The effects of U.S. monetary policy uncertainty shock on international equity markets

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Abstract

In this study, we quantify the propagation effects of the U.S. monetary policy uncertainty (MPU) shock on real equity prices of 33 advanced and emerging countries over the period 1980Q1 to 2019Q4. We employ a large-scale global vector autoregressive (GVAR) model which simultaneously accounts for country-specific macroeconomic conditions as well as regional and global trade and financial linkages among the countries. We show that the U.S. MPU shock spreads negative (but temporary) effects on the real equity prices, albeit with greater impacts on the advanced markets than their emerging counterparts owing to the greater connections of the former with the U.S. economy. Our results hold important implications for portfolio investors and policymakers.

Keywords: Monetary Policy Uncertainty, Global Vector Autoregressive Model, U.S., Emerging Markets, Advanced Markets

JEL Codes: C32, G15, E40, E52, E44

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1. Introduction

This paper examines the global spillover effects of the U.S. monetary policy uncertainty shock across developed and emerging stock markets. The motivation for this research objective is informed by the potential of U.S. monetary policy announcements to engender far-reaching effects on macroeconomic fundamentals across diffrerent economies, developed and emerging economies (see for example, Mumtaz & Surico, 2017; Swanson, 2018; Gupta et al., 2019; Demirer et al., 2019; Razmi et al., 2020; Yeldiz et al., 2021; Lastauskas & Nguyen, 2021, among others). Theoretically, the connection between policy uncertainty and stock markets performance can be explained via the theory of irreversible investment in which firms' future investment opportunities are suppressed as they adopt "wait and see" approach during uncertainty until the financial environment calms (see Demers (1991). Thus, we hypothesize negative relationship between the U.S. MPU and equity markets performances of developed and emerging markets particularly given the signaling effect of U.S. monetary policy shock on investor sentiment on a global scale (see also Albagli et al., 2019; Zada et al., 2021; Lin et al., 2021; Tumala et al., 2021).

Further motivation for this study emanates from policy perspective of international risk transmission as evidenced by the global financial crisis spillover in 2007/08. Understanding the dynamics of international propagation of the U.S. monetary policy uncertainty could be of immense benefit to investors as such information could help in informing investment/diversification decisions because risk spillovers affect stocks valuation. Also, the study is justified considering the fact that many policymakers often cite uncertainty associated with the United States policy decisions as the basis for discretionary policy and for revising the economic forecasts given the impact of the U.S. monetary policy uncertainty on interntional capital flows and external financing (see Cheng & Ku, 2016; Kose et al., 2017).

A number of notable studies have examined the U.S. monetary policy uncertainty from regional or global perspective (see for example, Alqahtani et al., 2019; Paule-Vianez et al., 2020; Lakdawala et al., 2021). The study of Alqahtani et al. (2019) on the U.S. policy uncertainty shock spillover is limited to stock markets in the Gulf Cooperation Council (GCC) and the findings may therefore not be generalizeable for prominent equity markets such as the developed and emerging equity markets. Paule-Vianez et al. (2020) also examine the effect of U.S. MPU on the U.S. equity market rather than the spillover to international equity markets. The Lakdawala et al. (2021) study find that US policy uncertainty impacts the equity markets in both advanced and emerging

countries. However, the study employs an analytical technique that ignores salient features of the economies of interest. We therefore build the contribution for the present study on the examination of the propagation of the U.S. monetary policy uncertainty to global equity markets via a framework that simultaneously accounts for individual country peculiarities as well as regional and global trade and financial linkages among the countries.

With this contribution, we tease out the salient cross-border impacts of U.S. monetary policy uncertainty on the global stock markets using the global vector autoregression (GVAR) model that incorporates various country linkages through trade/financial flows and other macroeconomic interactions among the countries. In the global model (GVAR), we utilize data covering the U.S. alongside 32 other advanced and developing countries, which together account for about 90% of the global economy. For robustness, we consider both the Equity Market Volatility-based Monetary Policy Uncertainty tracker (hereinafter, EMV-MPU) of Baker et al. (2021) and a Monetary Policy Uncertainty Index developed by Husted, Rogers, and Sun (2019) (hereinafter, HRS-MPU)[4], both computed for the U.S. Both measures are text-based measures of the U.S. monetary policy uncertainty included disticnly to achieve robustness and in all to show whether the choice of monetary policy uncertainty indicator matters in the stock market dynamics of the countries.

Our findings advance the literature on the role of U.S. MPU shock to global stock markets and we show that U.S. monetary policy uncertainty shock propagates negative and significant impacts internationally. However, the effects appear to be greater on the advanced markets than their emerging counterparts. The negative effects are equally greater when EMV-MPU index is used relative to the HRS-MPU index, implying that the choice of monetary policy uncertainty indicator matters in modeling the response of international stock markets to U.S. monetary policy uncertainty shock. These findings hold significant implication for the direction of portfolio diversification destination towards emerging markets when policy uncertainty heightens in the U.S. The implication of the findings is instructive as policymakers and international investors may find the role of monetary policy uncertainty originating from the U.S. crucial when valuing stocks and taking policy actions to influence capital flows. Equally, the differences observed in the extent

[4] Rogers and Xu (2019) study the forecasting performance of EPU over real and financial outcome variables, along with other measures of uncertainty and show that the forecast outcome is sensitive to alternative measures of uncertainty (see also De Pooter et al., 2020; Tillmann, 2020).

of propagation of the international spillover effects by the two indicators of U.S. monetary policy uncertainty employed (EMV-MPU and HRS-MPU) seem to stem from the computational scope of these indicators, thus, choosing the appropriate measure of MPU when modelling monetary policy uncertainty is crucial to derive outcomes that properly reflect its inherent connections with the variable(s) of interest.

The remainder of the paper is presented thus: Section 2 discusses literature review, section 3 discusses the methodology, Section 4 presents the results and discussion while Section 5 concludes the paper.

2. Literature Review: Empirical and Theoritical Issues

On the theoretical front, the work of Demers (1991) provides the impetus regarding uncertainty shock and stock markets performance through the framework of irreversible investments in which firms future investment opportunities are treated as real options and the role of wait until uncertainty is resolve is amplified, resulting in reduction in investments and consequent deterioration of equity prices. The impact of the U.S economy on other economies has been extensively addressed in the literature, especially after the the 2007-2009 crisis (Bagliano et al., 2012; Razmi et al. 2015; Choudhry et al., 2020; Marcal et al., 2020). The financial crisis showed that the U.S economy has a crucial influence on the global volatility. The U.S monetary policy is essential for the achievement of country's economic goals, and unceretainty around the policy will eqully spill cross-border effects. One of the most widely used indicators of uncertainty is the economic policy uncertainty (EPU) index developed by Baker et al. (2016).

Researchers have used EPU indexes to show that policy uncertainty can affect the economy and asset prices. For example, Gulen and Ion (2016) and Baker et al. (2016) using firm-level data, have shown that policy uncertainty seems to reduce investment and employment, especially in firms that are more dependent on government spending. At the macro level, Bachmann, Elstner, and Sims (2013) and Baker et al. (2016) have shown that higher policy uncertainty can lower investment, output, and employment. Thus, monetary policy effectiveness is undermined during episodes of policy uncertainty (Aastveit, Natvik, and Sola, 2013), giving rise to incearsed stock market volatility (Pastor and Veronesi, 2012; Pastor and Veronesi, 2013; Brogaard and Detzel, 2015) as well as default risk and credit spreads (Li and Rose, 2006; Chow and Choy, 2009; Manzo,

2013) and increased financial intermediation costs (Francis, Hasan, and Zhu, 2014; Chow et al. 2019; Aye 2021).

There is a growing strand of literature on the effect of the monetary policy uncertainty on various market prices. For example, Swanson (2006) uses the derivative-based measure from euro-dollar futures and options to find that increased transparency in Federal Reserve communications, that is naturally associated with decline in monetary policy uncertainty, has led to improved private sector interest rates forecasts. Using the same MPU measure, De Pooter et al. (2020) document that the level of the MPU matters for the reaction of medium- and long-term yields on the nominal and real U.S. Treasury securities to monetary policy surprises. Bauer, Lakdawala, and Mueller (2019) use a similar Market-MPU measure based on the euro-dollar futures and options - a standard deviation of conditional risk-neutral distribution of changes in the short-term interest rate at different horizons, to study the effect of the MPU on financial markets. The study shows that changes in uncertainty have pronounced effects on asset prices, distinct from the effects of changes in expected policy rates. In particular, the study documents that when uncertainty is low, monetary policy surprises have stronger effects on asset prices.

Tillmann (2020) uses three measures of monetary policy uncertainty to assess its effect on the term structure of interest rates. The first is the news-based MPU measure by Husted et al. (2020), the second is the interquartile range of the 12-month ahead forecasts about 3-month Treasury bills from the Survey of Professional Forecasters; and the third is a disagreement in 12-month ahead forecasts about 10-year yields from Consensus Economics introduced by Istrefi and Mouabbi (2018). In line with De Pooter et al. (2020), Tillmann (2020) also finds that the level of the monetary policy uncertainty is important for the reaction of the term structure of interest rates to monetary policy surprises. Bundick, Herriford, and Smith (2017) provide a model for the relationship of the term premium, interest rate uncertainty and correlation of bond yields with consumption, in a representative agent endowment economy. Husted, Rogers, and Sun (2016) also show that U.S. output and inflation fall and credit costs become tighter following shocks that increase the MPU index.

3. Methodology

3.1 The Model

The Global Vector Autoregressive (GVAR) framework comes in handy for achieving the study's objective which is to estimate the spillover effects of U.S. uncertainty shock among global equity markets. The GVAR model, by design, incorporates time series, panel data, and factor analysis techniques in a unified framework to analyse the response of different macroeconomic fundamentals (output, real equity and real exchange rate) to different shocks (regional and global shocks) (see the foundation discussions in Pesaran et al., 2004). It combines individual country/regional vector error-correcting models, where the domestic variables are related to corresponding foreign variables constructed exclusively to match the international trade, financial or other desired patterns of the country under consideration.

The GVAR model has been applied to a variety of research questions, such as the international linkages of the euro area (see Dées et al., 2005, 2007a), credit risk analysis (Pesaran et al. 2006), the construction of measures of steady-state of the global economy (Dées et al. 2009), an analysis of the UK's and Sweden's decision to or not to join the European Monetary EMU (Pesaran et al. 2007), the analysis of international trade and global imbalances (Greenwood-Nimmo et al., 2010; Konstantakis & Michaelides, 2014; Cashin et al., 2016, 2017b). Some other applications of the the global model include international macroeconomic transmission of weather shocks (Cashin et al. 2017a), the impact of commodity price shocks (Mohaddes and Pesaran, 2016, 2017; Mohaddes and Raissi, 2019).

The GVAR modeling approach proceeds from the comprehensive model of individual country $VARX^*(p_i, q_i)$ models across $N+1$ group of emerging and advanced countries, such that $i = 0,1,2,...,32$. The $(N+1)^{th}$ country is the U.S., which is so included to serve as the reference or dominant country through which the monetary policy uncertainty shock is propagated to the global economy. The country-specific $VARX^*(p_i, q_i)$ models express the endogenous (domestic) variables conditional on the foreign and global variables and their lagged values as follows:

$$\beta_{i1}(L, p_i)x_{it} = \delta_{i1} + \delta_{i2}t + \beta_{i2}(L, q_i)x_{it}^{*} + \zeta_{it};\ t = 1,2,...,T., \qquad (1)$$

where $\beta_{i1}(L, p_i)$ and $\beta_{i2}(L, q_i)$ are lagged polynomials with p_i and q_i as the lag orders of the endogenous and weakly exogenous variables; δ_{i1} and δ_{i2} are vector of constants and coefficients

of linear trend, respectively; ζ_{it} are $\lambda x1$ vector of spherical errors. Each of the country-specific $VARX^*(p_i, q_i)$ models contains $\lambda_i x1$ vector of endogenous variables (x_{it}) (these are domestic macroeconomic variables, namely, inflation, real equity prices, exchange rate, and interest rate), and $\lambda_i^* x1$ vector of weakly exogenous foreign and global variables (x_{it}^*). The global variables are commodity prices, metal prices, and due to the import of this study, we include US monetary policy uncertainty shock. The foreign variables are the mirror counterparts of the domestic variables constructed by pre-weighting the latter with trade weights, w_{ij}, obtained from the cross-country trade linkages. Given these matrices, the foreign variables are constructed as:

$$x_{it}^* = \sum_{j=0}^{N} w_{ij} x_{jt}; \ \sum_{j=0}^{N} w_{ij} = 1; \ w_{i1} = 0, \tag{2}$$

We combine the country-specific $VARX^*(p_i, q_i)$ models into a solvable (stacked) global model using $(\lambda_i + \lambda_i^*) \times \lambda$ link matrix, w_i such that the model can be specified strictly in terms of observables (x_t) as follows:

$$\beta_{i1} w_i x_t = \sum_{\ell=1}^{p} \beta_{i,\rho} w_i x_{t-\rho} + v_{it}; \ \forall i, \tag{3}$$

$$G_1 x_t = \sum_{\rho=1}^{p} G_\rho x_{t-\rho} + v_t \ , \tag{4}$$

$$x_t = \sum_{\rho=1}^{p} G_\rho^* x_{t-\rho} + v_t^* \ , \tag{5}$$

where x_t is a $\eta x1$ vector of all variables, $\upsilon_{it} = \delta_{i1} + \delta_{i2} t + \zeta_{it}$, $z_{it} = w_i x_t$, $\rho = 1, 2, ..., p$, $G_1 = \beta_{i1} w_i$, $G_\rho = \beta_i^\rho w_i$, $G_\rho^* = G_1^{-1} G_\rho$, $v_t^* = G_1^{-1} v_t$. The reduced form $GVAR(p)$ model specified in Equation (5) can be solved recursively and impulse responses are obtained provided that G_1 is invertible, that is, the determinant of G_1 is not zero.

3.2 Data Issues

The GVAR dataset includes quarterly macroeconomic variables for 33 developed and emerging economies including Argentina, Australia, Austria, Belgium, Brazil, Canada, Chile, China, Finland, France, Germany, India, Indonesia, Italy, Japan, Malaysia, Mexico, The Netherlands, New Zealand, Norway, Peru, Philippines, Saudi Arabia, Singapore, South Africa,

South Korea, Spain, Sweden, Switzerland, Thailand, Turkey, the U.K., and the U.S for the period 1980Q1-2019Q4. This creates a global modelling framework for analyzing international macroeconomic transmission of shocks, taking into account drivers of economic activity, interlinkages and spillovers between different countries and the effects of the observed and unobserved common factors. The macroeconomic variables include six domestic variables namely the log real GDP (y_{it}), the rate of inflation (dp_{it}), short-term interest rate (r_{it}), long-term interest rate (lr_{it}), the log deflated exchange rate (ep_{it}), and log real equity prices, eq_{it}), and three global variables commodity prices (oil prices, $poil_t$, agricultural raw material, $pmat_t$, and metals prices, $pmetal_t$,) and the U.S.MPU index, which is the variable of interest.

All the data used in this study, with the exception of U.S. EMV-MPU and HRS-MPU, are obtained from the updated GVAR toolbox by Mohaddes and Raissi (2020) [5]. We use both the U.S. monetary policy uncertainty index of Baker et al. (2021) (i.e., EMV-MPU) obtained from the database of the Federal Reserve Bank of St. Louis (see https://fred.stlouisfed.org/series/EMVMONETARYPOL) and the U.S. MPU developed by Husted et al. (2019) for the United States (HRS-MPU) available at http://www.policyuncertainty.com/hrs_monetary.html. While the EMV-MPU focuses on equity market volatilty related uncertainties that cover a large spectrum of the U.S. newspapers regardless of whether those concerns involve U.S or foreign monetary policy, the HRS-MPU uses three U.S newspapers (Wall Street Journal, New York Times, and Washinton Post) in the construction of the index.[6]

There are primarily three broad approaches to quantify monetary policy uncertainty (Gupta et al., 2018): (1) A text-based approach that builds on searches of major newspapers or country-reports for terms related to monetary, interest rate, Fed rate, and policy uncertainty, and then uses the results to construct indices of uncertainty; (2) Econometric approach in which measures of uncertainty are derived from stochastic-volatility estimates of various types of small and large-scale structural models related to macroeconomics and finance, and; (3) Market approach where uncertainty is captured by the dispersion of professional forecasters' disagreement. As far as the metric of uncertainty that we utilize in our analysis is concerned, the first-type of approach is

[5] See link to the data: http://www.econ.cam.ac.uk/people-files/emeritus/mhp1/GVAR/GVAR.html
[6] For technical details on the MPU indices, we refer readers to the relevant articles (i.e., Baker et al. (2021) and Husted et al. (2019)).

considered more appropriate as it measures implied volatility which reflects the sentiments or perception of economic agents about the polcies.

4. Results

This study traces the propagation of monetary policy uncertainty shocks originating from the U.S. to international equity prices of 32 developed and emerging markets. We present the results using two proxies for U.S. monetary policy uncertainty i.e., EMV-based MPU index and the HRS-based MPU index, first, to test if the choice of proxy for uncertainty matters, second, to evaluate robustness of the results. For convenience and ease of interpretation, we reorganize the individual countries into relevant groups and the results are presented accordingly. Thus, we consider the following groups: the G-7 market, G-7 market less the U.S., Advanced markets, Advanced markets less the U.S., Emerging markets, and the Euro market. The group-based impulse response functions that capture the two proxies are rendered in Figures 1 and 2. The impulse response functions (IRFs) (in solid lines) represent (the median) response to a one standard deviation shock to U.S. monetary policy uncertainty given the lower and upper bootstrapped 5%-95% error bands (in dashed lines) to show statistical significance.

The grouped-based IRFs in Figure 1 indicate greater negative effect of the U.S. monetary policy uncertainty shock on the real equity prices utilizing the EMV-MPU. The results show that uncertainty shock propagates significant negative effects across the developed and emerging markets. However, the effects tend to fizzle out at about the 10^{th} forecast horizon, implying a temporal U.S. MPU shock impact devoid of persistence effect. The import of these findings rests on the fact that distortions in international capital markets on account of U.S. uncertainty are transient as the global stock market will always recover from negative shocks associated with uncertainty, on average. The results equally depict differences between the groups associated with developed and emerging markets. For instance, about at the ninth forecast horizon when the impact is highest, real equity prices are reduced by 9.1% in the Euro market, by 8.6% for the G-7 and developed markets less the U.S., and by 7.5% in emerging markets, following U.S. monetary policy uncertainty shock.

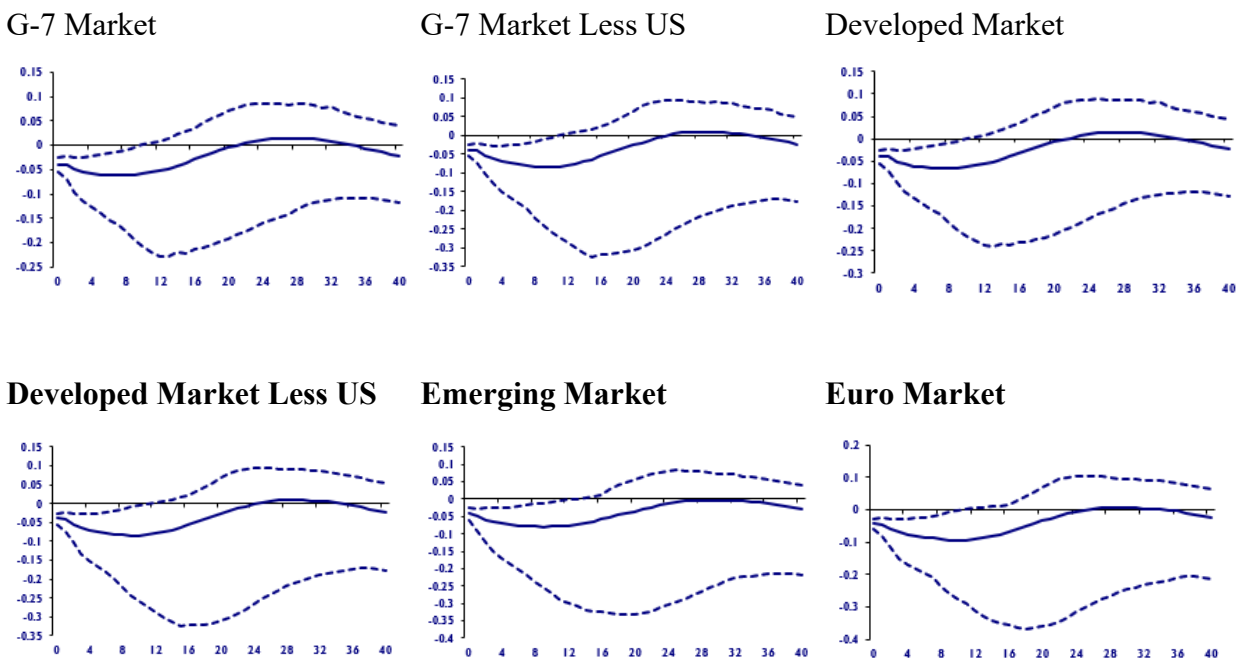

Figure 1: Group Impulse Response Function of Real Equity Prices to a One Standard Deviation US Monetary Policy Uncertainty Shock (EMV-Monetary Policy Uncertainty Index). The median impulse response is presented in solid lines, while the 5%–95% lower and upper bootstrapped error bands are shown in dotted lines. The impact is measured in percentage points (by multiplying the estimates in the figure with 100) over the quarterly horizon.

In otherwords, while all the considered groups respond negatively to the U.S. monetary policy uncertainty shock, the developed markets (including those in the Euro market) respond more to the shock than the emerging markets. The higher negative impact for the developed and Euro market economies highlights the depth of integration of these economies both in terms of policy actions, financial markets, and institutional quality (Kurov, and Stan, 2017). Our results further reveal portfolio diversification destination options towards emerging markets when monetary policy uncertainty in the U.S. is on the rise. The implication of the findings is instructive as policymakers and international investors may find the role of monetary policy uncertainty originating from the U.S. crucial when valuing stocks and taking policy actions to influence capital flows.

The group-based IRFs in Figure 2 show that the significant negative impact of the U.S. monetary policy uncertainty shocks on real equity prices is hardly sustained across the developed and emerging markets using the HRS measure of uncertainty indicator. The results render

significant negative effects of uncertainty shock only to the first forecast horizon and fizzle out, thus exhibiting greater temporal effects than the EMV-MPU indicator. The differences observed in the extent of propagation of the international spillover effects by the two indicators of U.S. monetary policy uncertainty employed (EMV-MPU and HRS-MPU) seem to stem from the computational scope of these indicators. While the EMV-based monetary policy uncertainty indicator reflects the equity market volatility that seems to propagate monetary policy uncertainty shock more to the stock market as compared to the HRS indicator that incorporates other components of monetary policy uncertainty. Thus, the sensitivity of the international equity markets to alternative measures of U.S. MPU is not out-of-place and therefore choosing the appropriate measure of MPU when modelling monetary policy uncertainty is crucial to derive outcomes that properly reflect its inherent connections with the variable(s) of interest.

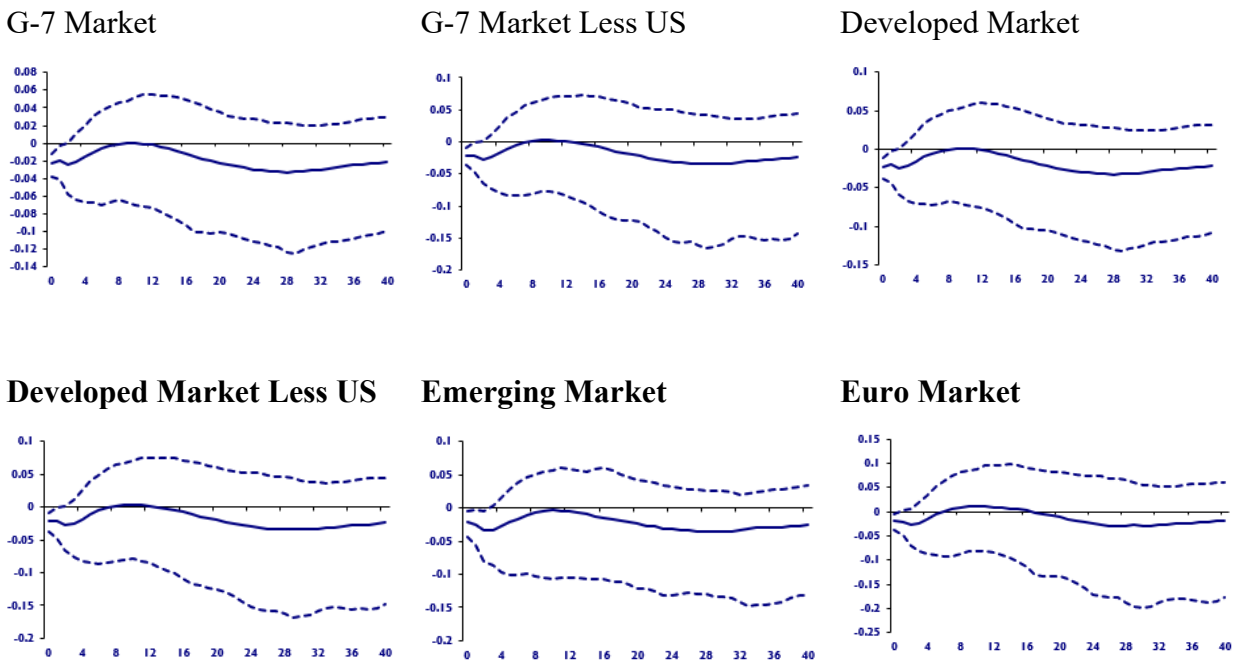

Figure 2: Group Impulse Response Function of Real Equity Prices to a One Standard Deviation US Monetary Policy Uncertainty Shock (HRS-MPU, Monetary Policy Uncertainty Index). The median impulse response is presented in solid lines, while the 5%–95% lower and upper bootstrapped error bands are shown in dotted lines. The impact is measured in percentage points (by multiplying the estimates in the figure with 100) over the quarterly horizon.

5. Conclusion

In this paper, we estimate a global vector autoregressive (GVAR) model to trace the effects of U.S. monetary policy uncertainty shocks on real equity markets of 32 advanced and emerging countries (note that the U.S. is the reference economy in this framework), using quarterly data over the period of 1980Q1 to 2019Q4. The motive for the study is anchored on the potential of the U.S. policy shocks to engender far-reaching effects on economic fundamentals across diffrerent economies. We therefore focus the analysis on the stock market dynamics to tease out the salient cross-border impacts of U.S. monetary policy uncertainty on the global stock market. Understanding this relationship is desirable as stock markets provide a niche for international capital flows particularly portfolio capital. Also, uncertainty associated with the U.S. policy decisions has often reflected as the basis for analysts and policy makers to revise their forecasts.

We contribute evidence to the literature that the U.S. monetary policy uncertainty shock propagates negative and significant spillover effects on real equity prices of other advanced and emerging markets with greater impacts on the former than the latter, highlighting higher linkages between the U.S. and other advanced markets. Our results further reveal portfolio diversification destination options towards emerging markets when monetary policy uncertainty in the U.S. heightens. The results also highlight the need for policy makers to pay attention to the U.S. monetary policy uncertainty when taking policy actions capable of influencing the direction of capital flows. For instance, a sudden rise in U.S. monetary policy rate relative to other (proximate) economies will attract more capital inflows to the U.S. economy which can by extension strengthen trading activities in its stock market relative to others. As part of future research, it would be interesting to formally explore the comparative effects of U.S. fiscal and monetary policy uncertainty shocks, subject to data availability, on international equity markets covering both the developed and emerging markets.

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