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International Transmission of US Monetary Policy Shocks to Asia

by

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Abstract

This study estimates the individual responses of major Asian economies to an expansionary US monetary policy shock. The main result is that a US expansion leads to a real appreciation for several small, open Asian economies, with a negative impact on trade balances, eventually leading to a decline in GDP. The observed pattern of responses, where the trade balance plays a central role, is consistent with the Mundell-Fleming model. There is no evidence to support the existence of an interest rate channel in Asia, a central feature of new microfounded open economy macroeconomic models. A US expansion lowers real interest rates in the region, but Asian GDP, consumption and investment also generally fall.

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Introduction

In a recent study, Soyoung Kim (2001) attempts to analyze the international monetary transmission mechanism of US monetary policy shocks to non-US G6 countries (Canada, Italy, Germany, UK, Japan and France). Apart from ascertaining the workings of the transmission mechanism itself, Kim attempts to determine whether the pattern of responses to expansionary US monetary policy is consistent with the predictions of the traditional Mundell-Fleming model, or predictions of recent intertemporal models, such as Obstfeld and Rogoff (1995). Kim employs the empirical strategy of estimating vector autoregressions (VARs) containing US and aggregated international variables to achieve his objective, arguing that compared to other studies in the past which estimate structural models to analyze the transmission mechanism, the particular VAR model he uses "employs minimal identifying restrictions and does not depend much on a specific theoretical model."

In order to identify US monetary policy shocks, Kim estimates a baseline VAR model with the recursive policy shock identification method first introduced by Christiano, Eichenbaum and Evans (CEE). He then employs the "marginal" method: adding each national and international variable one by one to the baseline model, inferring the transmission mechanism of US monetary policy shocks through an analysis of the resulting impulse responses. In his study, Kim concludes that the trade balances of the non-US G6 countries seem to play a minor role in the transmission of US monetary policy shocks. On the other hand, changes in the real interest rate can better explain short-run responses of the non-US G6 countries. In general, Kim finds that expansionary monetary shocks from the US lead to positive spillovers to output in non-US G-6 countries. He also finds that the US trade balance worsens after a shock, but then subsequently improves. After analyzing the pattern of impulse responses from the VARs, Kim concludes that extensions of traditional and intertemporal models need to be made in order to reconcile the data with the theoretical models.

This study employs similar techniques in an analysis of the impact of US monetary policy shocks to Asian countries. There is one important difference, however: in this paper, most of the analysis is done at the individual country level. Kim aggregates non-US G6 time series data in order to estimate his recursive vector autoregressions, while this study looks primarily at disaggregated country-level data. This study recognizes the heterogeneity of Asian countries and therefore does not attempt to generalize the region's response to policy shocks, but rather tries to ascertain whether there are country-specific responses. The main advantage is that cross-country differences in responses to US expansions can be analyzed. One basic objective, however, remains the same – to determine whether the pattern of responses corresponds to the Mundell-Fleming model, or to new intertemporal and micro-founded sticky price models.

1. Traditional and Modern Models of the International Transmission Mechanism

1.1 The Traditional Mundell-Fleming Model

Until recently, the canonical model for analyzing international macroeconomic policy transmission in the presence of sticky prices has been the two-country version of the Mundell-Fleming model (MFD). The structure and implications of the 2-country MFD were first described in a static optimization problem in Mudell (1967). Since the MFD is too well-known to expound upon in detail here, it suffices to say that the two-country model essentially extended results from the one-country MFD into a two-country setting. Mundell's analysis focused on the international spillover effects of a monetary expansion in one country. The basic results are summarized as follows:

1) After a monetary expansion, the nominal interest rate falls in the expanding country;
2) This leads to a capital outflow, which then leads to an incipient depreciation of the currency of the expanding country;
3) In a two-country world, this means that the other country has undergone an incipient appreciation;
4) The depreciation leads to an increase in exports, a reduction in imports and an improvement in the trade balance of the expanding country (an expenditure-switching effect);
5) Conversely, the appreciation leads to a decrease in exports, an increase in imports and an deterioration in the trade balance of the other country;
6) The improvement in the trade balance, as well as the reduction in interest rate lead to a rise in the expanding country's output;
7) However, the other country's output has fallen because of the deterioration in its trade balance with the expanding country.

The implication of the foregoing is that a monetary expansion undertaken in one country is beggar-thy-neighbor. However, the result can be reversed if the monetary expansion in the home country increases income sufficiently to increase overall imports from the other country (an income absorption effect).[2] Note the prominence of the role of the exchange rate and its effect on the trade balance in the transmission mechanism. In MF, the monetary shocks get transmitted primarily through movements in the trade balance.

In recent years, however, new microfounded and optimization-based models with nominal price rigidities have been developed to address the same questions. Such models bear little similarity in structure to the original MFD in that they rely on representative agent models typically solved by dynamic optimization. The latter models also come equipped with better-specified production and supply blocks which model nominal price rigidities as: a simple one-time price rigidity, or some form of price-staggering by producers.

1.2 The Intertemporal Model

The publication of Obstfeld and Rogoff's (OR, 1995) paper represented an important shift in open economy model building. Prior to its publication, building general

[2] See Betts and Devereux (2000) and Bergin (1996) for this possibility.

equilibrium open economy models was an elusive proposition, as researchers grappled with the complexities of putting together a complete optimization-based model which combined an intertemporal model of the current account, a well-specified production sector described by imperfect competition, and where pricing decisions by firms led to price rigidities, leading to a non-neutral response to expansionary monetary policy.

A description of the international monetary transmission mechanism in the intertemporal model is available from different authors. Besides Obstfeld and Rogoff (1997), interpretations of the standard intertemporal model are available in Sarno (2000), Mark (2001), Lane (2001), Bowman and Doyle (2003), and Walsh (2003). In general, when one country pursues expansionary monetary policy, the following are the predictions of the basic intertermporal model for the domestic and international transmission of the shock:

1) the real interest rate at home declines (with the size of the decline a function of the size of the home country), with several effects:

   a) nominal home currency depreciation (terms of trade of home country declines), but in a manner that is less than proportional to the change in money) and nominal foreign currency appreciation (terms of trade of home country rises) occur due to arbitrage because uncovered interest parity is assumed to hold

   b) the home depreciation raises the domestic price level and thus reduces the real price of domestic goods. Thus, aggregate demand (AD) at home increases; home consumption and income rise (so money is non-neutral in the short-run)

   c) AD in the foreign country increases; foreign consumption rises, but the effect on foreign income is ambiguous because effect of decline in world real interest rate is offset by effect of the foreign currency appreciation

2) From 1a, home consumption rises by less than the increase in home output (saving increases due to need to smooth consumption), so in the short-run, home runs a current account (CA) surplus; home net foreign assets (NFA) increase if the investment response to the fall in interest rates does not offset the rise in savings.

3) From 1b, the nominal home depreciation translates into a nominal foreign appreciation, leading to expenditure-switching away from foreign goods. This, coupled with the fact that foreign consumption rises means that in the short-run, the foreign country runs a CA deficit; net foreign assets decline in the foreign country

4) The reduction in the world real interest rate may stimulate foreign aggregate demand, consumption and investment in the foreign country. In the end, foreign GDP may increase. There may be no beggar-thy-neighbor effect, unlike in the Mundell-Fleming model.

At the initial stages, the intertemporal model has the same basic predictions compared to Mundell-Fleming. The domestic monetary expansion should lead to a fall in interest rates, home currency depreciation, a rise in home exports and a temporary increase in home income. Because of consumption smoothing, home consumption rises by less than the increase in income, so the home current account improves. However, the home current account may worsen if the fall in the interest rates induces a sufficiently high increase in investment. The fall in the world interest rate, however, increases aggregate demand in both countries, so foreign output may grow. **In the intertemporal model, domestic variables respond primarily to changes in the world interest rate in addition to changes in the exchange rate.**

To summarize, the basic prediction of the Mundell-Fleming model is that home monetary shocks get transmitted to other countries primarily through the trade balance, while the intertemporal model predicts that the main transmission mechanism is the through capital markets (affecting the world interest rate).

2. Empirical Tests of the International Transmission Mechanism

2.1 Recursive VAR Modeling

Consider an n x 1 vector of (endogenous) variables, y_t. From its name, a vector autoregression (VAR) is a vector of variables, y_t, regressed on time lags of itself: y_{t-1}, y_{t-2}, …, y_{t-p}, where p is the number of periods. In matrix notation, this is expressed as:

$$y_t = A(L)y_{t-1} + \varepsilon_t \quad (1)$$

in matrix form, where ε_t is white noise and $\text{cov}(\varepsilon_t) = \Omega$ and μ is a vector of constants. A(L) is an n x n matrix polynomial in L, the lag operator, L = 0, 1, 2,…, p.

Since the VAR in (1) is a system of reduced form (RF) equations, the maximum likelihood estimate of the VAR (provided the disturbances are normally distributed and serially uncorrelated) is the same as OLS on each equation in the reduced form done separately. We therefore get consistent estimates of the coefficients of the VAR by implementing ordinary least squares on the RF equation by equation.

The standard approach taken is to examine pattern of responses to the vector of reduced form or structural form shocks (more on these later) to discern the time path of the effect of shocks on the endogenous variables over time.

(1) implies that

$$y_t = [I - A(L)L]^{-1}\varepsilon_t \quad (2)$$

where it is clear that the last equation above is the impulse-response function, or the vector moving average (VMA) form of the VAR, relating the vector of endogenous variables to the reduced-form shocks. (2) can be written as

$$y_t = C(L)\varepsilon_t \qquad (3)$$

Since (3) is a reduced form, it follows that the VMA is a series of responses of y_t to the reduced form shocks comprising ε_t. However, economists are usually more interested in determining the VMA and variance decomposition with respect to structural shocks, which we assume to be a linear function of the reduced form shocks:

$$u_t = F\varepsilon_t \quad , \text{with } \text{var}(u_t) = D \qquad (4)$$

where F is an invertible n x n matrix containing the coefficients of ε_t. The variance of the structural shocks is D. Usually, D is assumed to be diagonal. Using (4), we can rewrite the VMA in (3) as

$$y_t = F^{-1}u_t + C_1F^{-1}u_{t-1} + C_2F^{-1}u_{t-2} + C_3F^{-1}u_{t-3} + \ldots \quad (5)$$

Both (4) and (5) have more profound economic interpretations than (1) and (3), respectively. However for us to be able to estimate (4) and (5), we need to be able to identify the structural parameters of the structural form of the model. Since D is usually taken to be equal to I, then this usually amounts to choosing an appropriate form for F that allows us to achieve exact- or over-identification.

Suppose economic theory suggests that the structural form of a model is:

$$Fy_t = \alpha + B_1y_{t-1} + \ldots + B_py_{t-p} + u_t, \; u_t \text{ is white noise, } \text{cov}(u_t) = D \quad (6)$$

then, since F is invertible, then we could rewrite (6) as

$$y_t = F^{-1}\alpha + F^{-1}B_1y_{t-1} + \ldots + F^{-1}B_py_{t-p} + F^{-1}u_t \quad (7)$$

$$= \mu + \quad A_1y_{t-1} \quad + \ldots + A_py_{t-p} \quad + \varepsilon_t \qquad (8)$$

These imply that

$$\mu = F^{-1}\alpha, \quad A_s = F^{-1}B_s, \text{and } \varepsilon_t = F^{-1}u_t \quad , \text{so that } \Omega = F^{-1}D(F^{-1})' \quad (9)$$

where ε_t is white noise and $\text{cov}(\varepsilon_t) = \Omega$

The structural shocks u_t, are called orthogonalized innovations, since when multiplied by the matrix F^{-1}, they are orthogonal to the reduced form innovations ε_t. Note that (7) and (8) are VAR forms, which are really reduced form models, since each variable is regressed against its own lags and lags of other variables, so therefore, all regressors are predetermined. Since the reduced form (RF) in (7) and (8) may be estimated directly from time series data, it is possible to recover the structural parameters in the structural form (SF) in (6) provided we impose enough restrictions on the structural parameters F, B_s , α, and D.

Almost all VAR studies impose enough restrictions on the RF to just-identify the model.[3] For structural VARs, the most common identifying restrictions are those that impose zero restrictions on F and normalize the elements in the D matrix. Assume F is lower triangular (n(n-1))/2 restrictions), and that D = I (n(n+1))/2). This identification scheme yields just enough restrictions (n^2) to exactly identify the model.

Note that a lower triangular F implies that the first variable can react to its own lags and the first shock, the second variable to its own lags and the first two shocks, etc. This identification pattern means that this is a recursive simultaneous equations model, so we have to be careful in ordering the variables in this VAR. In order to actually implement this identification pattern, a Cholesky decomposition is applied to the covariance matrix of RF shocks, Ω. This will (automatically) yield a lower triangular F matrix and restrict D = I. The Cholesky decomposition is carried out as follows: since Ω is symmetric, it follows by definition that it can be decomposed into two lower triangular matrices, X and X' with 1's on their main diagonal. If Ω is a symmetric positive definite matrix, then there exists a lower triangular matrix X such that

$$\Omega = XX' \qquad (10) \quad \text{so that}$$

$$chol(\Omega) = X \qquad (11)$$

However,

$$\Omega = F^{-1}D(F^{-1})', \quad \text{so to pattern this after (11), let } D = I \text{ to get}$$

$$\Omega = F^{-1}(F^{-1})' \qquad (12) \quad \text{and so,}$$

$$chol(\Omega) = F^{-1} \qquad (13)$$

Since F^{-1} is lower triangular, it follows that its inverse, F, will also be lower triangular. F will have 1's on its main diagonal, zero's above the main diagonal, and unrestricted parameters elsewhere. Thus, it follows that applying the F derived from the Cholesky decomposition on the SF in (6) yields a fully recursive system of equations (which, as is

[3] The possible exception is the VAR study by Bernanke and Mihov (1997). They impose over-identifying restrictions on monetary policy, and conduct tests of these restrictions.

well known, is exactly-identified). Any time the D = I restriction is imposed, structural shocks are assumed to be of the magnitude of one standard deviation (or have unit variance). Signs of the elements in F may be chosen freely.

2.2 Methodology in Identifying the International Transmission Mechanism of US Monetary Policy Shocks

2.2.1 Identifying the Recursive Baseline VAR Model of US Monetary Policy Shocks

I follow the "marginal" procedure when examining the transmission mechanism of US monetary policy shocks into the aggregate non-US G6 economy. A prerequisite for implementing the "marginal" procedure is the development of a baseline model to identify US monetary policy shocks. The practice among most authors using this technique is to develop two baseline recursive VAR models of monetary policy for the USA. Based on the structure of successfully estimated recursive VARs in previous studies (notably, Christiano, Eichenbaum and Evans – referred to as CEE in the balance of this paper), I estimate two baseline VARs in three or four variables, placing enough restrictions on the model in order to reasonably identify US monetary policy shocks. These restrictions come in the form of zero restrictions implied from the recursive structure of the structural model. The ordering of the variables in the structural model then reflects assumptions regarding the information set the Federal Reserve uses when formulating US monetary policy, as well as assumptions regarding which variables are affected contemporaneously (or not) by monetary policy actions of the Fed.

CEE's two basic monetary VAR models are exactly identified because of their recursive structure. In general, the baseline VAR models utilize the following sequence of variables:

1) (model CEE-R) real GDP, price level, commodity prices, federal funds rate; and
2) (model CEE-X) real GDP, price level, commodity prices, a measure of nonborrowed reserves and the federal funds rate.

The instrument or indicator of the stance of monetary policy specified in the first baseline model (CEE-R) is the federal funds rate, while the instrument or indicator specified in the second baseline model (CEE-X) is non-borrowed reserves. These indicator variables come after the information set in the VAR sequence. This reflects the assumption that the Fed uses the information to determine the stance of monetary policy.

The inclusion of commodity prices is necessitated by the well-known price puzzle in many VAR studies of monetary policy (when commodity prices are not included in the VAR, prices respond negatively to an expansionary money shock).

What does the recursive nature of the VAR developed by CEE imply about how monetary policy is assumed to be formulated? In the baseline model, this means that the federal funds rate reacts to its own lags and contemporaneous shocks to real GDP, the

price level and commodity prices in the CEE-R model, and to real GDP, the price level, commodity prices, and a measure of nonborrowed reserves in the CEE-X model. In the augmented model, Asian variables are assumed to react to own lags and to contemporaneous shocks to US real GDP, US price level, US commodity prices and to the US federal funds rate in the CEE-R model, and to US real GDP, US price level, US commodity prices, a measure of US nonborrowed reserves, and the US federal funds rate in the CEE-X model. The information set of the Federal Reserve is assumed to be comprised of real GDP, the GDP deflator (to capture current prices), as well as the producer price index (to capture inflation expectations).

Using aggregate non-US G6 data for different economic variables, Kim adds non-US G6 variables one at a time and estimates one VAR for each added variable. The baseline VARs are augmented one non-US G6 variable at a time and then estimated.[4] The international transmission mechanism of US monetary policy shocks is inferred from an examination of the impulse responses from the estimated augmented VARs.

2.2.2 Results of Baseline Model Identification

The research conducted for this study uses disaggregated Asian national data from 1980:1 to 2000:4 in order to analyze differences in the way individual countries respond to US monetary policy shocks. Because the time periods for this study and others prior to this are different, the pattern of impulse responses yielded by the baseline model used in this study may differ.[5] Kim concludes that his two baseline VAR models reasonably identify US monetary policy shocks because they produce impulse response functions which are similar in shape to those produced by other studies, and because these responses are generally consistent with predictions made by economic theory.

After estimating VARs using different variables and using different assumptions regarding the appropriate indicator of the stance of monetary policy for the sample period, the following CEE-R identification scheme emerged as the best baseline model for this study: log of US real GDP (LRGDP), log of US GDP deflator (LGDPDEFUS), log of US producer price index for all goods (LPPIALL) and the federal funds rate (FFR).[6] A US monetary expansion is defined as a negative unit shock to the federal funds rate. The impulse response function produced by the baseline VAR is displayed in Figure 1. The dotted lines surrounding each response are two standard error bands. Most of the non-US data comes from *International Financial Statistics* and *Direction of Trade*

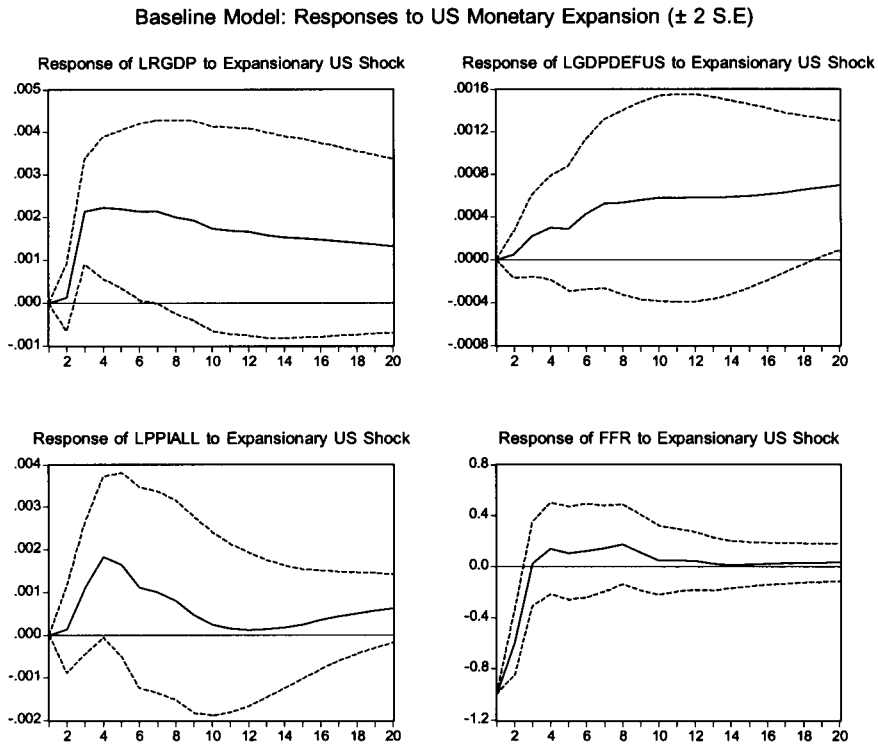
[4] After identifying the baseline VARs, Kim analyzes more identifying restrictions for the added variables: he estimates a VAR where US monetary policy affects the additional variable contemporaneously (and the additional variable does not affect US monetary policy contemporaneously) (C), and another VAR where US monetary policy has no contemporaneous effect on the additional variable (N). In the former (C), the additional variable is ordered *before* the monetary policy instrument. In the latter (N), the additional variable is ordered *after* the monetary policy instrument.

[5] Kim uses data from 1974 to 1996. This study uses data from 1980 to 2000. The difference in time periods was also necessitated by the dearth of quarterly data for many Asian countries in the 1970's.

[6] We did not consider the log of the federal funds rate in order to be consistent with the studies of CEE and Kim.

Statistics of the International Monetary Fund.[7] I downloaded all US data from the *Economagic* website at http:\\www.economagic.com.

Figure 1



Note that a US monetary expansion (a fall in the federal funds rate) leads to a persistent increase in output (even after 5 years, the effect remains positive), a persistent increase in prices, a rise, then fall in producer prices. The result is slightly different from Kim's baseline CEE-R, in which the response of output to an expansionary shock does not display persistence (the shock dies down eventually within the relevant horizon). We may attribute this difference to a change in the time horizon for the US sample data. At any rate, the results of the baseline model seem to suggest that monetary shocks are much more persistent in more recent data.

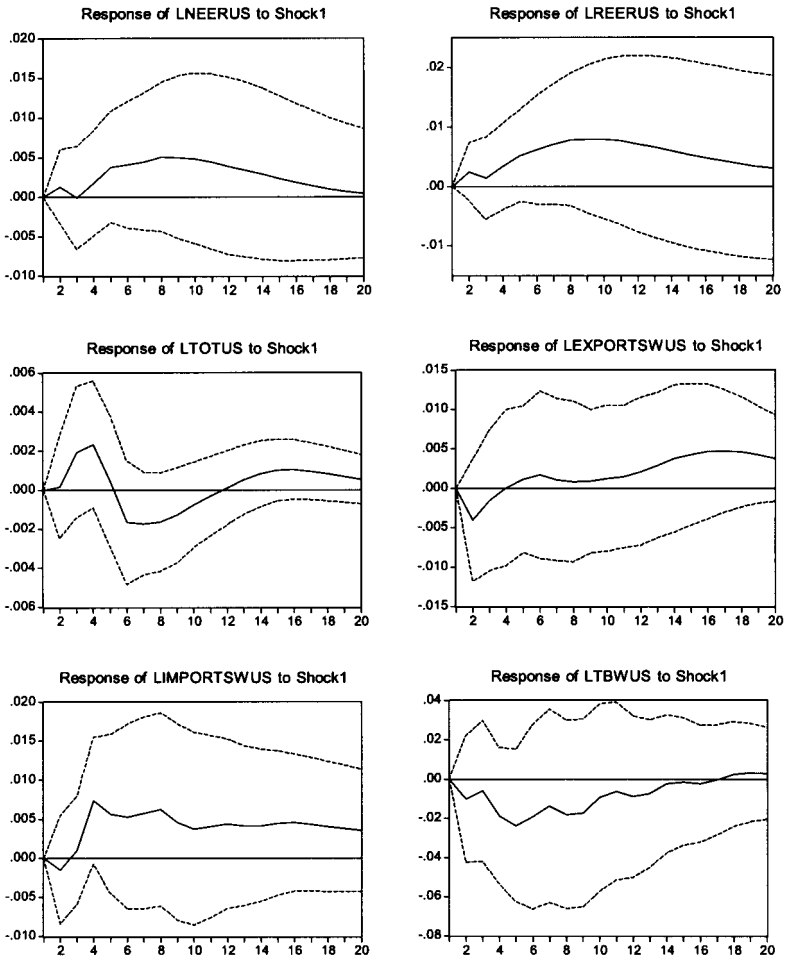
Unfortunately, VAR estimates using non-borrowed reserves as an indicator of the stance of monetary policy (the CEE-X identification scheme) did not yield good results, as the pattern of impulse responses generated by this identification scheme did not appear to be consistent with predictions made by economic theory (the price level stayed flat and did not experience a sustained rise in response to expansionary monetary policy). Thus, it was decided to consider results from just one model specification (where the policy indicator is the federal funds rate, FFR).

[7] I thank James Cargill for some of the quarterly Chinese data.

2.3 Using the Marginal Method to Further Identify the Extended Model and to Test Theories of the International Monetary Transmission Mechanism

In order to further test the Mundell-Fleming model, I use the marginal method to extend the baseline model, first with additional US variables, then with additional international variables.

2.3.1 Extended Model: Impact of US monetary shock to variables beyond the basic model

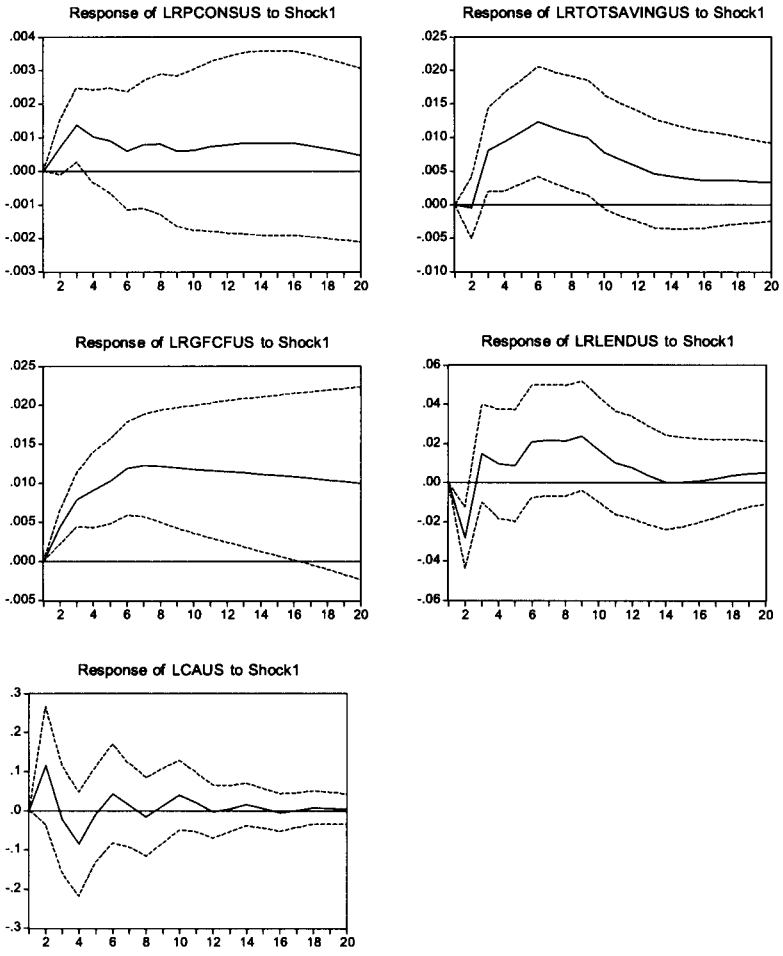


The above figure shows the result of the marginal procedure for additional US variables to test the Mundell-Fleming transmission mechanism.[8] The results suggest that in response to a US monetary expansion, the US nominal (LNEERUS) and real exchange rates (LREERUS) depreciate (and display persistence), terms of trade (LTOTUS -defined as the unit price of imports over the unit price of exports) rises, and then falls. Both total

[8] Shock1 in the graphs refers to a negative shock to the US federal fund rate.

exports (LEXPORTSWUS) and total imports (LIMPORTSWUS) initially decline then rise in the long-run, but the overall trade balance with the world (LTBWUS) falls, and does not return to its initial level until about 4 to 5 years after the expansion. The dynamics of the US trade balance are similar to Kim's result. In terms of the MF model, the results are consistent with a situation where US exports are stimulated by the real depreciation, but the income absorption effect of a monetary expansion brings about an import demand so strong that the overall US trade balance with the world declines: the income absorption effect more than offsets expenditure-switching effect of the monetary expansion. The dynamics are consistent with the MF model.

3.3.2 Test of the Intertemporal Model



It turns out that the intertemporal model can explain the empirically observed dynamics between expansionary monetary policy and real output. It performs well in augmenting the Mundell-Fleming model in explaining the response of US variables to US monetary policy shocks.

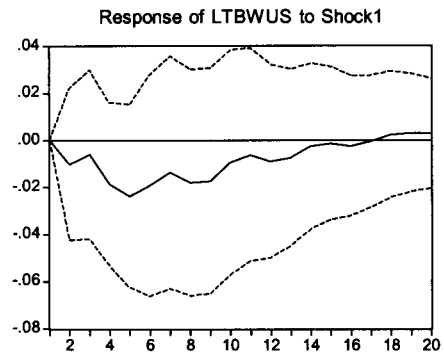
The above figures show the response of real private consumption (LRPCONS), saving, and investment (LRGFCFUS - gross fixed capital formation), as well as real US lending rates (LRLENDUS) to a monetary expansion. The intertemporal model suggests that a fall in the real interest rate stimulates consumption and investment. Savings increases, since the increase in income may be viewed as temporary (so consumption is smoothed). If the increase in savings is greater than the increase in investment, the current account (LCAUS) improves, which is also validated by the marginal procedure.

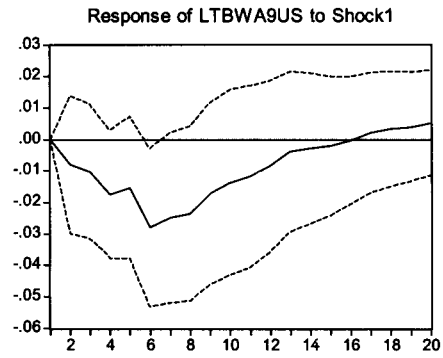
3.3.3 Testing the International Transmission Mechanism

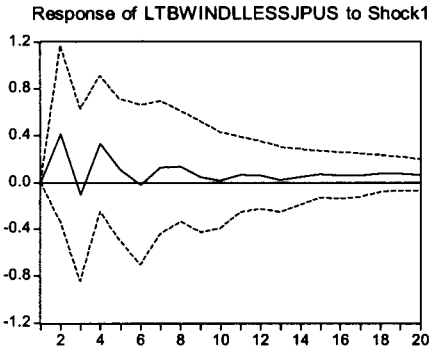
So far, our test of models of the transmission mechanism have dealt with the impact of expansionary monetary policy on US variables. To complete an analysis of the international transmission mechanism, we examine the impact on international variables. For our purposes, we examine the response of economic variables in the following countries to US monetary expansions:

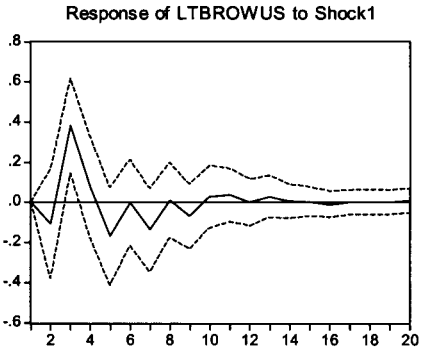
1) People's Republic of China
2) Hong Kong
3) Indonesia
4) Japan
5) Korea
6) Malaysia
7) Philippines
8) Singapore
9) Thailand

We refer to this set of countries as "Asia 9". These are the major economies of Asia for which data is widely available. The graphs below depict the response of four aggregated Asia 9 variables to a US monetary expansion. The heterogeneity of this group makes it imperative to perform analysis at the individual country level, which could yield richer results than analysis at the aggregate level.









The above graphs detail the response of trade balances of different country groups to a US monetary expansion. There is a persistent US trade deficit with the world (LTBWUS), which is very different from the findings of Kim (2001) for a different sample period. A worsening of the US trade balance with the Asia 9 countries (LTBWA9US) in the short-run, and in the long-run, an improving trade balance across countries. As seen in the graphs above, the trade balance of the US with Asia and non-industrialized countries outside of Asia (the rest of the world) - LTBROWUS deteriorates in the very short-run (i.e., two quarters after the expansionary shock). On the other hand, the US trade balance deteriorates in the long-run only with Asia, and generally improves with non-Asian countries. Thus, the real depreciation of the dollar generates expenditure-switching effects which improve the US trade balance with non-Asian industrial countries (LTBWINDLESSJPUS). However, in terms of US trade with Asia 9, expenditure-switching effects are more than offset by the increased long-run demand for imports (from all areas) owing to increased US income. Thus, the US trade balance with Asia 9 deteriorates and improves only after four years of decline.

As mentioned previously, analysis of regional aggregates may obscure the potential for individual country analysis to yield richer results. For example, since Japan is the largest economy in the region, it is possible that the US trade balance with Japan may account for the large and persistent deterioration in the Asia 9 trade balance above. In order to test the Mundell-Fleming model for individual countries, the following variables are added to this baseline VAR of US monetary policy one at a time (with name of variable in parentheses):

1) nominal exchange rate (LMEXR)
2) real exchange rate (LREER)
3) real exports (LREXP)
4) real imports (LRIMP)
5) real trade balance (LRTBRP)
6) exports to the US (LEXPORTSUSA)
7) imports from the US (LIMPORTSUSA)
8) trade balance with the US (LTBRPUSA)
9) GDP (LRGDP)

These variables will be added to this benchmark model one at a time and each resulting VAR model will be estimated to allow a determination of the implied transmission mechanism.

This study also examines the responses of consumption, saving, investment and interest rates to a monetary expansion in order to test the implications of the intertemporal model for non-US G6 countries. In order to test the intertemporal model for Asia 9, the following variables are added to this baseline VAR of US monetary policy one at a time:

1) real interest rate (a measure of the real lending rate, LLEND)
2) real consumption (LRCONS)
3) investment (LRGFCF)
4) savings (LTOTSAVING)
5) current account (LCA)

The following tables list the results of the exercise for individual countries. Instead of displaying the graphs, we list the direction of the impulse response ("+ or increasing" or "- or declining") of each variable 0 - 2, 3 - 4, 5 – 8 and 9 - 20 quarters after the expansionary shock. Then, based on the pattern of responses, an attempt is made to infer the international transmission mechanism for individual countries and for the region.

Based on impulse responses, Asia 9 countries may be grouped into two categories:

1) Group 1: countries which experience a real appreciation relative to the US dollar within the first 2 quarters of a US monetary expansion. This group includes China, Korea and Indonesia. This is not the conventional response to a US monetary expansion.

2) Group 2: countries which experience a real depreciation relative to the US dollar within the first 2 quarters of a US monetary expansion. This group includes the Philippines, Malaysia, Thailand, Singapore, Hong Kong and Japan. This is the conventional response to a US monetary expansion.

Group 1

China	Quarters after shock			
Variables	**0 – 2**	**3 - 4**	**5 - 8**	**9 – 20**
Nominal exchange rate (-)	-	-	+	+/-
Real exchange rate (-)	+	+	+	+
Exports to US (-)	-	+	+	+
Imports from US (+)	-	+	+	+
Trade balance with US (-)	-	-/+	+/-	-/+
Exports to the rest of the world (-)	-	+	+/-	-/+
Imports from the rest of the world (+)	+	+	+	+
Trade balance with the rest of the world (-)	-	-	-	-/+
Current account (-)				
GDP (- in MF) (+ in intertemporal model)	+	+	+	+
Real interest rate (-)	-	-	-/+	+/-
Savings (+)				
Consumption (+)				
Investment (+)				

(several variables for China had insufficient observations, signs beside the variables indicate the expected response of the variables in the Mundell-Fleming model or in the intertemporal model)

In response to a US monetary expansion, the nominal exchange rate appreciates in China, but the real exchange rate experiences a persistent depreciation. This is not consistent with the MF model. This outcome makes interpreting the responses of the other variables immediately after the shock difficult to interpret. Exports and imports to the US, as well as the trade balance between China and the US immediately deteriorate. The trade balance with the rest of the world worsens. In spite of the initial deterioration of the trade balance with the US and the rest of the world, GDP increases, and this displays much persistence. There is insufficient data to make an assessment of the applicability of the intertemporal model for China.

Korea	Quarters after shock			
Variables	**0 – 2**	**3 - 4**	**5 - 8**	**9 – 20**
Nominal exchange rate (-)	+	+	+	+
Real exchange rate (-)	+	+	+	+/-
Exports to US (-)	-	-	-	+
Imports from US (+)	-	-	-	-/+
Trade balance with US (-)	+	+/-	-/0	+/-
Exports to the rest of the world (-)	-	-/+	+/-	-/+
Imports from the rest of the world (+)	-	-	-	-/+
Trade balance with the rest of the world (-)	-	-	+	+/0
Current account (-)	+	+	-/+	+
GDP (- in MF) (+ in intertemporal model)	-	-/+	+/-	+
Real interest rate (-)	-	-	-/+	+/-

Savings (+)	-	-	-	-
Consumption (+)	+	+	+	+
Investment (+)	-	-/+	-	-

In Korea, the nominal and real exchange rates appreciate in response to a US monetary expansion. This may be consistent with a policy whereby countries follow a reduction in the US federal funds rate with an expansionary reduction in their own interest rates. Thus, the domestic currency depreciates in real and nominal terms. Thus, the Korean won depreciates following a US monetary expansion. The response of the trade variables are not consistent with the MF model with fixed exchange rates. In spite of the depreciation of the won, however, Korean exports to the US decline for up to 8 quarters after the shock. The trade balance with the US improves. Exports to and imports from the rest of the world decline, and GDP also declines initially, before rising in the fourth quarter after the shock.

The intertemporal model does not seem to fit the data as well. Following US monetary shock, the real interest rate falls. While consumption increases, the response of investment is generally negative. Saving declines persistently. Since the current account is persistently positive, this suggests that the decline in investment is larger than the decline in saving.

Indonesia	**Quarters after shock**			
Variables	**0 - 2**	**3 - 4**	**5 - 8**	**9 - 20**
Nominal exchange rate (-)	+	+	+	+/-
Real exchange rate (-)	+	+	+	+/-
Exports to US (-)	+	-	+/-	-/+
Imports from US (+)	+	-	-	-/+
Trade balance with US (-)	-	-	-/+	-
Exports to the rest of the world (-)	0/-	-	-	-/+
Imports from the rest of the world (+)	-	-	-	-/+
Trade balance with the rest of the world (-)	+	+/0	-	-/+
Current account (-)	+	+	+/-	-
GDP (- in MF) (+ in intertemporal model)	-	+	+/-	-/+
Real interest rate (-)	-	-/+	+	+
Savings (+)	+	+/-	-	-/+
Consumption (+)	-	-/+	+/-	-/+
Investment (+)	-	-/+	-	-/+

Like Korea, Indonesia experiences a persistent nominal and real exchange rate depreciation following a US monetary shock (again, suggestive of some form of policy-induced reduction in domestic interest rates). Exports to the US (as well as imports from the US) increase within the first two quarters after the shock. The trade balance with the

US, however, declines, as the rise in imports may offset the rise in exports to the US. The trade balance with the rest of the world improves. GDP, however, falls within the first two quarters of the expansion.

The real interest rate falls within the first two quarters of the shock, but this fails to stimulate consumption or investment in the short-run.

Group 2

Hong Kong	**Quarters after shock**			
Variables	**0 – 2**	**3 - 4**	**5 - 8**	**9 – 20**
Nominal exchange rate (-)	-	-	-	-
Real exchange rate (-)	-	-/+	+	+
Exports to US (-)	-	-/+	+	+
Imports from US (+)	-	-/+	+/-	-/+
Trade balance with US (-)	-	-/+	+	+
Exports to the rest of the world (-)	-	-	-/+	+
Imports from the rest of the world (+)	-	-/+	+	+
Trade balance with the rest of the world (-)	-	-	-	-
Current account (-)				
GDP (- in MF) (+ in intertemporal model)	-	-/+	+	+/-/+
Real interest rate (-)	-	-	+	-
Savings (+)	+	+	+/-	-/+
Consumption (+)	+	+	+	+
Investment (+)	-	-	+	+

(current account data for Hong Kong were insufficient)

In Hong Kong, both the nominal and real exchange rates appreciate within the first four quarters after the US monetary expansion. The nominal exchange rate depreciation persists, while the real exchange rate initially appreciates, then starts to depreciate in the fifth quarter after the expansion. The response of exports to the US is consistent with expenditure-switching away from Hong Kong goods when the real exchange rate initially appreciates. However, imports from the US also initially fall, then rise after 3 quarters. The trade balance with the US initially deteriorates, then improves. This suggests that after the US shock, exports fall faster than exports. The trade balance with the rest of the world deteriorates, perhaps also due to the real appreciation. GDP declines up to the third quarter after the shock hits, but then increases thereafter. These dynamics are consistent with to the predictions of the Mundell-Fleming model where a fall in the federal funds rate leads to a capital outflow into Hong Kong, the Hong Kong dollar appreciates in real terms, exports and the trade balance both fall, with an initial negative impact on GDP lasting for three quarters. Thus, Hong Kong experiences no positive spillover from the US expansion. The intertemporal model does not appear to match Hong Kong's dynamics. Following a fall in the real interest rate, consumption rises (as expected), but investment falls.

In the medium to long-run (9 to 20 quarters after the shock), however, the real exchange rate continues to depreciate, the trade balance with the US improves, and since the trade balance with the rest of the world declines, GDP tends to fall. This is also consistent with the MF model. There is also some evidence in favor of the intertemporal model in the long-run: the fall in the real interest rate appears to stimulate consumption and investment. GDP increases and savings rises, but insufficient current account data precludes a complete analysis of the intertemporal model.

Philippines	**Quarters after shock**			
Variables	**0 - 2**	**3 - 4**	**5 - 8**	**9 - 20**
Nominal exchange rate (-)	-	-	-	-/+
Real exchange rate (-)	-	-	-/+	+
Exports to US (-)	-	-/+	+	+
Imports from US (+)	-	-/+	+/-	-/+
Trade balance with US (-)	-	-/+	+	+
Exports to the rest of the world (-)	-	-	-	-/+
Imports from the rest of the world (+)	-	-	-	-/+
Trade balance with the rest of the world (-)	-	-	-	-
Current account (-)	-	-/+	+	+
GDP (- in MF) (+ in intertemporal model)	-	-/+	+/-	-/+
Real interest rate (-)	+	-	-	-
Savings (+)	-	-/+	-	-
Consumption (+)	-	-	-	-
Investment (+)	-	-	-	-/+

Among the Asia 9 countries, the response of the Philippines to expansionary US policy most closely resembles the predictions of the MF model. The nominal and real exchange rate appreciate relative to the US dollar (perhaps because capital flows into the country after the federal funds rate falls), this leads to a deterioration in the trade balance with the US. The aggregate trade balance also declines. GDP falls within the first quarter. The real interest rate initially rises, but then falls after the sixth month. However, the Philippines is not consistent with the intertemporal model because both consumption and investment do not respond positively to the fall in the real interest rate from the third to the eighth quarter after the US shock. The current account also declines, then improves after around 3 quarters. Both consumption and investment fall, perhaps because of the negative income absorption effect from the decline in GDP.

The short-run decline in the current account is inconsistent with the intertemporal model, but occurs perhaps because the decline in savings exceeds the decline in investment.

In the long-run, the real exchange rate depreciates. The trade balance with the US and the rest of the world improves, and GDP also increases. These dynamics are again consistent with the MF model. The long-run decline in the real interest rate fails to generate consumption and investment growth. Saving declines. Overall, these dynamics are not consistent with the intertemporal model.

Thailand	Quarters after shock			
Variables	**0 - 2**	**3 - 4**	**5 - 8**	**9 - 20**
Nominal exchange rate (-)	-	-	+	+
Real exchange rate (-)	-	+	+	+/-
Exports to US (-)	+	-	+	+
Imports from US (+)	-	-	-	-/+
Trade balance with US (-)	+	+	+	+/-
Exports to the rest of the world (-)	-	-	+	+
Imports from the rest of the world (+)	-	-	-	-/+
Trade balance with the rest of the world (-)	+	+	+	+/-
Current account (-)	+	+/-	+	+
GDP (- in MF) (+ in intertemporal model)	**0**	-/+	+/-	-/+
Real interest rate (-)	-	-/+	-	-
Savings (+)	-	+/-	-/+	+/-
Consumption (+)	+	-	-	-/+
Investment (+)	-	-	-	-/+

Both the Thai nominal and real exchange rate appreciate relative to the US dollar in the short-run (perhaps because of capital inflows in the wake of the fall in the federal funds rate). In spite of this, the trade balance with the US improves. The overall trade balance also improves. This is consistent with an income absorption effect of a US expansion that exceeds the expenditure switching effect. The initial impact on GDP is negligible to slightly negative, however. The real interest rate falls within the first two quarters, but investment falls and the initial increase in consumption does not persist. These short-run dynamics are not consistent with the intertemporal model. The current account improves, perhaps because the fall in investment exceeds the fall in savings.

In the medium to long-run, the real interest rate continues to decline, exports and the trade balance with the US and the rest of the world tend to increase, consistent with the MF model. Consumption, investment and GDP also increase. These dynamics are generally consistent with the intertemporal model: the increase in consumption may be smaller than the increase in GDP (due to a desire for consumption smoothing). Savings increases and the current account improves

Singapore	Quarters after shock			
Variables	**0 - 2**	**3 - 4**	**5 - 8**	**9 - 20**
Nominal exchange rate (-)	+	-	+	+
Real exchange rate (-)	-	-	+/-	+/-
Exports to US (-)	-	-/+	-	+
Imports from US (+)	-	-/+	-	-/+
Trade balance with US (-)	-	-	-/+	+/-
Exports to the rest of the world (-)	**0**	+	+/-	-/+

Imports from the rest of the world (+)	+	+	+/-	-/+
Trade balance with the rest of the world (-)	+	+/-	-	-/+
Current account (-)				
GDP (- in MF) (+ in intertemporal model)	-	-/+	+/-	-/+
Real interest rate (-)	-	+	+	+
Savings (+)				
Consumption (+)	-	-	-	-/+
Investment (+)	**0**	+	+/-	-/+

(current account and savings data for Singapore were insufficient)

In Singapore, the nominal exchange rate appreciates in the first two quarters. This is followed by a nominal depreciation. The real exchange rate, however, responds to a US monetary expansion by appreciating up to one year after the shock (perhaps due to capital inflows in the wake of the fall in the federal funds rate). The trade balance with the US deteriorates, consistent with the MF model. The aggregate trade balance, however, improves. On balance, however, the short-run impact of the US expansion on GDP is negative, consistent with the MF model. Some aspects of the intertemporal model, however, are not consistent with Singapore short-run dynamics. The real interest rate falls in the first two quarters. But this does not trigger a corresponding short-run increase in investment and consumption. Consumption falls and increases only in the later quarters of analysis. Investment, however, displays a tendency to increase. Unfortunately, no statistics for saving are available for a complete assessment of the intertemporal model.

The long-run response of the variables are also not consistent with the intertemporal model: the real interest rate rises.

Malaysia	**Quarters after shock**			
Variables	**0 - 2**	**3 - 4**	**5 - 8**	**9 - 20**
Nominal exchange rate (-)	+	+	+	+
Real exchange rate (-)	-	-	-	+
Exports to US (-)	-	-	-	-/+
Imports from US (+)	-	-/0	0/-	-/+
Trade balance with US (-)	-	-	+	+/-
Exports to the rest of the world (-)	-	-	-	-/+
Imports from the rest of the world (+)	-	-	-	-/+
Trade balance with the rest of the world (-)	+	+	+	+/-
Current account (-)	+	+	-	-/+
GDP (- in MF) (+ in intertemporal model)	-	-/+	+/-	+
Real interest rate (-)	-	-	+	+
Savings (+)	+	+	+/-	-/+
Consumption (+)	-	-	-	-/+
Investment (+)	-	-	-	-/+/-

In Malaysia, the nominal exchange rate depreciates and this is persistent. The real exchange rate, however, appreciates for up to 8 quarters after the monetary shock (perhaps due to capital inflows). Consistent with MF, the trade balance with the US deteriorates and GDP declines in the first 3 quarters after the shock. The Malaysian short-run dynamics do not appear to be to be consistent with the intertemporal model. The real interest rate declines, but this does not translate into an increase in consumption or investment. Nor are long-run dynamics consistent with the intertemporal model: the real interest rate increases beginning in the fifth quarter onwards, but consumption and investment generally increase.

Japan	**Quarters after shock**			
Variables	**0 - 2**	**3 - 4**	**5 - 8**	**9 - 20**
Nominal exchange rate (-)	**0**	-	-	+/-
Real exchange rate (-)	-	+	+	-/+
Exports to US (-)	-	-/+	+	+
Imports from US (+)	-	-	-	-/+
Trade balance with US (-)	+	+	+	+/-
Exports to the rest of the world (-)	-	-/+	+/-	-/+
Imports from the rest of the world (+)	-	-	-	-/+
Trade balance with the rest of the world (-)	-	-/+	+	+
Current account (-)	+	**+/0**	+	+/-
GDP (- in MF) (+ in intertemporal model)	-	-	-	-
Real interest rate (-)	+	+/-	-	-
Savings (+)	-	-/+	-	-
Consumption (+)	+	-	-	-
Investment (+)	-	-	-	-

In Japan, the nominal exchange rate is initially not responsive to a US monetary expansion. However, the real exchange rate appreciates in the short-run. This leads to a short-run improvement in the trade balance with the US, which is very persistent. This is consistent with a strong income absorption effect from the US expansion, which offsets the expenditure switching effect of the real depreciation. However, in spite of the persistent improvement in the trade balance, Japanese GDP declines. This is not consistent with the MF model. This result is also not consistent with Kim's result for non-US G6 countries. For Japan, at least, there is no positive spillover of a US expansion.

Japanese short-run dynamics also seem not to be consistent with the basic version of the intertemporal model. The fall in the real interest rate is not followed by an increase in consumption and investment (which experience persistent declines).

An interesting feature of the dynamics is that Japanese real interest rates rise immediately after the US monetary expansion. Among the Asia 9 countries, it is the only country in which real interest rates rise in response to a US monetary expansion. This

perhaps reflects the government's desire to mitigate the impact of a US expansion on already low Japanese real interest rates.

3.3.4 Some important cross-country observations

The real exchange rate depreciation that China, Korea and Indonesia experience following a US monetary expansion makes an assessment of the applicability of either model difficult. Thus, the focus will be on Japan and the other small open economies comprising Asia 9: the Philippines, Malaysia, Hong Kong, Thailand and Singapore.

It appears that the MF model is consistent with the behavior of these five small open economies of Asia 9 after a US monetary expansion. The short-run dynamics displayed in the Philippines, Malaysia, Singapore and Hong Kong are all consistent with a Mundell-Fleming scenario where the trade balance is the transmission mechanism. Immediately following a negative shock to the federal funds rate, signaling a US monetary expansion, capital inflows into these economies lead to a real currency appreciation, triggering a fall in exports to and imports from the US and deterioration in the trade balance with the US, a deterioration of trade balances with the rest of the world and a corresponding decline in GDP. Thus, the conventional beggar-thy-neighbor effect occurs. Since the trade balance with the US also initially falls for many of the small Asia 9 open economies, this suggests that the fall in exports exceeds the fall in imports.

In Thailand, the income absorption effect of the US monetary expansion leads to an increase in exports to the US in the first two quarters after the shock. This leads to a short-run improvement in the trade balance with the US. The impact on the Thai GDP, however, is negligible.

The intertemporal model generally fails to do well in describing most of Asia 9 short-run responses because in most countries in the group:

1) GDP falls;
2) Consumption and investment fall in spite of the decline in real interest rates;
3) The current account in these countries responds positively. This can be explained by the fall in GDP. Consumption may not fall by as much as the fall in GDP, due to the desire for consumption smoothing. Thus, savings rises. Coupled with the general fall in investment, this means that the current account responds positively.

One of the most interesting results of this study is that most of the Asia 9 countries import less from the US after a US monetary expansion. This is not an intuitive result since the real appreciation that occurs in most of the countries should enhance demand for US goods. This occurs in all of the countries except Indonesia. The general decline is persistent. This result might be consistent with the hypothesis that exports to the US of the five small open economies have inputs imported primarily from the US (for example, exports of garments and electronics goods to the US might have a high US import input content). This matter is left for further study.

3. Conclusions

The main findings of this study are that:

1) After including more recent data in the sample period for this study, US non-borrowed reserves no longer seem to be a good predictor of the stance of US monetary policy. Also US real output displays more persistence in response to expansionary monetary policy.

2) The Mundell-Fleming model appears to do a reasonably good job in describing the short-run dynamics of Asia 9 economies immediately following a US monetary expansion triggered by a fall in the federal funds rate.

3) The intertemporal model does not appear to explain Asia 9 dynamics sufficiently.

4) There appears to be no positive spillover effect of a US monetary expansion to major Asian economies, including Japan. This differs from Kim's (2001) study for the non-US G6 countries (which includes Japan). While the world real interest rate appears to play an important role in the transmission mechanism of US policy shocks to non-US G6 countries, the trade balance plays a more important role in the transmission mechanism for Asia 9 countries. The absence of a positive spillover effect is the strongest evidence against the intertemporal model.

5) The fall in imports to the US by the Asia 9 small open economies may be intimately linked to the fall in exports to the US. It is possible that this is the result of a decline in imported inputs from the US, which may comprise a significant component of goods exported by these same countries to the US.

The fact that the trade balance seems to play a more important role in the transmission of US monetary policy shocks to Asia (in contrast with other industrialized countries outside of Asia) should not come as a surprise. Many of the small open economies in Asia 9 countries are heavily dependent on trade to the extent that their trade balances with the US appear to influence the direction of the response in their real outputs. The fact that the intertemporal model fails in the short-run in many instances also suggests that the real interest rate channel is weak. The fall in consumption and investment in most cases appears to be a response to the fall in GDP. This accounts for the general increase in the current account in the Asia 9 countries after a US monetary expansion.

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Appendix

Asia 9 cross-country impulse responses by variable

Nominal exchange rate (-)	0 - 2	3 - 4	5 - 8	9 - 20
Korea	+	+	+	+
Indonesia	+	+	+	+/-
Thailand	-	-	+	+
Singapore	+	-	+	+
Malaysia	+	+	+	+
Hongkong	-	-	-	-
RP	-	-	-	-/+
Japan	0	-	-	+/-

Real exchange rate (-)	0 - 2	3 - 4	5 - 8	9 - 20
Korea	+	+	+	+/-
Indonesia	+	+	+	+/-
Thailand	-	+	+	+/-
Singapore	-	-	+/-	+/-
Malaysia	-	-	-	+
Hongkong	-	-/+	+	+
RP	-	-	-/+	+
Japan	-	+	+	-/+

Exports to USA (-)	0 - 2	3 - 4	5 – 8	9 – 20
Korea	-	-	-	+
Indonesia	+	-	+/-	-/+
Thailand	+	-	+	+
Singapore	-	-/+	-	+
Malaysia	-	-	-	-/+
Hongkong	-	-/+	+	+
RP	-	-/+	+/-	-/+
Japan	-	-/+	+	+

Imports from USA (+)	0 - 2	3 - 4	5 - 8	9 - 20
Korea	-	-	-	-/+
Indonesia	+	-	-	-/+
Thailand	-	-	-	-/+
Singapore	-	-/+	-	-/+
Malaysia	-	-/0	0/-	-/+
Hongkong	-	-/+	+/-	-/+
RP	-	-	-	-
Japan	-	-	-	-/+

Trade balance with the USA (-)	0 - 2	3 - 4	5 - 8	9 - 20
Korea	+	+/-	-/0	+/-
Indonesia	-	-	-/+	-
Thailand	+	+	+	+/-
Singapore	-	-	-/+	+/-
Malaysia	-	-	+	+/-
Hongkong	-	-/+	+	+
RP	-	-	-/+	+/-
Japan	+	+	+	+/-

Exports with the rest of the world (-)	0 - 2	3 - 4	5 - 8	9 - 20
Korea	-	-/+	+/-	-/+
Indonesia	0/-	-	-	-/+
Thailand	-	-	+	+
Singapore	0	+	+/-	-/+
Malaysia	-	-	-	-/+
Hongkong	-	-	-/+	+
RP	-	-	-	-/+
Japan	-	-/+	+/-	-/+

Imports from the rest of the world (+)	0 - 2	3 - 4	5 - 8	9 - 20
Korea	-	-	-	-/+
Indonesia	-	-	-	-/+
Thailand	-	-	-	-/+
Singapore	+	+	+/-	-/+
Malaysia	-	-	-	-/+
Hongkong	-	-/+	+	+
RP	-	-	-	-/+
Japan	-	-	-	-/+

Trade balance with the rest of the world (-)	0 - 2	3 - 4	5 - 8	9 - 20
Korea	-	-	+	+/0
Indonesia	+	+/0	-	-/+
Thailand	+	+	+	+/-
Singapore	+	+/-	-	-/+
Malaysia	+	+	+	+/-
Hongkong	-	-	-	-
RP	+	+	+	+
Japan	-	-/+	+	+

Current account (+)	0 - 2	3 - 4	5 - 8	9 - 20
Korea	+	+	-/+	+
Indonesia	+	+	+/-	-
Thailand	+	+/-	+	+
Singapore				
Malaysia	+	+	-	-/+
Hongkong				
RP	-	-/+	+	+
Japan	+	+/0	+	+/-

GDP (- in Mundell-Fleming, + in intertemporal model)	0 – 2	3 - 4	5 - 8	9 - 20
Korea	-	-/+	+/-	+
Indonesia	-	+	+/-	-/+
Thailand	0	-/+	+/-	-/+
Singapore	-	-/+	+/-	-/+
Malaysia	-	-/+	+/-	+
Hongkong	-	-/+	+	+/-/+
RP	-	-/+	+/-	-/+
Japan	-	-	-	-

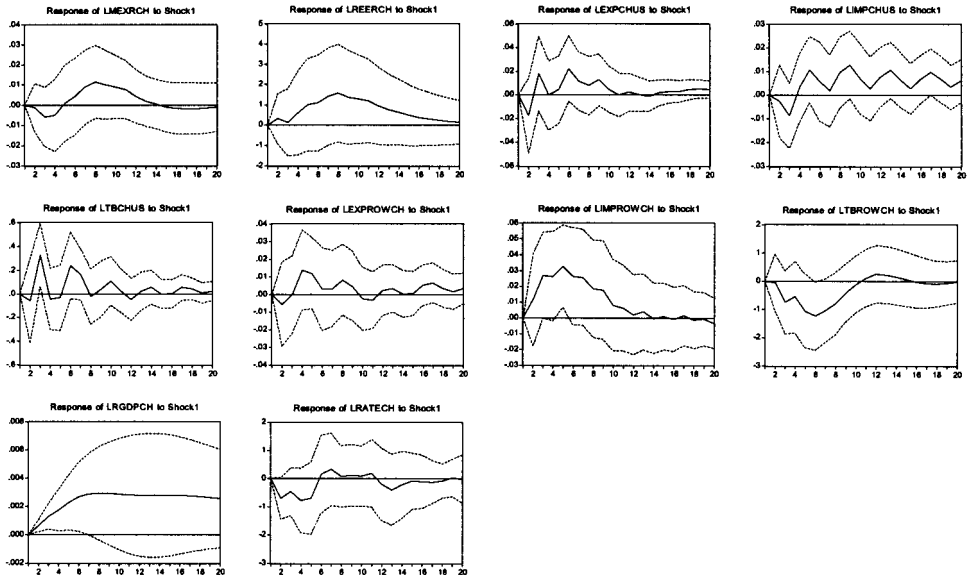
Consumption (+)	0 – 2	3 - 4	5 - 8	9 - 20
Korea	+	+	+	+
Indonesia	-	-/+	+/-	-/+
Thailand	+	-	-	-/+
Singapore	-	-	-	-/+
Malaysia	-	-	-	-/+
Hongkong	+	+	+	+
RP	-	-	-	-
Japan	+	-	-	-

Investment (+)	0 - 2	3 - 4	5 - 8	9 - 20
Korea	-	-/+	-	-
Indonesia	-	-/+	-	-/+
Thailand	-	-	-	-/+
Singapore				
Malaysia	-	-	-	-/+/-
Hongkong	-	-	+	+
RP	-	-	-	-/+
Japan	-	-	-	-

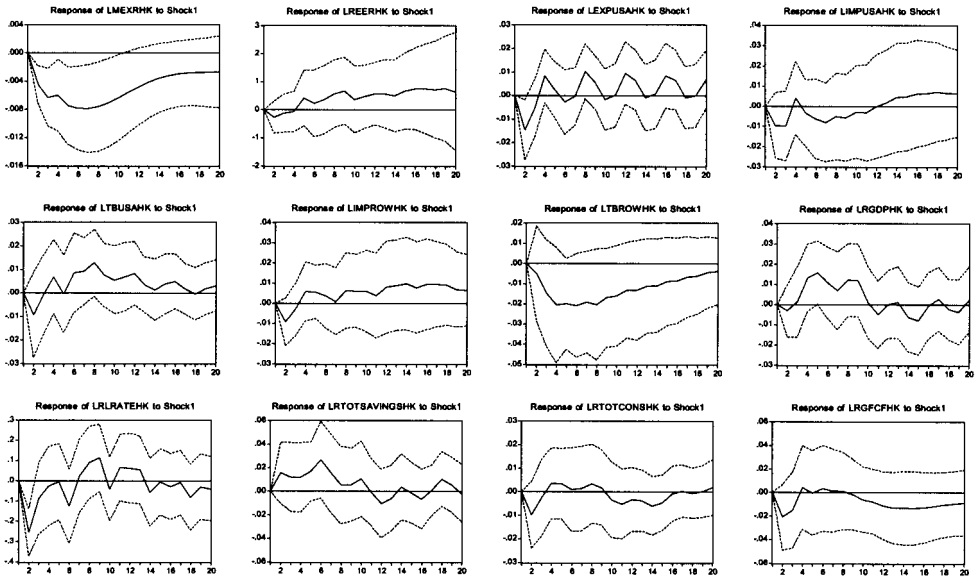
Savings (+)	0 - 2	3 - 4	5 - 8	9 - 20
Korea	-	-	-	-
Indonesia	+	+/-	-	-/+
Thailand	-	+/-	-/+	+/-
Singapore				
Malaysia	+	+	+/-	-/+
Hongkong	+	+	+/-	-/+
RP	-	-	-/+	+/-
Japan	-	-/+	-	-

Real interest rate (-)	0 - 2	3 - 4	5 - 8	9 - 20
Korea	-	-	-/+	+/-
Indonesia	-	-/+	+	+
Thailand	-	-/+	-	-
Singapore	-	+	+	+
Malaysia	-	-	+	+
Hongkong	-	-	+	-
RP	+	-	-	-
Japan	+	+/-	-	-

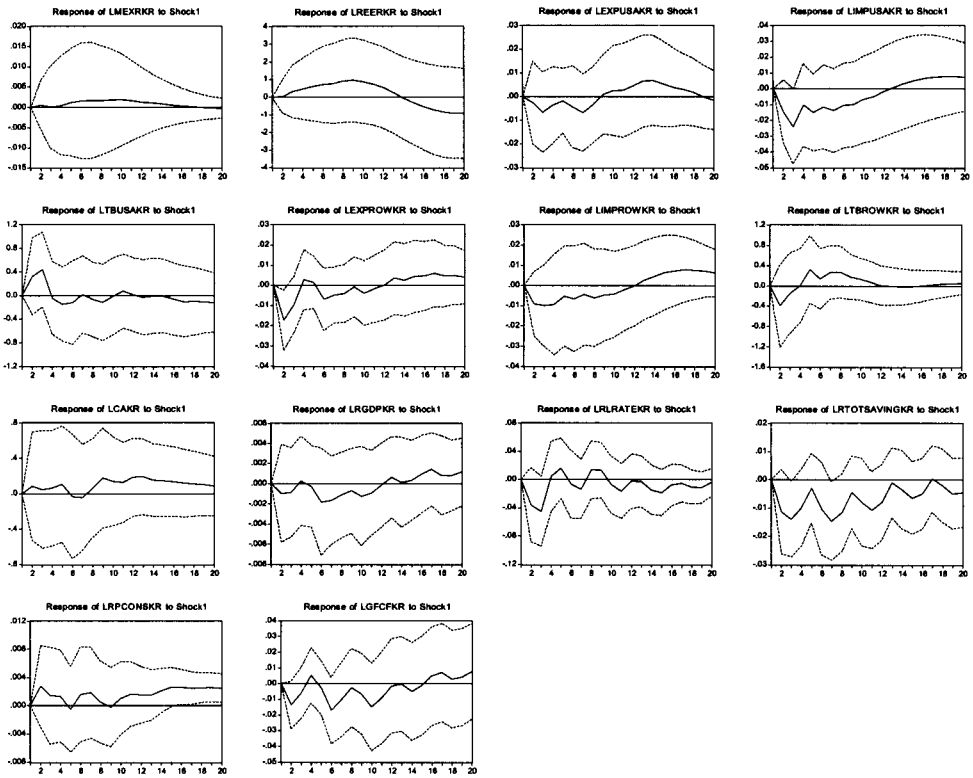
China impulse responses



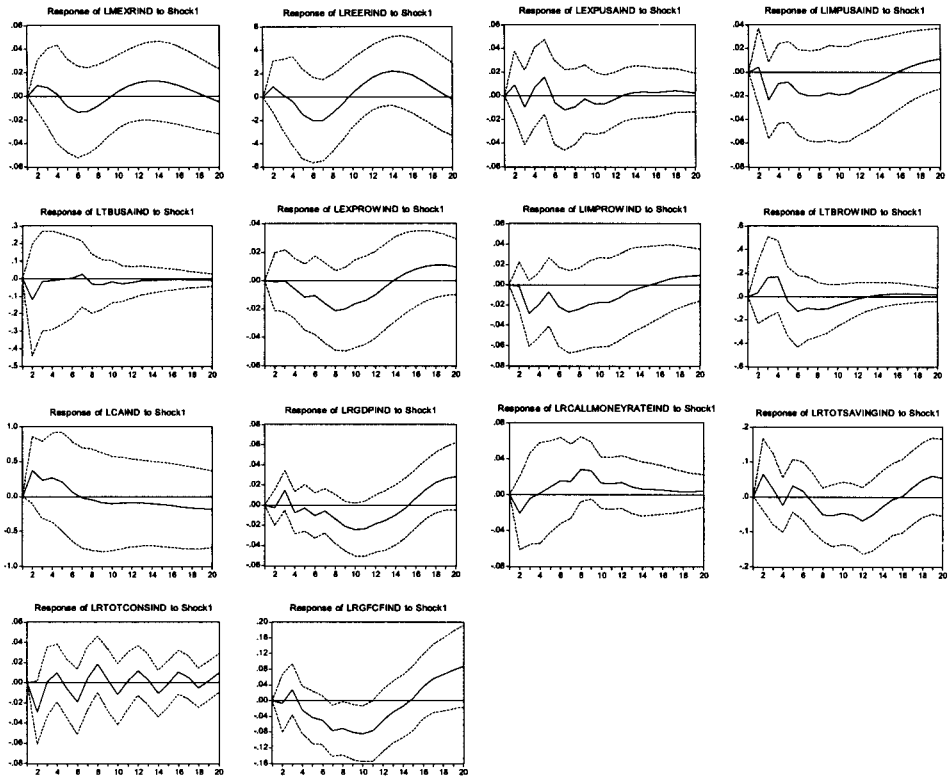
Hong Kong impulse responses



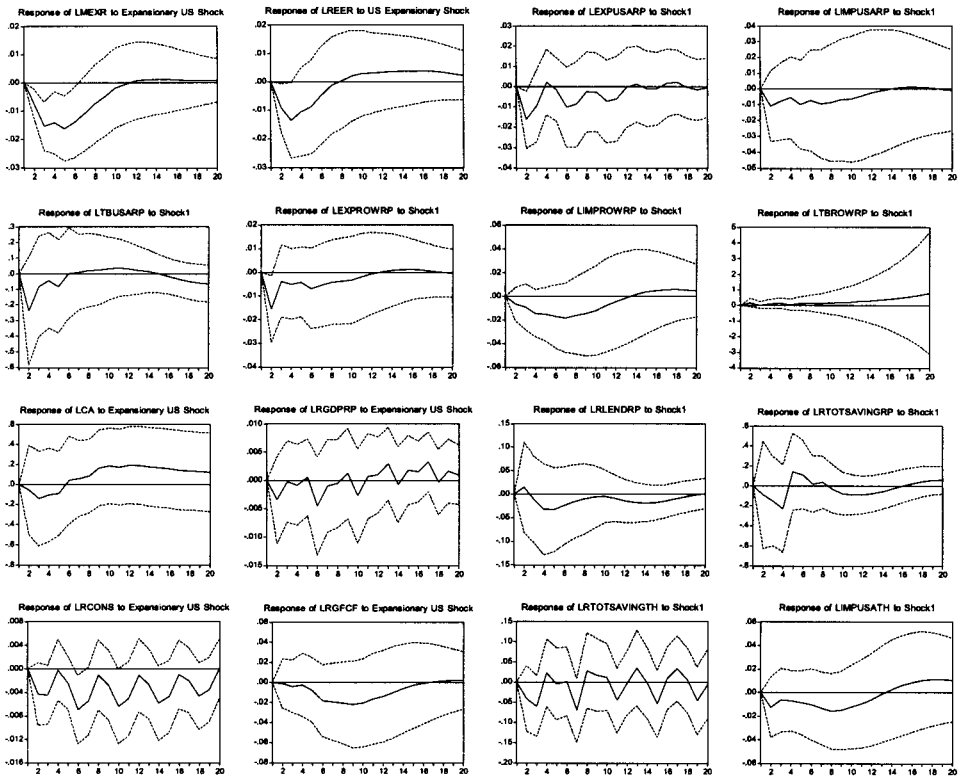
Korea impulse responses



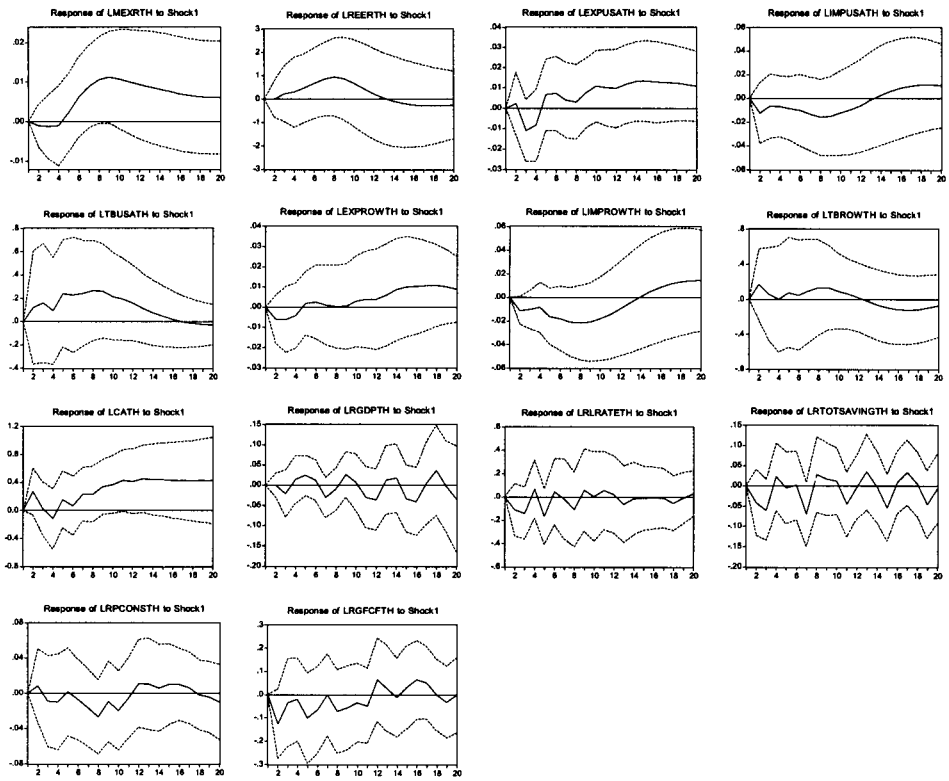
Indonesia impulse responses



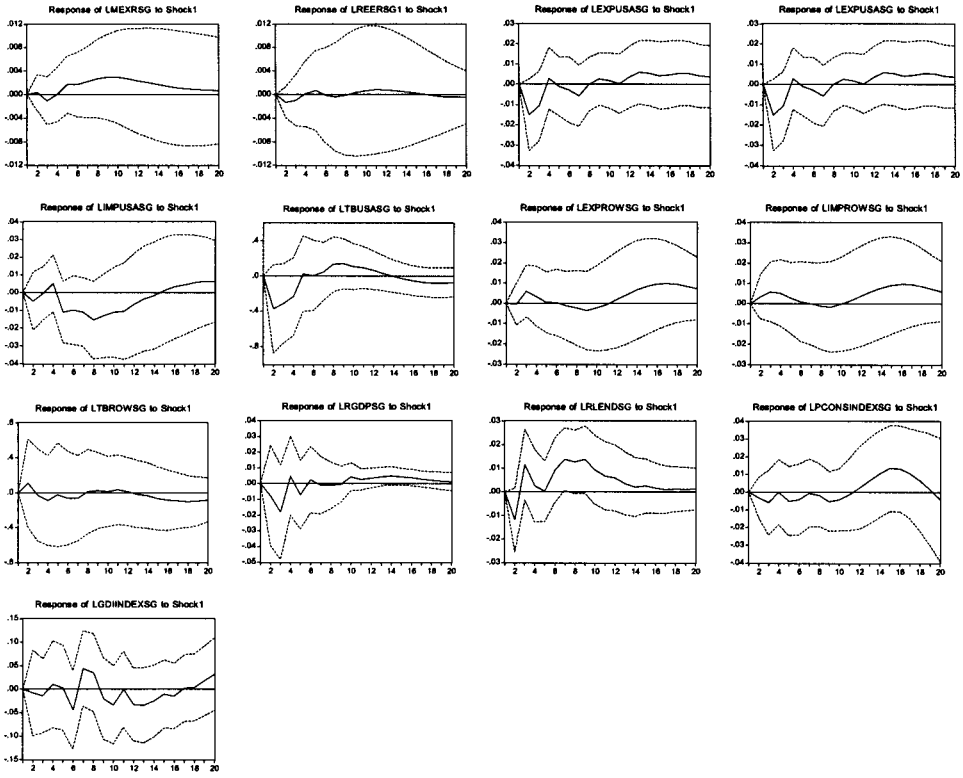
Philippines impulse responses



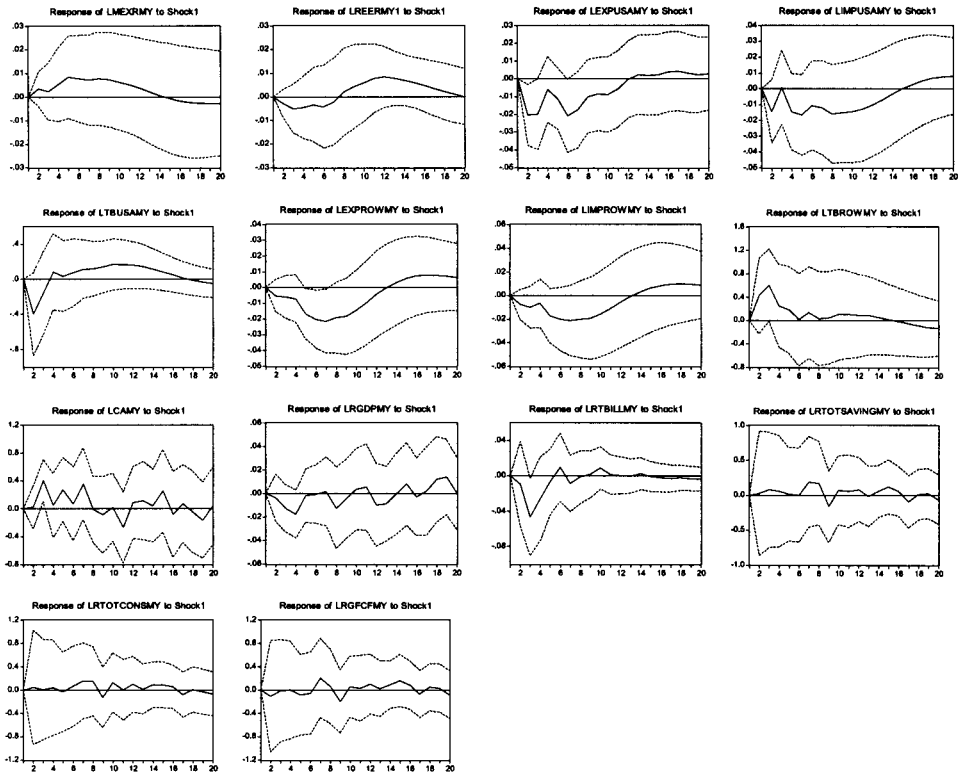
Thailand impulse responses



Singapore impulse responses



Malaysia impulse responses



Japan impulse responses