Brunel UNIVERSITY LONDON

Department of
Economics and Finance

Working Paper No. 12-11

Economics and Finance Working Paper Series

Sanjay Banerji, Alexia Ventouri and Zilong Wang

The sovereign spread in Asian emerging economies: The significance of external versus internal factors

September 2012

http://www.brunel.ac.uk/economics

The sovereign spread in Asian emerging economies:

The significance of external versus internal factors

Sanjay Banerji[†], Alexia Ventouri[*], Zilong Wang[‡]

Abstract

This paper investigates the dynamic relations between external factors, domestic macroeconomic factors and sovereign spreads in Asian emerging countries. We conduct our analysis using a methodology that combines theoretical and empirical elements, using a Structural Vector Autoregression (SVAR) model. In particular, we investigate how the spread of sovereign debt is influenced over time by both external as well as domestic factors. Moreover, we generate variance decompositions and impulse response functions. Our results show that variations in sovereign spreads are mainly driven by external shocks, with the term structure of U.S. interest rate and the global risk aversion having the most important role. The findings also indicate that shocks from the U.S. have a direct effect on sovereign spread and an indirect effect via domestic macroeconomic fundamentals. Finally, the evidence produced validates the presence of some response patterns of sovereign spread to the external shocks.

Keywords: Bond spread; SVAR; Sovereign risk; Emerging market; Risk aversion

JEL classification codes: F34; F41; G15

*(Corresponding author): School of Social Sciences, Department of Economics and Finance, Brunel University, Uxbridge, UB8 3PH (United Kingdom); Tel: +44-1895-267165. Email: alexia.ventouri@brunel.ac.uk.

† Nottingham University Business School, University of Nottingham, Nottingham, NG8 1BB (United Kingdom); Tel: +44-1159-515276. Email: Sanjay.Banerji@nottingham.ac.uk.

‡ Essex Business School, University of Essex, Colchester, CO4 3SQ (United Kingdom); Email: zwango@essex.ac.uk.

1. Introduction

Since the 1990s, there is a significant increase in the amount of outstanding debt and by 2010, the world had over 77 trillion dollars aggregate outstand sovereign bond according to BIS. Not only such bonds formed an important class of portfolio for investors, they were also key source of funds for the Governments of the emerging markets. Hence, understanding the factors behind the magnitude of spread and its volatility and how they are influenced by foreign and domestic factors over time are important not only for the purpose of inclusion in a well diversified portfolio but also for grasping its efficacy as a financial instrument of the government in emerging economies. The sovereign spreads of the U.S. Dollar denominated bond are typically defined as the difference in yield between the bond and a benchmark U.S. Treasury bond of a similar maturity and are normally expressed in basis point. The return on emerging market issues of such bonds is in general expressed in terms of their spread rather than their absolute yield.

In this paper, we aim to assess the relative importance of both domestic and external factors in influencing the variations of spread of the sovereign bonds issued by the Asian emerging countries. In order to resolve endogeneity problems stemming from the dynamic interdependence between these variables, we employ a Structural Vector Autoregression (SVAR, hereafter) model. In addition, instead of following the traditional approach relying on exchange rate, we use the U.S. Dollar index[1] as a proxy for the currency risk that affects the probability of default of sovereign bonds and their spread.

Based on this framework, results show that external factors cause variations of both domestic macroeconomic variables (trade balance to GDP ratio and debt to GDP ratio) and sovereign spreads. Moreover, there is evidence suggesting that external factors

[1]Dollar index is a trade-weighted average of six foreign currencies against the dollar. Currently, the index includes Euros (EUR), Japanese yen (JPY), British pounds (GBP), Canadian dollars (CAD), Swedish kronas (SEK) and Swiss francs (CHF).

not only directly affect sovereign spread, but indirectly causes fluctuation of sovereign spread via its impact on the domestic macroeconomic fundamentals. Although the evidence shows the indirect effects are limited, still we cannot ignore this fact.

This paper advances the previous literature in the following directions: Firstly, one of the main advantages is that we explicitly take into account currency risk by bringing the Dollar exchange rate into the analysis. The bulk of empirical evidence on capturing currency risk tends to use the exchange rate between domestic currency and the U.S. Dollar (treated as a domestic factor). However, currency risk can be seen as a pure external factor, implying that the Dollar index can be used as a more appropriate measurement to capture this fact. Specifically, the exchange rate can be affected by domestic factors, such as high debt level etc. Yet, previous studies on this issue have already included those variables in the model, which in turn implies that after controlling for domestic macroeconomic fundamentals, exchange risk can be seen as a pure external factor. A second advancement of this paper is that we investigate the dynamic role of term structure of U.S interest rate on domestic economy and sovereign spread, most of previous work focus on the spot U.S interest rate since their models are static. An increase in the expected future short term U.S interest rate might cause a higher cost of borrowing in emerging countries, but on the other hand it signals a recovery in a world economy.

A third advancement of this paper is that we conduct our investigation using data from Asian emerging markets. As far as we are aware, our study is the first to explore the dynamic impact of debt on the sovereign spread, within the Asian market. Lastly, from a methodological point of view, our approach considers the inclusion of two proxies for the global risk aversion as determinants of the spread: (a) volatility risk, measured by

variance risk premium of the S&P 500; and (b) credit risk, based on the spreads on high-yield BAA U.S. corporate bonds.

The role of sovereign bond spreads in emerging economies has generated a lot of interest among economists for the best part of the past century. Edwards (1984) provides a simple valuation framework for the determination of emerging market sovereign bonds under the assumption that investors are risk neutral. The analysis is based on a sample of 19 developing countries over 1976-1980. Using random effects components estimation, he provides evidence suggesting that the spread is determined by the reserves-to-GNP, debt-to-GDP and Debt-service ratios, as well as by the propensity to invest. Based on the same methodology, Arora et al. (2001) investigate the impact of changes in the U.S. monetary policy on country risk and economic growth in several developing countries in Latin America, Asia, and Eastern Europe over the period 1994-1999. The results indicate that the level of U.S. interest rates has a direct positive effect on sovereign bond spreads. The findings also document that country risk (proxied by sovereign bond spreads) is influenced by the U.S. monetary policy, the country-specific fundamentals, and the conditions of the global capital markets.

Diaz and Gemmill (2006) use end-of-month market prices of Par Brady bonds to investigate the impact of global, regional and country-specific factors on the creditworthiness of four emerging countries. The time span considered is from April 1994 to October 2001. The results document that credit risk (as measured by the estimated distance-to-default) is mainly driven by systematic global and regional factors, implying that credit risk should be treated as non-diversifiable. Thus, their result tend to suggest that credit ratings for those emerging markets should be based more strongly on global and regional economic factors than on local factors. One notable result which relate to this paper is that they use term structure of U.S interest rate as an explanatory

variable, it has significant positive effects on the distance-to-default, but when the on period lag of the term structure of U.S. interest rate takes into account, the effects disappear in Brazil and Mexico.

The abovementioned studies rely on OLS and panel regressions to investigate the relationship between sovereign spread, credit ratings and macroeconomic variables. More recently, studies have turned their attention to the endogeneity of sovereign spread and the role of risk aversion. More specifically, two strands of literature have emerged as the most prominent in the field of sovereign spread. One investigates the interaction of sovereign spread with domestic business cycles. A second strand of literature has engaged in examining the impact of risk aversion on sovereign spread.

Uribe and Yue (2006) examine the interaction of sovereign spreads, the world interest rate, and business conditions in emerging markets. Using a panel VAR model, the authors find that sovereign spreads affect aggregate activity, but, interestingly, at the same time respond to domestic macroeconomic conditions. Even more importantly, their findings highlight the issue of sovereign spreads and their dependence on domestic fundamentals and the world interest rate appear to be of great interest in understanding business cycles in emerging countries. However, this analysis does not take into account the role of global risk aversion, which may also affect sovereign spreads, especially in an open emerging market economy.

The novelty of the second strand of literature is that it explicitly investigates risk aversion and its impact on sovereign spread (Blanchard, 2005). Dungey et al. (2004) use SVAR to explore the role of investor' risk aversion during three financial crisis period (Russian crisis, LTCM crisis and Brazilian crisis). Their results suggest that the increase in the sovereign spread in most of the countries during Russian and LTCM crisis is mainly caused by credit risk and country risk, whereas during Brazilian crisis period, the

increase in sovereign spread is driven by credit, liquidity and volatility risk. Garcia-Herrero and Ortiz (2006) use a four variables SVAR model to identify the underlying foreign determinants of Latin American sovereign spreads. Their findings suggest that U.S. growth and interest rate have a direct effect on sovereign spread and an indirect effect on global risk aversion. Yet, the issue of endogeneity is not explicitly captured by this model. In a more recent study, Fracasso (2007) attempts to fill this gap in the literature by considering both the endogeneity of the credit spreads and relate them to the degree of risk aversion of international investors, as well as to domestic and international macroeconomic factors.[2] The analysis is based on a VAR system encompassing six domestic and three foreign variables[3] capturing global factors in Brazil during 1999-2004. The evidence broadly supports the view that foreign factors, in particular global appetite for risk and global risk aversion, are important determinants of the development of the domestic variables.

Finally, Eichler and Maltritz (2012) examine the determinants of the government bond yield spread of EMU member across different maturities. Using a panel regression, the authors find that both economic growth and countries' openness are significant determinants of government bond yield spread for all maturities. The countries' debt to GDP ratio is only significant for short term government bond yield spread, whereas net lending, interest rate costs and trade balance are significant for long term government bond yield spread.

Overall, understanding these relationships has important policy implications as researchers should take into account both domestic and external factors, as well as the role of global risk aversion, when investigating emerging economies. Although several

[2]The focus of this study is to examine the impact of foreign global shocks on the behaviour of domestic macroeconomic variables (in particular external debt and EMBI spread) in Brazil.

[3] The author uses the industrial cycle; primary deficit; real depreciation; inflation; external debt; and EMBI spread as domestic variables while the US industrial cycle; US Federal fund rate; US-BAA corporate high yield spread are used as foreign variables.

studies have investigated sovereign spread in emerging markets, none of them offer explicit consideration of foreign and domestic factors in determining the shapes of the spread over time. Table B in the Appendix B presents a summary of the previous studies on sovereign spread, along with their main findings. On balance, the existing literature indicates that foreign and domestic factors can significantly influence sovereign spread.

The remaining of the paper is organized as follows: Section 2 develops the theoretical model. Section 3 presents the data and variables. Section 4 presents the estimation strategy of a SVAR model. Section 5 discusses the empirical results for the variance decomposition and impulse response functions, and Section 6 concludes.

2. Theoretical model

In order to show interdependence between various variables, we resort to a simple framework that combines an incentive model of debt overhang (Obstfeldt and Rogoff, 1996; chapter 6) with a framework by Blanchard (2005) who analyzed capital inflow, debt and default in the context of a portfolio allocation model.

We consider a one period model with two risk averse representative investors: An emerging market investor whom we call the Malaysian investor and international investor. There are three assets: 1) A risk free one-period Malaysian bond denominated in domestic currency with rate of return r. 2) A one-period Malaysian government bond denominated in U.S. dollar with rate of return r^{MA}, let p be the probability of default on Malaysian government bond. 3) A risk free one-period U.S. government bond denominated in U.S. dollar with rate of return r^{US}. We also assume that there are some capital flow restrictions: 1) Malaysian investor can only buy Malaysian risk free bond and Malaysian government's U.S. dollar bond; 2) International investor can only buy U.S. government's bond and Malaysian government's U.S. dollar bond.

2.1. Portfolio allocation model

Consider the Malaysian investor with initial endowment W and invest x amount on Malaysian risk free bond, then her utility is:

$$pU(x(1+r)) + (1-p)U(x(1+r) + (W-x)\frac{\varepsilon'}{\varepsilon}(1+r^{MA})) \tag{1}$$

By the expected utility theory, we can rewrite equation (1):

$$U\{px(1+r)) + (1-p)[x(1+r) + (W-x)\frac{\varepsilon'}{\varepsilon}(1+r^{MA})] - f[(W-x),\theta, p]\} \tag{2}$$

where ε is the real exchange rate measure by domestic good per foreign good, primes denote next-period variables, f is the premium that agents willing to pay to get a certain payment, θ measure the degree of risk aversion and f is a function of W-x, θ and p. We assume f is a linear function of W-x, θ and p and

$f = (W-x)\theta p$, then rewrite (2)

$$U\{x(1+r) + (1-p)(W-x)\frac{\varepsilon'}{\varepsilon}(1+r^{MA})] - (W-x)\theta p]\} \tag{3}$$

Maximise (3) respect to x:

$$(1-p)\frac{\varepsilon'}{\varepsilon}(1+r^{MA}) = (1+r) + \theta p \tag{4}$$

Using same methodology for international investor:

$$(1-p)(1+r^{MA}) = (1+r^{US}) + \theta^* p \tag{5}$$

where θ* is the degree of risk aversion of international investor.

2.2. Capital flows and debt dynamic

Since international investor choose between Malaysian government U.S. dollar bond and U.S. government bond, rewrite equation (5) in terms of Malaysian good:

$$(1-p)\frac{\varepsilon'}{\varepsilon}(1+r^{MA}) = \frac{\varepsilon'}{\varepsilon}(1+r^{US}) + \theta^* p$$

Capital flows are given by:

$$CF = C\{(1-p)\frac{\varepsilon'}{\varepsilon}(1+r^{MA}) - \frac{\varepsilon'}{\varepsilon}(1+r^{US}) - \theta^* p\} \qquad C' > 0$$

Use equation (4),

$$CF = C\{1+r-\frac{\varepsilon'}{\varepsilon}(1+r^{US}) + (\theta-\theta^*)p\}$$

Assume there is home bias, so international investors are more risk averse than Malaysian investor, which in turn θ*>θ. We further assume

$$\theta = \lambda\theta^*, \qquad \lambda \le 1$$

then capital flow are given by:

$$CF = C\{1+r-\frac{\varepsilon'}{\varepsilon}(1+r^{US}) - (1-\lambda)\theta^* p\}$$

Assume the net exports are a function of the real exchange rate:

$$NX = N(\varepsilon) \qquad N'(\varepsilon) > 0$$

In the equilibrium condition, the sum of the capital flow and the net exports has to be zero gives:

$$C\{1+r-\frac{\varepsilon'}{\varepsilon}(1+r^{US}) - (1-\lambda)\theta^* p\} + N(\varepsilon) = 0$$

Since this is a one-period model, we normalize the long run equilibrium exchange rate to be equal to one, then assume

$$\varepsilon' = \varepsilon^{\eta}, \qquad 0 \le \eta \le 1$$

replacing ε' in the equilibrium condition:

$$C\{1+r-\varepsilon^{\eta-1}(1+r^{US})-(1-\lambda)\theta^{*}p\}+N(\varepsilon)=0 \quad (6)$$

The equation (6) determines the exchange rate $\varepsilon = \varepsilon(p)$ as a function of p the probability of default. Consider the Malaysian government inherited an outstanding amount of U.S. dollar debt D$, then the debt at the start of next period is given by:

$$D'=(1+r^{MA})D^{\$}\varepsilon'-R$$

where, R is the primary surplus, D' and R are measured in Malaysian goods.

Use equation (5)

$$D'=(\frac{1+r^{US}}{1-p}+\frac{\theta^{*}p}{1-p})D^{\$}\varepsilon^{\eta}-R \quad (7)$$

The equation (7) gives a relationship between D and p. The debt in the next period depends on the probability of default directly as well as via exchange rate $\varepsilon = \varepsilon(p)$ from the equilibrium condition (6).

2.3. Incentive model

The Malaysian government needs to repay D' in the second period and there are two output states in the second period, good state output Y_G and bad state out Y_B. We further assume that Y_G>D'> Y_B, and in the bad state, the Malaysian government default and pays nothing to the bond holder. The state depends on the Malaysian government's effort e, hence the probability of the default depends on Malaysian government's effort, and there is a dislike of effort, then the cost of effort is φ(e), where e is continuous, φ() is a convex function with φ(0)=0, φ'(0)=0 and φ(1)=+∞. In order to simplify the problem, we assume that p(e)=1-e and φ(e)= $0.5me^2$, this assumption does not affect our results. The Malaysian government maximizes its utility:

$$eU(Y_G-D')+(1-e)U(Y_B)-0.5me^2$$

By first order condition:

$$U(Y_G - D') - U(Y_B) = me$$

Replacing e with 1-p:

$$U(Y_G - D') - U(Y_B) = m(1-p) \quad (8)$$

The equation (8) and (7) determine the equilibrium p and D' together, as a function of risk aversion parameter, GDP and other variables. By implicit function theorem, the following comparative statics are computed (see for more details Appendix A):

$$\frac{\partial D'}{\partial \theta^*} > 0, \frac{\partial D'}{\partial r^{US}} > 0, \frac{\partial p}{\partial \theta^*} > 0 \text{ and } \frac{\partial p}{\partial r^{US}} > 0$$

Define the sovereign spreads as the rate of return difference between the Malaysian government U.S. dollar bond and the U.S. government U.S. dollar bond, rearrange (5):

$$S = r^{MA} - r^{US} = (1 + r^{US} + \theta^*)\frac{p}{1-p}$$

$$\frac{\partial S}{\partial r^{US}} = \frac{p}{1-p} + (1 + r^{US} + \theta^*)\frac{1}{(1-p)^2}\frac{\partial p}{\partial r^{US}}$$

$$\frac{\partial S}{\partial \theta^*} = \frac{p}{1-p} + (1 + r^{US} + \theta^*)\frac{1}{(1-p)^2}\frac{\partial p}{\partial \theta^*}$$

The first term in the above two equations is the direct effects of U.S. interest and international risk aversion on sovereign spread, whereas the second term is the indirect effects via probability of default.

To summarize, we can construct the following hypothesis:

1. If there is an unexpected increase in the U.S. interest rate, there will be an increase in the emerging countries' debt level, probability of default and sovereign spread.

2. If there is an unexpected increase in the international investors' risk aversion, there will be an increase in the emerging countries' debt level, probability of default and sovereign spread.

Given that the estimation of the above model reveals a complicated equilibrium relationship between sovereign spread, domestic and external factors, we use a SVAR, model. This method allows for valid inference and resolves the endogeneity problem that seems to plague our estimations.

3. Data and variables

This study uses a SVAR model to study the relative contribution of external and internal variables to the volatility of macroeconomic variables and credit spread. In order to account for the endogeneity of sovereign spread and risk aversion, we include the following sets of foreign (external) and domestic (internal) variables:

$$FOREIGN = (\text{TERM STRUCTURE, CBS, VRP, DOLLAR}) \quad (9a)$$

$$DOMESTIC = (\text{TRADE/GDP, DEBT/GDP, LOGSPREAD}) \quad (9b)$$

The vector FOREIGN (equation 9a) includes four sets of external variables: the term structure of the U.S. interest rate (TERM STRUCTURE); the U.S.-BAA corporate bond spread (CBS); the variance risk premium (VRP) and the Dollar Index (DOLLAR). Similarly, the vector of domestic variables (DOMESTIC) in equation (9b) contains the trade balance to GDP ratio (TRADE/GDP); the debt to GDP ratio (DEBT/GDP) and the LOGSPREAD, as measured by the log to the level of EMBI global index.

In particular, we control for the future short term interest rate and prospect of future U.S. economy by using the term structure of the U.S. interest rate. To account for global risk aversion we use two proxies: the U.S.-BAA spread (CBS) and the variance risk premium (VRP). The Dollar index is used as a proxy of the real value changed of Dollar. Turning to the variables capturing the domestic factors, we use the trade balance

to GDP ratio (TRADE/GDP) as a proxy for domestic liquidity condition and debt to GDP ratio (DEBT/GDP) as a proxy for the domestic solvency condition. Both variables have been identified as important determinants of the emerging market sovereign spreads (see among others, Min, 1998; Arora et al., 2001; Eichler and Maltritz, 2012). Finally, the LOGSPREAD variable is a measure of the cost of borrowing. Table 1 provides detailed information on the variables employed in the model.

<Insert table 1 about here>

The sovereign spread of a U.S. Dollar denominated bond is defined as the difference in yield between the bond and a benchmark U.S. Treasury bond of a similar maturity, and is normally expressed in basis point. The return on emerging market issues is expressed as their spread rather than their absolute yield (LOGSPREAD). This study uses the J.P. Morgan EMBI Global spread index as a proxy of sovereign spread for different countries. The EMBI Global is a weighted average of the spreads of U.S. Dollar-denominated individual bonds issued by a particular emerging market country.[4] The EMBI Global controls for floating coupons, principal collateral, rolling interest guarantees, and other unusual features of the bonds, and it is computed for all the main emerging market sovereign issuers, which also allows direct comparability of the results across countries in the sample.

The dataset used in this study is composed of different sample periods for each country under investigation.[5] In particular, and due to the data availability,[6] the chosen

[4] Other studies (e.g. Dungey et al., 2004) use a benchmark bond for each country to define the spread. However, and given that the purpose of this study is to look at the spread related to the risk of a sovereign issuer rather than the spreads of individual bonds, the EMBI Global is considered more appropriate for this type of investigation.

[5] We choose the largest time span possible.

time span per country is as follows: Chinese data are from Jan. 1995 to Sep. 2009; Malaysian data are from Nov. 1996 to Sep. 2009; Philippine data are from Jan. 1998 to Sep. 2009; and finally Indonesian data are from Jun. 2004 to Sep. 2009. For similar reasons, when only quarterly and yearly data are available,[7] we convert the corresponding series to monthly frequency. Table 2 presents the full raw data information.

<Insert Table 2 about here>

Table 3 presents the summary statistics for the variables employed in the model per country. China presents the lowest mean value of sovereign spread and debt to GDP level...On the other hand, Philippines has the highest mean value of sovereign spread and debt to GDP level. Malaysia presents the highest mean value of trade balance to GDP ratio, whereas Indonesia has the lowest trade balance to GDP ratio. By ranking the mean value of the DEBT/GDP ratio, Philippines represent the largest group, followed by Indonesia, Malaysia and China. Table 3 also presents the results after checking for stationarity. The unit root tests we ran include the Augmented Dickey Fuller (ADF Tests) and the Kwiatkowski, Phillips, Schmidt and Shin (KPSS tests). According to both tests, the CBS, DOLLAR and DEBT/GDP variables are I(1) stationary, with the remaining ones being I(0) stationary. For that reason, CBS, DOLLAR and DEBT/GDP variables are measured by taking the difference of their logs.

<Insert table 3 about here>

[6]Since the information on the J.P. Morgan EMBI Global index is not available for all countries and years, we construct our analysis based on the available data.
[7]This is due to the fact that data for the debt level in China are available in years.

4. The empirical model

To test the dynamic relations between sovereign spread, domestic macroeconomic variables and external factors we use a SVAR method as our modeling framework. This method allows us to generate an impulse response function, which simulates the effects of a shock to one variable in the system on the conditional forecast of another variable. In this context, the application of a SVAR model allows us to obtain the variance decomposition, which determines how much of the forecast error variance of each of the variables can be explained by exogenous shocks to the other variables. Finally, we also compare the short-term and the long-term effects. Specifically, we estimate the following econometric model that constructs impulse response function and variance decomposition:

$$AY_t = \alpha + A_1 Y_{t-1} + \ldots A_p Y_{t-p} + B\varepsilon_t \tag{10}$$

where, A represents a matrix of instantaneous relations between the variables in Y; B is a matrix of contemporaneous relationships among the structural disturbances ε and p is the period of lag. The vector Y_t in the model contains the set of external and internal variables as specified in equations (9a and 9b). Therefore, equation (10) can be re-written as follows:

$$A\begin{pmatrix} TERM\ \ STRUCTURE_t \\ CBS_t \\ VRP_t \\ DOLLAR_t \\ TRADE/GDP_t \\ DEBT/GDP_t \\ LOGSPREAD_t \end{pmatrix} = A_1\begin{pmatrix} TERM\ \ STRUCTURE_{t-1} \\ CBS_{t-1} \\ VRP_{t-1} \\ DOLLAR_{t-1} \\ TRADE/GDP_{t-1} \\ DEBT/GDP_{t-1} \\ LOGSPREAD_{t-1} \end{pmatrix} + \ldots A_p\begin{pmatrix} TERM\ \ STRUCTURE_{t-p} \\ CBS_{t-p} \\ VRP_{t-p} \\ DOLLAR_{t-p} \\ TRADE/GDP_{t-p} \\ DEBT/GDP_{t-p} \\ LOGSPREAD_{t-p} \end{pmatrix} + B\varepsilon_t$$

In order to estimate the SVAR model, two issues have to be considered: impulse restrictions and autocorrelation. In particular, the solution of the SVAR model involves a number of restrictions that have to be implemented. That is, given that the U.S. market is a large, integrated financial centre, this implies that the U.S. Dollar and U.S. investors play a very important role in the global financial market. As such, we implicitly assume that the U.S. variables are appropriate proxies of global factors, and that all the U.S. variables should be treated as exogenous ones. We adopt this restriction because it is reasonable to assume that the U.S. variables may affect, but not be affected by the domestic ones.

An additional restriction we impose in estimating the SVAR system is that the TERM STRUCTURE variable is non- contemporaneous and unaffected by any other variables. The TERM STRUCTURE has a contemporaneous effect on CBS and VRP, but CBS and VRP do no contemporaneously affect each other. Alternatively, the TERM STRUCTURE, CBS and VRP have a contemporaneous effect on the DOLLAR. In addition, all the external variables have a contemporaneous effect on TRADE/GDP, while the DEBT/GDP is contemporaneously affected by the external variables and the TRADE/GDP. Finally, all variables have contemporaneously effect on sovereign spread.

Another important issue for the estimation of the SVAR model is to address for autocorrelation. In order to make sure no autocorrelation appears in the error term after estimation, a sufficient number of lags have to be employed. We first select for the appropriate lag length using the Akaike Information Criterion (AIC) and the Hannan-Quinn Information Criterion (HQIC). Following this methodology, we ending up with 14 lags for Malaysia, China and Philippines, and 5 lags for Indonesia.

5. Empirical results

This section first evaluates the empirical results for the variance decomposition analysis (Section 5.1). Then, it discusses the results deriving from the impulse response function of the variables employed in the VAR system (Section 5.2).

5.1 Variance decomposition analysis

To consider the contribution of the various shocks in the empirical model, we perform a variance decomposition of the variables contained in the VAR system at different horizons. Specifically, we focus on the fraction of the variance of the forecasting error explained by each shock.

<Insert Table 4 about here>

Table 4 presents the contribution of all variables to the forecasting error variance of sovereign spread. The column aggregate foreign factor is the sum of the TERM STRUCRURE, CBS, VRP and DOLLAR variables. At 24 months horizon, foreign shocks could explain 64%, 71%, 53% and 58% fluctuation in LOGSPREAD in Malaysia, Indonesia, China and Philippines accordingly. The longer the horizon is, the greater the effect of foreign shocks. The TERM STRCURE shock appears to be the most important driven factor for LOSGPREAD, especially in the medium run between 6 and 18 months horizon. Focusing on the different variables capturing risk aversion, credit risk (CBS) appear to be more important than volatility risk (VRP), however they present different explanatory patterns. That is, CBS shocks have great impact on fluctuation of LOGSPERAD in the short run, but gradually lose its explanatory power, except for the

case of Indonesia. On the other hand, VRP shocks have limited effect on LOGSPREAD, in the short run, while this effect increases the larger the horizon gets.

As far as the internal variables are concerned, the explanatory power for the internal factors is under 10%, on average. This result implies that the domestic shocks have limited effects on the fluctuation of LOGSPREAD. Interestingly, the results for Philippines indicate that the DEBT/GDP shock can explain about 20% variation of LOGSPREAD at 1 month horizon, but its effect disappears later on, while the TRADE/GDP shock has almost no effects on the variation of LOGSPREAD, but pick up at medium run, after 12 months horizon. This result indicates that policy makers should always counteract unexpected changes in U.S. factors since they affect LOGSPREAD at most either in medium or long run.

<Insert table 5 about here>

Table 5 reports the results for the contribution of U.S. variables to the forecasting error variance of TRADE/GDP ratio. Overall, Aggregate foreign shocks could explain 55%, 70%, 45% and 69% of fluctuations in TRADE/GDP in Malaysia, Indonesia, China and Philippines at 24 month horizon. Table 6 analyses the contribution of U.S. variables to the forecasting error variance of debt to GDP ratio. Overall, aggregate foreign shocks could explain 55%, 66%, 54% and 54% of fluctuations in DEBT/GDP in Malaysia, Indonesia, China and Philippines, at 24 month horizon. Unexpected FOREIGN shocks could explain large amounts of fluctuation in domestic macroeconomic fundamentals, while the longer the horizon is, the larger the effect. This finding is in line with previous findings (Fracasso, 2007).

<Insert table 6 about here>

In summary, foreign shocks could explain 50-70% the variation of domestic variables, in particular, the TERM STRUCTURE shock could explain about 20%, which is line with previous findings (Uribe and Yue, 2006). Our results also indicate that risk aversion shocks could explain 20-40% variation of domestic variables. This result corresponds to previous findings in the literature (Garcia-Herrero and Ortiz, 2006). Finally, the DOLLAR shock could explain 10% variation of domestic variables. This is also in line with previous findings in the literature (Fracasso, 2007). Furthermore, domestic variable shocks could explain part of fluctuation in LOGPREAD. The next step is to examine whether LOGSPREAD shock can also drive domestic variables. Table 7 reports the results from the contribution of sovereign spread to the forecasting error variance of TRADE/GDP and DEBT/GDP. LOGSPREAD shock could explain about 10% variation of TRADE/GDP and DEBT/GDP. This result also in line with previous findings provided by Uribe and Yue (2006), who suggest that sovereign spread shock, can explain about 12% of movements in domestic economic activities.

<Insert table 7 about here>

5.2. Impulse response analysis

This section analysis the impulse response pattern of the variables employed in the VAR system at different horizons. To recall, the SVAR method allow us to generate the impulse response function, which simulates the effects of a shock to one variable in the system on the conditional forecast of another variable. In that way, we attempt to further investigate the response pattern of the various shocks in the empirical model. Given that

our findings suggest that domestic factors have no affect on the variation of sovereign spread, the analysis for the domestic variable shocks are not presented in the paper.[8]

<Insert figure 1 about here>

Figure 1 illustrates the impulse response of sovereign spread to U.S. variable shocks. The figure shows that if there is one unit of unexpected increase of one variable, how other variables changes over the next 24 months. The solid line depicts point of estimate of impulse response, and the dotted lines depict 95% confident interval. Overall, the results in Figure 1 are consistent for all countries except the response pattern for VRP shock, an ambiguous result given that the 95% confident interval includes zero. The LOGSPREAD displays an increasing trend whenever there is a positive shock on the TERM STRUCTURE, CBS or the DOLLAR index. This increasing affect continues until the 3-6 months horizon, and then the response patterns are ambiguous, since the shaded area is 95% confident include zero. The response of the risk aversion shocks are in line with Garcia-Herrero and Ortiz (2006) who found a positive relationship between risk aversion and sovereign spread. The result of the TERM STRUCTURE shock is quite interesting, suggesting that if there is a shock of increasing expected future U.S. short term interest rate, the present LOGSPREAD would go higher. This result suggest that when the U.S feudal reserve use QE (quantitative easing) or operational twist, which causes decline of the term structure of U.S interest rate, the countries in our sample would benefit from those U.S monetary policy and incur a lower cost of sovereign borrowing. This result is in line with Diaz and Gemmill (2006) who suggest the default probability has positive relationship with the Term structure of U.S. interest rate.

[8] The figures for the domestic variable shocks are not reported but are available with the authors upon request.

6. Conclusion

This paper contributes to the existing literature by analyzing the dynamic relations between external factors, domestic macroeconomic factors and sovereign spreads in Asian emerging countries. Our analysis includes a theoretical framework that combines an incentive model of debt overhang (Obstfeldt and Rogoff, 1996; chapter 6) with Blanchard (2005)'s who analyzed capital inflow, debt and default in the context of a portfolio allocation model. Then we use a SVAR model to empirically investigate how the spread of sovereign debt is influenced over time by both external as well as domestic factors. In addition, using the estimated SVAR, we generate variance decompositions and impulse response functions. One feature of this paper is that we explicitly take into account currency risk by bringing the Dollar index into the analysis. Another important advancement is the use of two global risk aversion proxies, namely volatility and credit risk, as external factors. Those variables play an important role in both domestic macroeconomic factors and sovereign spread. Finally, the present study attempts to shed more light in an area that has not been extensively examined, such as the Asian emerging market.

By combining the term structure of the U.S. interest rate, the BAA corporate bond spread, the variance risk premium and the Dollar index as external factors, our findings indicate that the variation of sovereign spreads in Asian emerging countries is mainly driven by external shocks, with the term structure of U.S. interest rate and the credit risk aversion playing the most important role. Moreover, we find that shocks from the U.S. could largely explain fluctuations in domestic macroeconomic fundamentals, implying that Asian economies are heavily rely on U.S. factors. This in turn implies that the U.S. variables have a direct effect on sovereign spread and an indirect effect via domestic macroeconomic fundamentals. Our findings also validate the presence of some

response patterns of sovereign spread to the external shocks. Sovereign spreads increase the response to all kinds of external shocks.

From a public policy perspective, understanding the relationships among foreign, domestic factors and sovereign spread is important for both investors and policy makers alike, in deciding a suitable investment or government policy, especially in emerging economies. Furthermore, our evidence highlights the crucial role of sovereign bond in Asia, which is mainly driven by the U.S. economy. Asian economies appear to be heavily depending on U.S., which in turn implies that when a shock is coming from the U.S., its affect can be continuous in the medium and long run.

Yet there is no doubt that the recent financial markets turmoil puts this discussion on a new basis. Further research could focus on the role of risk aversion under different economies characteristics, e.g. under different exchange rate regime or under different macroeconomic fundamental, those results would give policy maker more insight on the best strategy to response for risk aversion shocks.

REFERENCES

Arora, V. and M. Cerisola, (2001), "How does U.S. monetary policy influence sovereign spreads in emerging markets?" *IMF Staff Papers*, Vol. 48, pp. 474-498.

Blanchard, O., (2005), "Fiscal Dominance and Inflation Targeting. Lessons from Brazil", In Giavezzi, F., Goldfajn I. and S. Herrera (Eds.), *Inflation Targeting, Debt, and the Brazilian Experience, 1999 to 2003*, Cambridge: MIT Press.

Diaz, W.D and G. Gemmill, (2006), "What drives credit risk in emerging markets? The roles of country fundamentals and market co-movements" *Journal of International Money and Finance,* Vol. 25 (3), pp.476-502.

Dungey, M., Fry, R., González-Hermosillo, B. and V. L. Martin, (2004), "Characterizing Global Investors' Risk Appetite for Emerging Market Debt during Financial Crises", *IMF Working Paper*, No. 03/251.

Edwards, S., (1984), "LDC Foreign Borrowing and DEFAULT Risk: An Empirical Investigation 1976-1980", *American Economic Review*, Vol. 74, pp.726-734.

Eichengreen, B. and A. Mody, (1998), "What explains changing spreads on emerging-market debt: fundamentals or market sentiment?", *NBER working paper*, No 6408.

Eichler,S. and D. Maltritz, (2012), "The term structure of sovereign default risk in EMU member countries and its determinants", *Journal of Banking & Finance, Forthcoming*.

Fracasso, A., (2007), "The role of foreign and domestic factors in the evolution of the Brazilian EMBI spread and debt dynamics", HEI Working Paper No: 22/2007.

Garcia-Herrero A. and A. Ortiz, (2006), "The role of global risk aversion in explaining Latin American sovereign spreads", *Economía*, Vol. 7 (1), pp. 125-155.

Grandes, M., (2003), "Convergence and Divergence of Sovereign Bond Spreads: Theory and Facts from Latin America", Paris, France: Delta, ENS/EHES.

Min, Hong G., (1998), "Determinants of Emerging Market Bond Spread: Do Economic Fundamentals Matter?", *Policy Research Working Paper* No. WPS 1899, The World Bank, Washington D.C.

Sims, C., J. Stock, and M. Watson, (1990), "Inference in linear time series models with some unit roots," *Econometrica, Econometric Society*, Vol. 58 (1), pp. 113-144.

Sims, C., (1980), "Macroeconomics and reality", *Econometrica, Economometric Society*, Vol.48 (1), pp.1-48.

Obstfeld, M, and K. Rogoff, (1996), *Foundations of international macroeconomics*, Cambridge MA: MIT Press.

Uribe, M. and V.Z. Yue, (2006), "Country spreads and emerging countries: who drives whom?", *Journal of International Economics*, Vol. 69 (1), pp. 6-36, and *NBER Working Paper* 10018.

Zhou, H., (2010), "Variance Risk Premia, Asset Predictability Puzzles, and Macroeconomic Uncertainty", *Finance and Economics Discussion Series*, 2010-14, Board of Governors of the Federal Reserve System (U.S.).

Appendix A: Theoretical model statics

From equilibrium condition (6)

$$F_1 = C\{1 + r - \varepsilon^{\eta-1}(1 + r^{US}) - (1-\lambda)\theta^* p\} + N(\varepsilon) = 0 \quad (6)$$

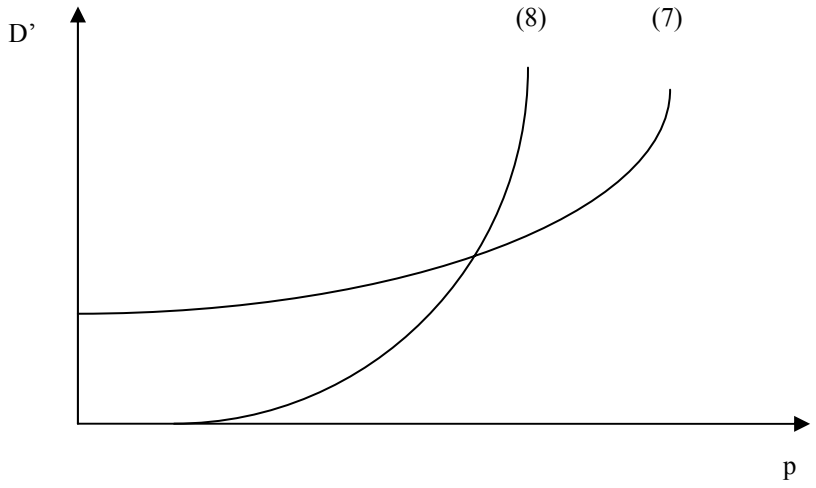
By using implicit function theorem:

$$\frac{\partial \varepsilon}{\partial p} = -\frac{\frac{\partial F_1}{\partial p}}{\frac{\partial F_1}{\partial \varepsilon}} = -\frac{-(1-\lambda)\theta^* C'}{-(\eta-1)\varepsilon^{\eta-2}(1+r^{US})C' + N'} > 0$$

Recall equilibrium condition (7) and (8)

$$D' = (\frac{1+r^{US}}{1-p} + \frac{\theta^* p}{1-p})D^{\$}\varepsilon^{\eta} - R \quad (7)$$

$$U(Y_G - D') - U(Y_B) = m(1-p) \quad (8)$$



Second order condition for (7) and (8)

$$1dD' - D^{\$}[(\frac{1+r^{US}+\theta^*}{(1-p)^2})\varepsilon^{\eta} + \eta(\frac{1+r^{US}}{1-p} + \frac{\theta^* p}{1-p})\varepsilon^{\eta-1}\frac{\partial \varepsilon}{\partial p}]dp = \frac{D^{\$}\varepsilon^{\eta}}{1-p}dr^{US} + \frac{pD^{\$}\varepsilon^{\eta}}{1-p}d\theta^*$$

$$-U'dD' + mdp = 0dr^{US} + 0d\theta^*$$

The Jacobian determinant is

$$|J| = \begin{vmatrix} 1 & -D^{\$}[(\frac{1+r^{US}+\theta^{*}}{(1-p)^{2}})\varepsilon^{\eta} + \eta(\frac{1+r^{US}}{1-p} + \frac{\theta^{*}p}{1-p})\varepsilon^{\eta-1}\frac{\partial\varepsilon}{\partial p}] \\ -U' & m \end{vmatrix} > 0$$

Since the above graph shows that the equilibrium can only exist if the gradient of (7) is smaller than (8), then the Jacobian determinant has to be bigger than zero.

$$\frac{\partial D'}{\partial r^{US}} = \frac{\begin{vmatrix} \frac{D^{\$}\varepsilon^{\eta}}{1-p} & -D^{\$}[(\frac{1+r^{US}+\theta^{*}}{(1-p)^{2}})\varepsilon^{\eta} + \eta(\frac{1+r^{US}}{1-p} + \frac{\theta^{*}p}{1-p})\varepsilon^{\eta-1}\frac{\partial\varepsilon}{\partial p}] \\ 0 & m \end{vmatrix}}{|J|} = \frac{m\frac{D^{\$}\varepsilon^{\eta}}{1-p}}{|J|} > 0$$

$$\frac{\partial D'}{\partial \theta^{*}} = \frac{\begin{vmatrix} \frac{pD^{\$}\varepsilon^{\eta}}{1-p} & -D^{\$}[(\frac{1+r^{US}+\theta^{*}}{(1-p)^{2}})\varepsilon^{\eta} + \eta(\frac{1+r^{US}}{1-p} + \frac{\theta^{*}p}{1-p})\varepsilon^{\eta-1}\frac{\partial\varepsilon}{\partial p}] \\ 0 & m \end{vmatrix}}{|J|} = \frac{m\frac{pD^{\$}\varepsilon^{\eta}}{1-p}}{|J|} > 0$$

$$\frac{\partial p}{\partial r^{US}} = \frac{\begin{vmatrix} 1 & \frac{D^{\$}\varepsilon^{\eta}}{1-p} \\ -U' & 0 \end{vmatrix}}{|J|} = \frac{U'\frac{D^{\$}\varepsilon^{\eta}}{1-p}}{|J|} > 0$$

$$\frac{\partial p}{\partial \theta^{*}} = \frac{\begin{vmatrix} 1 & \frac{pD^{\$}\varepsilon^{\eta}}{1-p} \\ -U' & 0 \end{vmatrix}}{|J|} = \frac{U'\frac{pD^{\$}\varepsilon^{\eta}}{1-p}}{|J|} > 0$$

Appendix B

Table B

Selected Studies on Sovereign Spread

Author (publication date)	Period under study	Sample	Methodology	Main Findings
Edwards (1984)	1976-1980	727 public and publically guaranteed Eurodollar loans	Panel regression	Spreads are determined by the debt to GNP and the dept service rations, as well as by the propensity to invest.
Min (1998)	1991-1995	11 Emerging countries	Panel regression	Spreads are determined by the debt-to-GDP, reserves-to-GDP and debt-service-to exports ratios, as well as by the import-export growth rates, the inflation rate, the net foreign assets, the terms of trade and the real exchange rate.
Eichengreen and Mody (1998)	1991-1996	1,000 developing country bonds	Panel regression	The launch spreads depend on the issue size, the credit rating of the issuer, and the debt-to-GDP and the debt-service-to-exports rations.
Arora and Cerisola (2001)	1994-1999	11 Emerging countries	OLS and ARCH methods	Country-specific fundamentals are important in explaining the fluctuations in country risk and domestic interest rate, while the level of U.S. interest rates has a direct positive effect on sovereign bond spreads.
Dungey et al. (2004)	Russian crisis; LTCM crisis; Brazilian crisis	9 Emerging countries	SVAR method	Russian crisis is characterized by a sharp increase in global credit risk, while the relative size of global risk factors is mixed for the Brazilian crisis.

Garcia-Herrero and Ortiz (2006)	1994-2003	9 Latin American countries	SVAR method	U.S. growth and interest rate have a direct effect on sovereign spread and an indirect effect via global risk aversion. Global risk aversion shows a positive and significant relation to Latin American sovereign spreads.
Diaz and Gemmill (2006)	1994-2001	4 Latin American countries	OLS regression	Credit risk is mainly driven by systematic global and regional factors, implying that credit risk should be treated as non-diversifiable.
Uribe and Yue (2006)	1994-2001	7 emerging countries	Panel VAR method	Sovereign spreads affect aggregate activity; while at the same time respond to domestic macroeconomic fundamentals.
Fracasso (2007)	1995-2004	Brazil	VAR method	Brazilian series, in particular EMBI spread and external debt, are strongly affected by foreign exogenous innovations.
Eichler and Maltritz (2012)	1999-2009	EMU member states	Panel regression	Economic growth and countries' openness are significant determinants of government bond yield spread for all maturities. The countries' debt to GDP ratio is significant for short term default risk, whereas net lending, interest rate costs and trade balance are significant for long term default risk.

Table 1
Variables employed in the model estimation

Symbol	Definition	Calculation	Description and sources
External variables			
TERM STRUCTURE	Term structure of U.S. interest	Yield of 20 U.S. years Treasury notes minus yield of 2 years U.S. Treasury notes	Proxy for future short-term interest rate and future U.S. economy (source: DataStream)
CBS	BAA corporate bond spread	Yield of U.S.-BAA bond minus yield of 10 years U.S. Treasury notes	Proxy for global investor's risk aversion. The higher the global investor's risk aversion, the higher premium required (source: DataStream)
VRP	Variance risk premium	Difference between the implied and expected VIX	Proxy for global investor's risk aversion. The higher the global investor's risk aversion, the higher premium required (source: Federal Reserve System; Zhou, 2010)
DOLLAR	Dollar Index	Weighted average measure of Dollar against major currencies.	Proxy for the real value changed of Dollar (source: DataStream)
Internal variables			
TRADE/GDP	Trade balance to GDP ratio	(trade balance * exchange rate)/GDP	Proxy for domestic liquidity conditions (source: DataStream)
DEBT/GDP	Debt to GDP ratio	(Debt*exchange rate)/GDP	Proxy for domestic solvency conditions (source: DataStream)
LOGSPREAD	Logspread	Log to the level of EMBI Global index	Proxy for the cost of borrowing (source: DataStream)

Table 2

Raw data sample size and frequency

Country	Sample size	Variable	Data Frequency
U.S.	Jan.1995-Sep 2009	Yield of 2 years treasury note	Monthly
		Yield of 10 years treasury note	Monthly
		Yield of 20 years treasury note	Monthly
		Yield of U.S.-BASS bond	Monthly
		Variance risk premium	Monthly
		Dollar index	Monthly
China	Jan.1995-Sep.2009	GDP	Quarterly
		Trade balance	Monthly
		External debt	Yearly
		Nominal exchange rate	Monthly
		EMBI Global Index	Monthly
Malaysia	Nov.1996-Sep.2009	GDP	Quarterly
		Trade balance	Monthly
		External debt	Monthly
		Nominal exchange rate	Monthly
		EMBI Global Index	Monthly
Philippines	Jan.1998 to Sep.2009	GDP	Quarterly
		Trade balance	Monthly
		External debt	Quarterly
		Nominal exchange rate	Monthly
		EMBI Global Index	Monthly
Indonesia	Jun.2004-Sep.2009	GDP	Quarterly
		Nominal exchange rate	Monthly
		Trade balance	Monthly
		External debt	Quarterly
		EMBI Global Index	Monthly

Source: All data are from DataStream. Data for the VRP variable is from the Federal Reserve System, Zhou (2010).

Table 3
Selected descriptive statistics of the variables employed in the model

U.S.					
Variable	**Mean**	**Std. Dev.**	**Median**	**Observations**	**Stationarity**
TERM STRUCTURE	1.39	1.12	0.90	177	I(0)
CBS	2.35	0.91	2.07	177	I(1)
VRP	18.31	22.91	14.49	177	I(0)
DOLLAR	110.80	10.13	111.19	177	I(1)
China					
Variable	**Mean**	**Std. Dev.**	**Median**	**Observations**	**Stationarity**
TRADE/GDP	0.036	0.027	0.031	177	I(0)
DEBT/GDP	1.448	0.267	1.442	177	I(1)
LOGSPREAD	4.575	0.441	4.610	177	I(0)
Malaysia					
Variable	**Mean**	**Std. Dev.**	**Median**	**Observations**	**Stationarity**
TRADE/GDP	0.163	0.065	0.170	155	I(0)
DEBT/GDP	1.688	0.331	1.691	155	I(1)
LOGSPREAD	5.051	0.614	5.081	155	I(0)
Philippines					
Variable	**Mean**	**Std. Dev.**	**Median**	**Observations**	**Stationarity**
TRADE/GDP	-0.039	0.099	-0.058	141	I(0)
DEBT/GDP	11.691	3.158	12.650	141	I(1)
LOGSPREAD	5.944	0.389	5.999	141	I(0)
Indonesia					
Variable	**Mean**	**Std. Dev.**	**Median**	**Observations**	**Stationarity**
TRADE/GDP	0.075	0.041	0.092	64	I(0)
DEBT/GDP	4.371	1.035	3.979	64	I(1)
LOGSPREAD	5.684	0.456	5.624	64	I(0)

Sources: All date are from DataStream. Data for the VRP variable is from the Federal Reserve System, Zhou (2010). The TERM STRUCTURE and CBS variables are measured in %.

Notes: TERM STRUCTURE= Term structure of U.S. interest rate; CBS= BAA Corporate Bond Spread; VRP= Variance Risk Premium; Dollar= Dollar Index; TRADE/GDP= Trade balance to GDP ratio; DEBT/GDP= Debt to GDP ratio; LOGSPREAD= Log to the level of EMBI Global index.

Table 4
Contribution of all variables to the forecasting error variance of sovereign spread

Malaysia	Horizon	TERM STRUTURE	CBS	VRP	DOLLAR	Aggregate Foreign Factor	TRADE/GDP	DEBT/GDP
	1	8.35	24.00	1.45	8.52	42.31	2.53	2.83
	6	11.53	5.77	9.52	10.76	37.57	5.41	9.66
	12	8.67	9.76	24.86	10.39	53.68	3.71	9.18
	18	7.53	15.82	27.61	9.40	60.36	7.94	6.95
	24	9.20	17.15	26.77	10.66	63.78	7.55	6.57
Indonesia	Horizon	TERM STRUTURE	CBS	VRP	DOLLAR	Aggregate Foreign Factor	TRADE/GDP	DEBT/GDP
	1	35.48	0.28	4.33	8.18	48.26	0.85	1.72
	6	39.93	10.81	2.54	8.74	62.02	5.28	1.40
	12	38.32	12.77	6.21	7.09	64.39	12.24	1.99
	18	36.85	23.74	9.20	5.34	75.13	7.60	2.32
	24	24.68	36.79	6.14	3.20	70.82	4.94	1.61
China	Horizon	TERM STRUTURE	CBS	VRP	DOLLAR	Aggregate Foreign Factor	TRADE/GDP	DEBT/GDP
	1	1.31	13.24	1.09	0.07	15.71	2.28	1.76
	6	3.63	16.41	2.50	6.98	29.52	4.65	4.99
	12	11.29	15.14	3.65	9.02	39.10	2.69	9.83
	18	15.58	11.45	9.78	9.89	46.69	3.02	13.82
	24	19.77	9.79	11.05	12.84	53.44	4.48	11.81
Philippines	Horizon	TERM STRUTURE	CBS	VRP	DOLLAR	Aggregate Foreign Factor	TRADE/GDP	DEBT/GDP
	1	19.51	12.99	0.66	0.47	33.63	0.38	19.63
	6	43.51	5.85	5.58	13.65	68.59	2.71	5.99
	12	27.09	8.87	8.66	13.18	57.80	26.82	5.51
	18	23.37	10.80	12.16	11.93	58.25	26.89	6.05
	24	21.42	9.61	13.21	14.19	58.43	27.26	5.53

Sources: All date are from DataStream. Data for the VRP variable is from the Federal Reserve System, Zhou (2010). The TERM STRUCTURE and CBS variables are measured in %.
Notes: TERM STRUCTURE= Term structure of U.S. interest rate, CBS= BAA Corporate Bond Spread, VRP= Variance Risk Premium, Dollar= Dollar Index, Aggregate Foreign Factor= TERM STRUCRURE+CBS+VRP+DOLLAR, TRADE/GDP= Trade balance to GDP ratio, and DEBT/GDP=debt to GDP ratio.

Table 5
Aggregate contribution of U.S. variables to the forecasting error variance of TRADE/GDP ratio

Malaysia	Horizon	TERM STRUCTURE	CBS	VRP	DOLLAR	Aggregate Foreign Factor
	1	0.01	0.60	4.33	5.29	10.24
	6	2.18	10.96	12.50	6.03	31.68
	12	3.05	15.04	11.53	7.53	37.15
	18	2.84	14.04	25.71	8.47	51.05
	24	5.43	14.19	26.90	8.41	54.93
Indonesia	Horizon	TERM STRUCTURE	CBS	VRP	DOLLAR	Aggregate Foreign Factor
	1	18.81	0.78	7.72	0.48	27.79
	6	39.15	3.96	11.67	3.48	58.25
	12	43.99	17.63	9.59	3.09	74.30
	18	32.56	29.43	5.89	2.29	70.17
	24	26.11	37.33	4.32	1.63	69.40
China	Horizon	TERM STRUCTURE	CBS	VRP	DOLLAR	Aggregate Foreign Factor
	1	0.00	2.74	0.04	2.27	5.05
	6	15.56	6.50	1.83	3.43	27.33
	12	23.97	5.33	3.84	4.93	38.07
	18	21.45	8.33	7.74	6.70	44.22
	24	17.39	9.32	9.61	9.16	45.48
Philippines	Horizon	TERM STRUCTURE	CBS	VRP	DOLLAR	Aggregate Foreign Factor
	1	0.69	0.26	0.26	0.18	1.39
	6	29.16	8.70	6.40	7.34	51.60
	12	30.60	18.99	6.62	13.54	69.74
	18	28.05	17.09	7.87	15.45	68.46
	24	26.20	18.02	8.16	16.66	69.04

Sources: Data for the VRP variable is from the Federal Reserve System, Zhou (2010). The TERM STRUCTURE and CBS variables are measured in %.
Notes: TERM STRUCTURE= Term structure of U.S. interest rate, CBS= BAA Corporate Bond Spread, VRP= Variance Risk Premium, Dollar= Dollar Index, Aggregate Foreign Factor= TERM STRUCRURE+CBS+VRP+DOLLAR.

Table 6
Contribution of U.S. variables to the forecasting error variance of DEBT/GDP ratio

Malaysia	Horizon	TERM STRUCTURE	CBS	VRP	DOLLAR	Aggregate Foreign Factor
	1	15.12	0.24	0.26	8.33	23.96
	6	13.29	7.45	11.23	14.06	46.03
	12	11.83	9.76	10.87	14.20	46.66
	18	12.79	10.96	14.82	11.47	50.04
	24	16.22	10.11	19.21	9.61	55.14
Indonesia	Horizon	TERM STRUCTURE	CBS	VRP	DOLLAR	Aggregate Foreign Factor
	1	32.85	13.32	23.52	1.09	70.78
	6	31.06	15.97	19.56	5.54	72.13
	12	31.13	12.47	16.02	8.30	67.92
	18	29.26	15.36	14.76	8.97	68.36
	24	27.44	14.62	14.57	8.94	65.57
China	Horizon	TERM STRUCTURE	CBS	VRP	DOLLAR	Aggregate Foreign Factor
	1	0.19	1.29	1.22	0.10	2.80
	6	0.32	3.86	3.08	6.57	13.84
	12	4.82	17.14	4.86	6.33	33.15
	18	4.97	17.10	15.84	7.40	45.31
	24	12.37	17.72	15.80	8.08	53.96
Philippines	Horizon	TERM STRUCTURE	CBS	VRP	DOLLAR	Aggregate Foreign Factor
	1	0.01	0.38	6.64	7.44	14.46
	6	5.02	4.43	7.80	11.82	29.06
	12	8.73	12.17	7.33	10.60	38.83
	18	8.69	12.74	7.13	11.29	39.85
	24	18.56	16.77	8.13	10.35	53.81

Sources: Data for the VRP variable is from the Federal Reserve System, Zhou (2010). The TERM STRUCTURE and CBS variables are measured in %.
Notes: TERM STRUCTURE= Term structure of U.S. interest rate, CBS= BAA Corporate Bond Spread, VRP= Variance Risk Premium, Dollar= Dollar Index, Aggregate Foreign Factor= TERM STRUCRURE+CBS+VRP+DOLLAR.

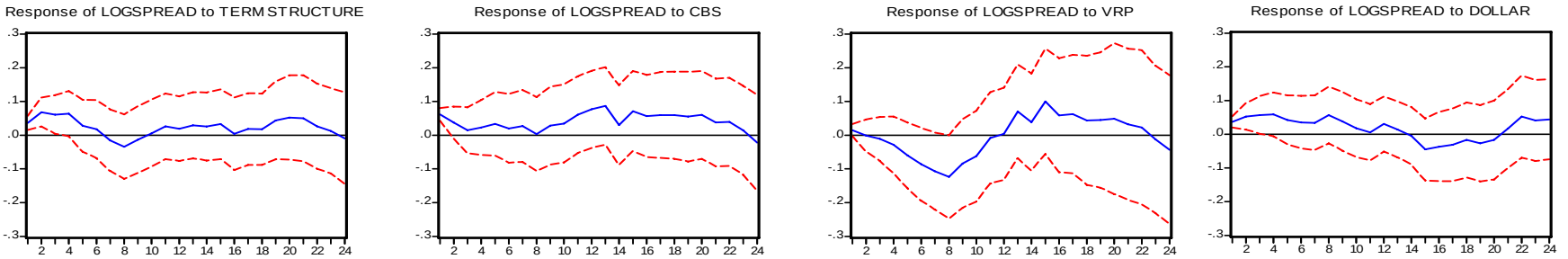
Table 7
Contribution of sovereign spread to the forecasting error variance of domestic variables

Malaysia	Horizon	TRADE/GDP	DEBT/GDP
	1	0.00	0.00
	6	4.52	4.90
	12	8.03	10.20
	18	8.37	12.66
	24	8.32	12.62
Indonesia	Horizon	TRADE/GDP	DEBT/GDP
	1	0.00	0.00
	6	3.89	5.27
	12	5.53	10.81
	18	16.45	10.32
	24	20.84	11.51
China	Horizon	TRADE/GDP	DEBT/GDP
	1	0.00	0.00
	6	11.88	14.16
	12	13.23	7.86
	18	11.58	12.87
	24	12.45	11.98
Philippines	Horizon	TRADE/GDP	DEBT/GDP
	1	0.00	0.00
	6	3.47	6.97
	12	3.12	9.65
	18	5.42	10.38
	24	6.51	9.02

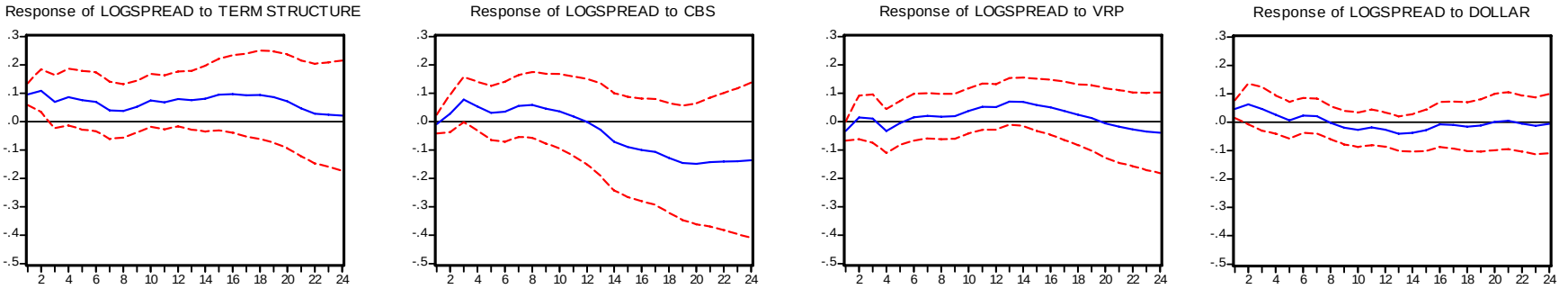
Sources: All date are from DataStream.
Notes: TRADE/GDP= Trade balance to GDP ratio and DEBT/GDP= Debt to GDP ratio.

Figure 1
Impulse response of sovereign spread to U.S. variable shocks

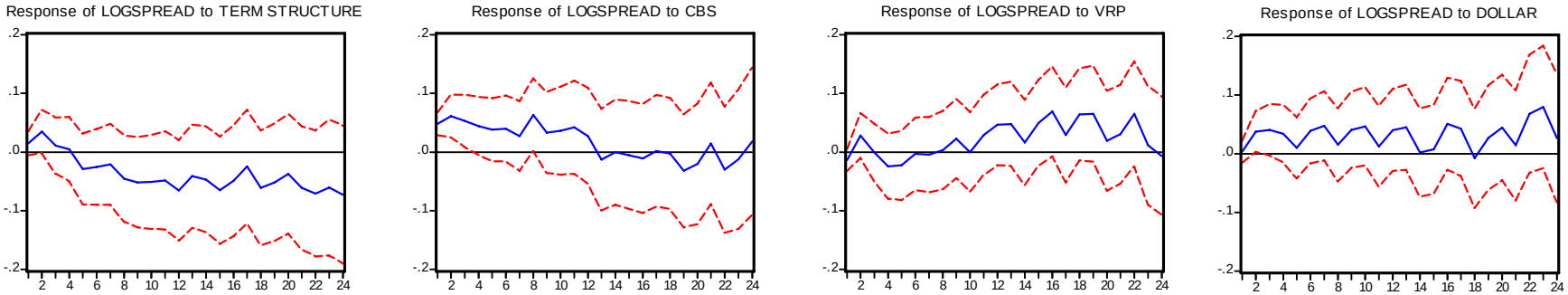
Malaysia



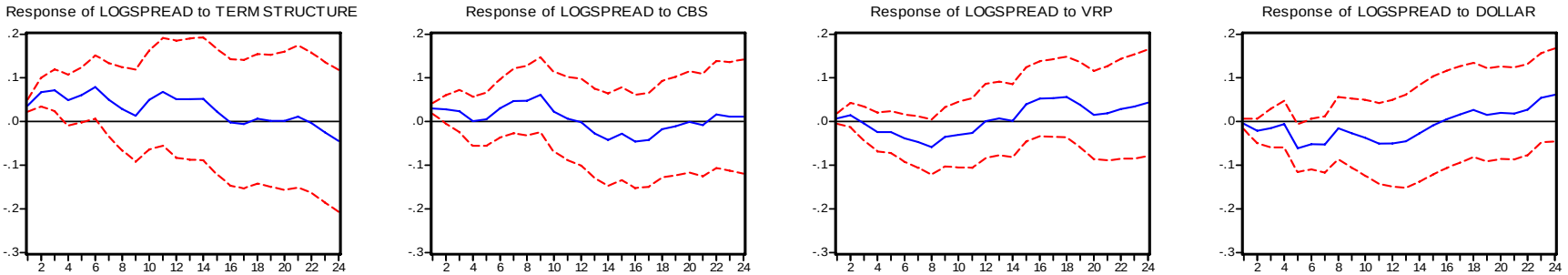
Indonesia



China



Philippines



Notes: solid lines depict point estimates of impulse response, and dotted lines depict 95% confident interval.