

Exchange rate uncertainty and economic fluctuations in typical emerging economies

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ABSTRACT

This paper examines the role of Exchange Rate Uncertainty (ERU) in driving economic fluctuations in emerging economies using a VAR with stochastic volatility in the mean. We use the quarterly data of three typical emerging economies from 1972Q3 to 2009Q4 within a VAR model. We show that ERU plays a vital role in driving the business cycles of emerging economies. First, an ERU can provoke risks in the financial market and the real economy. Second, ERU hurts equity prices and the output growth of emerging economies. Further investigation shows that the adverse effects of ERU on output are more severe under the fixed exchange rate regime than under the flexible exchange rate regime. This finding implies that adopting the flexible exchange rate regime can help emerging economies mitigate the adverse effects of uncertainty shocks.

1. Introduction

Exchange rate policy plays a crucial role in emerging economies because the economy strongly depends on international trade and capital flows. The large swings in the exchange rate market can trigger instability in the financial markets, banking system, and, thus, the real economy (Nordstrom et al., 2009). After the 2008 - 2009 global financial crisis, uncertainty has emerged as a driver in driving the fluctuations of the global economy. For this reason, a growing literature has analyzed the macroeconomic effects of the various types of uncertainty, such as monetary policy uncertainty (Husted, Rogers, & Sun, 2019), macroeconomic uncertainty (Jurado, Ludvigson, & Ng, 2015), trade policy uncertainty (Caldara, Iacoviello, Molloy, Prestipino, & Raffo, 2020), and economic policy uncertainty (Baker, Bloom, & Davis, 2016). The economic impacts of ERU, in particular on emerging economies, have received great attention in the empirical literature, for example, output and investment (Aghion, Bacchetta, Rancière, & Rogoff, 2009; Servén, 2003), trade volumes (Arize, Osang, & Slottje, 2000; Bahmani-Oskooee & Gelan, 2018; Caballero & Corbo, 1989; Sugiharti, Esquivias, & Setyorani, 2020), and unemployment (Demir, 2010). However, almost all the previous studies often used exchange rate volatility as a measure for ERU. However, the exchange rate can alter over time for many reasons rather than changes in uncertainty (e.g., risk aversion, the leverage effects) (Ozturk & Sheng, 2018). Therefore, the exchange rate volatility used in the previous literature is not a good proxy for ERU and is not consistent with the theoretical concept of uncertainty as shown in Jurado et al. (2015). As a result, this literature has provided conflicting and ambiguous results regarding the effects of ERU (Tavlas, Dellas, &

Stockman, 2008). In this paper, we improve the measure of ERU by using a Bayesian VAR model with stochastic volatility in the mean and then re-examine its role in driving economic fluctuations in emerging economies.

Our study is first related to the literature on quantifying the macroeconomic effects of uncertainty in general. This literature has found robust evidence of the adverse impacts of the different types of uncertainty shocks on the real economy, for instance, economic policy uncertainty (Baker et al., 2016), trade policy uncertainty (Caldara et al., 2020), monetary policy uncertainty (Husted et al., 2019), and macroeconomic policy uncertainty (Jurado et al., 2015). Our paper contributes to this literature by examining the role of ERU in explaining the macroeconomic fluctuations of emerging economies. In general, we find that an ERU shock significantly hurts the output growth of emerging economies. This effect is more severe under the fixed exchange rate regime.

Second, our study is related to the literature on quantifying the effects of ERU. This literature has argued various channels through which ERU can affect the real economy, for instance, trade flow (Rahman & Serletis, 2009), investment (Servén, 2003), and economic growth (Aghion et al., 2009; Amuedo-Dorantes & Pozo, 2001). However, this literature has provided conflicting and ambiguous results regarding the effects of ERU (Tavlas et al., 2008). This can stem from the problem of ERU measures. Indeed, almost all the previous studies often measure the ERU by using exchange rate volatility that is often estimated based on GARCH-type models. However, such models cannot separate uncertainty estimates from the first-moment shock (Ozturk & Sheng, 2018). Indeed, the exchange rate can alter over time for many reasons rather than changes in uncertainty (e.g., risk aversion, the leverage effects). Therefore, the measure of ERU by using exchange rate volatility is inconsistent with the theoretical concept of uncertainty (Jurado et al., 2015). We extend this literature by modeling ERU based on a Bayesian VAR model with stochastic volatility in the mean. This model allows a shock to the second moment that is independent of the first moment, thus separating the ERU estimates from the first-moment shocks (Ozturk & Sheng, 2018). Our ERU measure is better than the previous studies and is consistent with the spirit of measuring uncertainty proposed by Jurado et al. (2015); Fernández-Villaverde, Guerrón-Quintana, Rubio-Ramírez, and Uribe (2011). This implies that the exchange rate becomes more uncertain when it becomes less predictable (Jurado et al., 2015).

The rest of this paper is organized as follows. Section 2 is the related literature. Section 3 is the empirical model and data. Section 4 presents empirical results and discussions. Section 5 is the robustness analysis, and the conclusions and policy implications are presented in Section 6.

2. Related literature

The literature has provided various channels through which exchange rate volatility/uncertainty can affect the real economy. Almost all the studies in this literature have focused on the effects of exchange rate volatility on international trade. From a theoretical perspective, if economic agents are risk-averse, the large fluctuations in exchange rates increase uncertainty and thus raise the cost of conducting international trade. As a result, exchange rate volatility/uncertainty dampens international trade (Arize, Osang, & Slottje, 2008; Caballero & Corbo, 1989; Perée & Steinherr, 1989; Rahman & Serletis, 2009). However, other studies found negative impacts and even no effects (see Barkoulas, Baum, & Caglayan, 2002).

Exchange rate volatility can also hurt domestic consumption. Obstfeld and Rogoff (1998) argued that exchange rate volatility creates uncertainty about prices, and importing firms can

charge higher prices, leading to a significant reduction in domestic consumption (Iyke & Ho, 2020). Bahmani-Oskooee, Kutan, and Xi (2015) further emphasized that exchange rate volatility creates uncertainty about inflation, thus distorting domestic consumption.

Exchange rate volatility can affect the real economy as suggested by the theory of “real option” effects of uncertainty (Bernanke, 1983; Bloom, 2009). Theoretically, exchange rate volatility can generate uncertainty, and thus firms are reluctant to postpone their investment (Aghion et al., 2009; Atella, Atzeni, & Belvisi, 2003; Binding & Dibiasi, 2017; Darby, Hallett, Ireland, & Piscitelli, 1999; Servén, 2003), and thus also hurt employment (Demir, 2010; Feldmann, 2011) and economic growth (Aghion et al., 2009; Amuedo-Dorantes & Pozo, 2001; Arratibel, Furceri, Martin, & Zdzienicka, 2011). However, other studies suggested that exchange rate variability could favor growth because it works as a shock absorber when prices and wages are sticky in the short run (Bleaney & Francisco, 2007; Levy-Yeyati & Sturzenegger, 2003; Rose, 2011).

Exchange rate volatility also affects the international capital inflows to emerging economies. Kiyota and Urata (2004) examined the effects of exchange rate volatility on foreign direct investment and found negative effects. However, Görg and Wakelin (2002) found no impacts. Differently, Fidora, Fratzscher, and Thimann (2007) examined the effects of ERU on portfolio capital flows to emerging economies, and they argued that exchange rate volatility increases international transaction costs and, thus, the acquisition of foreign securities such as bonds and equities becomes riskier. As a result, risk-averse investors prefer domestic to foreign securities to mitigate their vulnerabilities to uncertainty. The recent work of Caporale, Ali, Spagnolo, and Spagnolo (2017) confirmed the arguments of Fidora et al. (2007) when they found that ERU harms portfolio capital flows to emerging economies.

3. Empirical model and data

We employ a VAR model with stochastic volatility in the mean as follows:

$$Z_t = c + \sum_{j=1}^P \beta_j Z_{t-j} + \sum_{k=0}^K \phi_k \tilde{h}_{t-k} + \Omega^{1/2} e_t \quad (1)$$

$$\Omega = A^{-1} H_t A^{-1} \quad (2)$$

$$\tilde{h}_t = \alpha + \theta \tilde{h}_{t-1} + S^{1/2} \eta_t, \eta_t \sim N(0, I_N), E(e_t, \eta_t) = 0 \quad (3)$$

Equation (1) is the VAR model of the endogenous variables (Z). However, it is different from the standard VAR model by adding the log volatility of the structural shocks ($\hat{h}_t$) on the right-hand side. The advantage of this approach is that it allows us to examine the effects of a shock on the volatility of structural shocks on the endogenous variables (Z) in the VAR (Mumtaz & Surico, 2018). Equation (2) specifies the structural shocks in the VAR. In particular, H is a diagonal matrix with $\exp(h_{1t}, h_{2t}, \dots, h_{Nt})$ on its main diagonal while A is a lower triangular matrix with ones on its main diagonal. Equation (3) is the stochastic volatility of structural shocks. Given the estimated parameters from equation (1) - (3), we can compute the impulse responses of the endogenous variables (Z) in equation (1) following a shock to the volatility equation η_t in equation (3) (Mumtaz & Theodoridis, 2020).

Our model consists of two innovations. First, all real and financial uncertainty/volatility ($\hat{h}_t$) are incorporated in the observed equation (1). This approach allows us to obtain the pure

effects of ERU while separating the impacts of other types of uncertainty. Second, almost all the papers in this literature often estimate ERU using the GARCH-type models. However, such models cannot separate uncertainty estimates from the first-moment shocks (Ozturk & Sheng, 2018). Our model is different by allowing a shock to the second-moment to separate uncertainty estimates from the first-moment shocks as shown in Jurado et al. (2015). Note that the estimate $\hat{h}_t$ in Equation 3 includes the time-varying volatility of the unpredictable components of the exchange rate movements, which is our proxy for ERU. Our measure for ERU is consistent with the spirit of measuring uncertainty in Jurado et al. (2015). In other words, our ERU measure implies that the exchange rate becomes more uncertain when it becomes less predictable (Jurado et al., 2015).

Equations (1) to (3) are estimated using Bayesian method. Gibbs sampling algorithms are summarized as follows. We first draw the conditional posterior distribution of parameters $\Gamma=[c, \beta, \phi]$ of the VAR using the algorithm proposed by Carter and Kohn (1994). The second step is to estimate matrix A using a series of linear regression models amongst the elements of the residual matrix. The parameters θ_i and variances S_i in equation (3) can be drawn using standard linear regressions. The final step is to simulate stochastic volatility $\tilde{h}_t$ using the particle Gibbs sampling proposed by Andrieu, Doucet, and Holenstein (2010). Steps 1 to 3 are replicated 15,000 times and retain only the last 5,000 replications for our empirical results.

We use the data of three typical emerging economies, including Thailand, Argentina, and Chile. These countries are selected due to data available for long periods. The data is spanned from 1979Q3-2019Q4. Due to a short data sample, we use two lags for the VAR and one lag for the volatility as suggested by Mumtaz and Zanetti (2013). The endogenous variables in the VAR are real exchange rate (EX), real output (GDP), short-term interest rate, and real equity price (EQ), which are measured as follows:

$$Y = \ln(GDP_t) - \ln(GDP_{t-1}) \quad (4)$$

$$EX = \ln(EP_t / CPI_t) - \ln(EP_{t-1} / CPI_{t-1}) \quad (5)$$

$$R = 0.25 \ln(1 + r / 100) \quad (6)$$

$$EQ = \ln(eq_t / CPI_t) - \ln(eq_{t-1} / CPI_{t-1}) \quad (7)$$

Where GDP is the real GDP index (2015 = 100). EP is the nominal exchange rate per U.S. dollar. r is the policy rate while eq is the equity price¹.

We examine the effects of ERU using the standard Cholesky decomposition. We order the variables as follows: Real output growth (Y), Real exchange rate (EX), real equity price (EQ), and short-term interest rate (R). We place the output first because of its slow movement as suggested by Husted et al. (2019). Because financial variables are more sensitive to uncertainty shock (Bloom, 2009), we order the variable of the real equity price (EQ) after the variable of the exchange rate (EX). Finally, we place the interest rate (R) last, allowing the central bank to stabilize the economy using its monetary policy. It is striking to note that our results still hold when using alternative orders.

¹ All the data is obtained from the global VAR database provided by Mohaddes and Raissi (2020). All the variables are stationary. The unit root tests are available upon request

4. Empirical results and discussions

Figure 1 plots the ERU index for each country in our sample, which is estimated using equation (1) - (3). We find that the measure for ERU is quite a good fit for the ERU events in each country. For instance, for Argentina, ERU jumps up the high degrees during the hyperinflation periods of 1987 and 1990, the 2001 recession, and the 2018 economic crisis. For Chile, ERU reaches the highest levels during the 2008 - 2009 global financial crisis. For Thailand, ERU jumps up to the highest degrees during the Asian financial crisis of 1997 - 1998, and the 2008 - 2009 global financial crisis.

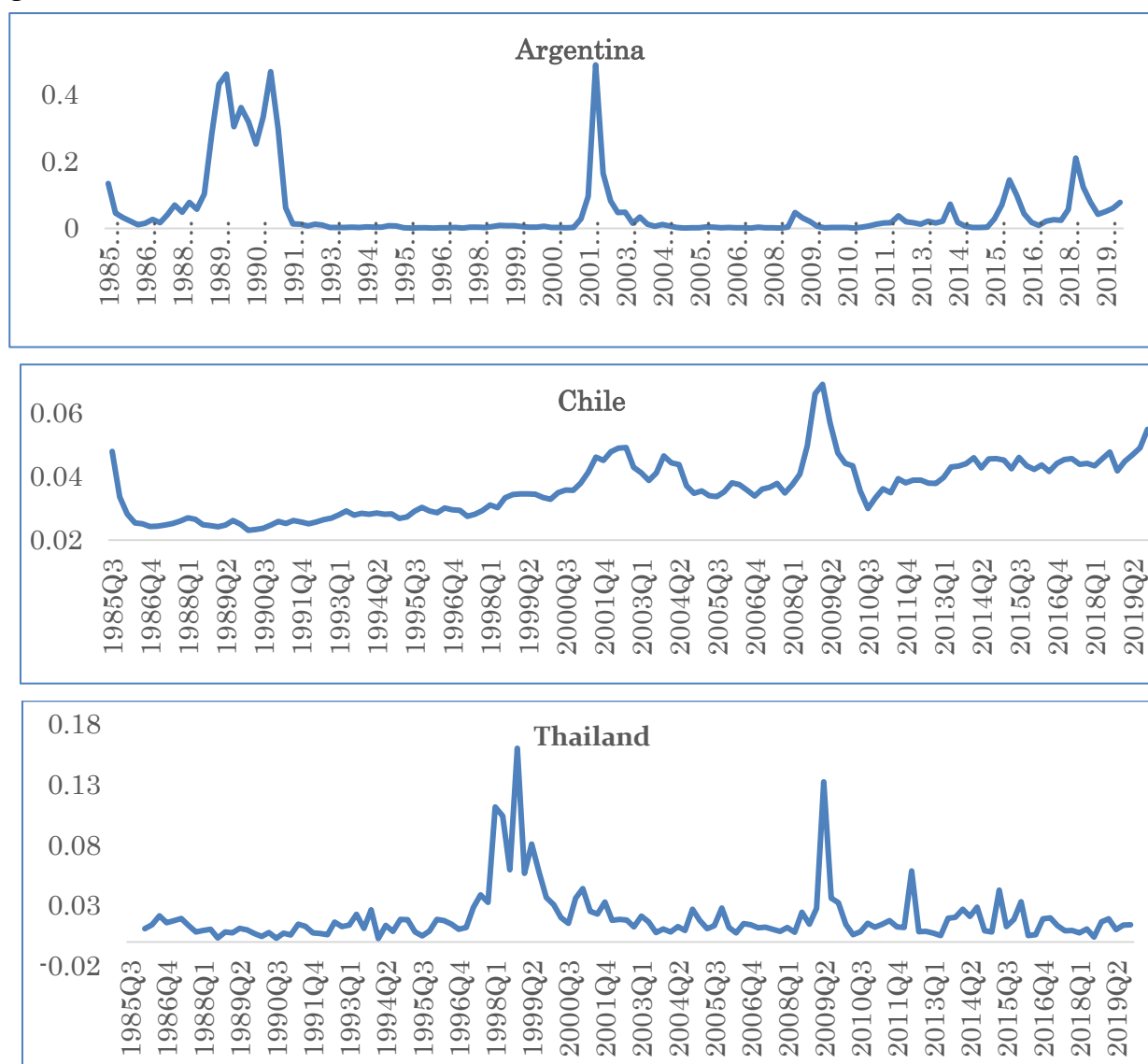


Figure 1. ERU index for Argentina, Chile, and Thailand

Figure 2 plots the responses of the emerging economies' macroeconomic variables to one standard error positive shock to ERU. We first find that an ERU shock can evoke instability in both the financial market and the real economy. This argument is proven in Figure 2 when we find that the volatility of the equity market and the real output significantly increases after an ERU shock. Second, we find that equity price significantly declines following an ERU shock, ranging from 0.5% to 10% on impact. This effect is more highly consistent for all the countries but more severe for Argentina. Our empirical results imply that an ERU shock can create risks and increase international transaction costs. This, in turn, lowers international portfolio capital inflows, and thus

equity price. Our finding is generally consistent with the “Home Bias” phenomenon in the literature (Fidora et al., 2007).

Third, the response of real output is estimated to be statistically negative following an ERU shock. This effect is sizable and highly consistent for all the countries, varying from 0.4% to 1% on impact. Our finding here provides two implications. First, an ERU shock can provoke uncertainty in both the financial market and the real economy. As a result, firms are reluctant to postpone their investment to avoid costly mistakes, thus leading to lower output growth in emerging economies. Our argument here is highly consistent with the theory of the “real option” effect of uncertainty (Aghion et al., 2009; Bernanke, 1983; Bloom, 2009). Second, as shown in Figure 2, an ERU shock can trigger currency depreciation in emerging economies. Second, as shown in Figure 2, an ERU shock can trigger currency depreciation and increase the costs of imported raw materials, thus forcing firms to lower their investment and output.

What is the importance of ERU shocks? Figure 3 answers this question by showing the forecast error variance decomposition of the output growth and equity price after an ERU shock. We find that the contributions of the ERU shock to the output growth of emerging economies are profound for all countries. For example, ERU interprets the fluctuations in output growth at around 20% for Thailand, 23.4% for Argentina, and 10% for Chile. Our empirical results here strengthen the argument of Nordstrom et al. (2009) that in emerging economies, large swings in the exchange rate can induce large swings in the real economy.

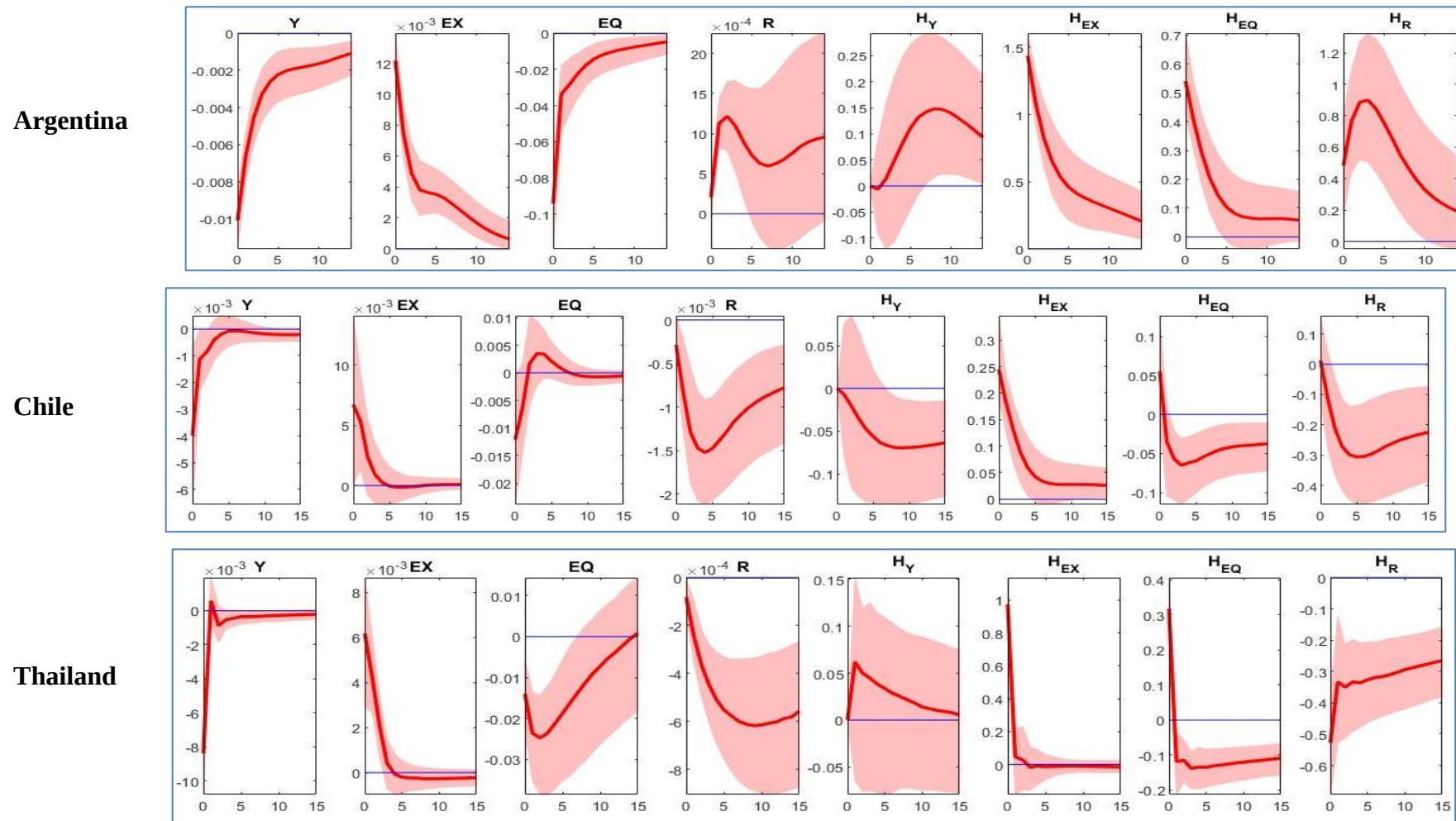


Figure 2. The impulse responses of emerging economics variables to an ERU shock

Note: Median estimates are present by the solid lines, and 68% confidence bands are illustrated by the shaded areas

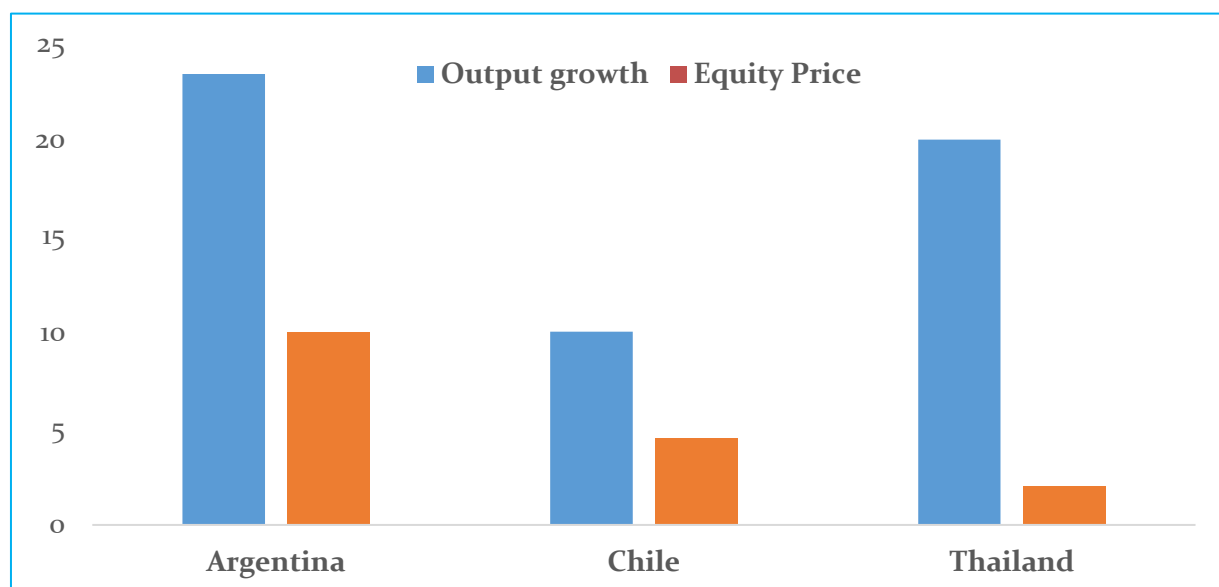


Figure 3. The forecast error variance decomposition of equity price and output growth due to an ERU shock after eight quarters (percentage)

So far, we have found that an ERU shock can provoke instability in the both financial market and the real economy, leading to a reduction in the output of emerging economies. One crucial question emerging from our analysis is which exchange rate regimes emerging economies should adopt to reduce the adverse effects of an uncertainty shock. An extensive body of literature has tried to grasp the above question by examining the role of the exchange rate regime on growth performance. In general, there is inconclusive regarding the role of exchange rate regimes (Tavlas et al., 2008). Some studies found the positive effects of exchange rate variability (Bleaney & Francisco, 2007; Levy-Yeyati & Sturzenegger, 2003; Rose, 2011) while other studies argued that countries with stable exchange rates grow faster (Bailliu, Lafrance, & Perrault, 2003; De Grauwe & Schnabl, 2008; Dubas, Lee, & Mark, 2005; Husain, Mody, & Rogoff, 2005). We try to grasp the above question by examining the effects of an ERU shock under different exchange rate regimes. To do so, we divide the sample of each country into two periods: the fixed and flexible exchange rate regimes. We then re-estimate the model for each country under the different regimes, and their results are presented in Figure 4 and Figure 5.

First, as expected, we find that an ERU shock hurts the economic growth of emerging economies under both flexible and fixed exchange rate regimes. However, this effect is more severe under the fixed exchange rate regime, ranging from 0.3% to 1.3% on impact, but only 0.2 to 0.5% under the flexible exchange rate regime. Our findings imply that the flexible exchange rate regime can mitigate the vulnerability of emerging economies following an uncertainty shock. Our empirical results here favor the argument that the flexible exchange rate regime can work as a shock absorber when prices and wages are sticky in the short run (Broda, 2004; di Giovanni & Shambaugh, 2008; Edwards & Yeyati, 2005; Levy-Yeyati & Sturzenegger, 2003).

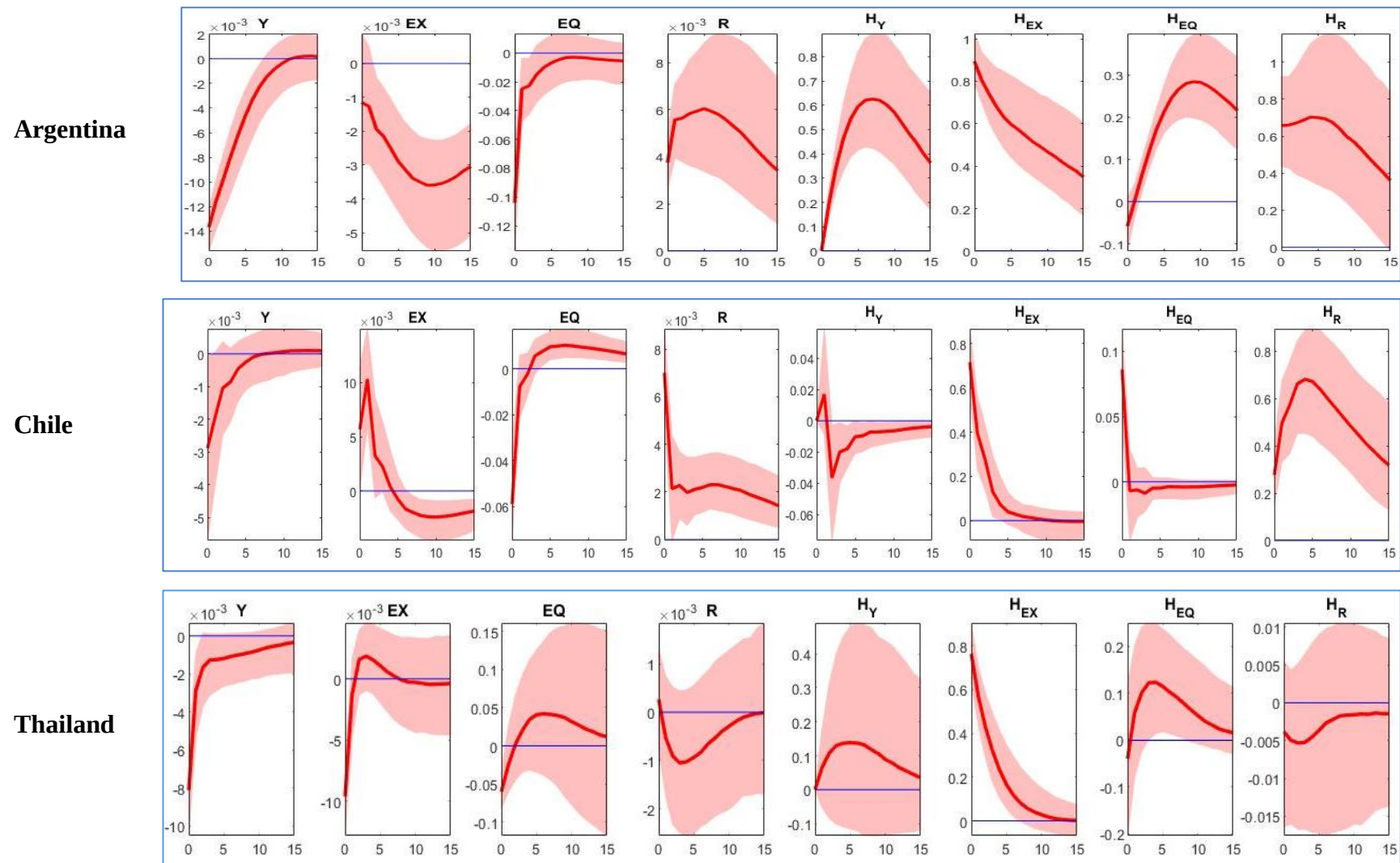


Figure 4. The responses of emerging economic variables to an ERU shock under the fixed exchange rate regime

Note: Median estimates are present by the solid lines, and 68% confidence bands are illustrated by the shaded areas

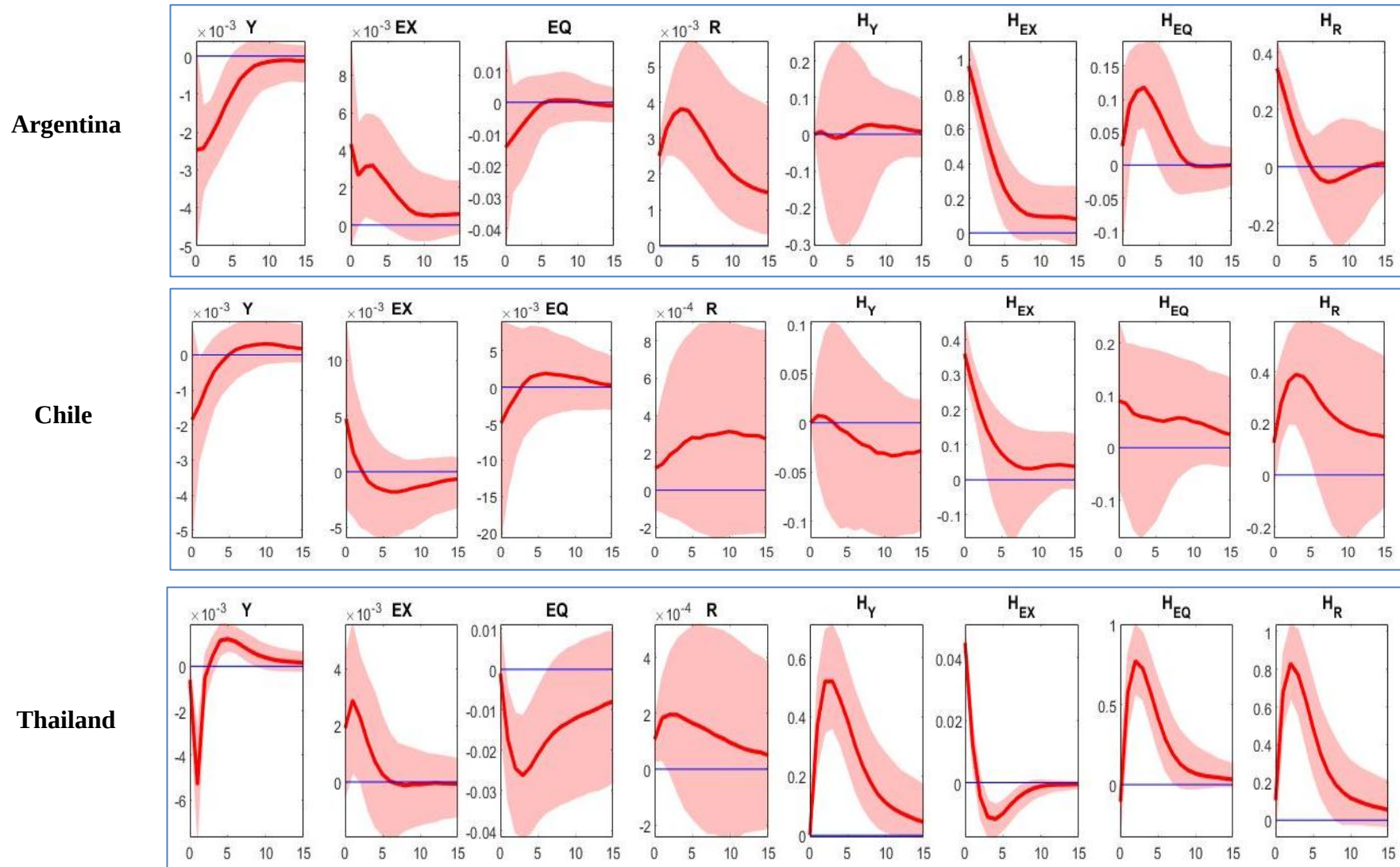


Figure 5. The responses of emerging economic variables to an ERU shock under the flexible exchange rate regime

Note: Median estimates are present by the solid lines, and 68% confidence bands are illustrated by the shaded areas

5. Robustness analysis

In this section, we check the robustness of our baseline results by using different orders. Specifically, we place the variables in our system as follows: Exchange rate (EX), Equity price (EX), output growth (Y), and short-term interest rate (R). Figure 6 presents the results of the robustness analysis. We confirm that our empirical results are almost consistent. An ERU shock can evoke instability in both the exchange rate and financial market, and, thus, the real economy. The reaction of the output is still negative for all countries. An ERU shock harms the capital flows to emerging economies, thus lowering equity prices. This finding is completely consistent with our baseline results. We find that an ERU can trigger currency depreciation as our baseline result.

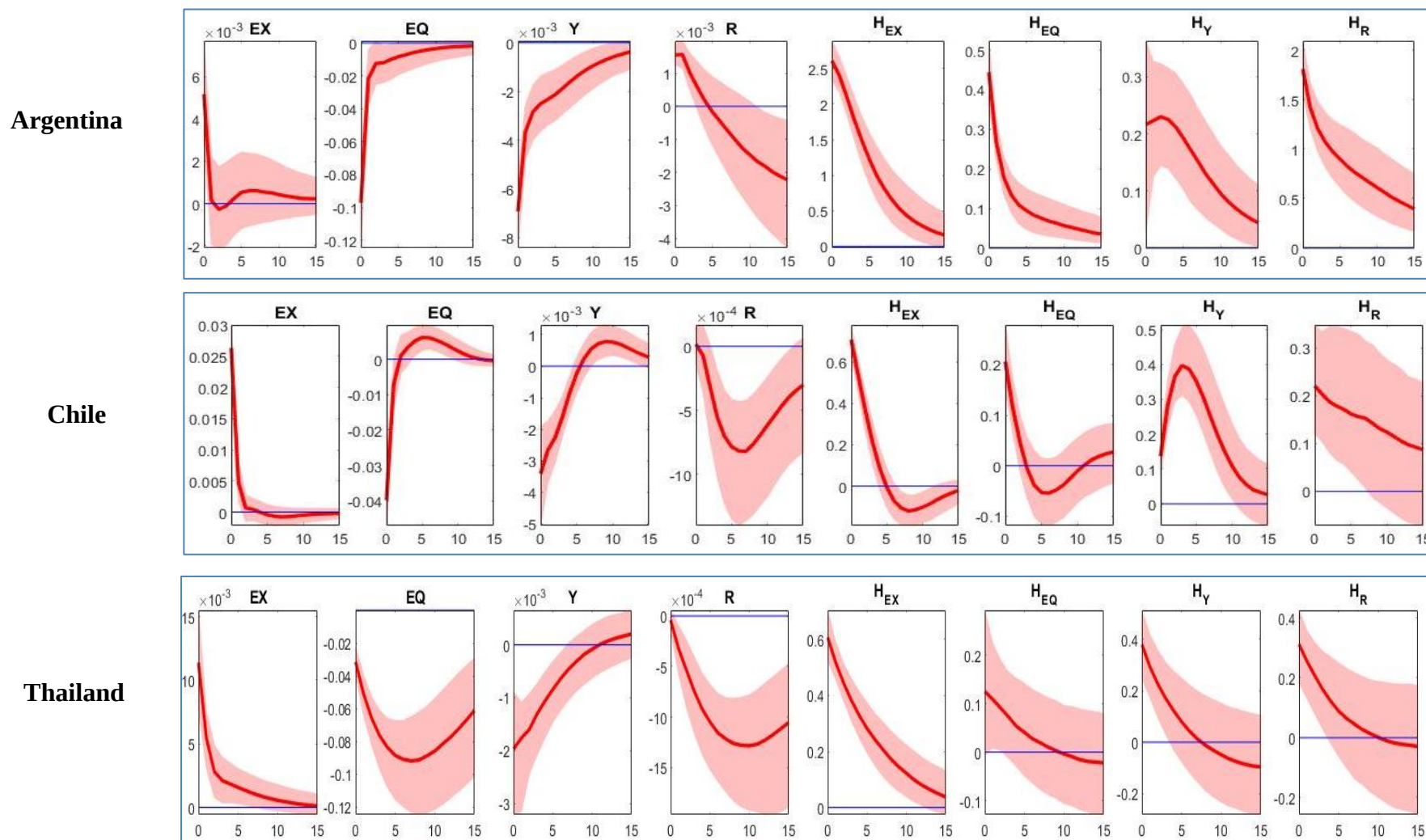


Figure 6. The responses of emerging economic variables to an ERU shock

Note: Median estimates are present by the solid lines, and 68% confidence bands are illustrated by the shaded areas

6. Conclusions

This paper examines the macroeconomic effects of ERU on emerging economies. We model ERU using a Bayesian VAR model with stochastic volatility in the mean, allowing a shock to the second moment that is independent of the first moment. We apply the model to different emerging economies and find that ERU plays a crucial role in driving the economic fluctuations of emerging economies. Specifically, an ERU shock can provoke risks for the financial market and the real economy. An ERU shock significantly hurts the output growth of emerging economies. This effect is more severe under the fixed exchange rate regime. Our finding implies that a flexible exchange rate regime can help emerging economies mitigate their vulnerability to uncertainty shocks. The limitation of this study is that we selected a sample of three emerging economies to validate our model. Future research could strengthen our empirical results by including many emerging countries in different regions.

Conflict-of-interest statement

The author declares that the author has no conflicts of interest. The author certifies that the submission is original work and is not under review at any other publication.

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