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30 January 2022

Influence of Hong Kong RMB offshore market on effectiveness of structural monetary policy in the Mainland China

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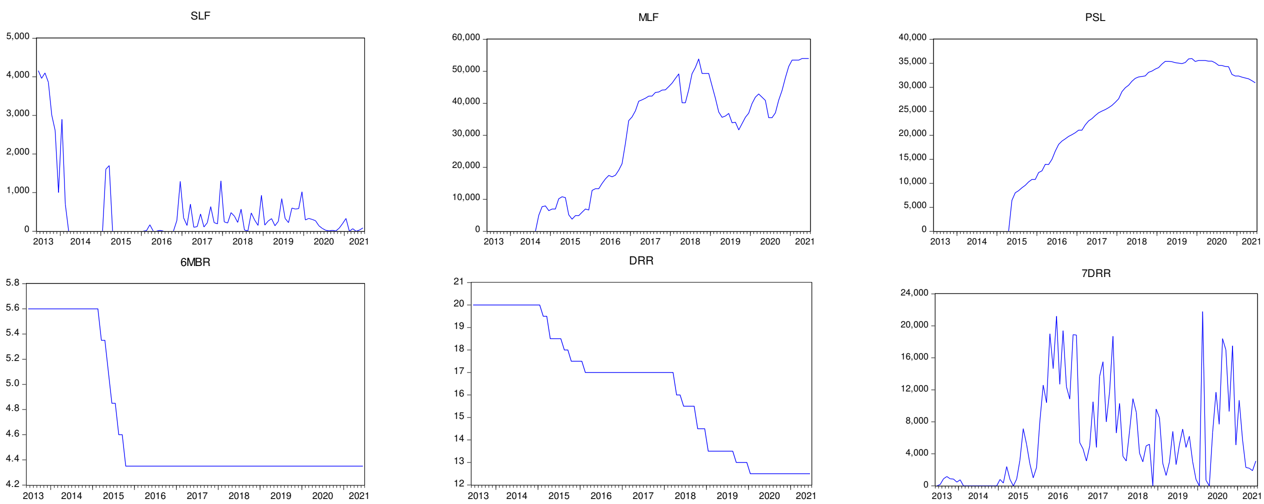
Abstract: We find that the monetary policy in the mainland China will underestimate the volatility of major macro variables when it fails to consider the influence of capital flows to and from the Hong Kong RMB offshore market. Analyses of SVAR model reveals that the Hong Kong RMB offshore market affects money market in the mainland China through changes in the financial flows and exchange rates. In the early stage of the implementation of structural monetary policy (SMP) for macroeconomic stability, the cross-border flows of capital occurs due to changes in arbitrage behavior from the Hong Kong RMB offshore market, which affects not only money supply but also expectations of households and firms about actual interest rate and exchange rates that often produce opposite of intended effects in the price and output. Scenario one of SVAR simulations, that ignored the Hong Kong RMB offshore market came with lower volatilities of the target macro variables but the model generated values of variables did not match well to the actual data. Scenario two of the simulation of the same SVAR model including the Hong Kong RMB offshore market, had model values of model variables closely matching to the actual data though with slightly higher volatilities of those variables.

Keywords: RMB offshore market, monetary policy, macroeconomic volatility, exchange rate

1. Introduction

Since the Hong Kong RMB offshore market was officially established in July 2010, its RMB offshore quotes have gradually become the core price of offshore RMB. The implementations of Shanghai-Hong Kong Stock Connect, Shenzhen-Hong Kong Stock Connect and Bond Connect policies from 2014 to 2017 have enriched channels of capital exchanges between the Mainland and Hong Kong. The introduction of "three links" policy enhanced and promoted the development of Hong Kong RMB offshore market. During September 2021, nearly 12.3 trillion yuan (RMB) was converted into Hong Kong dollars and other currencies, and an equivalent of 12.3 trillion yuan of Hong Kong dollars and other currencies were converted into Renminbi through authorized institutions engaged in Renminbi business. At the same time, there were 116,957 Renminbi remittance transactions from Hong Kong to Mainland, amounting to RMB 2.6 trillion yuan. Nearly 70% of the international transactions and settlement businesses of RMB are carried out through Hong Kong. Hong Kong has become an important window connecting Mainland of China and its international capital markets. The scale of capital flow between Hong Kong and Mainland are ever-increasing.

The reactions to monetary policies of onshore and offshore markets varied due to different market mechanisms and their impacts on results in interest rate spread and exchange rate spread which stimulate speculative arbitrage activities further. Considering that the Mainland of China haven't fully-open capital account, speculations on values of offshore RMB would change actual money supply and interest rate, thus lowering the effectiveness of monetary policy. China's conventional monetary policies have limited room for regulation, as shown by the benchmark interest rate on RMB deposits has been maintained at 0.35percent since July 2012. For this reason the People's Bank of China implemented structural monetary policies such as Standing Lending Facility (SLF), Medium-term Lending Facility (MLF) and Pledged Supplementary Lending (PSL) since 2013, in order to maintain and regulate reasonable level of liquidity and to prevent the slowdown of economic growth.



Δi

Figure 1. Variables for the model

Definition of variables: Trends of Standing Lending Facility (SLF), Medium-term Lending Facility (MLF) and Pledged Supplementary Lending (PSL), 6 months benchmark loan interest rate (6MBR), the deposit reserve ratio of large deposit financial institutions (DRR), 7 days repurchase for analysis (7DRR), Shanghai and Hong Kong interbank interest rate (Shibor and Hibor) spread (Δi), RMB Hong Kong offshore and onshore exchange rate difference (ΔEX), Hot Money (HM), Shanghai interbank offered rate (Shibor), Hong Kong interbank offered rate (Hibor), M1, CPI, industrial value added growth rate (IVAD).

With the rapid development of Hong Kong offshore RMB market, onshore and offshore markets have been interacting more deeply in recent years. We investigate the degree of influence of the Hong Kong offshore market on the effectiveness of conventional and structural monetary policies of Mainland China, an issue not clearly investigated thus far, in this paper. For this, we assessed the significance of such arbitrage through empirical tests based on simulation scenarios of the SVAR model. These results also provide insights for other emerging developing economies that are in process of opening up their capital markets.

2. Literature on onshore and offshore market spillovers

We focus here on three types of researches relating to offshore and onshore exchange rate linkage, interest linkage, the offshore effect on monetary policy.

First, let us start with research on off-shore and on-shore exchange rate linkage. Cheung and Rime(2014) found that the offshore renminbi exchange rate ($e_t^o: CNH$) has an increasing impact on the onshore exchange rate ($e_t^m: CNY$). Xu et al.(2017) found the e_t^m and e_t^o exchange rates show a weak alternate lead-lag structure in most of the times. Qin(2019) and Wan et al.(2020) argued that there is an evidence of stronger causality running from the e_t^o to e_t^m than vice versa, which implies that the foreign impulses have had a stronger influence on the domestic market. Sun et al.(2019) found that there was a continuous positive correlation between the volatility of the onshore and offshore USD/RMB exchange rates, which manifested stronger in the spot market. Li et al.(2020) revealed that the economic policy uncertainty (EPU) have asymmetric and significant effects on the e_t^m and e_t^o spreads and positive shocks to the composite EPU inducing widening the spreads. Sun et al.(2020) also found that both the price level and the price differences of onshore and offshore RMB markets are greatly affected by economic fundamentals. Chen and Zhen(2017) revealed that the RMB exchange rate spread cannot be narrowed in a short time and stays stable in the long term.

Secondly we consider research on international market and monetary policy. Georgiadis and Mehl(2016) found that financial globalization has modified the transmission of monetary policy by strengthening the importance of the exchange rate channel. Jiao and Ye(2017) found that the RMB offshore market in HK has a certain impact on China's money policy. He et al.(2021)found that onshore-offshore exchange rate differential makes the long run equilibrium in the currency market nonlinear and omitting such nonlinearity leads to biased inference on the effectiveness of monetary policy.

Thirdly on policy spillovers. Bhattarai et al.(2021) illustrate the global spillover effects due to demand and technology shocks can lead either to complementary or competitive monetary policies and recommend for international policy coordination to mitigate the adverse consequences. These are based on in-depth studies on the linkage between the offshore and onshore RMB exchange rates.

There are relatively few studies on how the offshore RMB market impacts on Chinese monetary policy effectiveness, especially on the structural monetary policies. This paper makes two contributions towards this literature. First it analyses of the mechanism offshore market effects on China monetary policy, and then it constructs an empirical SVAR model to investigate and simulate the impacts of Hong Kong RMB offshore market on China structural monetary policies.

3. Analysis of spillover influence mechanism

The mechanism of Hong Kong RMB offshore market developments on Chinese monetary policies, mainly through cross-border arbitrage activities, includes interest rate and exchange rate channels. When SLF, MLF and PSL policies of the Central Bank of China increase money supply, it leads to expectations of lower values of exchange rate and interest rate in the onshore market. Hong Kong offshore market usually experiences greater fluctuations than onshore market owing to more active mechanism in market pricing, which manifests itself in onshore-offshore exchange rate and interest rate spreads (onshore minus offshore). Thus, monetary policy shocks widen onshore-offshore interest rate and exchange rate spreads triggering arbitrage opportunities and cross boarder financial transactions and activities. The existence of arbitrage triggered capital flows cause fluctuations in money supply of China mainland drastically due to money multiplier effect. This weakens the link between money supply and real economy that would have prevailed without arbitrage flows, this lowers the effectiveness of monetary policy in the mainland China.

Arbitrage mechanism of interest rate spread: According to the "interest rate parity" theory, investors tend to borrow from low-interest-rate countries and invest in high-yield countries. The paper assumes that offshore arbitrage traders use RMB letter of credit to carry out arbitrage activities through internal insurance and external loans. If the interest rate in the mainland is higher than that in the Hong Kong, $r_t^m > r_t^o$, the mainland company deposits RMB of amount $Q_¥$ in the bank at the interest rate r_t^m. Then the bank issues a letter of credit with the amount of $Q_¥$. After that, the company uses the letter of credit to pay for the imports of Hong Kong affiliates. The Hong Kong affiliates mortgage the RMB letter of credit as collateral and obtain RMB loans $Q_¥$ or US Doller(USD) loans $Q_\$$ from the Hong Kong bank with interest rates of r_t^o. Specifically, there are three different forms of arbitrage schemes: In the first scheme, a Hong Kong company applies for a RMB loan and obtains a profit of $Q_¥(r_t^m - r_t^o)$. In the second scheme, a Hong Kong company applies for a US dollar loan and obtains a profit of $Q_¥(r_t^m - r_t^o)$+$Q_\$(e_t^o$-$e_T^o)$, where e_T^o is exchange rate of RMB against USD during the period T repayment. The third option is for Hong Kong companies to apply for USD loans and purchase forward foreign exchange for risk hedging. At this time, the return is $Q_¥(r_t^m - r_t^o)$+$Q_\$(e_t^o$-NDF)-C, where NDF is forward exchange rate of RMB against the USD without principal delivery, and C is the cost of hedging operations. The three above arbitrage processes lead to increase in onshore deposits and money supply and decline of interest rates, while raising Hong Kong offshore loan demand and interest rates. Conversely, if $r_t^m < r_t^o$, the arbitrage mechanism lead to money supply decline and interest rates increase in the onshore market.

Arbitrage mechanism of exchange rate spread: Exchange rate spread arbitrage are divided into trade settlement arbitrage and speculative arbitrage. For the trade settlement arbitrage, the RMB settlement of cross-border trade has certain degree of speculative attributes, which result in long-term impact on the RMB settlement and payment ratio of cross-border trade. When exchange rate in mainland is lower $e_t^o > e_t^m$, importers change foreign currency and settle in onshore market, and the cost saving is $Q_\$(e_t^o - e_t^m)$; while export enterprises change foreign currency to RMB in offshore market, and the additional income obtained is $Q_\$(e_t^o - e_t^m)$. If $e_t^o < e_t^m$, importers change and settle foreign currency in Hong Kong offshore market, and saving cost is $Q_\$(e_t^m - e_t^o)$; while export enterprises change foreign currency to RMB in onshore market, and the additional income is $Q_\$(e_t^m - e_t^o)$. As for speculative arbitrage, when $e_t^o < e_t^m$, enterprises of Mainland China change the amount of $Q_\$$ USD to $Q_¥$ RMB in onshore market, and pay to Hong Kong affiliates. Then the Hong Kong affiliates change it to the amount of $Q_\$^o$ US Dollars in offshore market, and gains amount of $Q_\$(e_t^m - e_t^o)$. At the same time, the RMB flows from onshore to offshore market. Conversely, if $e_t^o > e_t^m$, speculative arbitrage activities result in RMB flowing from offshore to onshore market.

4. Methodology and Data

4.1 Methodology

We use a VAR model, as introduced by Sims, to analyze the dynamic interdependence among variables and to assess the impacts of disturbances to monetary policies. This is a multivariate time series model less dependent on economic theories but more on dynamic interactions among variables. A regular VAR becomes SVAR econometric model with restrictions on parameters in various equations as implied by economic theories. It can be specified as following in our context:

$$A\begin{bmatrix}MP_t\\Arb_t\\Obj_t\end{bmatrix} = \mathrm{B}_0 + \mathrm{B}_1\begin{bmatrix}MP_{t-1}\\Arb_{t-1}\\Obj_{t-1}\end{bmatrix} + \mathrm{B}_2\begin{bmatrix}MP_{t-2}\\Arb_{t-2}\\Obj_{t-2}\end{bmatrix} + \cdots + \mathrm{B}_p\begin{bmatrix}MP_{t-p}\\Arb_{t-p}\\Obj_{t-p}\end{bmatrix} + \begin{bmatrix}\varepsilon_{1t}\\\varepsilon_{2t}\\\varepsilon_{3t}\end{bmatrix} \quad t = 1,2,\cdots T \qquad (1)$$

It could be written as eq. (2)

$$\begin{bmatrix}MP_t\\Arb_t\\Obj_t\end{bmatrix} = A^{-1}\mathrm{B}_0 + A^{-1}\mathrm{B}_1\begin{bmatrix}MP_{t-1}\\Arb_{t-1}\\Obj_{t-1}\end{bmatrix} + A^{-1}\mathrm{B}_2\begin{bmatrix}MP_{t-2}\\Arb_{t-2}\\Obj_{t-2}\end{bmatrix} + \cdots + A^{-1}\mathrm{B}_p\begin{bmatrix}MP_{t-p}\\Arb_{t-p}\\Obj_{t-p}\end{bmatrix} + A^{-1}\begin{bmatrix}\varepsilon_{1t}\\\varepsilon_{2t}\\\varepsilon_{3t}\end{bmatrix} \quad t = 1,2,\cdots T \qquad (2)$$

The reduced form of this VAR system is then given by:

$$\begin{bmatrix}MP_t\\Arb_t\\Obj_t\end{bmatrix} = \Gamma_0 + \Gamma_1\begin{bmatrix}MP_{t-1}\\Arb_{t-1}\\Obj_{t-1}\end{bmatrix} + \Gamma_2\begin{bmatrix}MP_{t-2}\\Arb_{t-2}\\Obj_{t-2}\end{bmatrix} + \cdots + \Gamma_p\begin{bmatrix}MP_{t-p}\\Arb_{t-p}\\Obj_{t-p}\end{bmatrix} + \begin{bmatrix}u_{1t}\\u_{2t}\\u_{3t}\end{bmatrix} \quad t = 1,2,\cdots T \qquad (3)$$

Where $\Gamma_0 = A^{-1}\mathrm{B}_0 \ldots\ldots \Gamma_p = A^{-1}\mathrm{B}_p$, are vectors of reduced form coefficients, u_t the vector of reduced random disturbances, *p* is the number of lag intervals. The structural form VAR in equation (1) has corresponding reduced-form VAR in eq. (3). Unbiased estimation requires that the link between the structural and the reduced form errors are as follows:

$$\varepsilon_t = Au_t,\ E(\varepsilon_t) = 0_k,\ E(\varepsilon_t, \varepsilon_t') = I_k$$

Where ε_t are structural disturbance vector and is assumed to be orthogonal. In order to identify eq.**Error! Reference source not found.**, we choose the short-term identification constraint method based on literature (Afrin, 2017; Bernanke and Mihov, 1998). Namely, we directly assign values to the elements in matrices A, based on the interactions between monetary policy and macroeconomic variables. Considering the hysteresis of the policy effect and the incomplete rationality of the expectations, we assume that monetary policy variables and real economic variables have no influence on each other in the current period, especially when the frequency of the data is short-term (monthly). However intermediate financial variables are more sensitive to change in monetary policy and react contemporarily, thus monetary policy affects financial variables in the current period. We also assume that the order of variables in Cholesky's orthogonal recursive decomposition in this SVAR model matters in measuring impulse response of shocks to model variables. In this order, the first set of variable represents monetary policy instruments, the second set of variables is for channels of monetary policy transmission variables, and the third set is for variables representing the objectives of monetary policy. Thus the structural and reduced form shocks in Eq. (1) and (3) have the following relationship:

$$\begin{bmatrix} \varepsilon_{MP} \\ \varepsilon_{Arb} \\ \varepsilon_{Obj} \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 \\ * & 1 & 0 \\ 0 & * & 1 \end{bmatrix} \begin{bmatrix} u_{MP} \\ u_{Arb} \\ u_{Obj} \end{bmatrix} \tag{4}$$

In this model, structural innovation ε_t, are white noises and they aren't correlated, so the elements of its off the main diagonal are zero. Thus, we can use the SVAR model to identify the shocks because the shocks to each variable are determined by the error terms of the SVAR model. The reasons for the order of recursive recognition of equations in the system are:

First, similar to Patnaik et al. (2011) and Afrin (2017), we put the financial variables before the actual economic variables, and assume that the financial variables will affect the actual variables in the current period, but not the opposite. From the perspective of enterprise micro-decision, the change of exchange rate and interest rate would affect financing cost of enterprises or credit rationing immediately. They then effect on macroeconomic fluctuations. This is one of the reasons why the decision-making of monetary authorities usually based on the observations of lagged economic variables.

Second, the order of financial variables is monetary policy variables (SLF, MLF, PSL) and then monetary policy transmission channel variables (exchange rate, interest rate, etc.). The exchange rate and interest rate are unidirectionally affected by monetary policy in the current period, because of the central bank make decisions after observing changes of former variables. The exchange rate is placed after the monetary policy variables, for that China's exchange rate is still a floating exchange rate system under management conditions with limited scope and lack of flexibility. The interest rate is placed behind monetary policy because monetary policy is the main factor of interest rate fluctuations.

Third, output and price are placed in the third position. Because output and price may be affected by current changes of all previous variables, while output and price changes generally do not cause changes of other variables at the same time. Because the existence of market imperfection and price stickiness, the response of CPI to shocks from monetary policy appear after certain lags (Li et al., 2021).

4.2 Data

There two approaches of measuring monetary policy effectiveness, the one is measuring intermediary goal of monetary policy, another is measuring final goal of monetary policy. The implementation of structural monetary policies in China is mainly to alleviate bank liquidity pressure as well as to promote and restructure real economy. Therefore, this paper selects both intermediate and final target variables as indicators for measuring the effectiveness of structural monetary policies.

Conventional monetary policies also are included in the model for comprehensive and representative reasons. Seven days reverse repurchase is a conventional policy that central bank of China adopts quite often, thus we select the volume of seven days repurchase for analysis (7DRR). We also choose 6-month benchmark loan interest rate（6MBR） and the deposit reserve ratio of large deposit financial institutions（DRR） as representative variables, because both of them are most important instruments for conventional policies.

In terms of structural monetary policy variables, the main structural monetary policies implemented by the People's Bank of China include Standing Lending Facility (SLF), Medium-term Lending Facility (MLF) and Pledged Supplementary Lending (PSL). We adopted absolute value of monetary balance for SLF, MLF and PSL, in order to reflect the degree of impacts on economy better.

As for arbitrage mechanisms, the onshore e_t^m and offshore e_t^o direct quotation of spot exchange rate of RMB against USD are used to calculate the difference (ΔEX) for measuring exchange rate expectations. Usually the RMB offshore exchange rate is higher than onshore exchange rate under RMB devaluation expectation, $e_t^m - e_t^o$ is a negative value, otherwise is positive value. For onshore and offshore interest rates, the one-month inter-bank lending rate of shanghai Shibor and Hong Kong Hibor are selected for calculating difference to obtain interest rate spread Δi. We choose China's new foreign exchange reserve growth rate (Hot Money, HM) as proxy variable of arbitrage capital flow. [3]

As for intermediary objectives of monetary policy, the Shanghai Interbank Offered Rate (Shibor) is selected as a measure of market interest rate, as it is highly representative of reflecting market situation. The indicators of measuring money supply include M0, M1 and M2. M0 only covers cash and is less representative. M2 is less sensitive to international capital flow due to the inclusion of fixed deposits and involves economic cycle. M1 as transaction currency responds more sensitively to international capital flows and real economic activities. Therefore, we choose chain growth rate of M1 as proxy indicator of money supply.

Referring the final objectives of monetary policy, we mainly focus on price and economic growth. As an economic price signal, CPI plays a key role for macro-policy decision-making. It reflects price changes and macro economy conditions comprehensively. At the same time, CPI also is an important reference indicator for policy formulation and implementation by the central bank of China. We choose monthly CPI growth rate as measure of price changes. Real GDP is also an important monetary policy objective of China, and due to lack of monthly data of GDP growth, we choose monthly industrial value added growth rate (IVAD) as a proxy of real goods products.

5. Empirical results

The paper is focus on structural monetary policies, the empirical model constructed by including conventional policies for comprehensive reasons. However the conventional policies wouldn't be reported here

[3] Data source: Choice financial database, unit: US$100 million.

for space reasons.

The main assumption of VAR model is that time series are stationary unless they are cointegrated. So, we adopted Augmented Dickey and Fuller (ADF) and Phillips and Perron (PP) tests before feeding data to the model. Table 1 shows results of stationarity test of variables at their levels and first differences, where the existence of a unit root or non-stationarity is the null hypothesis of the test. According to the results presented in Table 1, the variables of MLF, PSL, 6MBR, DRR, Δi and M1 are stationary at their first differences, namely they are I(1) process; SLF, 7DRR, ΔEX, Hot money, Shibor, CPI and IVAD is stationary at their levels, they are I(0) processes.

Table 1. ADF and PP unit root tests for stationarity of model variables.

Variables	test model	AFD test		PP test		Remarks
		Level	First diff.	Level	First diff.	
SLF	Intercept	-4.582^{***}	——	-4.582^{***}	——	I(0)
	Trend and intercept	-4.461^{***}	——	-4.354^{***}	——	
MLF	Intercept	-0.994	-6.613^{***}	-0.834	-6.588^{***}	I(1)
	Trend and intercept	-1.967	-6.578^{***}	-1.721	-6.552^{***}	
PSL	Intercept	-1.502	-7.013^{***}	-1.389	-7.068^{***}	I(1)
	Trend and intercept	1.184	-7.297^{***}	0.505	-7.288^{***}	
7DRR	Intercept	-3.395^{***}	——	-5.157^{***}	——	I(0)
	Trend and intercept	-3.442^{**}	——	-5.433^{***}	——	
6MBR	Intercept	-2.139	-2.705	-1.692	-9.349^{***}	I(1)
	Trend and intercept	-2.689	-2.914	-1.158	-9.547^{***}	
DRR	Intercept	-0.325	-10.822^{***}	-0.324	-10.769^{***}	I(1)
	Trend and intercept	-1.943	-10.764^{***}	-2.117	-10.718^{***}	
ΔEX	Intercept	-4.253^{***}	——	-4.151^{***}	——	I(0)
	Trend and intercept	-4.293^{***}	——	-4.171^{***}	——	
Δi	Intercept	-2.865^{*}	-9.861^{***}	-2.879^{*}	-9.861^{***}	I(1)
	Trend and intercept	-2.825	-9.805^{***}	-3.055	-9.805^{***}	
HM	Intercept	-5.785^{***}	——	-5.954^{***}	——	I(0)
	Trend and intercept	-5.804^{***}	——	-5.952^{***}	——	
M1	Intercept	-0.384	-12.919^{***}	-0.397	-13.269^{***}	I(1)
	Trend and intercept	-1.851	-12.848^{***}	-2.214	-13.192^{***}	
Shibor	Intercept	-3.348^{**}	——	-3.389^{**}	——	I(0)
	Trend and intercept	-3.750^{**}	——	-3.998^{**}	——	
CPI	Intercept	-7.685^{***}	——	-8.067^{***}	——	I(0)
	Trend and intercept	-7.658^{***}	——	-7.935^{***}	——	
IVAD	Intercept	-10.262^{***}	——	-19.846^{***}	——	I(0)
	Trend and intercept	-10.275^{***}	——	-22.480^{***}	——	

Notes: *** p<0.01, ** p<0.05, * p<0.1

We also need to determine optimal lags of VAR model before doing estimation and analysis. According to the Schwarz Information Criterion for the VAR model, we select optimal lag 1. Then we examine the stability of the model, as Figure 2 shown that all the inverse roots are inside the unit circle, so the VAR model is stable for estimation.

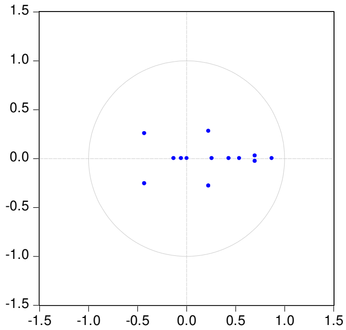


Figure 2. Inverse roots of AR characteristic polynomial

The analysis of model results are organized as follows: First, we examine responses of arbitrage channels and policy objectives to structural monetary policy shocks. Then, we simulate monetary objective variables with or without the Hong Kong offshore market. Then we verify the impact of Hong Kong offshore market on the effectiveness structural monetary policy in China Mainland. See model estimation in Tables A1 and A2 in the appendix.

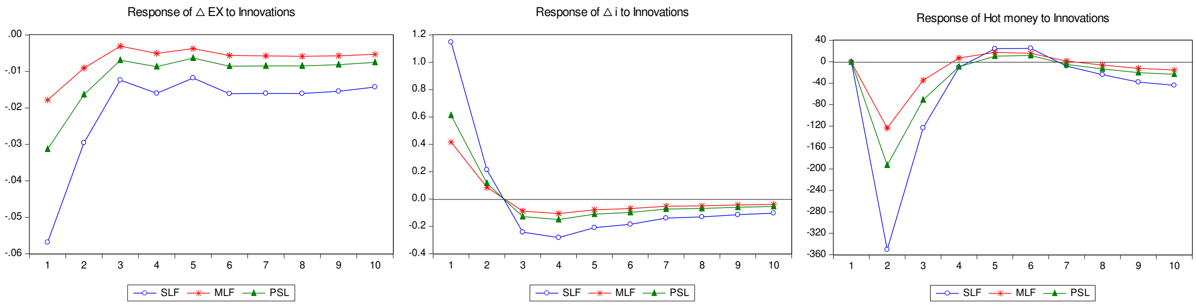


Figure 3. Responses of exchange rate, interest rate and money supply to SLF, MLF, PSL policies

1. Shock responses of arbitrage channels to structural monetary policies

As mentioned, the most important purpose of SVAR model estimation is to analyze the impulse response functions to exchange rate and interest rate spreads. Impulse response functions examine how one variable response at different periods to a standard deviation increase in the value of shocks to another variable. The results of impulse response function are illustrated in Figure 3. One-unit structural shock of SLF, MLF and PSL cause ΔEX decrease negatively, and then increase to be stable after the third period. That is as monetary policy is implemented, RMB offshore exchange rate depreciates more quickly than in onshore market. However, the responses of Δi to structural monetary policies are positive in the first period and decline to zero gradually by ten periods, which means offshore interest rate declines more quickly than that in the onshore market. The reaction of hot money to structural monetary policies is the most negative in the second period, and then tend to zero over time. Sum all, as implement of structure monetary policies, offshore exchange rate and interest rate reacted more quickly than onshore market, that induce hot money outflowed for arbitrage. As the hot money outflowing, exchange rate spread and interest rate spread narrowed, and also hot money flow tend to be zero.

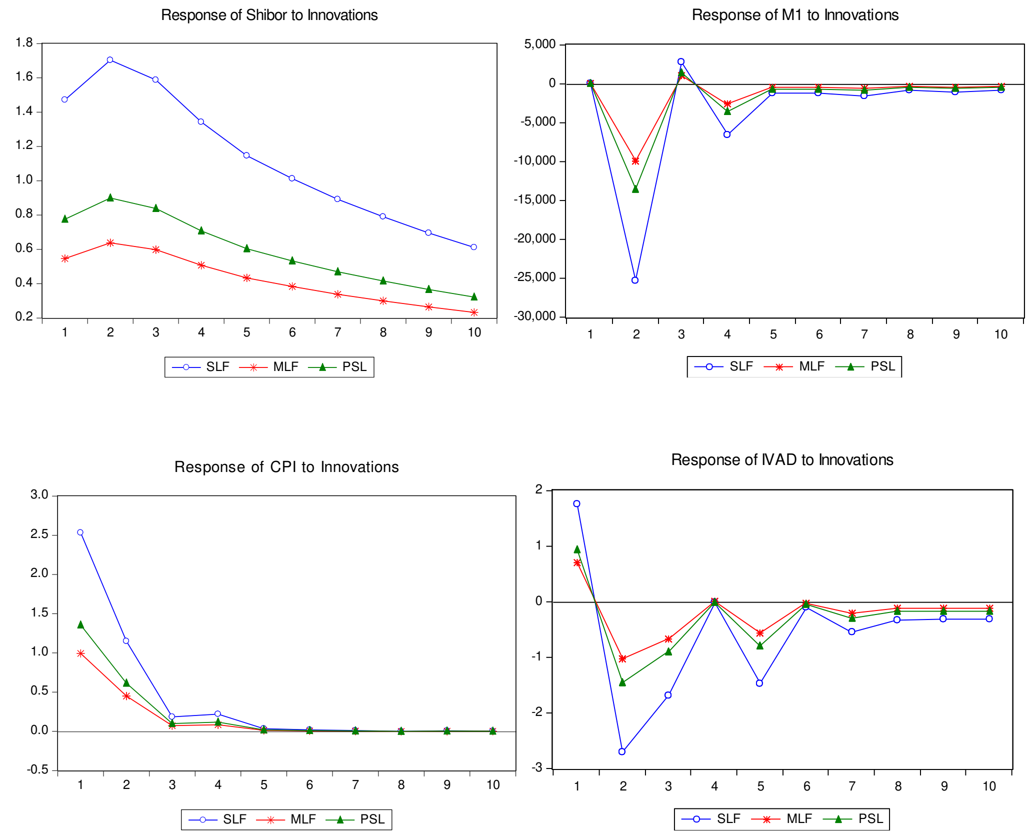


Figure 4. responses of target variables to SLF, MLF, PSL policies

2. Shock responses of intermediary and final objectives to the structural monetary policies

The response of Shibor to SLF, MLF, and PSL policy is positive, and response of M1 dropped negative drastically. Referring Figure 3, for arbitrary and outflow of capital, the supply of M1 dropped and Shibor interest rate increased. The response of CPI and industrial added value are positive in the first period, this means that structural monetary policies effect on CPI and real goods production. However, being capital flow out of onshore market, the real goods production falls and then tends move towards zero overtime.

In summary, the response of Shibor lasts longer than CPI and IVAD, that means the structural monetary are more effective on financial market than on the real economy. Arbitrage activity reduces the effects of structural policies effects on target variables and such contractions are in contradiction to the expectation of expansionalry monetary policies.

4.3 Policy simulation

The central bank policy-making procedure usually is based on examination of real historical data and their predictions due to changes in economic policies. In order to imitate policy decision-making process, we performed a static simulation of the SVAR model by Eviews for scenario analysis. This exercise provides one-period ahead forecasts of endogenous variables using actual values of both exogenous and lagged endogenous variables. For comparison purpose, we solved and simulated two different scenarios for two sets of off-shore onshore link assumptions: scenario 1, Hong Kong offshore market is regarded as exogenous to Mainland China economy – thus there is not link between the two markets; scenario 2, Hong Kong RMB offshore market is closely interlinked to the Mainland Chinese economy.[4] The results of the model simulations for M1, Shibor, CPI and IVAD under these two scenarios are shown in Figure 5. simulations of Hong Kong offshore market influence on structural monetary policies

Notes: the solid lines represent actual data; the dshed lines represent the scenario 1 which exclude Hong Kong offshore market; the dotted line represents the scenario 2 that include Hong Kong market.

. The solid lines represent actual data; the dashed lines represent the scenario 1 which exclude Hong Kong offshore market; the dotted lines represent the scenario 2 that assumes interlink between the Hong Kong and the mainland Chinese markets.

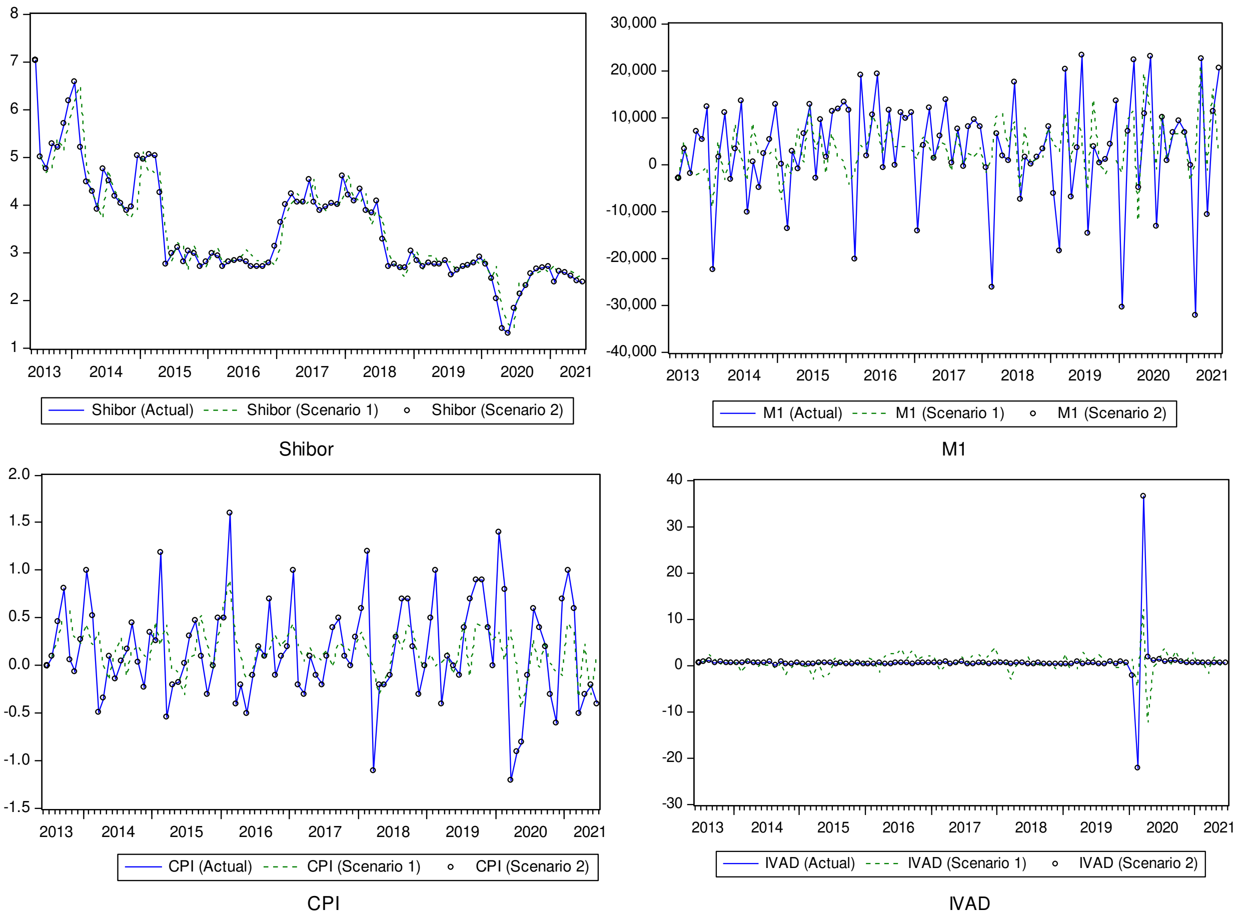


Figure 5. simulations of Hong Kong offshore market influence on structural monetary policies

Notes: the solid lines represent actual data; the dshed lines represent the scenario 1 which exclude Hong Kong offshore market; the dotted line

[4] That is ΔEX, Δi and hot money are regarded as endogenous variables of the model if Hon Kong offshore market is regarded as part of China economy; otherwise ΔEX, Δi and hot money are regarded as exogenous variables of the model.

represents the scenario 2 that include Hong Kong market.

As simulations revealed above, scenarios that excluded Hong Kong offshore market, shows low effectiveness of structural monetary policy. The actual data of Shibor, M1, CPI and IVAD have high volatility, indicating that great uncertainty of actual macro economy. And the simulated data from scenario 2 are very close to actual (the solid lines and dots almost overlap to each other), indicating that the model including the RMB offshore market is more accurate and can better depict the real effect of monetary policy. However the simulation of scenario 1, the simulated data are lagged behind actual and there are large gap between the two of them. The contrast between these policy measures are clear. The implementation of monetary policy without considering arbitrage, would lead to lagged expectation and greater gap between the expected value and reals. Thus, the central bank should better take account of the inter-linkage effect of monetary policies, and also consider the impact of arbitrage capital flow while evaluating the effectiveness of monetary policy in the mainland China.

5. Conclusion

This paper examined and simulated the impacts of Hong Kong RMB offshore market on effectiveness monetary policies in Mainland China. The main conclusions and recommendations are as follows:

First, Hong Kong RMB offshore market effect on effectiveness of Mainland China monetary policies mainly through arbitrage mechanisms in the exchange rates of RMB and the interest rates. On the basis of arbitrage mechanism, expansionary monetary policies cause capital flow from onshore market to Hong Kong offshore market, thereby reducing money supply and increasing interest rates of onshore market. Conversely, contractionary monetary policies induce capital flow from Hong Kong offshore market to onshore market, thus increase onshore market money supply and lower the interest rates. The cross-border capital flows caused by arbitrage affect money supply and interest rate, then impact on the effectiveness of monetary policy on inflation and output.

Second, arbitrage activities reduce effectiveness of structural monetary policies. According to analysis of shock responses, the flow of hot money caused by arbitrage affects monetary policy effectiveness in the early stage of implementation, and even lead to results opposite of the theoretical expectations. The policy targets fluctuate more smoothly in the model economy without considering offshore market but then model does match well with the data. That is the arbitrage activities create wedges in prices where by the real data deviate from policy expectations generated from the model, thus reducing the effective of monetary policy when these are not incorporated in the model.

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Appendix

Table A1. Estimation of coefficients of SVAR model

Lag variables	SLF	MLF	PSL	6MBR	DRR	7DRR	ΔEX	Δi	HM	Shibor	M1	CPI	IVAD
	0.7003	-0.518	-0.0969	-9E-06	-4E-05	-0.0407	1E-05	6E-05	0.0653	2E-05	0.3931	5E-05	0.0002
SLF(-1)	(-0.0798)	(-0.3496)	(-0.1121)	(-0.0000)	(-0.0000)	(-0.7896)	(-0.0000)	(-0.0000)	(-0.0939)	(-0.0000)	(-1.6627)	(-0.0000)	(-0.000)
	[8.7723]	[-1.4814]	[-0.8637]	[-1.0943]	[-1.0058]	[-0.0515]	[2.6252]	[0.8593]	[0.6942]	[0.3883]	[0.2364]	[0.6351]	[0.3137]
	-0.0179	0.2626	0.0327	-2E-06	-5E-06	0.0711	2E-06	-2E-05	0.0281	-3E-05	-0.2578	1E-05	-0.0003
MLF(-1)	(-0.0252)	(-0.1107)	(-0.0355)	(-0.0000)	(-0.0000)	(-0.2502)	(-0.0000)	(-0.0000)	(-0.0297)	(-0.0000)	(-0.5268)	(-0.0000)	(-0.0002)
	[-0.7091]	[2.3700]	[0.9215]	[-0.6373]	[-0.3934]	[0.2839]	[1.4704]	[-1.1471]	[0.9452]	[-1.7618]	[-0.4893]	[0.3931]	[-1.4021]
	-0.0189	-0.8413	0.2972	-2E-05	2E-05	1.4706	4E-06	3E-05	0.056	5E-05	1.0032	-4E-05	-0.0006
PSL(-1)	(-0.0767)	(-0.3361)	(-0.1078)	(-0.0000)	(-0.0000)	(-0.7590)	(-0.0000)	(-0.0000)	(-0.0903)	(-0.0000)	(-1.5982)	(-0.0000)	(-0.0006)
	[-0.2468]	[-2.5029]	[2.7569]	[-2.9566]	[0.6297]	[1.9374]	[0.9169]	[0.4867]	[0.6203]	[0.9790]	[0.6277]	[-0.4699]	[-0.9087]
	1621.1	-1251.6	2160.2	-0.1654	0.3154	17226	0.058	0.1052	-151.55	0.0733	-4860.2	0.3739	-2.9271
6MBR (-1)	(-1119.6)	(-4904.6)	(-1573.0)	(-0.1112)	(-0.5226)	(-11076)	(-0.0662)	(-0.9432)	(-1318.3)	(-0.8023)	(-23322)	(-1.1318)	(-8.977)
	[1.4478]	[-0.2552]	[1.3732]	[-1.4877]	[0.6035]	[1.5552]	[0.8767]	[0.1115]	[-0.1149]	[0.0914]	[-0.2084]	[0.3304]	[-0.3261]
	131.3	-545.44	-1535.4	0.0405	-0.1292	221.85	-0.012	0.2317	-76.763	0.4763	5866.1	0.0026	2.8594
DRR (-1)	(-247.41)	(-1083.7)	(-347.60)	(-0.0245)	(-0.1155)	(-2447.5)	(-0.0146)	(-0.2084)	(-291.32)	(-0.1773)	(-5153.5)	(-0.2501)	(-1.9836)
	[0.5307]	[-0.5033]	[-4.4171]	[1.6485]	[-1.1189]	[0.0906]	[-0.8185]	[1.1116]	[-0.2634]	[2.6864]	[1.1382]	[0.0102]	[1.4414]
	0.0036	0.0719	0.0213	7E-07	-8E-07	0.494	5E-07	3E-06	-0.001	3E-06	0.2013	-6E-06	0.0002
7DRR (-1)	(-0.0108)	(-0.0472)	(-0.0151)	(-0.0000)	(-0.0000)	(-0.1068)	(-0.0000)	(-0.0000)	(-0.0127)	(-0.0000)	(-0.2248)	(-0.0000)	(-0.0000)
	[0.3316]	[1.5199]	[1.4026]	[0.6426]	[-0.1515]	[4.6252]	[0.8594]	[0.3019]	[-0.0773]	[0.3841]	[0.8952]	[-0.5102]	[1.8042]
	-1194.5	3786.8	-3054.3	0.6064	1.0296	989.69	0.642	0.3754	4846.5	0.9969	-524.08	0.0236	4.3577
ΔEX(-1)	(-1623.4)	(-7111.4)	(-2280.8)	(-0.1611)	(-0.7578)	(-16060)	(-0.0959)	(-1.3676)	(-1911.6)	(-1.1633)	(-33815)	(-1.6411)	(-13.016)
	[-0.7357]	[0.5325]	[-1.3390]	[3.7623]	[1.3586]	[0.0616]	[6.6889]	[0.2744]	[2.5353]	[0.8568]	[-0.0155]	[0.0144]	[0.3347]
	-98.023	-28.959	-148.85	0.0063	0.0052	1461.1	0.0152	0.1021	174.47	0.152	-27.592	0.0119	-0.8628
Δi(-1)	(-120.03)	(-525.80)	(-168.64)	(-0.0119)	(-0.0560)	(-1187.4)	(-0.0071)	(-0.1011)	(-141.33)	(-0.0860)	(-2500.2)	(-0.1213)	(-0.9623)
	[-0.8166]	[-0.0550]	[-0.8826]	[0.5307]	[0.0936]	[1.2305]	[2.1386]	[1.0094]	[1.2344]	[1.7673]	[-0.0110]	[0.0984]	[-0.8965]
	-0.0209	-0.3708	0.0211	-1E-05	7E-05	-0.3107	-5E-06	1E-05	0.3219	-4E-05	-0.3715	-0.0001	-0.0005
HM(-1)	(-0.0953)	(-0.4177)	(-0.1339)	(-0.0000)	(-0.0000)	(-0.9434)	(-0.0000)	(-0.0000)	(-0.1122)	(-0.0000)	(-1.9864)	(-0.0000)	(-0.0007)
	[-0.2187]	[-0.8875]	[0.1572]	[-1.1322]	[1.5288]	[-0.3293]	[-0.8051]	[0.1669]	[2.8665]	[-0.5883]	[-0.1870]	[-1.1741]	[-0.6057]
	38.969	399.97	183.47	0.0015	-0.0115	-1048.2	-0.0036	-0.1158	61.092	0.9272	-1822.7	0.026	0.0082
Shibor(-1)	(-64.885)	(-284.22)	(-91.160)	(-0.0064)	(-0.0302)	(-641.87)	(-0.0038)	(-0.0546)	(-76.401)	(-0.0465)	(-1351.5)	(-0.0655)	(-0.5202)
	[0.6005]	[1.4072]	[2.0126]	[0.2268]	[-0.3782]	[-1.6331]	[-0.9374]	[-2.1193]	[0.7996]	[19.942]	[-1.3486]	[0.3956]	[0.0157]
	0.0032	0.0238	-0.0027	4E-07	3E-06	-0.0647	-5E-07	3E-06	-0.0034	4E-06	-0.5703	2E-05	7E-05
M1(-1)	(-0.0062)	(-0.0273)	(-0.0087)	(-0.0000)	(-0.0000)	(-0.0618)	(-0.0000)	(-0.0000)	(-0.0073)	(-0.0000)	(-0.1301)	(-0.0000)	(-0.0000)
	[0.5089]	[0.8694]	[-0.3097]	[0.6532]	[1.0430]	[-1.0463]	[-1.2995]	[0.6276]	[-0.4644]	[0.8060]	[-4.3814]	[2.8360]	[1.3357]
	110.71	1140.1	-162.66	0.0078	0.1011	-974.91	-0.0037	0.1004	-148.15	0.0876	-8615.2	0.4313	-0.3092
CPI(-1)	(-135.79)	(-594.84)	(-190.78)	(-0.0134)	(-0.0633)	(-1343.3)	(-0.0080)	(-0.1144)	(-159.89)	(-0.0973)	(-2828.5)	(-0.1372)	(-1.0887)
	[0.8152]	[1.9166]	[-0.8525]	[0.5777]	[1.5953]	[-0.7257]	[-0.4627]	[0.8775]	[-0.9265]	[0.9005]	[-3.0458]	[3.1420]	[-0.2840]
	-0.2412	30.232	-5.8922	0.0015	0.0049	78.29	0.0024	0.0196	5.8613	-0.0008	-487.89	0.003	-0.3986
IVAD(-1)	(-13.252)	(-58.051)	(-18.619)	(-0.0013)	(-0.0061)	(-131.1)	(-0.0007)	(-0.0111)	(-15.604)	(-0.0095)	(-276.04)	(-0.0134)	(-0.1062)
	[-0.0182]	[0.5208]	[-0.3165]	[1.1019]	[0.7923]	[0.5972]	[3.0642]	[1.7585]	[0.3756]	[-0.0844]	[-1.7674]	[0.2242]	[-3.7512]
	-62.166	-1224.5	-604.09	-0.0061	-0.0371	6821	-0.0042	0.3225	-256.74	0.2229	12041	-0.0511	0.2333
C	(-244.53)	(-1071.2)	(-343.56)	(-0.0242)	(-0.1141)	(-2419.1)	(-0.0144)	(-0.2060)	(-287.93)	(-0.1752)	(-5093.5)	(-0.2472)	(-1.9605)
	[-0.2542]	[-1.1431]	[-1.7583]	[-0.2500]	[-0.3249]	[2.8196]	[-0.2886]	[1.5653]	[-0.8916]	[1.2721]	[2.3640]	[-0.2068]	[0.1190]

Notes: Standard errors in ( ) & t-statistics in [ ]

Table A2. Model test statistics of SVAR model

Statistics	SLF	MLF	PSL	6MBR	DRR	7DRR	ΔEX	Δi	HM	Shibor	M1	CPI	IVAD
R-squared	0.64489	0.287708	0.357013	0.322376	0.140089	0.419199	0.585887	0.149088	0.34763	0.895517	0.255918	0.194281	0.28144
Adj. R-squared	0.587897	0.173389	0.253818	0.213621	0.002079	0.325984	0.519425	0.012522	0.242928	0.878748	0.136497	0.064968	0.166115
Sum sq. resids	20352851	3.91E+08	40173894	0.200612	4.435328	1.99E+09	0.071135	14.44465	28218628	10.45136	8.83E+09	20.79781	1308.301
S.E. equation	501.2682	2195.769	704.2542	0.049766	0.234002	4958.769	0.029635	0.42229	590.2357	0.359206	10441.11	0.506718	4.018939
F-statistic	11.31523	2.516721	3.459588	2.964255	1.015065	4.497123	8.815305	1.091693	3.320202	53.4034	2.142992	1.502412	2.440417
Log likelihood	-717.855	-858.184	-750.155	157.8131	10.75392	-935.573	207.060	-45.3303	-733.376	-29.9597	-1006.31	-62.6452	-259.373
Akaike AIC	15.40747	18.36176	16.08746	-3.02764	0.068339	19.99101	-4.06444	1.249061	15.73423	0.925469	21.4802	1.613585	5.755222
Schwarz SC	15.78383	18.73812	16.46383	-2.65128	0.444699	20.36737	-3.68807	1.625422	16.11059	1.30183	21.85656	1.989945	6.131583
Mean dependent	415.0792	568.4211	325.5368	-0.01315	-0.07894	6141.789	-0.01339	-0.02634	-118.999	3.412151	3441.09	0.158915	0.698842
S.D. dependent	780.8488	2415.106	815.2806	0.05612	0.234246	6040.026	0.042748	0.424959	678.3549	1.031571	11236.07	0.524026	4.401071