

The "Pure Contagion" Effect between SHIBOR and Multinational Benchmark Interest Rates

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Abstract: By the Crisis contagion canonical model put forward by Pesaran & Pick, this paper verified whether there is a pure contagion effect between the SHIBOR and the benchmark interest rates of several representative countries, and measured the scale of the effect. Finally, it is found that, the benchmark interest rates of developed countries except Japan have positive pure contagion effects on SHIBOR in varying degrees, while the SHIBOR has no significant pure contagion to the benchmark interest rates in developed countries except Japan; different from the empirical results of developed countries, the benchmark interest rate of BRICs member states has negative pure contagion effects of varying degrees to SHIBOR, but the SHIBOR has a more negative pure contagion effects on the benchmark interest rate of BRICs member states.

Keywords: benchmark interest rate; dependence; pure contagion

INTRODUCTION

In the end of 1980s, many developed countries and emerging market countries completed the reform of interest rate marketization. It has become the main means of macroeconomic control in many countries to affect key interest rates by deregulation of interest rates and the use of market resources, thereby affect the entire macro-economy, such as the federal funds rate in the United States, the interbank offered rate in Japan and Russia, and the interbank offered rate in Mumbai, India. China's SHIBOR was formally launched in January 4, 2007.

With the development of interest rate marketization, the market activity and market representativeness of SHIBOR were also improving. China has set up a market target interest rate system with SHIBOR as the short-term benchmark interest rate and Treasury bond repurchase interest rate as the long-term benchmark interest rate. Most countries usually use the interbank interest rate or repurchase rate as the central link of macro-control policies and currency market, the interbank offered rate level reflects the fund price level of interbank money market. However, the surge in interbank offered rates could be a leading indicator of the financial crisis, because interbank offered rate is the price of the short-term capital market, it is determined by the supply and demand relation of the capital market. When a large number of domestic banks lack mobility at the same time, monetary tightening leads to rising capital prices, what's more, there may be bank runs, and even lead to financial crisis. With the continuous improvement of the global economic integration, the benchmark interest rates in different countries are characterized by linkage. Especially during the economic crisis, this linkage will increase significantly, which may lead to the rate crisis

to occur in groups. Economists call this "group" phenomenon as contagion.

Masson [1] systematically divided the contagion effects into three categories according to the causes of the crisis. First, the "monsoon" effect, that is, change in one or more common factors leads to changes in the macro fundamentals of many countries. For example, the volatility of international oil prices may affect the supply and demand of capital markets and money markets in many countries, leading to a substantial fluctuation in asset prices and interest rates. Second, the "spillover" effect, that is, the crisis between countries is transferred through a "real connection", once a crisis breaks out in a country, this "real connection" will affect the macro fundamentals of other countries. Foreign trade, interest rate parity and international policy can be seen as a "real connection". Third, the "pure contagion" effect, this classification suggests that the market may jump from a good state to a bad state, because it cannot be explained by macroscopic fundamentals. The Asian financial crisis in 1997 was the most typical case of pure contagion. Foreign scholars have put forward a variety of theories to

explain the phenomenon of "pure contagion", which mainly includes the theory of endogenous liquidity shock, multiple equilibria and arousal effects, and political influence. Most of the theoretical foundations to interpret come from behavioral economics and social psychology. In addition, this article holds the opinion that information globalization may also be the cause of the "pure contagion". For example, domestic banks can quickly observe the crisis of foreign banks, and increase capital to meet the precautionary demand, resulting in tighter monetary policy and rising interbank offered rates. The contagion effects studied in this paper refer to "pure contagion". The "monsoon effect" and "spillover effect" can all be attributed to the "dependence" of economic variables.

At present, the researches on the relationship between interest rates and international interest rates in China are all based on the "monsoon effect" and "spillover effect". Li Cheng [2] studied the mean spillover effect and volatility spillover effect of interest rates before and after the financial crisis of China and America in the Multivariate asymmetric VAR-MVGARCH-ABEKK model, and found that the non-independence of interest policy in China and the United States was strengthened around the financial crisis. Zhao Dongxi [6] systematically studied the linkage between China and international interest rates, using the Grainger causality, he concluded that the U.S. interest rate policy will have a greater positive effect on interest rate policy of China, and the interest rate policy of China has little impact on the American interest rate policy. Yi Xiaowei [3] studied the impact of the implementation of unconventional monetary policy of the United States on the term structure of interest rates in China's money market and bond market using a VAR model, and found that the impact of the shock on the term structure of interest rates in the two markets is asymmetric.

Although the above studies have made a profound analysis on the causes of the linkage, their research belongs to the category of crisis "dependence", and didn't distinguish the existence of "pure contagion". This paper introduces a canonical model of contagion; the model provides a standard framework for simultaneous analysis of dependence and infectivity. The model can not only explain the existence of the "pure contagion" effect, but also estimate the scale of the contagion effect. This paper focuses on studying the contagion effect between China's SHIBOR with high market attributes and key policy interest rates of several representative developed and emerging market countries, in order to discover the "contagion effect" of international interest rate risk on China's interest rate formation mechanism.

Estimate of contagion effects

The existing methods of testing the financial (economic) crisis contagion include asset price correlation analysis, conditional probability choice model, VAR model as well as study on the Volatility Spillover of Financial Market. And there are inevitable defects in the asset price correlation analysis. First, the sample must be divided into data from the crisis period and data from the stationary period, which is biased because it is difficult to accurately distinguish between crisis and stability; second, the method can only detect the crises that occurred, and do not apply to the prediction of the crisis; the conditional probability model selection method overcomes some flaws of asset price correlation analysis: there is no need to divide the data into crisis period and non-crisis period, what's more, more importantly; it makes it easier to analyze the presence of contagion quantitatively. However, the contagion effects identified by this method cannot be distinguished from the impact of unobservable global factors.

Pesaran and Pick [4] proposed the canonical model on the basis of the previous contagion models. The model provides a standard framework for simultaneous analysis of dependence and contagion, and does not require prior differentiation between crisis periods and non-crisis periods. And it can use short-term sample data of crisis duration to detect the contagion of short-term fluctuations in other countries. In addition, this model can not only identify the time of the crisis, but also explain the existence of the contagion effect and estimate the scale of the contagion effect. However, due to the introduction of the crisis indicating function in the model, the endogeneity of the explanatory variables leads to biased and inconsistent OLS. To solve this problem, Pesaran and Pick [4] use the IV method instead of OLS, which proves that the IV estimator has consistency.

Theoretical model

This paper applies the crisis contagion canonical model put forward by Pesaran & Pick [4]. First of all, when a country's key interest rate rises by more than a certain threshold in this period, it shows that the country is in crisis state in the current period. The model can not only distinguish between dependence and pure contagion effects. It can also discuss the contagion effects among countries with varying degrees of crisis by varying threshold values.

A canonical contagion model that consider a standard of two countries, as follows

$$y_{1t} = \delta_1 z_t + \alpha_1 x_{1t} + \beta_1 I(y_{2t} - \tilde{c}_2) + \mu_{1t} \quad (1)$$

$$y_{2t} = \delta_2 z_t + \alpha_2 x_{2t} + \beta_2 I(y_{1t} - \tilde{c}_1) + \mu_{2t} \quad (2)$$

y_{it} represents the key policy interest rate for a country ($i = 1, 2; t = 1, 2, \dots, T$), z_t is a s column vector, including the common factors of two countries, such as international oil prices, and commodity futures prices; x_{it} is k_i a column vector, including the influential factors of the i country, such as domestic price level, national economic policy variables and so on. μ_{it} is the random perturbation term, satisfying the z_t, x_{it}, μ_{it} are independent to each other; if the μ_{it} sequence is uncorrelated, the conditional mean is 0, and the conditional variance is $\sigma_{\mu_{it}, t-1}^2$; The correlation coefficient of μ_{it} and μ_{jt} is ρ_{ij} , it can use ρ_{ij} to estimate the "dependency" of key policy rates between the two countries". $I(\cdot)$ is indicative function, while \tilde{c}_i is threshold value.

Whether the infection effect exists or no is depended on the short-cut process of coefficient β_i . Whether β_i is zero decides the existence of contagion effect, and its data decides the contagion effect. By controlling the other two macro variables, this paper uses the correlation coefficient of the error terms of the two countries to distinguish infectivity and dependence. In view of the purpose of the study, only the contagion effect is considered here.

Empirical test and analysis

This paper takes the data of October 10, 2006 to June 12, 2015 as the object to study. The key interest rates of typical developed countries and representative emerging market countries are chosen as dependent variables, including the federal funds benchmark interest rate of America, the weekly repurchase rate of the UK, Overnight lending offered rates in Japan, Shanghai interbank offered rate (overnight), overnight lending offered rates in Russia, overnight offered rates between banks in Mumbai, India. The exchange rate and the average quoted price of these countries are selected as the special factors that affect the national benchmark interest rate. The price of WTI is chosen as a common factor affecting the benchmark interest rates of all countries. Through the following empirical analysis, we hope to find the "contagion effect" of the risk of international interest rate surge on SHIBOR in china".

Unit root test of structural mutation

Whether the above economic variables have the unit root character of structural mutation or the tendency of structural mutation remains to be tested. In this paper, we test the stationarity of the data by using the unit root test, ZA test of the endogenous structural mutation, which is put forward by Zivot & Andrews [5]. Here zero hypothesis: the base rate is the unit root process with structural mutations in the intercept term. Table 1 shows the test results:

Table-1: Unit root test of benchmark interest rate structural mutation in the countries

	number	Structural mutation time points	t-Static	$\alpha=0.01$	$\alpha=0.05$	$\alpha=0.1$
China	2	2010/12/20	-9.6976	-5.34	-4.93	-4.58
		2013/5/15	-8.1747			
Japan	3	2008/12/22	-8.1065			
		2009/12/29	-8.6238			
		2013/2/12	-5.7983			
US	3	2011/2/7	-8.5517			
		2013/5/7	-5.2696			
		2014/12/1	-6.6466			
UK	3	2008/10/14	-12.4621			
		2010/12/31	-9.0083			
		2014/8/1	-7.7773			
Russia	2	2009/12/16	-8.0572			
		2014/8/18	-6.1572			
India	2	2009/1/13	-9.4325			
		2011/1/21	-4.7708			

Thus, the key interest rates in various countries are stationary processes with structural mutation of intercept terms. The benchmark interest rates in the United States, Britain and Japan are more similar. They are representative of typical developed countries. The

SHIBOR is similar to the benchmark interest rate in Russia and India, which represent emerging market countries.

MODEL ESTIMATION AND ANALYSIS

The estimates for formula (1) and (2) are as follows:

Table-2: The contagion effects of other countries on China when c=1

	US	UK	Japan	Russian	India
Coefficient	9.6628	7.0505	-108.4090	-8.1780	-5.9617
t -Statistic	5.4746	3.5276	-0.4762	-2.4026	-2.8950
significance	**	**		**	**

Table-3: The contagion effects of China on other countries when c=1

	US	UK	Japan	Russian	India
Coefficient	19.3723	22.6667	54.2056	-10.0013	-19.0430
t -Statistic	1.2876	1.3644	3.1206	-4.3646	-4.5876
significance			**	**	**

Table-4: The contagion effects of other countries on China when c=2

	US	UK	Japan	Russian	India
Coefficient	26.3233	15.9426	-1879.0410	-216.9082	-9.4188
t -Statistic	3.4582	2.6860	-0.0476	-0.3274	-2.5303
significance	**	**			**

Table-5: The contagion effects of China on other countries when c=2

	US	UK	Japan	Russian	India
Coefficient	81.5969	100.7751	620.0264	-88.5346	-186.7743
t -Statistic	1.3183	1.3305	1.1842	-2.2473	-2.0604
significance				**	**

The economies of developed countries still lead the international financial markets

When the federal funds rate and the UK weekly repo rate soared by 1 standard deviation and 2 standard deviations, they have a contagion effect on SHIBOR, transmission coefficients are positive, and increase with the increase of C, t value is also very significant. It suggests that when the two countries tighten monetary policy, it will lead to a surge in SHIBOR. However, SHIBOR is positive for the US federal funds rate and the British weekly interbank offered rate, but its t value is not significant, that is, it cannot get the conclusion that SHIBOR has a pure contagion effect on the federal funds rate. Old developed countries such as Britain and the United States have formed the most complete and developed financial market in the world because of earlier deregulation and mixed management model, which is “financial textbooks” for other developing

countries". This "model effect" led to that crisis signal of the old developed countries was quickly observed by other countries, thereby amplified the impact of the crisis in advance.

The influence of China is gradually taking the place of Japan

The surge of interbank offered rates in Japan has no contagion effect on SHIBOR. Instead, when SHIBOR soared by 1 standard deviation, the contagion rate for Japanese interbank offered rates was 54.2056, and the t statistic was 3.1206, which is very significant. It shows that China has some contagion effects on Japan, and Japan does not have pure contagion on china. Since the twentieth Century, Japan has been in the doldrums for a long time affected by the collapse of the bubble economy. At the same time, China was in a "golden age" of reform and opening to the outside

world. And China is constantly promoting the opening of the financial market and actively participating in international financial market activities. In addition, China is also the largest contributor to Japan's tourism, import and export trade. The fluctuation of China's basic situation will make Japan's anticipation of the crisis in advance. As a result, SHIBOR's crisis signals are more likely to have an impact on the interbank offered rate in Japan.

Contagion effects among emerging market countries are obvious

Except when Russian interbank offered rates soared by 2 standard deviations, the contagion coefficients for SHIBOR were not significant, there is significant contagion effect between SHIBOR and Russian interbank offered rate and Mumbai interbank offered rate in India. It is worth noticing that the coefficients of contagion effects are significantly negative, and the external effects of China's external contagion are greater. When Russia's benchmark interest rate soared by a historical standard, the SHIBOR would fall by 8.178%. When the SHIBOR soared by a standard deviation, the benchmark interest rate in Russia would fall by 10%.

CONCLUSION

This paper introduces a crisis canonical model to test and estimate the pure contagion effect of short-term surge of benchmark interest rate between countries. Through the test and estimate of the pure contagion effect between SHIBOR and the benchmark interest rates of the United States, Britain, Japan, Russia and India, it is found that the "pure contagion" effect does exist. SHIBOR not only has a one-way infection with the developed countries of the United Kingdom and the United States, but also has two-way infection with Russia, India and other emerging market countries. The test and estimate can be confirmed to a certain extent, these crisis contagion factors that cannot be explained by economic fundamentals and macro-economic theory do exist, and relevant industry policy makers and investors should pay attention to them. Because the interest rate market has two sides, we should bear in mind the lessons of the financial tsunami in 2008 to China's economy, and attach great importance to pure contagion and dependence of financial (economic) crisis in the deepening of the opening up of capital projects, promoting the financial market reform of asset securitization and interest rate liberalization, to prevent and resist negative impact of foreign crisis on China's economy.

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