

# U.S. Monetary Policy Normalization and EME Policy Mix from a Global Liquidity Perspective

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\*\*\*\*First Draft\*\*\*\* Please do not quote this version.

June, 2014

## Abstract

The U.S. Federal Reserve (Fed) normalizes its monetary policy in a multi-stage process. This paper attempts to assess the impact of the process on emerging market economies. A one-percent-point increase in the Fed's policy rate is found to reduce the output growth rate of EMEs by 0.35 percent on average by the end of first year, and the resulting output loss is more severe to a fragile group in EMEs. Fragile EMEs are prone to experience sharper currency depreciations, compared to resilient EMEs. Sharper depreciations exert upward pressures on domestic inflation and, along with higher policy rates to mitigate the reversal in capital flows, reduce further domestic demand. The mix of two policy tools for EMEs, their policy rates and foreign reserves, are found to be conducive to macroeconomic and financial stability objectives. Our finding also suggests that, in the face of quantitative easing (QE) tapering, desirable policy mixes to stabilize both real and financial fronts could be different depending on whether respective countries are fragile or resilient EMEs.

JEL : F32, F42

Keywords : Global liquidity, Monetary transmission, Normalization of US monetary policy, Emerging market economies

\* The views expressed in this paper represent those of the authors and do not necessarily represent those of the Bank of Korea or IMF.

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# I. Introduction

The U.S. Federal Reserve (Fed) adopted the quantitative easing (QE) program to stabilize the real economy and financial market of the U.S. in the face of a financial crisis. The Fed has maintained the federal funds rate target in the range of zero and 0.25 percent from end-2008. With this near-zero interest rates, the Fed resorted to three rounds of quantitative easing programs. The third round of the program was put into effect in September 2012, and the monthly purchase of treasury bonds and mortgage backed securities through the large scale asset purchase (LSAP) program was escalated to 85 billions of dollars effectively in January 2013. Regarding the effect of such liquidity provisions, Fratzscher, Duca, and Straub (2012) argue that the first round of QE lowered long-term interest rates in global markets and boosted stock markets, and that the second round of QE stimulated capital movements from the U.S. to emerging market economies (EMEs). Bernanke (2013) attributed capital inflows into EMEs after the GFC to the disparity in growth prospect, rather than the interest rate gap, between advanced economies and EMEs.

The U.S. Fed announced the possibility of drawing down its LSAP in January 2013. This is the first step of a multi-year process to return to normalcy in its monetary policy. The minutes of FOMC meeting on this matter suggest that the tapering stage could be followed by a period of no reinvestments and then the first increase of the policy rate. The completion of QE tapering (QET) may correspond to unwinding assets held by the U.S. Fed to the pre-crisis level.

[Figure 1 about here.]

Prior to the actual start of QET, the U.S. Fed had alerted the imminence of the tapering. One of such occasions is Chairman Bernanke's press conference in late-May 2013,

to which some EMEs were susceptible substantively. Figure 1 contrasts two groups of EMEs in their exchange rate movements between May 2013 and February 2014. ‘Fragile’ group—comprising countries frequently mentioned in the financial press for their vulnerability in the coming era of receding liquidity from advanced economies—includes nine countries as listed in the figure. Nine EMEs seemingly free of such a downside symptom are dubbed as ‘Resilient’ group. Fragile group on average depreciated by twenty percent during the period, whereas Resilient group on average lost values of their currencies by mere two and half percent.

[Figure 2 about here.]

Stock markets have shown somewhat diverse performance between Fragile group and Resilient group. Fragile group excluding Argentina saw their stock markets in local currency lose on average by 3.8 percent and Resilient group excluding Bulgaria gained 3.5 percent between May 2013 and February 2014.<sup>1</sup>

[Figure 3 about here.]

[Figure 4 about here.]

Despite this recent divergence between the two groups, soundness indicators in Figure 3 do not suggest any clear dividing line among them at first glance. The only indicator that Resilient group does better than Fragile group is current account and fiscal balance. Fragile group collectively experienced deficits in both current account and fiscal balance,

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<sup>1</sup>Argentinian stock markets rallied during the period because favored exchange rates, so-called blue-chip swap rates, was applied in proceeds from stock markets while the official rates marked a drastic depreciation, resulting in little stock market gains in a U.S. dollar term. Another reason for Argentinian stock market boom during the period is that with high inflation and control on foreign currencies, locals turn to its stock markets in order to store the value.

whereas Resilient group showed surpluses in both current account and fiscal balance as depicted in Figure 4.

Despite this recent divergence between the two groups, soundness indicators in Figure 3 do not suggest any clear dividing line among them at first glance. The only indicators that Resilient group exhibits stonger stances than Fragile group does are the current account and fiscal balance. Fragile group collectively experienced deficits in both current account and fiscal balance, whereas Resilient group showed surpluses in both the current account (Figures 3 and 4) and fiscal balance (Figure 3).

[Figure 5 about here.]

When ebbs and flows of foreign investments affect local foreign exchange markets in EMEs, foreign reserves could serve an important line of defense for policy authorities in an effort to reduce volatility in foreign exchange rates. As shown in Figure 5, there is no clear difference in changes in foreign reserves between the two groups. All but Argentina experienced increase or less than five percent decrease in their foreign reserves during the period. In contrast to no clear difference in foreign reserve changes, the two groups have shown a stark divergence in policy rate responses, possibly in efforts to ameliorate waves in their capital flows. Fragile group on average raised their policy rates by 42 basis points (bps) during the period, whereras Resilient group on average lowered their policy rates by the same magnitude. These divergent actions must have consequences on their growth, inflation, exchange rates, and foreign investments.

[Figure 6 about here.]

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magnitude. These divergent actions must have consequences on their output, prices, exchange rates and foreign investments.

Against this backdrop of recent developments, this study aims to offer answers to questions on the impact of U.S. monetary policy normalization on EMEs. First, how much will real and financial fronts of EMEs' economies be affected by monetary policy normalization? Second, is there any differentiation in economic responses between Fragile and Resilient groups within EMEs? Third, how could EMEs' monetary policy goals be associated with policymakers' choice between alternative courses of policy actions?

We approach these questions using a factor-augmented vector autoregression model (FAVAR). The model incorporates global liquidity (GL) factors into a panel of EMEs. The GL factors are driven from financial data of advanced economies. We consider a situation in which GL—generated by monetary policy, or dissolved in financial markets, of advanced economies—spills over to EMEs. A companion paper, Choi, Kang, Kim, and Lee (2013), discusses derivations and characteristics of the model in details. While the companion paper builds the foundation of this study, this study has its own contribution in several areas. In this study, we evaluate the effect of U.S. monetary policy normalization on GL factors and use the result in simulating its impact on EMEs on average. We estimate FAVAR models adapted to different country groups and use those results in setting priors for country-specific data of Turkey and Korea in a Bayesian approach. We also linked the outcome of alternative EME policies to their policy options to explore proper policy mixes of EMEs against receding GL owing to U.S. policy normalization.

Key findings of this study pertain to estimating the impacts of U.S. monetary policy on EMEs and EME's alternative policy reactions. We estimated that a one-percent hike in U.S. policy rates will reduce EMEs' growth by 0.35 percent point after a year. It is found that the two groups of EMEs respond differently to receding policy-driven liquidity

from the U.S. Fragile group is subject to a larger depreciation than Resilient group. This larger loss in currency values brings about higher inflation thereby shrinking further the already-weak domestic demand and thus output growth. Our findings will help explain recent differentiations in policy responses and economic outcomes among EMEs.

The remainder of the paper is organized as follows. Section II presents a brief explanation of the econometric model. Section III evaluates the path of U.S. monetary policy normalization in terms of global liquidity. Section IV offers the impact of the receding global liquidity on EMEs and seeks implications on policy mix in policy spaces. Section V concludes.

## II. Empirical Model

This section briefly explains the empirical model used in this study. The model is introduced in the companion paper, Choi, Kang, Kim, and Lee (2013), which offers the characteristics of the model in detail. We assume that there are three global liquidity momenta  $F_t$ , namely, policy-driven liquidity momentum, market-driven liquidity momentum and risk averseness momentum. The three GL momenta are retrieved from financial data( $X_t$ ) of G5 (the U.S., Germany, France, Japan and the United Kingdom) through a factor model. They are identified by sign restriction. For example, policy-driven liquidity momentum is set to increase M0 of the U.S. Underlying financial time series used in retrieving factors are policy rates, domestic credit, international claims, lending rate spread, government bond yield, M0, real interest rate, stock price, and stock volatility.

$$X_t = \Lambda F_t + u_t \tag{1}$$

The above equation shows underlying data( $X_t$ ) is determined by factors( $F_t$ ) and its idiosyncratic innovation( $u_t$ ).

$$Y_t = \sum_{i=1}^k A_i Y_{t-i} + \sum_{i=1}^l B_i F_{t-i+1} + \epsilon_t \quad (2)$$

$$F_t = \sum_{i=1}^m C_i F_{t-i} + v_t \quad (3)$$

Factors are assumed to be exogenous in explaining macroeconomic and financial situation as expressed in (2). The economic status of an EME is described by several variables in  $Y_t$ . They are real GDP, consumer price index, stock price, nominal effective exchange rate, and capital inflows. Two policy variables, overnight call rate and foreign reserves are augmented. Except for overnight call rate and capital inflows, all variables are measured in year-on-year growth rate. Overnight call rate is the level itself and capital inflows are measure as a percent of GDP. The sample period goes from the second quarter of 1991 to the third quarter of 2013. Five lags are used for the endogenous variables and the contemporaneous factor is included in Equation (2). To recover shock( $v_t$ ) in GL momenta, an autoregressive structure with lag order one in (3) is assumed. The lag structure is determined by information criteria by Hannan and Quinn (1979).

### III. U.S. Monetary Policy Normalization and GL

According to series of FOMC meeting minutes, QET started in January 2014 and has followed gradual steps. Without an event or development which may cast its shadow on the recovery of the U.S. economy, this study assumes that OET will be completed by

end-October 2014 although the sales of assets accumulated by the LSAP might start in late-2015. Assuming the U.S. and the rest of advanced economies are in the third quarter of 2013 owing to real-time data availability as of early-March 2014, we gauge a shock to global liquidity momenta. The shock is estimated from the statistical model of factors and underlying variables depicted in (1). By assuming multivariate normality of  $X_t$  and  $F_t$ , it follows:

$$\begin{pmatrix} X_t \\ F_t \end{pmatrix} = N \left[ \begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{pmatrix} \Lambda' \Lambda + \Psi & \Lambda' \\ \Lambda & I \end{pmatrix} \right]. \quad (4)$$

And conditional distribution  $X_{t+1}$  given  $F_{t+1}$  is also given by

$$F_{t+1}|X_{t+1} \sim N [\Lambda(\Lambda' \Lambda + \Psi)^{-1} X_{t+1}, I - \Lambda(\Lambda' \Lambda + \Psi)^{-1} \Lambda']. \quad (5)$$

Since  $F_t$  has an autoregressive structure of the GL momenta as (3), the expected shock given future value of  $X_t$ ,  $X_{t+1}$  is

$$\mathbb{E}(F_{t+1}|X_{t+1}) = \Lambda (\Lambda' \Lambda + \Psi)^{-1} X_{t+1} \quad (6)$$

$$\mathbb{E}(v_{t+1}|X_{t+1}) = \mathbb{E}(F_{t+1}|X_{t+1}) - \sum_{i=1}^m C_i F_{t+1-i}. \quad (7)$$

[Table 1 about here.]

Table 1 offers the result of estimating the magnitude of shocks to GL stemming from



QET. We consider four hypothetical scenarios along with a baseline scenario, in which period  $t+1$  repeats period  $t$  with respect to GL momenta.<sup>2</sup> For each scenario, we identify the magnitude of shocks to support the particular scenario for each of three momenta of global liquidity. The magnitude of shocks is in the first row for each GL momenta in the table. We take that the gap of each hypothetical scenario from the baseline scenario is the innovation in GL which influences EME through a spillover mechanism identified in (2).

The first hypothetical scenario has U.S. M0 growth dropped by 21%. This scenario is based upon the assumption that tapering of QE ends October 2014. Although our econometrical model presumes quarterly observation, we simulate a shock equivalent to year-long magnitude for simplicity. For example, we forecast the M0 growth rate will gradually slow down over 2014 and the difference between the end of 2013 and 2014 will be 21 percent. The second scenario takes account the fact that other U.S. financial variables, Treasury bill yields, real interest rates, and lending rates are also affected by the path of U.S. M0. The effect of M0 growth on other variables is calculated from a simple vector autoregression model.<sup>3</sup> The third scenario is about the normalization of the U.S. federal funds rate. We hypothesize a situation that the rate increases by 1 percent in the first quarter. The fourth scenario takes into account of concomitant rise in Treasury bill yields and the real interest rates. For simplicity, we assume that the increase of other variables is of the same size of the federal funds rate, 1 percent.<sup>4</sup>

The factor model surmises that a decrease in M0 growth rate in the U.S. can be caused

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<sup>2</sup>With the baseline scenario, the system needs a shock to maintain the course of GL momenta owing to reversion to the steady state

<sup>3</sup>This vector autoregression model is taken to obtain a reasonable effect of M0 growth on other U.S. financial variables. The data used in this exercise is monthly data between 2008M1 and 2013M1. From Cholesky identification with M0 growth as exogenous, forecasts on other variables are obtained by giving the shock that supports M0 growth path in year 2014.

<sup>4</sup>The lending rate is not considered here because in deriving GL momenta, the spread between the lending rate and the federal funds rate is used.

by a joint change in three GL momenta. The estimated response of policy-driven liquidity is negative and reasonable. The positive response of market-driven liquidity may reflect market situation that helps drive M0 growth down. If the rest of the world is equal, increased asset purchases by the private sector, hence a decrease in M0, would have been prompted by an increase in the propensity of financial intermediary to extend lending or provide liquidity to the overall financial markets, which, in our model, is equivalent to an increase in market-driven liquidity. Since the joint distribution projects the most likely outcome of GL momenta jointly determined by given a particular set of values of underlying variables, the outcome suggests that historical data used in deriving factors have seen M0 changes predominately linked to changes in risk averseness to the degree that a change in market-driven liquidity factor is dwarfed by a change in risk averseness<sup>5</sup>, causing a comparison with the baseline value to register in an opposite direction. Fortunately, a shock to the federal funds rate is less subject to the aforementioned complication. An increase in the U.S. federal funds rate—say, tighter global monetary policy—is found to be driven by a combination of a fall in policy-driven liquidity, a rise in market-driven liquidity and a fall in risk averseness.

Although it is very likely that the change in policy stance of U.S. monetary authorities coincides with recovery in the financial and real sectors of the U.S. economy, which accompanies change in the other two momenta of GL in our work, the market-driven factor and risk averseness factor, we concentrate on the impact of observed or forecasted changes in key monetary policy measures on the policy-driven factor in order to single out the impact of U.S. monetary policy normalization.<sup>6</sup> By doing so, we can comparing the

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<sup>5</sup>Under normal circumstances, a rise in risk awareness refrains businesses and households from taking loans.

<sup>6</sup>One may believe that the normalization is made possible by recovery of market-driven liquidity and decline of risk averseness in the financial markets. In that case, a policy experiment with shock estimated in Table 1 would be an answer. However, in this study, we focus on actions by the U.S. Federal Reserve, who determines the pace and timing of the normalization process.

outcome of this work with more traditional approaches in estimating the spillover effect of U.S. monetary policy such as Romer and Romer (2004) and more recently IMF (2013) and Coibion (2011), which estimate the impact of monetary policy shock as changes in money supply or policy rates that are taken as a surprise since they are not a response to inflation or economic conditions. In this regards, the analysis here leans on the literature of policy experiment than practical econometric forecasts.

[Table 2 about here.]

In order to obtain the measured policy-driven liquidity momenta given the other two fixed, the same property of multivariate normality is used as above. Using the well-known formula of conditional expectations in multivariate normal distribution, we obtained the  $\mathbb{E}_t(F_{t+1}^1 | X_{t+1}, F_{t+1}^2, F_{t+1}^3)$  followed by  $\mathbb{E}_t(v_{t+1}^1 | X_{t+1}, F_{t+1}^2, F_{t+1}^3)$ . Table 2 has the result.

Comparing with Table 1, one can find that as the effect of policy action on the policy-driven liquidity factor is more pronounced with the other factors fixed. That is true especially for the scenario with M0 growth slowing down. In following assessment of the effect of QET on EMEs, the measured size of shocks reported in Table 2 will be applied. A one percent rise in U.S. monetary policy rates is found to be equivalent to a shock sized of the 56 percent of a one-standard-deviation shock to the policy-driven liquidity factor. The shock of QET is as large as one third of the shock associated with a one percent point increase in the U.S. policy rate.

## IV. Receding GL and EMEs

### A. Assessing the Impact of Receding GL on EMEs

The path to normalcy in U.S. monetary policy is expected to involve multi-phases. The first phase is QET, which started in December 2013. This phase will be reflected in slower expansions of the balance sheet of the U.S. Fed. The speedy accumulation of assets by the last round of the LSAP program will be contrasted with slower paces of asset purchases set by the FOMC. We project that owing to slower buying pace, the growth rate of M0 will be cut by 21 percent point in year-over-year basis.<sup>7</sup> The end of QET could be followed by a period during which the U.S. Fed no longer purchases assets and reinvests the proceeds from its asset holdings. The next phase will pertain to gradual increases in its policy rates. For this phase, we add a scenario in which the U.S. Fed increases its policy rate by one percent point during the first year of so-called “lift-off.” This scenario is also useful as a standard policy experiment which involves measuring the spillover effect of U.S. monetary policy across borders.

[Figure 7 about here.]

Figure 7 shows the impacts of two phases of U.S. monetary policy normalization. The relative size of responses of EMEs under two scenarios reflects that the impact of QET on GL momenta is tantamount to one third as much as that of a one-percent-point increase in the Federal funds rate.

The negative shock to the policy-driven GL embarked by QET, forces foreign investments to exit from EMEs by 0.12 percent of GDP in the first year. Such outflows of

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<sup>7</sup>This projection is based upon the assumption that QET ends by October 2014 in a gradualist approach.

capital render EMEs' currencies and stock markets subdued. The drainage of liquidity from EMEs have adverse impact on their economies by weakening aggregate demand, as revealed by reduced output growth. The positive impact on inflation suggests that the downward pressure of weaker demand on prices is more than offset by the inflationary pass-through effect stemming from currency depreciations.

The lift-off of U.S. policy rates is found to have its peaked impacts on the third quarter after the shock, dropping EMEs' real GDP growth by 0.35 percent point, which is reasonably consistent with IMF (World Economic Outlook, 2013), considering differences in sample countries and data ranges.<sup>8</sup> Canova (2005) reports that U.S. contractionary monetary disturbances increase the price level of Latin American countries and boost their GDP in the second quarter. He argues that capital flows to those countries due to the contractionary disturbances, quite opposite to what we found above. Since his sample period ends year 2002 whereas the sample period in this work starts 1996 and ends 2013, new developments in the 2000s, especially, the global boom preceding the global financial crisis are possibly attributable to differences in results.

[Table 3 about here.]

A recent development in the EMEs' responses to U.S. Fed policy is differentiation among EMEs, especially observed after May 2013. Since then some EMEs have been shown to be vulnerable to tightening liquidity in global financial markets, whereas others fared significantly better. Financial press designated vulnerable countries of the EME group as 'fragile.' Following suit, we divide our sample EMEs into two groups: fragile

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<sup>8</sup>IMF (2013) reports that the impact of the same policy on other countries is 0.7 percent contraction in industrial production after eight months. Since about 2.86 percent of industrial production is translated into the one percent of real GDP for EMEs, the reported value is roughly equivalent to 0.25 percent fall in GDP growth. The relationship between industrial production and real GDP are based on the ratio of the two series in terms of the standard deviation of each series' growth rate for 2008M1 and 2013M9. The ratio ranges between 1.3 and 5.81 with mean value 2.86 for EMEs and equals 3.04 for the U.S.

versus resilient.<sup>9</sup> Table 3 presents the summary statistics of the two groups that are subject to GL tightening caused by a one-percent policy rate increase by the U.S. Fed.<sup>10</sup>

The most striking difference between the two groups is the magnitude of depreciation. The fragile group depreciates three times as much as the resilient group depreciates, possibly owing to country-group-specific fundamentals or the shortage of foreign reserves to stave off depreciation. Fragile group indeed spends foreign reserves less than Resilient group does. Whatever the cause is, severe currency depreciations in Fragile group is translated into increased pressures on inflation which overwhelm the downward pressures on inflation stemming from reduced domestic demand with liquidity outflows. As a result, Fragile group experiences outright inflation while Resilient group sees falls in inflation dominated by downward pressure from reduced domestic demand. Reduced inflation upon the shock in Resilient group stimulates domestic demand, mitigating sluggish demand to some degree and making its trough shallower than Fragile group. Despite larger real exchange rate depreciations in Frigile group, their gains in external demand fail to offset the loss of domestic demand.

The above finding that Fragile group is subject to more severe loss in growth and sharper depreciations highlights inherent recovery channels. First, economies with reduced demand shock gradually bounce back to the steady state through a price adjustment mechanism. Second, the resulting real exchange rate depreciations boost net exports. Fragile group seems to be more susceptible to the shock because the former channel is largely ineffective owing to inflation brought by depreciations of their currencies and the second channel is also weak and slow.

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<sup>9</sup>Fragile group comprises Argentina, Brazil, Chile, Hungary, India, Indonesia, Russia, South Africa, and Turkey; and the rest of sample countries belong to Resilient group. They are Bulgaria, Czech Republic, Israel, Korea, Malaysia, Mexico, Philippines, Poland, Romania, and Thailand.

<sup>10</sup>Responses of two groups to U.S. monetary tightening are presented in Appendix.

In addition, Fragile group, in an effort to keep their currency values stable, tends to increase their policy rates by a greater margin than Resilient group, further suppressing weak domestic demand. Conversely, Resilient group readily utilizes their foreign reserves to contain disturbances in foreign exchange markets. This difference in reactions between the two groups is partly attributable to the adequacy of foreign reserves. If a country in Fragile group holds less than sufficient foreign reserves, its reluctance to buffering outgoing foreign funds using foreign reserves is well-grounded.<sup>11</sup>

Tempering drastic depreciations of domestic currencies can be instrumental to reduce output fluctuations during the era of receding global liquidity. A wide range of policies can be adopted to support such a strategy: the preemptive buildup of foreign reserves—through, for example, establishing currency-swap lines with other central banks and implementing macro-prudential policies to filter out inbound foreign investment that are prone to exit at the first sign of any trouble.

## **B. A Tale for Two Countries: Korea and Turkey**

Extending the previous analysis on the two groups of countries, we estimate the impact of receding GL on two representative countries: Turkey from Fragile group and Korea from Resilient group. Figures in the introduction shed light on different country characteristics.

Turkish lira has lost its value against the dollar by twenty percent during the period from May 2013 to February 2014, while Turkish stock markets have also been weakened during the same period. The current account deficit of the seven percent of GDP is one of the largest even within Fragile group. Since May 2013 Turkey had shored up its foreign reserves until November 2013 and has drawn them down since then. The Turkish central

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<sup>11</sup>As noted in the introduction, most fragile countries experienced current account deficits during the period 2010-2012.

bank raised its overnight rate by 4.25 percent point in late-January 2014.

Korean won is one of the few currencies that have been strengthened during the period. Although there was a rally in its stock markets in the third quarter of 2013, the market slowly lost its previous gain. In contrast with Turkey, Korea has maintained its current account in surplus. During the period from June 2013 to January 2014, Korea accumulated foreign reserves by more than five percent of its GDP, while keeping the policy rate unchanged.

[Figure 8 about here.]

To compare the probable responses of the two countries against monetary tightening in the U.S., we estimated the FAVAR model for each of the two countries in a Bayesian approach. For Turkey, we use the estimated result of Fragile group as prior and Turkish data since year 2000 in Bayesian estimation. For Korea, we use the estimated result of Resilient group as prior and Korean data since 2000 in Bayesian estimation. By using recent data for both countries, the results will be less susceptible to structural changes.<sup>12</sup> Figure 8 compares the responses of two countries against a one-percent rise in U.S. policy rates.<sup>13</sup> For the first year after the shock, the Turkish economy loses more than 0.46 percent point in output growth, and the Korean economy does only about 0.22 percent. Despite higher depreciations in Turkey, larger output losses in Turkey than in Korea is attributable to higher policy rates and inflation. A stark difference in policy reactions is that Korea reacts with foreign reserves against the shock while Turkey mainly reacts with policy rates with postponing the deployment of foreign reserves. Although the Turkish

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<sup>12</sup>In order to obtain inferences from the most recent and relevant data, we use the most recent data for the countries and to cope with limited data, we resort to use the Bayesian method. Canova and Pappa (2007) take a similar approach in studying effects of monetary union where European data is limited and U.S. estimation is taken as prior.

<sup>13</sup>Analyses under the same prior are presented in Appendix.



course of action can apparently be perceived as central bank's hawkish policy against inflation brought by depreciations, the effectiveness of this reaction could be reconsidered in light of a policy mix of policy rates and foreign reserves.

### **C. EMEs' Policy Mix in the Era of Receding GL: A Counterfactual Analysis**

U.S. monetary policy normalization inevitably accompanies the withdrawal of overall liquidity from EMEs which has been accumulated in this part of the world by investors in search for higher yields during the phase of U.S. monetary expansions. In previous subsection, we find that EME policymakers will increase their policy rates and deploy foreign reserves to defend the value of their currencies. An interesting question for policymakers would be whether they should go easy or hard on their policy measures. Choi, Kang, Kim, and Lee (2013) provide counterfactual analysis results in which the effect of alternative policies on policy rates and foreign reserves are evaluated against shocks in GL momenta. Using the same methodology, we analyze the possible outcome of alternative policy reactions by EMEs.

[Figure 9 about here.]

Figure 9 reports the counterfactual analysis of Resilient EMEs under a negative shock to policy-driven global liquidity. The shock size is set to the one-standard-deviation of the shock process, while the one-percent-point increase of U.S. policy rate amounts to the 56 percent of the shock considered. Upon this shock, Fragile group raises their policy rates by 3 bps on average. The left panel of the figure exhibits possible outcomes of alternative policies with respect to policy rates. Each alternative policy is chosen to achieve two

different policy goals. The first goal considered is to minimize macroeconomic volatility—measured by the sum of squared gaps of output growth and CPI inflation from respective steady-state levels. The other goal is to minimize external sector volatility—measured by the sum of exchange rate volatility and capital inflow volatility.

A more tightening policy chosen to minimize external sector volatility would relieve depreciative pressures on the local currency while depressing real GDP further. The shore-oriented policy would ameliorate ongoing capital outflows. With higher interest rates, the bond market of the country might become more attractive to foreign investors. However, a drag from weakened stock markets and smaller financing needs would outweigh the gain from the bond market with respect to capital flows.

While a more tightening policy is effective in supporting local currency values thereby stabilizing the foreign exchange markets, it would amplify fluctuation in growth. A policymaker concerned with macroeconomic stability would choose a more loosening policy stance, that is, a policy rate cut. Cutting policy rates against the outgoing foreign investments seems counterintuitive because it will reinforce capital outflows. The loosening policy, however, puts a greater emphasis on a remedy to the macroeconomic side-effect created by the receding liquidity. Although this policy may weaken the local currency, it stimulates domestic demand and countervails deflationary pressure.

Adjustments in foreign reserves do not seem to have direct impacts on growth. Release of foreign reserves has an ambivalent effect on exchange rates. There are two forces at work by which the deployment of foreign reserves affects exchange rates. As a direct and natural force, deployed foreign reserves become a part of the supply of foreign exchange in local foreign exchange markets, thereby reducing depreciative pressure on the local currency by matching the demand for foreign exchanges. On the other hand, the deployment of foreign reserves may lead to the depletion of foreign reserves. Since

foreign reserves deem partial insurance against a drastic currency depreciation, currency risk could rise with the deployment of foreign reserves. Reevaluating currency risk in light of lower foreign reserves embarks foreign investors to reduce their exposure to the local currency.

Depending on the strength of these two forces, a currency may appreciate or depreciate with additional release of foreign reserves. In the case of Resilient group, the direct channel dominates the insurance channel. In order to stabilize the foreign exchange market and volatility of capital flows, policymakers in Resilient EMEs could deploy a larger amount than the benchmark case.

Next, we consider possible combinations of two policy measures (policy rates and foreign reserves) and their composite effects, which are evaluated by stability metrics for two main areas of interest (core and shore). The policy experiments in Figure 9 show the possible outcomes of alternative policy mixes: for example, a more tightening policy rates given foreign reserves at the level of the benchmark case. For each of the two policy measures, we consider three alternative policy mixes including the benchmark—ending up with the experiment of all nine policy alternatives.

[Table 4 about here.]

Table 4 shows the performance of each of nine policy mixes with respect to aforementioned measures. The first value in each cell represents the metric of macroeconomic volatility under the corresponding particular policy mix; and the second one represents the metric of external sector volatility. Clearly, there is no policy mix that dominates the benchmark case. The policy authorities concerned with macroeconomic stability may choose monetary loosening, which is the Core-oriented policy as shown in the table. However, this policy would render the external sector more turbulent. Conversely, if the policy

authorities set their priority on external stability by raising policy rates, macroeconomic stability may be compromised.<sup>14</sup>

[Figure 10 about here.]

Figure 10 shows the counterfactual analysis for Fragile group. For policy rates, lower rates are found to be effective in limiting the negative impact of receding GL on growth while they temper capital outflows. Loosening monetary policy boosts the stock market and reduces current account surplus, which increases the financing need of the country. Either for the macroeconomic stability or for external-sector stability, this analysis suggests that Fragile group should take into account the impact of their policy on the real and financial fronts.

For foreign reserves, both policy goals gives out a similar policy reaction, reducing release of foreign reserves. Between two forces by which foreign reserves affect the exchange rate, foreign reserves as insurance seem to dominate the other force.

## V. Conclusions

This study investigates the impacts of U.S. monetary policy normalization on EMEs. Relying on the econometric model by Choi, Kang, Kim, and Lee (2013), which links global liquidity momenta to macroeconomic and financial variables in EMEs, we first estimated the impact of the normalization phase on global liquidity momenta. Then

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<sup>14</sup>Although we implicitly assume a single policymaker in this study, that may not be necessarily the case. Taking Table 4 as the payoff table of a non-cooperative game between two policymakers with one being of Core-oriented preference and the other being of Shore-oriented preference. The core-oriented policymaker chooses the level of policy rates for macroeconomic stability; and the shore-oriented policymaker chooses the amount of foreign reserves to deploy for external-sector stability. This exemplifies that a certain outcome can be obtained by setting up the incentive structure and policy tools for policy authorities.

we simulate the estimated model to assess the impacts of the shock to global liquidity momenta on the 19 countries of EMEs in a factor-augmented panel vector autoregression model.

Our policy experiment of a one-percent-point drop in U.S. policy rates suggests that EMEs on average will experience a 0.35 percent loss in output growth while the loss of Fragile group is 30 percent greater than that of Resilient group. Fragile group also experiences three times greater currency depreciations which call for higher inflation, compared to Resilient group. The higher inflation, along with a higher policy rate hike, contributes to larger losses in output growth for Fragile group. The divergence in exchange rates and policy rates between the two groups are consistent with cross-border observations from May 2013 to February 2014. Fragile group's responses may be dictated by their weak fundamentals revealed in current account deficit as well as by heightened concerns about the adequacy of foreign reserves.

Against the receding global liquidity embarked by QET, EME policymakers have two main policy tools at their disposal: policy rates and foreign reserves. For macro-economic stability and external-sector stability, they may deploy foreign reserves to keep foreign exchange markets less volatile and adjust their policy rates to prevent their economies from slowing sharply. This dichotomy in the use of policy tools reconciles well our experiment with the policy mix of EMEs, while we also see a possible trade-off between the two policy objectives.

Comparisons between Fragile and Resilient groups suggest that failures in managing the financial front in the face of global liquidity ebbs may threaten the real front with elevated inflation pressures and inevitable rise of policy rates. Although the upcoming era of receding global liquidity pose challenges to EME policymakers, it will shine those who hold enough policy space for the mix of policy rates and foreign reserves to keep the

real and financial fronts resilient to capital flow waves.

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# Appendix

## A Impact of Receding GL: alternative estimation

In this appendix, responses of groups or countries to U.S. Fed's one-percent-point increase in the policy rate are presented. The first figure exhibits the reaction of two EME groups, Fragile and Resilient group. The summary of the figure is shown in Table 3. The second figure repeats Figure 8 with two estimations having the same prior. Finally, a table for performance of policy mixes is presented for Fragile group.

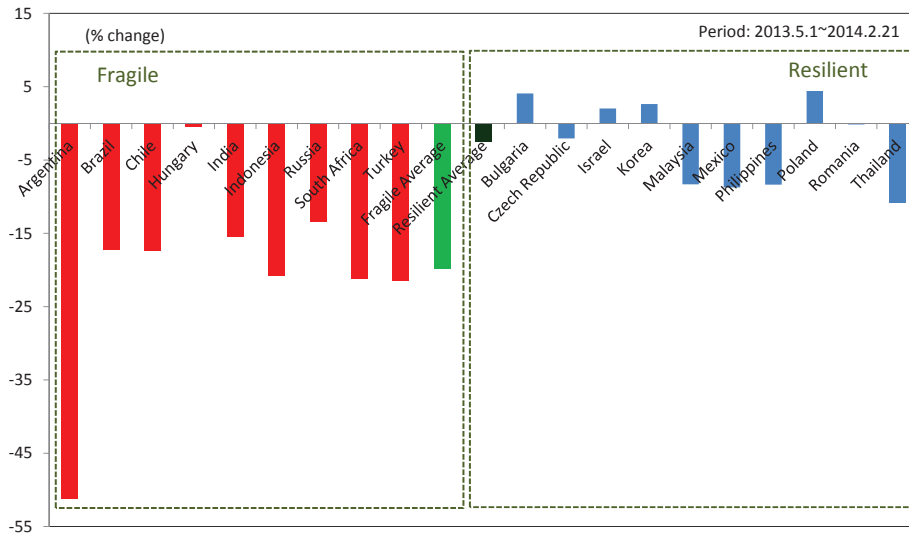
[Figure 11 about here.]

[Figure 12 about here.]

[Table 5 about here.]

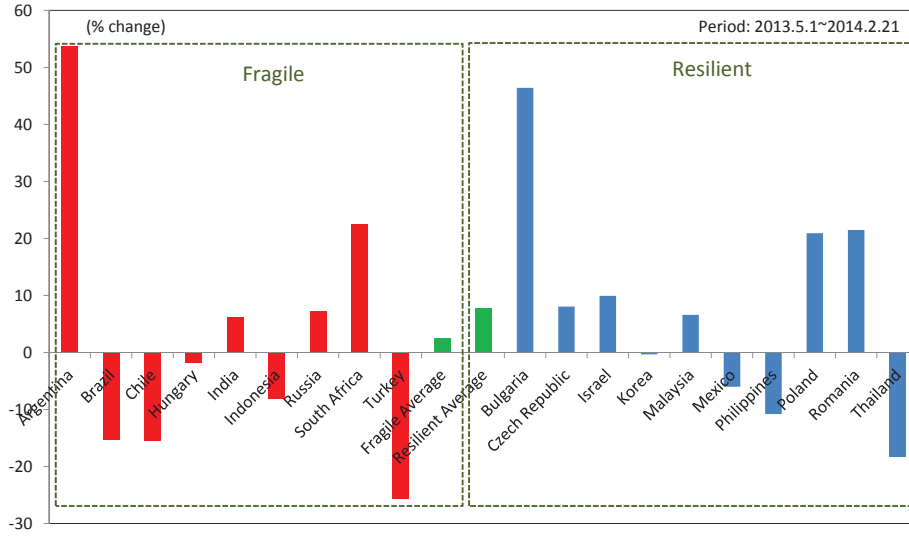


Figure 1: Exchange Rates of EMEs



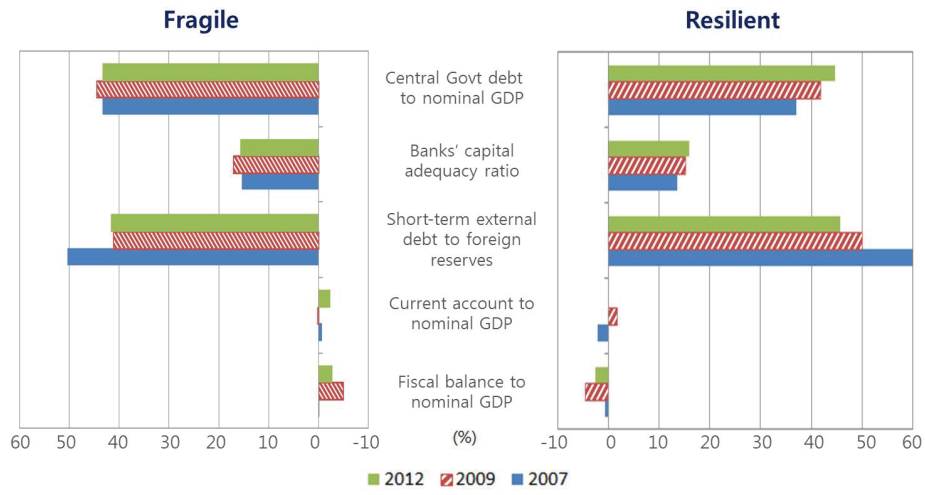
Note: This figure exhibits exchange rate changes for EMEs. Positive figures indicate that the currency has appreciated during the specified period.

Figure 2: Stock Prices of EMEs



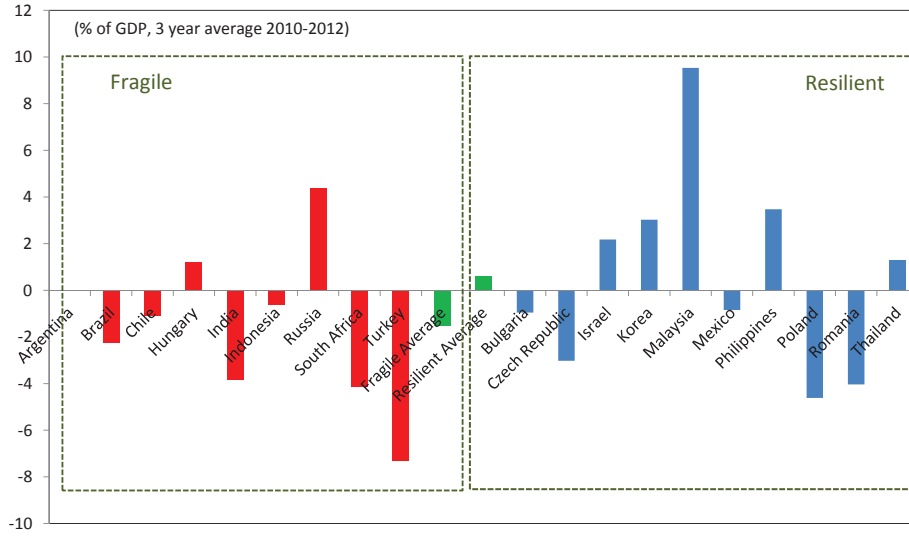
Note: Stock price changes are measured by representative index of each country.

Figure 3: Soundness Indicators of Two EME groups



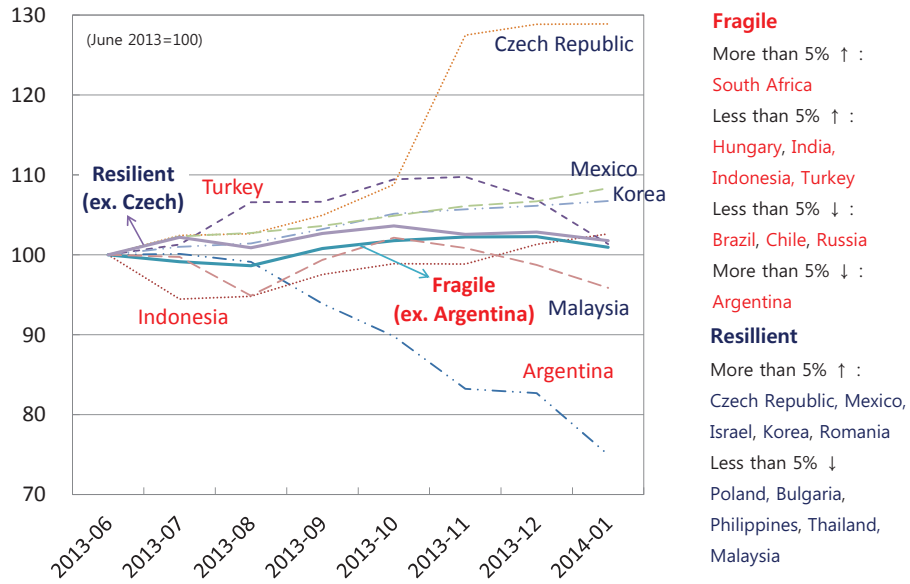
Note: Data are from Fiscal Monitor and Financial Soundness Indicators of IMF, World Bank, and CEIC

Figure 4: Current Account of EMEs



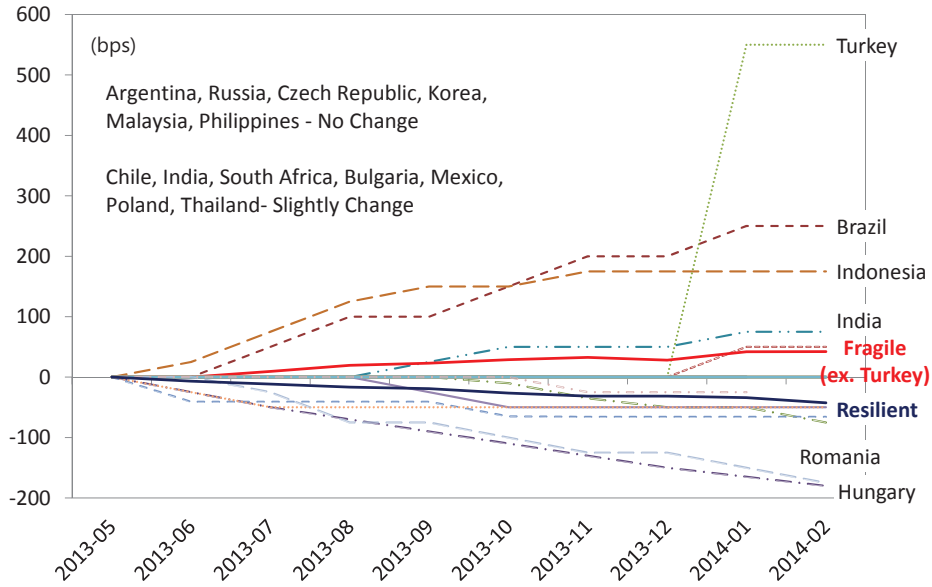
Note: The chart shows current account as percent of GDP averaged for three years from 2010 to 2012. Data are from World Bank.

Figure 5: Foreign Reserves of EMEs



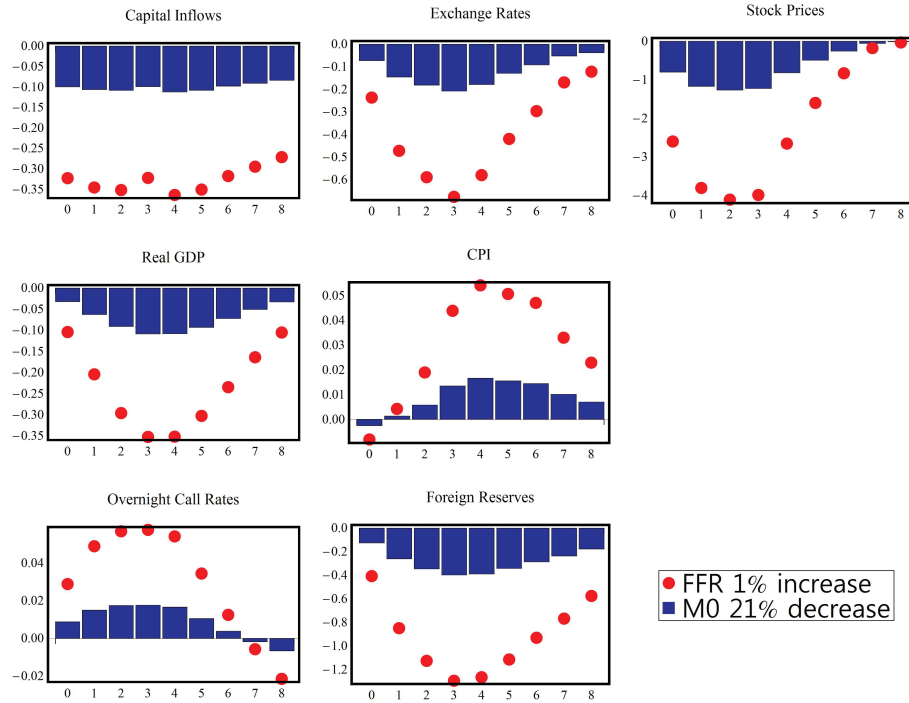
Note: The figure shows change in foreign reserves in EMEs between June 2013 and January 2014. Data are from CEIC except for Korea, Bulgaria, and Romania.

Figure 6: Policy Rates of EMEs



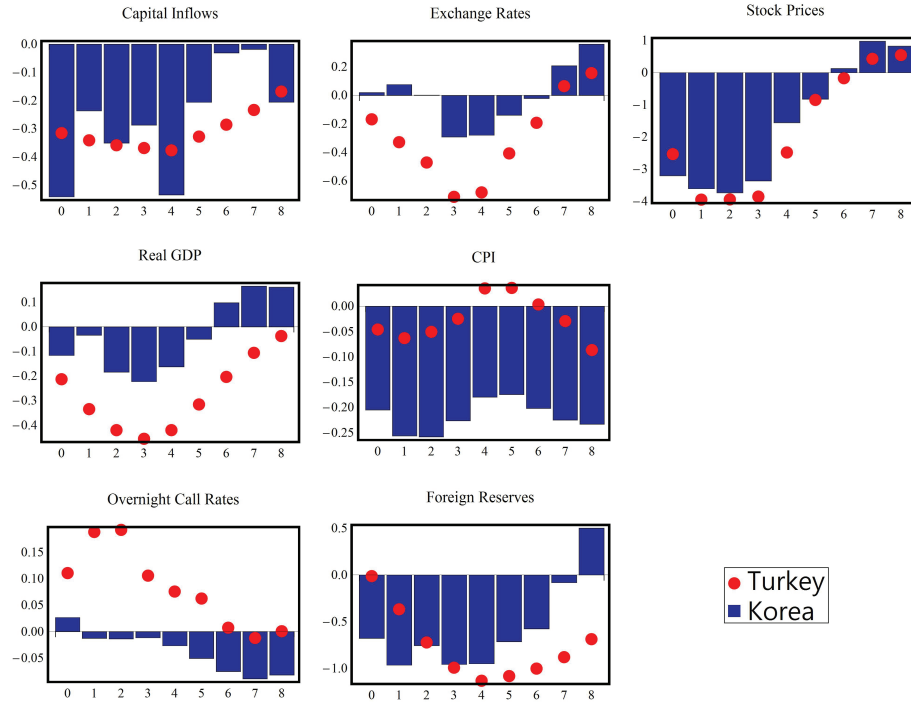
Note: The figure shows change in policy rates in EMEs between June 2013 and February 2014. Data are from IMF, Bloomberg and central banks.

Figure 7: Impacts of U.S. Monetary Policy Normalization on EMEs



Note: The figure shows the impulse responses of EMEs after U.S. monetary policy shocks, based upon the panel factor augmented VAR model. The units of variables are all in percent. The shocks considered are a one-percent increase of the Federal fund rate and a 21 percent decrease in the base money.

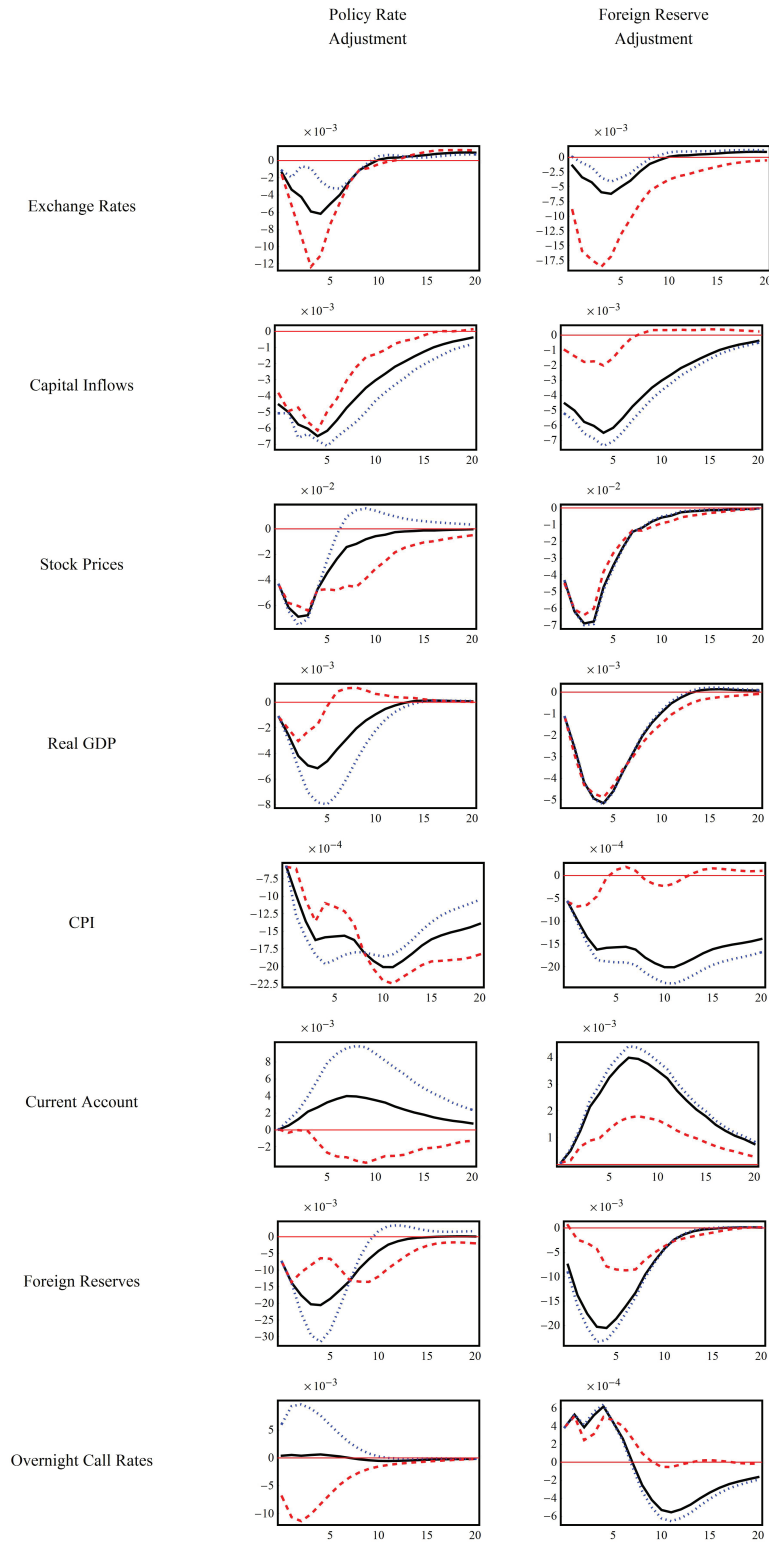
Figure 8: Impacts of a One-percent-point Hike in U.S. Policy Rates on Turkey and Korea



Note: The figure shows the impulse response of the two countries to the shock of a one-percent-point increase in the U.S. policy rates. Responses of each country are estimated by the Bayesian method with different priors.

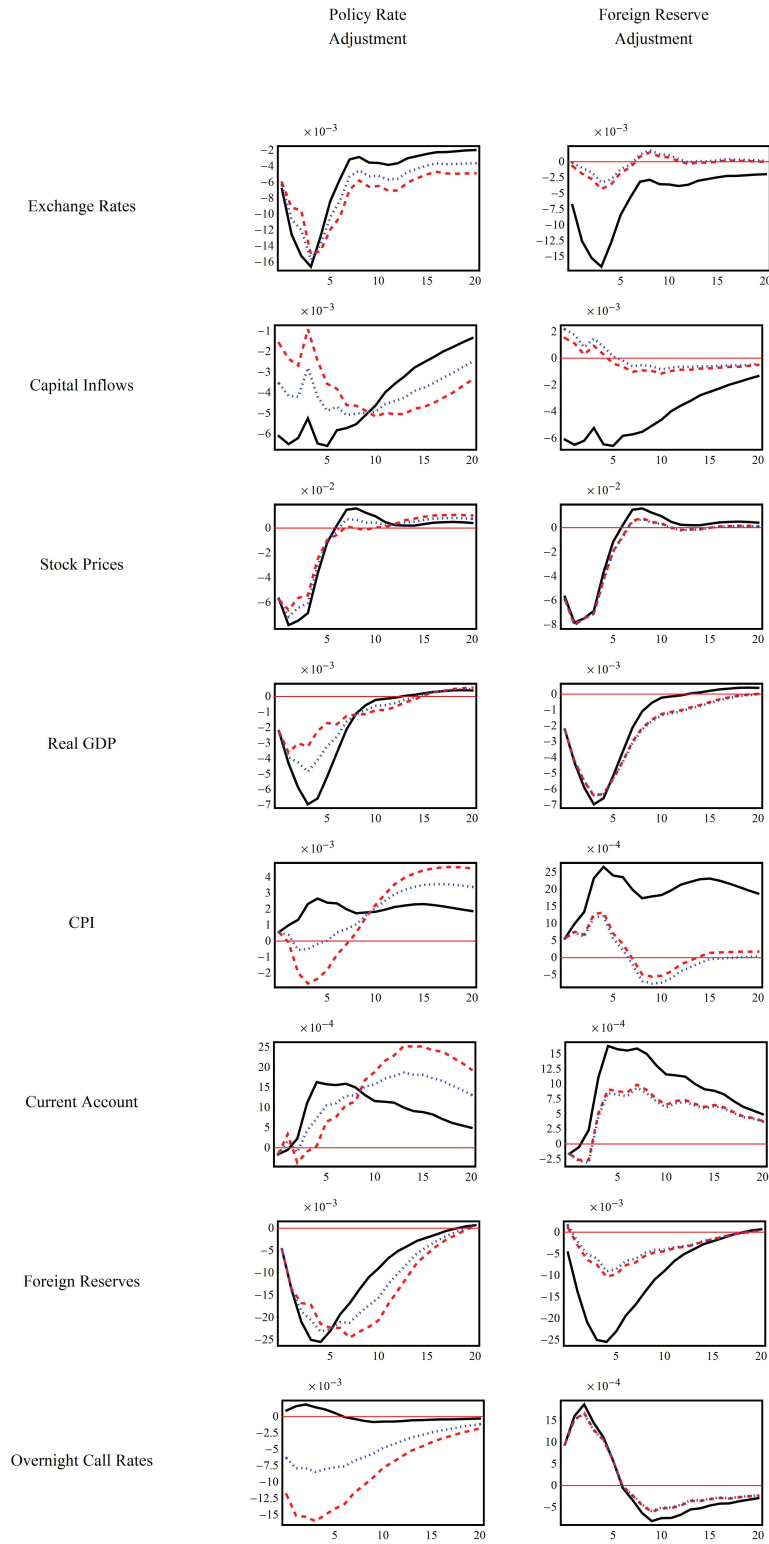


Figure 9: Counterfactual Analysis on Resilient EMEs



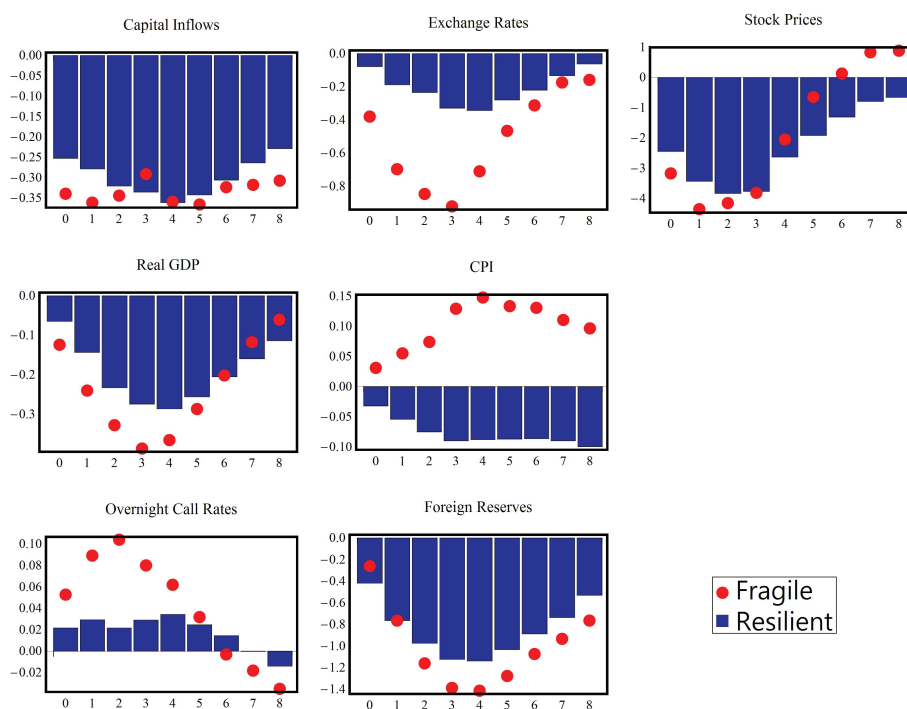
Note: The figure shows the impacts of alternative policy responses from resilient EMEs. The red dash line shows the alternative trajectory under core-oriented policy; and the blue dotted line shows the trajectory under shore-oriented policy. The core-oriented policy chooses a mix of policy rates and foreign reserves to minimize macroeconomic disturbances. Similarly, the shore-oriented policy chooses a mix of the policy instruments to curtail the volatility of exchange rates and foreign capital inflows.

Figure 10: Counterfactual Analysis on Fragile EMEs



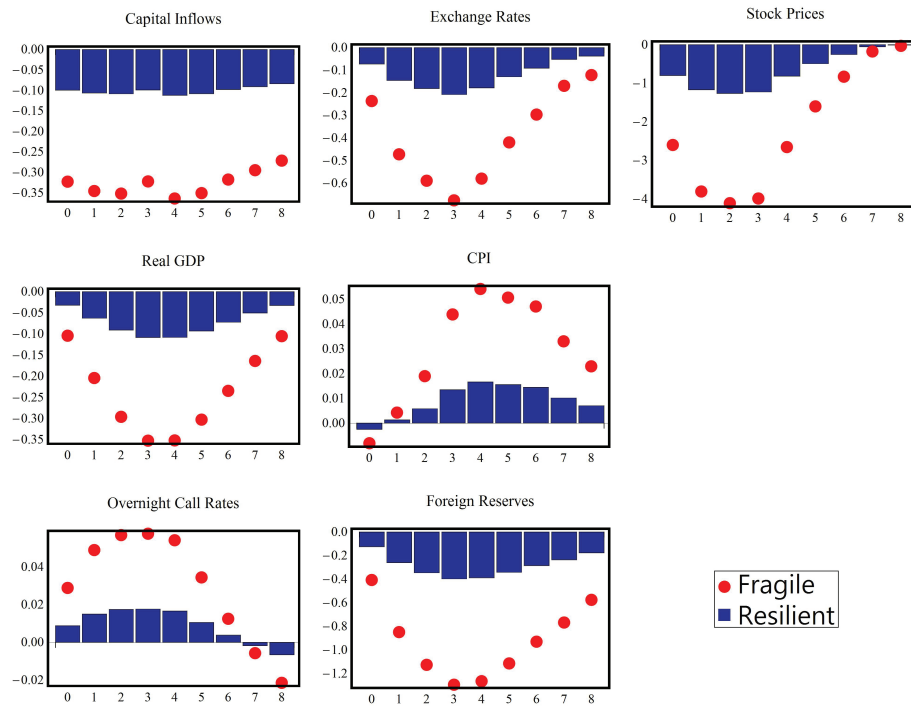
Note: The figure shows the impacts of alternative policy responses from fragile EMEs. See the 9 for legend.

Figure 11: Impact of a One-percent-point Hike in U.S. Policy Rates on the Two EME Groups



Note: This figure shows the responses of the two EME groups against the GL shock created by policy rate change in the U.S. The same analysis is used in Table 3.

Figure 12: Impact of a One-percent-point Hike in U.S. Policy Rates on the Two Countries under the same Prior



The figure shows the impulse response of the two countries under the shock created by a one-percent-point increase in the U.S. policy rates. Unlike 8, each country is estimated under the same prior.

Table 1: **Shocks to GL Momenta**,  $\mathbb{E}_t(v_{t+1}|X_{t+1})$

| Scenario        | Baseline | Policy rates<br>1% increase | M0 growth<br>21% decrease | Policy rates<br>1% increase &<br>concomitant effect <sup>a</sup> | M0 growth<br>21% decrease &<br>concomitant effect <sup>b</sup> |
|-----------------|----------|-----------------------------|---------------------------|--|--|
| Policy-driven   | 0.0646   | -0.2067<br>(-0.2713)        | -0.0074<br>(-0.0720)      | -0.4996<br>(-0.5642)   | -0.0350<br>(-0.0996)   |
| Market-driven   | 0.1363   | 0.3972<br>(0.2609)          | 0.0430<br>(-0.0933)       | 0.6777<br>(0.5414)   | 0.0110<br>(-0.1253)  |
| Risk averseness | -0.0582  | -0.1344<br>(-0.0762)        | -0.4053<br>(-0.3471)      | -0.4339<br>(-0.3757)   | -0.5728<br>(-0.5146)   |

<sup>a</sup> A one percent point increase in Treasury yield as well as in real interest rates

<sup>b</sup> Increase in Treasury yield and lending rates as estimated by a separately VAR model

\* The numbers in parentheses are differences from the baseline scenario

Table 2: **Shocks to Policy-Driven GL, Given Other GL Momenta**,  $\mathbb{E}_t(v_{t+1}^1 | X_{t+1}, F_{t+1}^2, F_{t+1}^3)$

| Scenario      | Baseline | Policy rates<br>1% increase | M0 growth<br>21% decrease | Policy rates<br>1% increase &<br>concomitant effect <sup>a</sup> | M0 growth<br>21% decrease &<br>concomitant effect <sup>b</sup> |
|---------------|----------|-----------------------------|---------------------------|--|--|
| Policy-driven | 0.0220   | -0.3250<br>(-0.3470)        | -0.0846<br>(-0.1066)      | -0.7351<br>(-0.7571)   | -0.1321<br>(-0.1541)   |

<sup>a</sup> A one percent point increase in Treasury yield as well as in real interest rates

<sup>b</sup> Increase in Treasury yield and lending rates as estimated by a separately VAR model

\* The numbers in parentheses are differences from the baseline scenario

Table 3: **Impacts of U.S. Monetary Policy Normalization on Two Groups of EMEs**

| Variable                          | All   | Fragile(F) | Resilient(R) | Difference(F-R) |
|-----------------------------------|-------|------------|--------------|-----------------|
| Real GDP <sup>a</sup>             | -0.35 | -0.39      | -0.27        | -0.11           |
| CPI <sup>b</sup>                  | 0.08  | 0.24       | -0.18        | 0.42            |
| Stock Prices <sup>c</sup>         | -4.11 | -4.36      | -3.83        | -0.53           |
| Exchange Rates <sup>d</sup>       | -0.68 | -0.92      | -0.34        | -0.58           |
| Overnight Call Rates <sup>e</sup> | 0.06  | 0.10       | 0.03         | 0.07            |
| Foreign Reserves <sup>f</sup>     | -0.41 | -0.26      | -0.42        | 0.16            |
| Capital Inflows <sup>g</sup>      | -0.36 | -0.37      | -0.36        | 0.00            |

<sup>a</sup> Cumulative effect for a year

<sup>b</sup> Cumulative effect for two years

<sup>c</sup> Biggest drop in prices

<sup>d</sup> Biggest depreciation

<sup>e</sup> Biggest Increase

<sup>f</sup> Initial Response

<sup>g</sup> Largest outflow as a per cent of GDP

Table 4: **Resilient EME’s Policy Mix against a Negative Shock on Policy-Driven GL**

| Policy Rates     |               |           |                |  |
|------------------|---------------|-----------|----------------|--|
|                  | Core-oriented | Benchmark | Shore-oriented |  |
| Foreign Reserves |               |           |                |  |
| Core-oriented    | 8, 94         | 34, 82    | 72, 71         |  |
| Benchmark        | 24, 56        | 53, 29    | 85, 18         |  |
| Shore-oriented   | 28, 48        | 57, 23    | 88, 30         |  |

Note: The table presents the performance of mixes of two policy tools, policy rates and foreign reserves, to policy-driven liquidity shock. Each policy tool is set to achieve the policy goal specified in the header row and in the header column. Core-oriented policy aims to stabilize the macroeconomic variables, growth rate and consumer price index, while Shore-oriented policy targets at reducing volatility in exchange rates and foreign capital inflows. For example, the element in the first row and third column represents the performances of the policy mix by which policy rates are chosen for external stability and foreign reserves are chosen for macroeconomic stability. The first value in each cell stands for macroeconomic performance (Core) and the second value represents performance in external sector (Shore). Performances are measured by percentiles from the kernel distribution derived from nine observations of each policy mix. Lower values indicate desirable policy performances. Each measure is normalized by standard deviations of its historical data.



Table 5: **Fragile EME's Policy Mix against a Negative Shock on Policy-Driven GL**

| Policy Rates     | Core-oriented | Benchmark | Shore-oriented |
|------------------|---------------|-----------|----------------|
| Foreign Reserves |               |           |                |
| Core-oriented    | 31, 52        | 58, 16    | 12, 33         |
| Benchmark        | 66, 83        | 94, 84    | 80, 81         |
| Shore-oriented   | 34, 53        | 60, 15    | 13, 33         |

Note: See Table 4 for details on the table.