; Hoek & Yoldas, 2021).

- **Impact of Fed policy changes on Chinese 10-year Treasury yields during quantitative easing**

Table 1 Impact of US monetary policy on Chinese Treasury yields

Sample interval	Variables	Δy_D^3	Δy_D^5	Δy_D^{10}
All period	MP^{US}	0.310*	0.0193	0.0619
（2006.1-2021.2）		(1.848)	(0.297)	(1.059)
Before financial crisis	MP^{US}	0.433**	0.0669	0.0758
（2006.1-2008.10）		(2.224)	(0.678)	(1.029)
QE after financial crisis	MP^{US}	0.133	-0.299	-0.242
（2008.11-2013.11）		(0.537)	(-1.167)	(-1.137)
Withdrawal from QE	MP^{US}	0.0451	0.0488	0.0332
（2013.12-2019.8）		(0.717)	(0.909)	(0.692)
Normalised easing	MP^{US}	1.550***	0.217***	0.440***
（2019.9-2020.1）		(6.660)	(3.827)	(8.549)
QE under the epidemic	MP^{US}	0.0323	0.0403	0.243***
（2020.2-2021.2）		(0.489)	(0.372)	(4.552)
Since normalized easing	MP^{US}	0.0474	0.0641	0.274***
（2019.9-2021.2）		(0.731)	(0.702)	(5.088)

Note: Heteroskedasticity robust standard errors in parentheses; *, **, *** represent parameters significant at the 10%, 5%, 1% levels respectively.

- **Impact of Fed policy changes on Chinese risk-neutral rate and risk premium during quantitative easing**

Table 2 Impact of Fed monetary policy changes on Chinese 10-year Treasury yields and implied risk-neutral rates and risk premia

Sample interval	Variables	Δy_D^{10}	ΔRN_D^{10}	ΔTP_D^{10}
All period	MP^{US}	0.0619	0.0663	-0.00442
（2006.1-2021.2）		(1.059)	(0.702)	(-0.0735)
Before financial crisis	MP^{US}	0.0758	0.0819	-0.00612
（2006.1-2008.10）		(1.029)	(0.594)	(-0.0663)
QE after financial crisis	MP^{US}	-0.242	-0.0742	-0.167
（2008.11-2013.11）		(-1.137)	(-0.635)	(-1.251)
Withdrawal from QE	MP^{US}	0.0332	0.0200	0.0132
（2013.12-2019.8）		(0.692)	(0.467)	(0.519)
Normalised easing	MP^{US}	0.440***	0.361***	0.0791***
（2019.9-2020.1）		(8.549)	(5.650)	(2.939)
QE under the epidemic	MP^{US}	0.243***	0.148*	0.0952*
（2020.2-2021.2）		(4.552)	(1.955)	(1.958)
Since normalized easing	MP^{US}	0.274***	0.178**	0.0958**
（2019.9-2021.2）		(5.088)	(2.512)	(2.405)

Note: Heteroskedasticity robust standard errors in brackets; *, **, *** represent parameters significant at the 10%, 5% and 1% levels respectively; ΔRN_D^{10} is China's 10-year risk-neutral interest rate and ΔTP_D^{10} is the risk premium implied in China's 10-year treasury bond yields. Same below.

- **Information Channel**

Table 3 Impact of key US macro indicators announcements on long-term interest rates and risk-neutral rates in China

Sample interval	Variables	Δy_D^3	Δy_D^5	Δy_D^{10}	RN_D^{10}	TP_D^{10}
Normalised easing	S_{CPI}^{US}	0.0420	-0.107**	0.0805	0.0372	0.0433
		(0.648)	(-2.022)	(1.401)	(0.877)	(0.868)
	S_{IP}^{US}	0.681**	0.346**	0.925***	0.542	0.383
		(2.582)	(2.334)	(3.733)	(1.253)	(1.559)
QE under the epidemic	S_{CPI}^{US}	0.387***	0.145*	0.162*	0.0459	0.116***
		(4.260)	(1.713)	(1.724)	(0.548)	(3.960)
	S_{IP}^{US}	-6.039*	-8.796***	1.532	2.367	-0.835
		(-1.662)	(-2.749)	(0.603)	(0.865)	(-0.689)
	S_{LAB}^{US}	6.025*	10.19***	-1.049	-1.639	0.590
		(1.653)	(3.103)	(-0.405)	(-0.590)	(0.480)
Since the "bond pass"	S_{CPI}^{US}	0.281***	0.0659	0.120	0.0344	0.0851**
		(2.599)	(0.765)	(1.630)	(0.583)	(2.300)
	S_{IP}^{US}	-6.066**	-8.435***	2.331	2.543	-0.212
		(-2.307)	(-3.510)	(1.224)	(1.280)	(-0.229)
	S_{LAB}^{US}	6.466**	9.290***	-1.602	-1.898	0.295
		(2.445)	(3.825)	(-0.830)	(-0.939)	(0.307)

Note: Heteroskedasticity robust standard errors in parentheses; *, **, *** represent parameters significant at the 10%, 5%, 1% levels respectively; Normal easing has no unemployment rate shock mainly because the US unemployment rate and US industrial output were released on the same day during the period and S_{IP}^{US} and S_{LAB}^{US} are fully covariant.

From the available empirical results, there is insufficient evidence to suggest that the Federal Reserve's monetary policy can have an impact on our long-term interest rates through the information channel.

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Changes in spillovers from the Fed's QE to long-term interest rates in China and identification of financial channels

- **Financial Channel**
- The spillover of the Fed's monetary policy on our term premium during the post-epidemic quantitative easing period has largely confirmed the existence of a financial channel for the spillover of the Fed's monetary policy on our long-term interest rates. This paper will examine the impact of the exchange rate on the risk-neutral interest rate and the term premium as well as further identification of the mechanism of action of the financial channel by examining the moderating effect of the exchange rate.

Table 4 Impact of the Fed's policy on the RMB exchange rate

Variables		Since "bond pass" dex_D	QE under the epidemic dex_D	Normalised easing dex_D
MP^{US}		0.217***	0.232***	0.154***
		(4.062)	(3.858)	(5.355)

Table 5 Impact of the RMB exchange rate on the spillover effect of Fed policy information on long-term interest rate of China

Sample interval	Variables	Δy_D^{10}	RN_D^{10}	TP_D^{10}
Since the "bond pass"	MP^{US}	0.371***	0.337***	0.0331
		(5.234)	(5.516)	(1.022)
	$L.dex_D \times MP^{US}$	-3.092*	-5.099***	2.007***
		(-1.898)	(-3.405)	(3.577)
QE under the epidemic	MP^{US}	0.350***	0.368***	-0.0177
		(2.746)	(3.141)	(-0.577)
	$L.dex_D \times MP^{US}$	-2.726	-5.589**	2.863***
		(-1.077)	(-2.299)	(5.185)
Normalised easing	MP^{US}	-0.654**	-1.322***	0.668***
		(-2.265)	(-4.780)	(5.223)
	$L.dex_D \times MP^{US}$	-2.115***	-3.254***	1.139***
		(-3.864)	(-6.218)	(4.677)

Note: Heteroskedasticity robust standard errors in parentheses; *, **, *** represent parameters significant at the 10%, 5% and 1% levels respectively.

$$\Delta y_{D,t}^h = a_{year}^h + \alpha_{month}^h + \alpha_1 L.dex_{D,t} + \alpha_2^h MP_t^{US} \times L.dex_{D,t} + \theta_1^h MP_t^{US} + \theta_2^h MP_t^D + \sum_n \gamma_{n,us} S_{n,t}^{US} + \sum_n \gamma_{n,D} S_{n,t}^D + \varepsilon_t^h$$

- During the new round of quantitative easing, the widening exchange rate float somewhat weakened the spillover from the Federal Reserve's monetary policy to our long-term and risk-neutral interest rates, but strengthened the spillover to the term premium.
- With the information channel not in effect, the Fed's monetary policy generated significant spillovers to our risk-neutral interest rate, suggesting that the asset portfolio channel played a role. However, exchange rate floating in turn weakened that spillover effect, an empirical result that suggests both an increase in the PBoC's tolerance for exchange rate volatility; and that the risk-taking channel may play a more pronounced role in the context of exchange rate floating.
- During the Fed's conventionalised easing period, exchange rate floating did not completely fail to safeguard monetary policy independence. Increased exchange rate flexibility weakened the spillover from the Fed's monetary policy to our risk-neutral interest rate and, in turn, the spillover from the Fed's policy to our long-term interest rate. In contrast, during this post-epidemic period of quantitative easing, or as a result of the increased scale of capital flows and the enhanced spillover of Fed policy on term premia, although exchange rate floating weakened the spillover of Fed monetary policy on risk-neutral interest rates, it did not significantly weaken the spillover of Fed policy on our long-term interest rates.

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- **Short Summary**

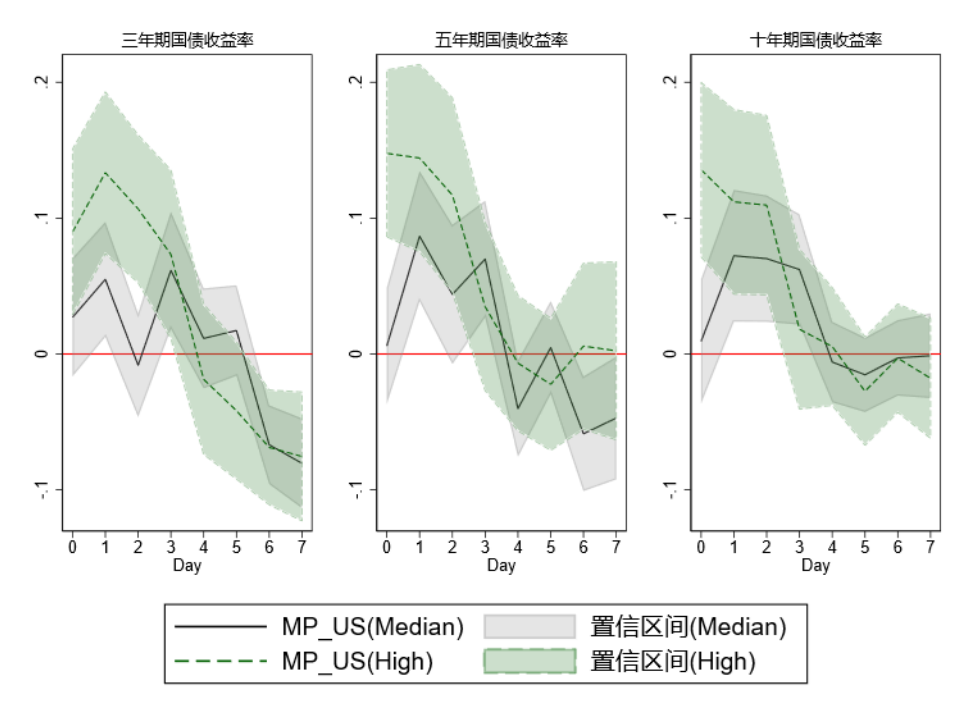
- The spillover effect of the Federal Reserve's monetary policy on our long-term interest rates during both the quantitative easing after the 2008 financial crisis and its withdrawal was not significant.
- The spillover effect of the Fed's monetary policy on China's long-term interest rates was significant during the regular easing of the Fed's monetary policy and the quantitative easing under the new epidemic crisis that started in 2019.
- The timing of the significance coincides with the opening of the "bond pass", and the paper speculates that the reason for the significant spillover may be related to the increased openness of China's bond market.
- Moreover, according to the decomposition of the term structure, the Fed's monetary policy has a spillover effect on China's risk-neutral interest rate and risk premium.
- In terms of the moderating effect played by the exchange rate and the spillover of other US macro information on the risk-neutral interest rate, the spillover channel is mainly the financial channel, with both the asset portfolio channel and the risk-taking channel playing a role, and the risk-taking channel probably playing a larger role, which does not support the effectiveness of the information channel for the time being.
- An increase in exchange rate float will to some extent weaken the spillover to the risk-neutral rate, while enhancing the spillover to the risk premium. Overall, during the quantitative easing period of the epidemic, increased exchange rate float did not significantly weaken the spillover from Fed policy information to our 10-year Treasury yields.

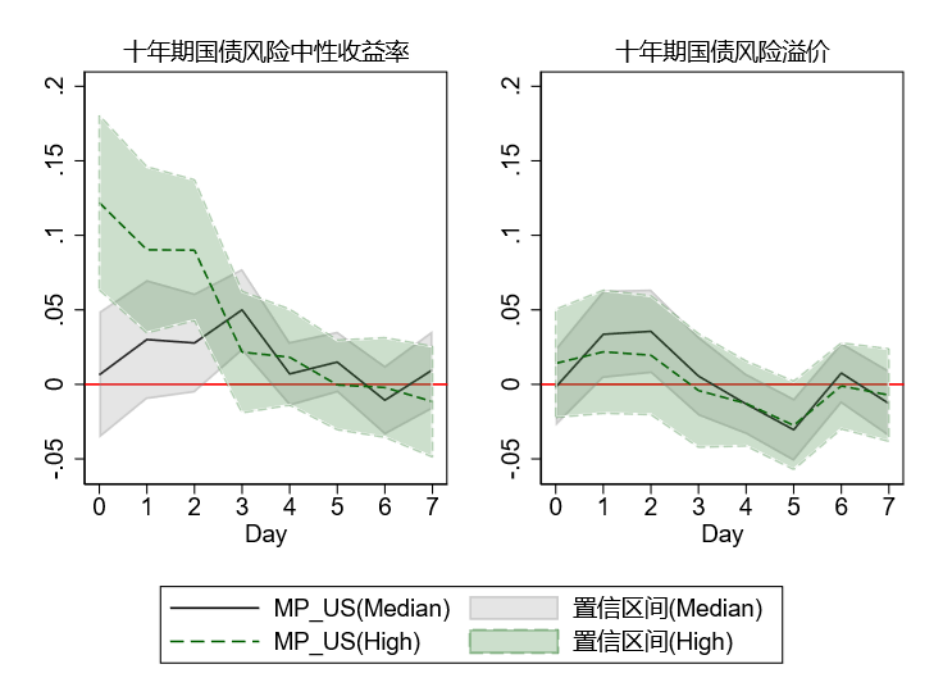
From the research in this paper, it can be seen that the time when the spillover effect of the Fed's monetary policy on China's long-term interest rates becomes significant coincides with the opening of the "bond pass", and the spillover channel is mainly the financial channel.

In order to determine whether the emergence of the financial channel and the salience of the immediate spillover affect monetary policy independence, and to measure the impact of capital account openness on the spillover effect of Fed policy, this paper will describe the relationship between spillover sustainability and the degree of capital account openness and spillover effect through a non-linear LP-VAR. Referring to Iacoviello and Navarro (2019), the empirical model of the article is set up as follows.

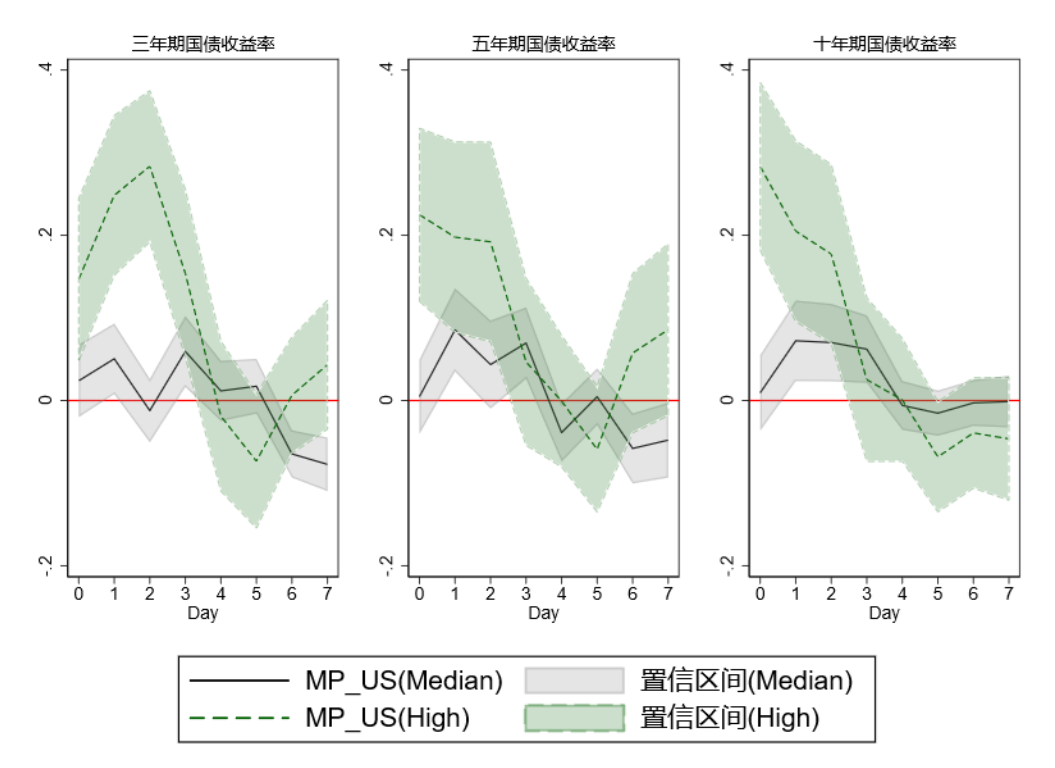
$$\Delta y_{D,t+f}^{h} = \alpha + a_{y}^{h} + \alpha_{m}^{h} + \beta_{1,f}^{h} MP_{t}^{US} + \beta_{1,f}^{hv} (e_{t}^{v} MP_{t}^{US})^{\perp} + \beta_{2,h}^{h} MP_{t}^{D} + \sum_{n} \gamma_{n,h,us} S_{n,t}^{US} + \sum_{n} \gamma_{n,h,D} S_{n,t}^{D} + \varepsilon_{t}^{h}$$

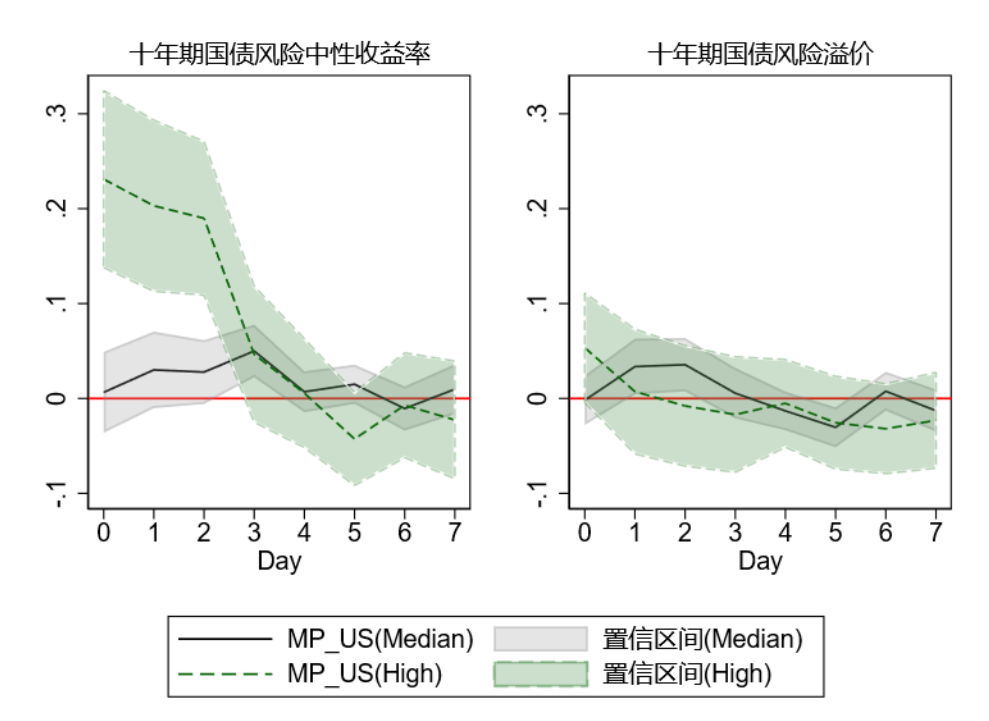
- **Capital account openness and the impact of Federal Reserve policy on China's long-term interest rates**





- **Foreign investor participation and the impact of Federal Reserve policy on long-term interest rates in China**





- **As capital account openness increases, the impact of the Fed's monetary policy on China's long-term Treasury yields increases significantly, and this is more pronounced when foreign investor participation increases.**

- **According to the empirical results of the LP-VAR model, the impact of the Fed's monetary policy on China's risk-neutral interest rate increases significantly when capital account openness increases and foreign investor participation increases, but only for about three periods.**

- **At the higher quartile of capital account openness, the impact of the Fed's monetary policy on China's risk premium is not significantly different from that at the median level of capital account openness, which may be related to the index of capital account openness chosen in this paper.**

- **When the share of foreign investors holding China's Treasuries is at the higher quartile, the impact of the Fed's monetary policy on China's risk premium is significantly slightly stronger in period zero than when the share of foreign investors holding is at the median, but the difference in the impact on the risk premium is not persistent.**

Conclusions

- **With the increased openness of the capital account, the spillover effect of the Federal Reserve's monetary policy on China's long-term Treasury yields has increased significantly.**

- **The financial channel is the main spillover channel.**

- **The mitigating effect of increased exchange rate flexibility on short-term shocks declines**

- **Spillover sustainability is not strong and the Fed's monetary policy is not sufficient to determine the long-term trend of China's 10-year Treasury yields.**

- **In November 2021, the Federal Reserve announced a reduction in asset purchases and a turnaround in Fed policy expectations. With the expansion of capital account opening, the monetary policy authorities should both fully consider the impact of capital account opening on the independence of monetary policy and prudently promote capital account opening; at the same time, they should maintain policy stability and need not panic too much over short-term market volatility, and need not overreact to short-term spillovers from the Fed's monetary policy when the shocks are not sustainable.**

Appendix

Exhibit 1: Impact of Fed monetary policy on Treasury yields in other economies (all samples)

Variables	Δy_D^2	Δy_D^{10}	ΔRN_D^{10}	ΔTP_D^{10}
All Period	0.0680**	0.0762***	0.107**	-0.0178
	(2.614)	(2.988)	(2.650)	(-0.710)
MP^{US}	0.111***	0.0451	0.0534	0.0760
Before financial crisis	(3.856)	(0.951)	(0.544)	(1.231)
MP^{US}	0.00847	0.0392	0.120**	-0.0970
QE after financial crisis	(0.345)	(1.190)	(2.239)	(-1.344)
MP^{US}	0.103**	0.150***	0.154***	-0.0231
Withdraw from QE	(2.498)	(2.935)	(3.307)	(-0.857)
MP^{US}	0.115*	0.299***	0.133	0.157*
Normalised easing	(1.808)	(3.685)	(1.500)	(1.748)
MP^{US}	0.306**	0.369***	0.214**	0.182*
QE under the epidemic	(2.182)	(4.544)	(2.214)	(2.057)

注：*** P 值< 1%, ** P 值 < 5%, * P 值 < 10%. 下同。

This paper conducts a cross-country panel empirical study of long-term interest rate spillovers from Fed monetary policy to 24 sample economies based on the model of Albagli et al. (2019), which finds that for all sample economies, emerging economies, and developed economies, the significance of spillovers from Fed monetary policy to long-term interest rates in other economies during the quantitative easing exit after the 2008 financial crisis is stronger than during the post-2008 crisis quantitative easing period.

DE:Australia, Canada, Germany, Eurozone, France, Italy, Japan, Korea, Singapore, Switzerland, Taiwan China, UK
EM:Brazil, Chile, Colombia, India, Indonesia, Mexico, Malaysia, Russia, South Africa, Thailand, Turkey, Poland

Exhibit 2: Impact of the Fed's monetary policy on emerging economies[5] Treasury yields

Variables	Δy_D^2	Δy_D^{10}	ΔRN^{10}	ΔTP_D^{10}
All Period	0.0593	0.0363	0.120*	-0.0557*
	(1.485)	(1.107)	(1.905)	(-1.821)
MP^{US}	0.130**	0.00483	0.104	0.0646
Before financial crisis	(2.470)	(0.0579)	(0.585)	(0.641)
MP^{US}	0.000984	0.0106	0.124*	-0.127
QE after financial crisis	(0.0328)	(0.256)	(1.813)	(-1.332)
MP^{US}	0.100	0.0778	0.138*	-0.0638
Withdraw from QE	(1.471)	(1.033)	(1.937)	(-1.713)
MP^{US}	0.188	0.178	0.00998	0.168
Normalised easing	(1.228)	(1.216)	(0.0806)	(1.520)
MP^{US}	0.477*	0.419**	0.178	0.217
QE under the epidemic	(1.808)	(3.081)	(0.972)	(1.532)

Exhibit 2: Impact of the Fed's monetary policy on developed economies[6] Treasury yields

Variables	Δy_D^2	Δy_D^{10}	ΔRN_10y	ΔTP_10y
All Period	0.0849***	0.150***	0.0917**	0.0515
	(3.846)	(3.861)	(3.151)	(1.317)
MP^{US}	0.0965***	0.0980*	0.0279	0.0904
Before financial crisis	(4.037)	(1.984)	(0.995)	(1.148)
MP^{US}	0.0549	0.119*	0.0853	-0.000701
QE after financial crisis	(1.247)	(1.947)	(1.806)	(-0.0301)
MP^{US}	0.105***	0.261***	0.177**	0.0483*
Withdraw from QE	(3.274)	(4.791)	(3.234)	(1.948)
MP^{US}	0.0902**	0.440***	0.230**	0.204
Normalised easing	(2.503)	(4.221)	(3.016)	(1.359)
MP^{US}	0.144**	0.292**	0.237**	0.128
QE under the epidemic	(2.973)	(3.044)	(2.850)	(1.276)

T H A N K S