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The Effect of US Uncertainty Shock on International Equity Markets: The Role of the Global Financial Cycle

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Abstract

We contribute to the literature on the international propagation of uncertainty shocks with a Global Vector Autoregressive (GVAR) model that quantifies the spillover effects of uncertainty shocks in the US on to real equity prices of 32 advanced and emerging countries (besides the US). In this regard, we also account for the role of global financial market conditions in the propagation of these shocks, using high and low values of the Global Financial Cycle (GFCy) index. Using quarterly data over 1980:1 to 2019:2, our findings reveal greater response of advanced markets than emerging counterparts to an US uncertainty shock. Further, we show consistent higher negative responses during weak financial conditions than otherwise, confirming the intervening role of the GFCy index. Our results have important implications for investors and policymakers.

Keywords: Uncertainty Shocks, International Financial Markets, Global Vector Autoregressive Model
JEL Codes: C32, G15

1. Introduction

Given that the Global Financial Crisis (GFC) originated in the United States (US) (due to the subprime mortgage crisis), there exists a large literature (see Trung (2018, 2019) and Gupta et al., (2019, 2020) for detailed reviews), which highlight the existence of significant negative spillover effect of US uncertainty on macroeconomic variables of other developed and emerging market economies (individually or in groups) via the trade, financial market, and exchange rate channels. The studies related to this line of research reveal that the effect of US uncertainty shocks on international macroeconomic

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aggregates are relatively stronger than corresponding domestic innovations of uncertainty. This result is not necessarily surprising given that there is widespread evidence that US uncertainty shock is in fact the main driver of global uncertainty (Klößner and Sekkel, 2014; Ko and Lee, 2015; Yin and Han 2018; Antonakakis et al., 2018). We aim to add to the existing literature on the spillover of US uncertainty shocks, by analyzing its impact on global equity markets, involving 32 developed and developing economies, besides the US, over the quarterly period of 1980:1 to 2019:2, with these countries covering 90% of the world Gross Domestic Product (GDP). For our purpose, we rely on the Global Vector Autoregressive (GVAR) framework, originally proposed by Pesaran et al., (2004), which can account for international transmission of shocks (in our case US uncertainty) based on a large panel of country-level macroeconomic data (i.e., output, inflation, short- and long-term interest rates, real exchange rate, metric of country-specific uncertainty as developed Ahir et al., (2018), over and above the equity prices) and global exogenous variables (like commodity prices). Indeed, a number of studies have analyzed the impact of US uncertainty shock on individual stock markets of Africa, Asia, Asia-Pacific, Europe and aggregate of emerging countries (see for example, Dakhlaoui and Aloui (2016), Christou et al., (2017), Chuliá et al., (2017a), Das and Kumar (2018), Asafo-Adjei et al., (2020), Chaing (2020), Bhattarai et al., (2020), Liang et al., (2020)). However, to the best of our knowledge, this is the first attempt to analyze the impact of US uncertainty spillovers on 33 countries considered simultaneously by controlling for a wide-array of domestic and global macroeconomic and financial variables, as well as uncertainty, which are known to drive international stock markets (Sousa et al., 2016; Aye et al., 2017; Phan et al., 2018). In the process, our paper provides more accurate inferences regarding the size of the impact of US uncertainty on global equity markets by preventing the omitted variable bias.

Besides this, another unique contribution of our paper is to analyze the effect of US uncertainty shock on stock markets of multiple developed and developing economies, by conditioning the impact on the state of global financial markets. In this regard, we augment the exogenous variables (oil prices, agricultural raw material prices, and metals

prices) in the GVAR, with the higher (above median) and lower (below median) values of the Global Financial Cycle (GFCy) index of Miranda-Agrippino and Rey (2020), considered in turn to mimic scenarios of lower and higher financial distress, respectively. Note that, the GFCy index is a single global factor that explains an important share of the variation of risky asset returns around the world. We must point out that the motivation to conduct the analysis contingent on bearish and bullish phases of financial markets emanate from the so-called "finance uncertainty multiplier" concept as coined by Alfaro et al., (2018). These authors, theoretically show that higher uncertainty alongside financial frictions not only induces the standard real options effects on investment and hiring, but also leads firms to hoard cash, thus further reducing investment and hiring. In other words, a positive US uncertainty shock is expected to have larger negative effect on global stocks markets in periods of financial distress than in tranquil times,[1] and our conditional approach incorporated in the GVAR model, allows us to test this hypothesis at the same time.

At this stage, we must emphasize that, while analyzing the spillover effect of US uncertainty on macroeconomic variables of other countries is a pertinent issue, the same analysis on stock markets, conditional on the state of the global financial markets, is also of tremendous importance to policymakers. This is because, equity markets are historically known to be leading indicators for output and inflation (Mauro, 2003; Stock and Watson, 2003), and hence the impact of US uncertainty on them are likely to make the effect on the macro variables more persistent. And if indeed this effect is dependent on phases of global financial markets, then the design of expansionary monetary policy to reduce the recessionary effect needs to accommodate for the initial state of the asset markets at the time the US uncertainty shock hits the world. Understandably, at the same time, our findings will also be informative for investors in making portfolio decisions.

[1] The reader is referred to the works of Popp and Zhang (2016), Alessandri and Mumtaz (2019), Caggiano et al., (forthcoming) for analyses on the finance uncertainty multiplier effect on US output.

The remainder of the paper is organized as follows: Section 2 describes the basics of the GVAR model, along with the data involved in its estimation, while Section 3 presents the empirical findings, with Section 4 concluding the paper.

2. Methodology and Data

As discussed in the introduction, we adopt the GVAR framework to explore the diffusion of uncertainty shocks originating in the US on equity markets of other advanced and emerging countries, besides the US itself, motivated by the works of Pesaran et al., (2004), Dées et al., (2007); Chudik and Pesaran (2013), and Smith and Galesi (2014).

The GVAR modelling 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: $i = 0,1,2,...,33$. The $(N+1)th$ country is the US, which is so included to serve as the reference country through which the uncertainty shock is propagated to the global financial systems. 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 respectively; δ_{i1} as the vector of constants and δ_{i2} as the vector ofare coefficients of linear trend; ζ_{it} is a λ x 1 vector of spherical errors. Each of the country-specific $VARX*(p_i, q_i)$ models contains a λ_i x 1 vector of endogenous variables (x_{it}) (these are domestic macroeconomic variables, namely, inflation, real equity prices, exchange rate, short- and long-term interest rates and uncertainty), and λ_i^{*} x 1 vector of weakly exogenous foreign and global variables (x_{it}^{*}). The global variables are commodity prices, metal prices, and the lower (below median) or higher (above median) values of the GFCy index, given the importance of this index as a measure of the global financial climate. 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 flows. Given the matrix of trade weights, 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 $(\lambda_i + \lambda_i^*)\text{x}\lambda$ 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 ηx1 vector of all variables, $v_{it} = \delta_{i1} + \delta_{i2} t + \zeta_{it}$, $z_{it} = w_i x_t$, $\rho = 1, 2, ..., p$, $G_1 = \beta_{i1} w_i$, $G_\rho = \beta_i^\rho w_i$, $G_\rho^* = G_1^{-1} G_\rho$, $v_t^* = G_1^{-1} v_t$. The reduced form $GVAR(p)$ model specified in Equation (5) can be solved recursively and impulse responses obtained provided that G_1 is invertible, that is, the determinant of G_1 is not zero (see Cashin et al., 2017).

The GVAR model is estimated with domestic variables for the $(N+1)$ advanced and emerging economies as in the GVAR toolbox of Smith and Galesi (2014), the data of which has been recently updated to end of 2019 by Mohaddes and Raissi (2020),[2] and includes log of real equity prices, short and long-term interest rates, US dollar-based real exchange rate, inflation rate, and global variables (common factors) namely, global prices of oil, agricultural commodities and metals. Given the focus of this study, we augment the country-specific variables with an indicator of uncertainty, as developed by Ahir et al., (2018), which is based on frequency counts of the term "uncertainty" (and its variants) in

[2] See link to the data at: http://www.econ.cam.ac.uk/people-files/emeritus/mhp1/GVAR/GVAR.html.

the quarterly Economist Intelligence Unit (EIU) country reports.[3] Moreover, to accommodate for the finance uncertainty multiplier, we augment the global variables set of commodity and the precious metal prices, with lower or higher values of the GFCy index,[4] which mimics the bearish and bullish phases of global asset markets. The GFCy index is based on the works of Miranda-Agrippino and Rey (2020) and Miranda-Agrippino et al., (2020),[5] and is generated as the common global factor extracted from a dynamic factor model (DFM) that involves a comprehensive panel of 1004 risky assets including equity and corporate bond indices that represent Europe, North America, Latin America, Asia-Pacific, and Australia as well as commodity prices excluding precious metals. Miranda-Agrippino and Rey (2020) show that this single common global factor alone accounts for over 20% of the common variation in the price of risky assets globally despite the heterogeneity of the asset markets included in the panel.

Our analysis covers 1980:1 to 2019:2, with the start and end dates defined by the data availability of GFCy index.

3. Results

The study traces the propagation of shocks originating in the US to global equity markets conditional on the lower and higher values of the GFCy, which operationalizes the intervening role of bearish of bullish financial markets in propagating the US-originated uncertainty shocks to stock markets of 33 developed and developing countries.

We present results for the two scenarios: high GFCy (bullish financial markets) and low GFCy (bearish financial markets). The impulse response functions (IRFs) that capture the first two scenarios are rendered in Figures 1-4 for the groups of advanced and emerging countries collectively and individually. The IRFs (in solid lines) represent (the median)

[3] The data is available at: http://policyuncertainty.com/wui_quarterly.html.

[4] The high (low) GFCy are constructed by multiplying the GFCy index by a dummy variable which takes the value of 1 when the GFCy is above (below) the median value (equal to 68.75) for the entire period, and zero otherwise.

[5] The link to the data is: http://silviamirandaagrippino.com/code-data.

responses to one standard deviation shock to US uncertainty given the upper and lower bootstrapped 95% error bands (in dashed lines) to show statistical significance.[6]

The group-based IRFs in Figure 1 show that the negative impact of the US uncertainty shocks on real equity prices is hardly significant across the developed and emerging countries under the high GFCy-state. This contrasts with the scenario for the low GFCy-regime in Figure 2, where the negative responses are consistently significant. Further, there are differences between the groups associated with developed and the emerging markets. For instance, about at the eighth forecast horizon when the impact is highest, real equity prices are reduced by 7% in the G7 and developed markets' panels, by 7.5% in G7 and developed markets excluding the US, by 8% in Euro, and by 5.5% in emerging markets, following the US uncertainty shock. Hence, this finding suggests that the US uncertainty shock affects developed and emerging countries differently, with the higher impact on advanced markets possibly due to greater financial dependence between them and the US than with emerging economies (Chuliá et al., 2017b).

Interestingly, the earlier findings are corroborated by the country-specific IRFs presented in Figures 3 and 4. Figure 3 shows that when GCFy is high, the negative impact of US uncertainty shocks is tempered and paled to insignificance. However, the negative responses are significantly evident on the equity prices of the countries during low GFCy. These findings not only establish the asymmetric response of equities to US uncertainty shock under weak and strong financial market conditions, but also affirm the moderating role of GFCy regarding the negative spillover effect of US uncertainty shock on global stock markets.

[6] In Figures A1 and A2, we present the results for own uncertainty shocks for all the 33 countries to further highlight the importance of US uncertainty shocks in driving global stock markets compared to domestic innovations of uncertainty, given the weak statistical evidence of the impact across the low and high GFCy-regimes.

Figure 1: Group Impulse Response Functions of Real Equity Prices to a One Standard Deviation Positive US Uncertainty Shock under the High GFCy-Regime

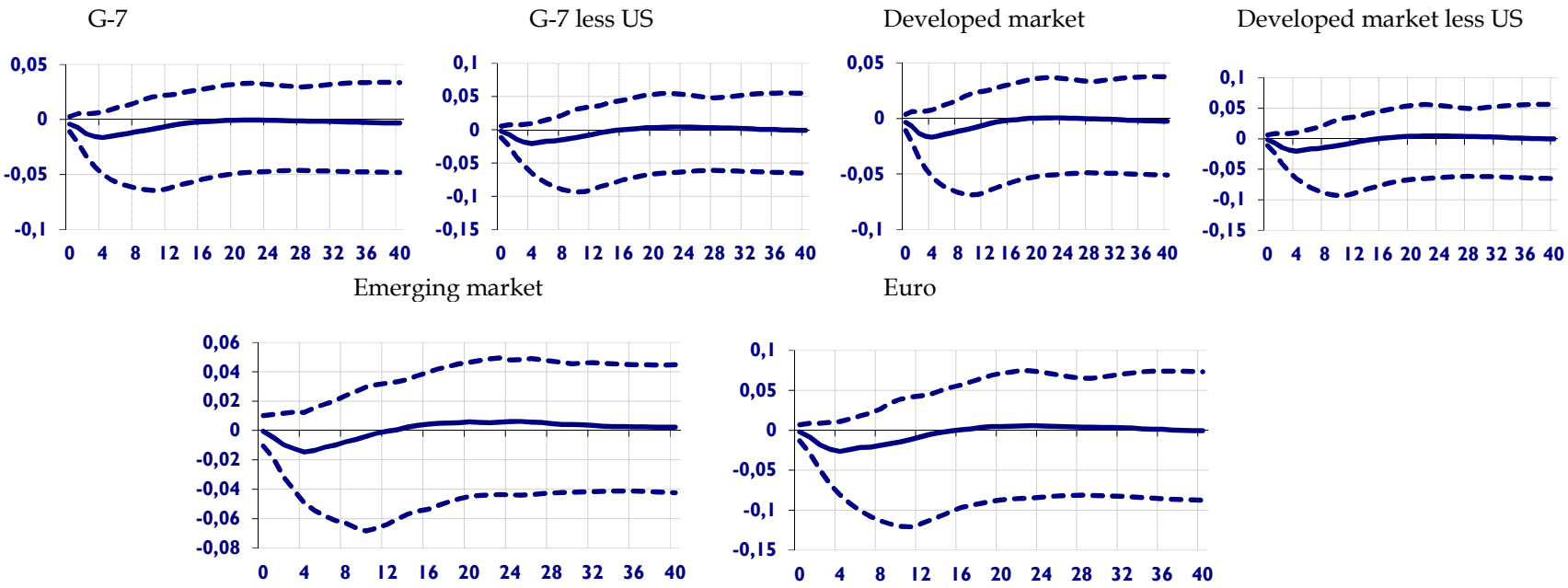


Figure 2: Group Impulse Response Functions of Real Equity Prices to a One Standard Deviation Positive US Uncertainty Shock under the Low GFCy-Regime

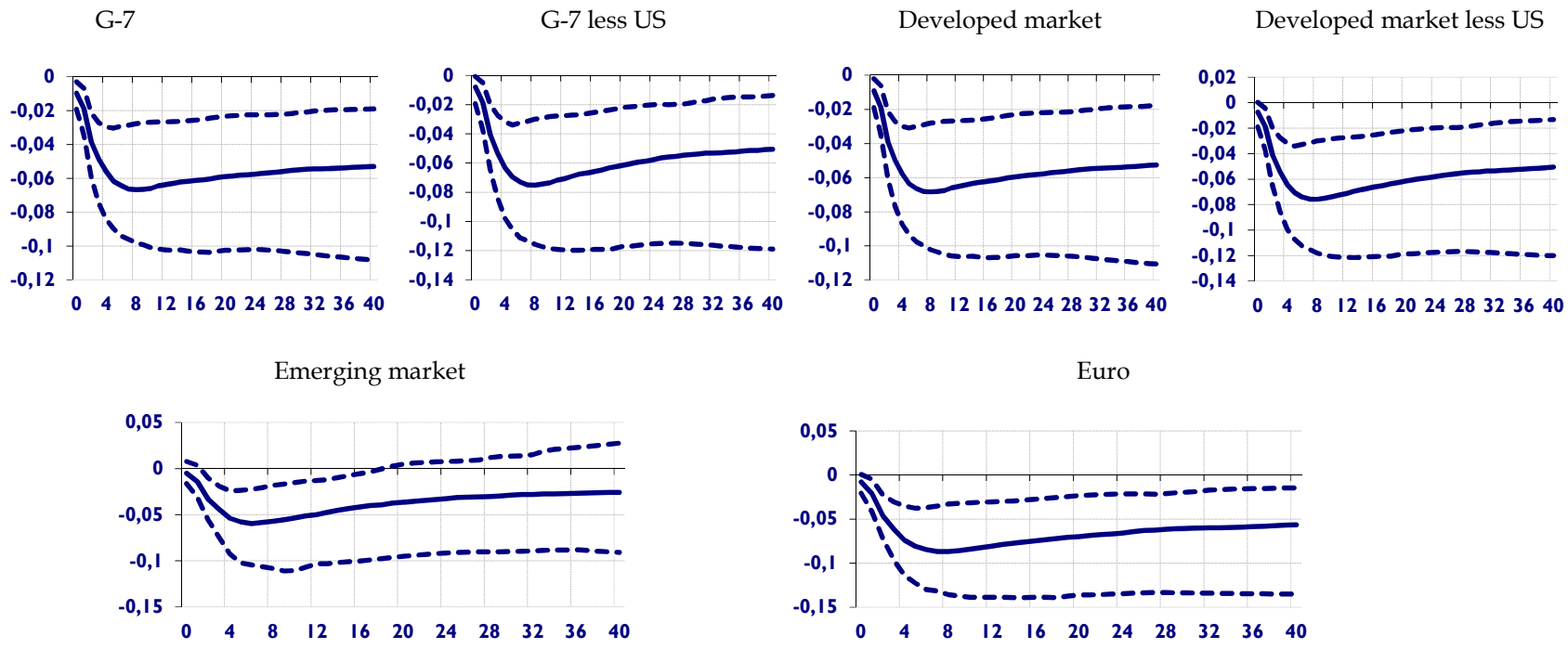
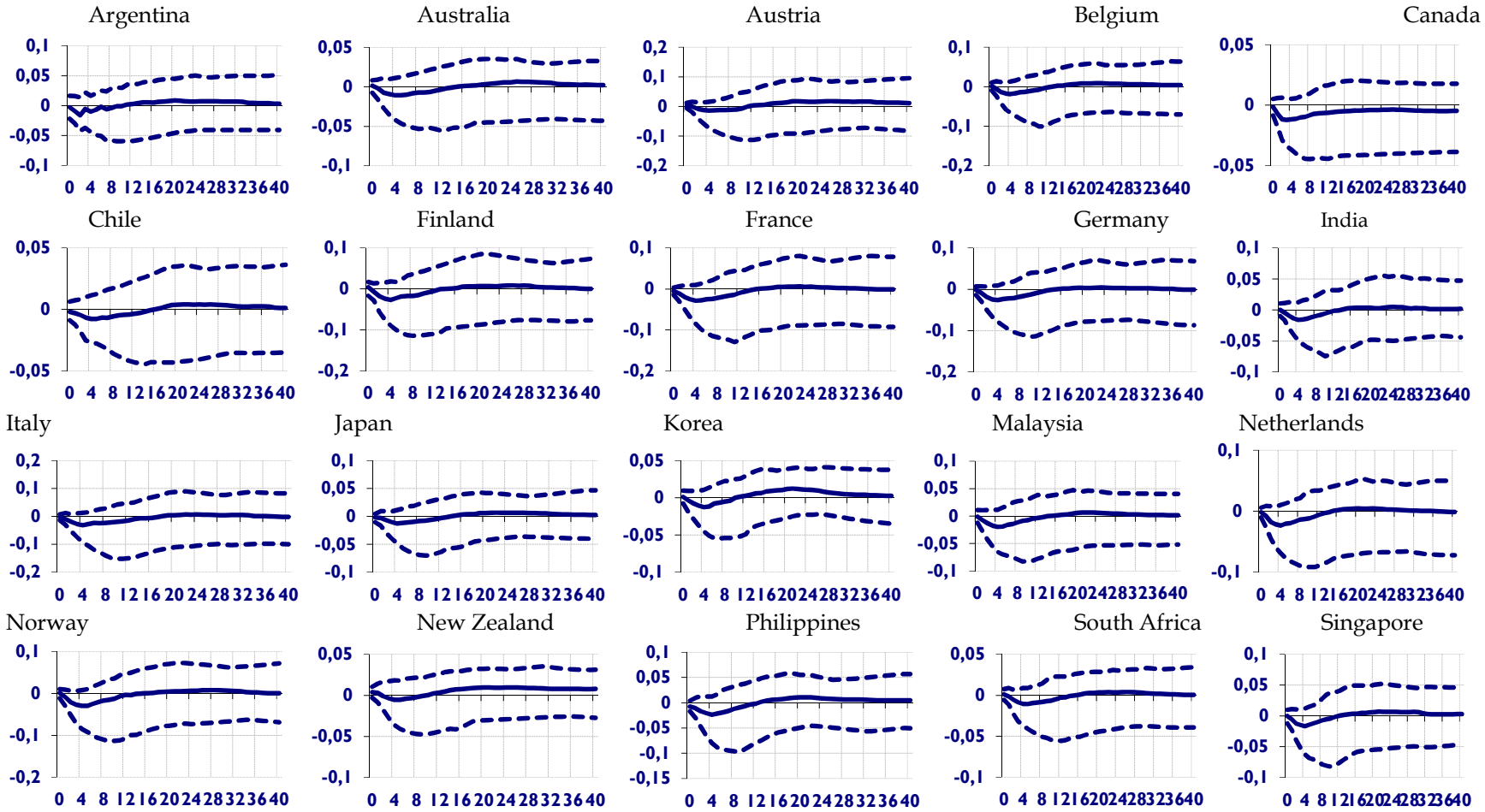


Figure 3: Country-Specific Impulse Response Functions of Real Equity Prices to a One Standard Deviation Positive US Uncertainty Shock under the High GFCy-Regime



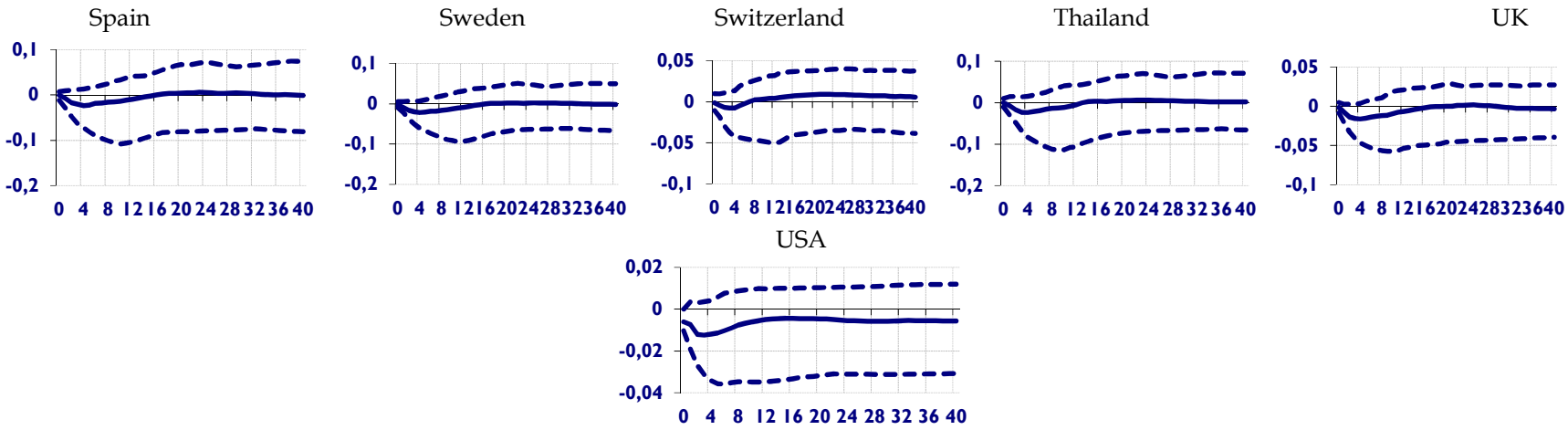
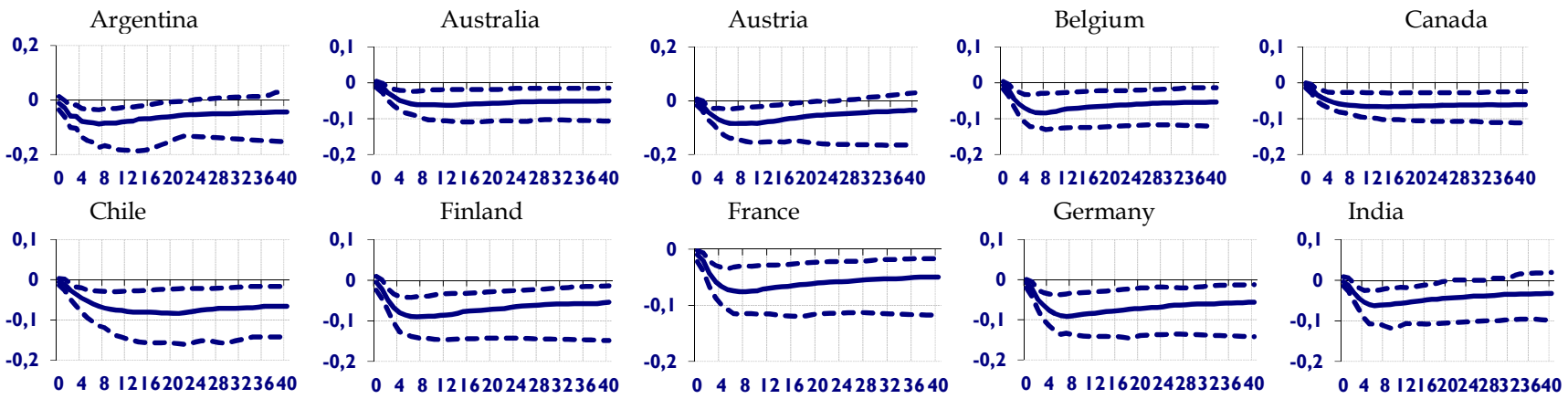
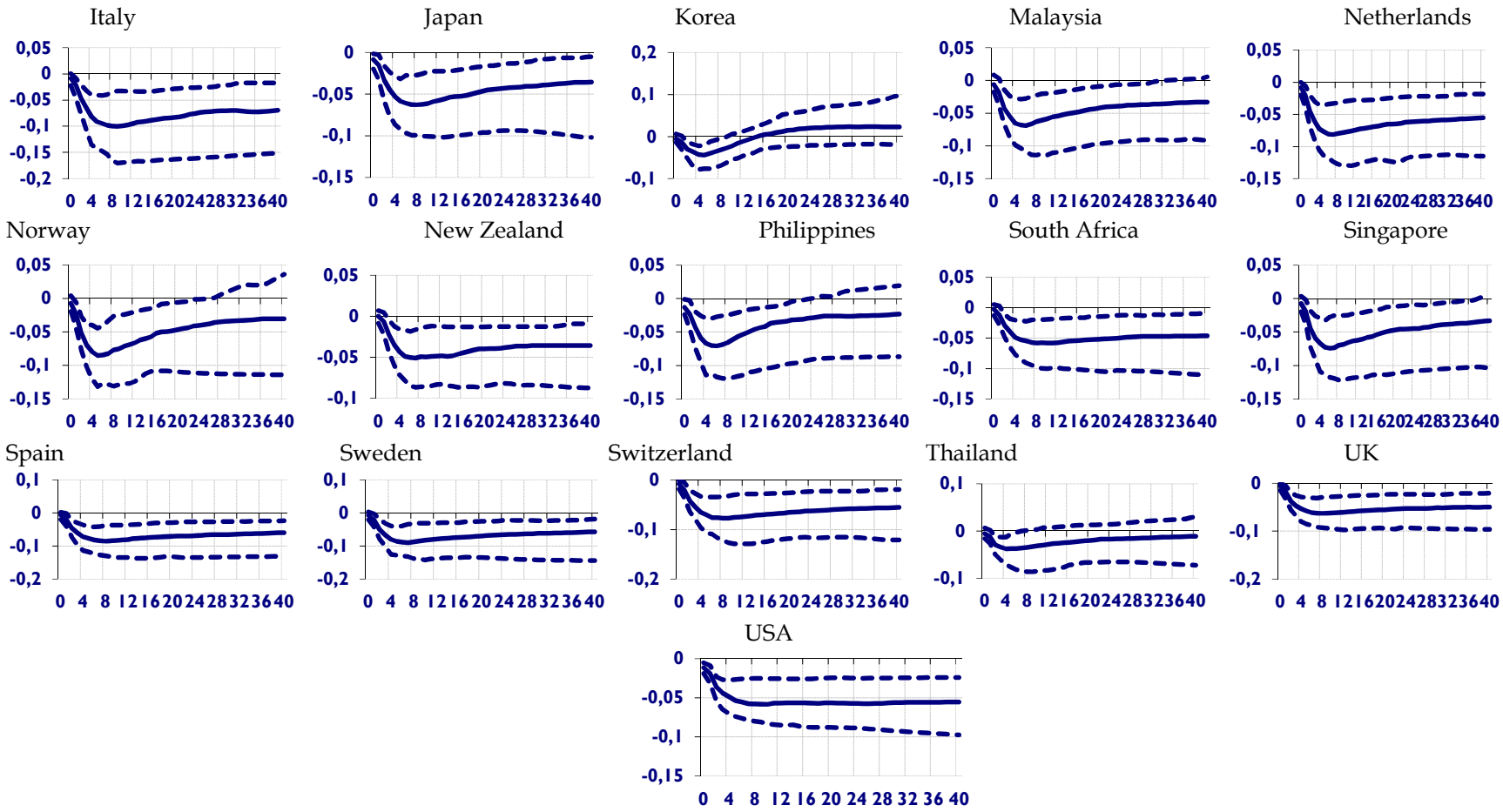


Figure 4: Country-Specific Impulse Response Functions of Real Equity Prices to a One Standard Deviation Positive US Uncertainty Shock under the Low GFCy-Regime

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New Zealand
Philippines
South Africa
Singapore
Spain
Sweden
Switzerland
Thailand
UK
USA

4. Conclusion

In this study, we use a Global Vector Autoregressive (GVAR) model to trace the effect of an uncertainty shock originating in the US on equity markets of 32 advanced and emerging countries (besides the US), conditional on the bearish- or bullish-state of the global asset markets. The regimes of the financial markets are captured by the corresponding low and high-values of the recently proposed Global Financial Cycle (GFCy) index, which in turn is a single global factor that explains an important share of the variation of risky asset returns around the world.

Using quarterly data over the period of 198:1 to 2019:2, we document greater response of US uncertainty shock spillover on the real equity prices of advanced markets than the emerging markets, highlighting stronger ties between the US and other advanced markets. Further, the negative responses are consistently greater during weak financial conditions than otherwise, confirming the importance of the state of global financial markets in the propagation of US uncertainty shocks on international stock markets.

Our results imply that when global financial markets are weak, and there is increased US uncertainty, then investors can reduce their portfolio risks by diversifying more into emerging market equities than those of other developed countries. From the perspective of policymaking, since stock markets decline more during bearish global financial conditions, the recessionary effect of US uncertainty shocks are likely to be prolonged via the equity markets, and hence monetary authorities would need to respond more strongly via expansionary monetary policy, compared to when global financial markets are witnessing tranquility or booms.

As part of future research, it would be interesting to formally explore the ability of US uncertainty, conditional on the states of the GFCy, in predicting international stock markets out-of-sample, since in-sample predictability does not guarantee forecasting gain (Rapach and Zhou, 2013).

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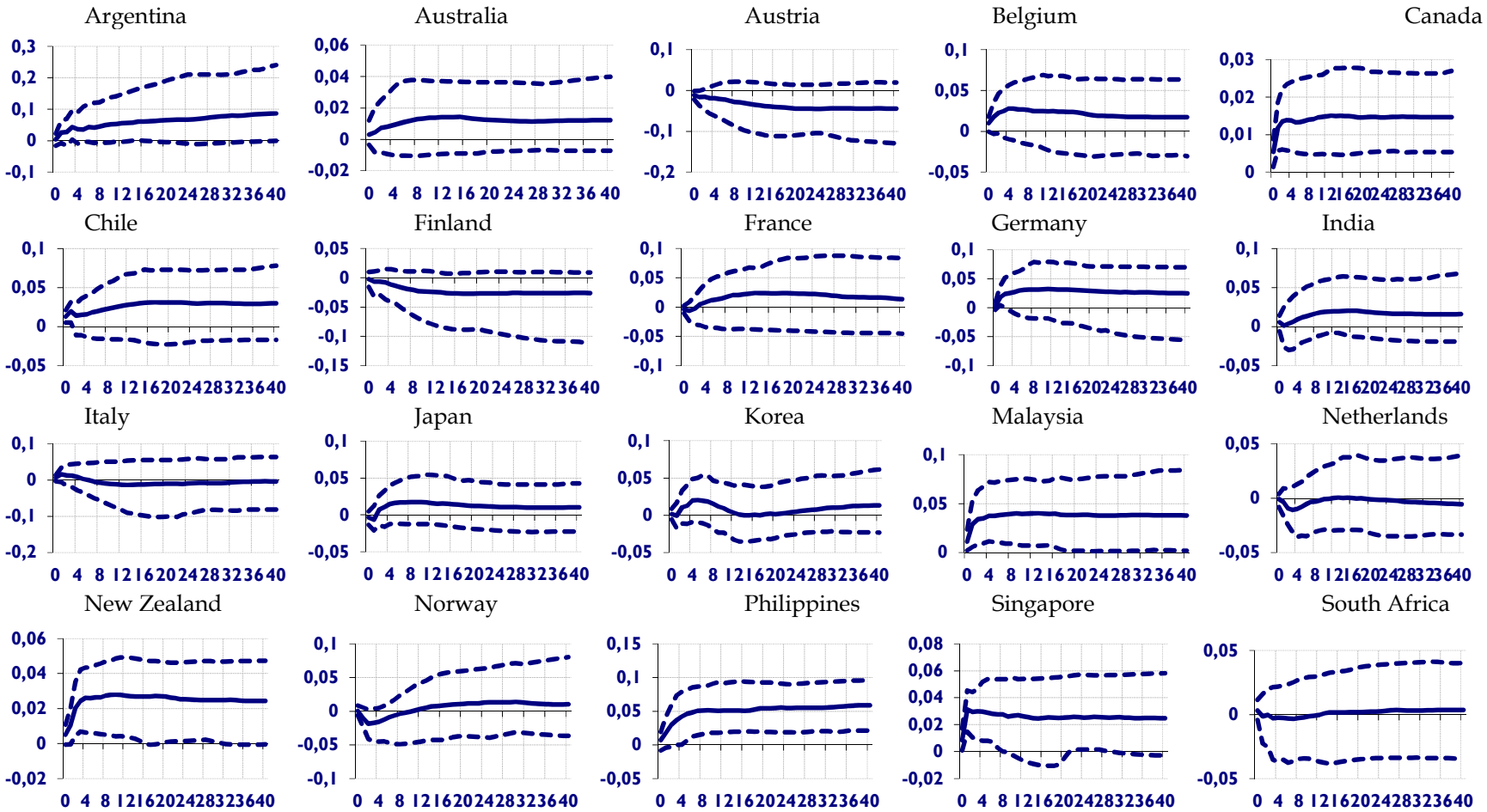
APPENDIX

Figure A1: Country-Specific Impulse Response Functions of Real Equity Prices to a One Standard Deviation Positive US Uncertainty Shock under the High GFCy-Regime



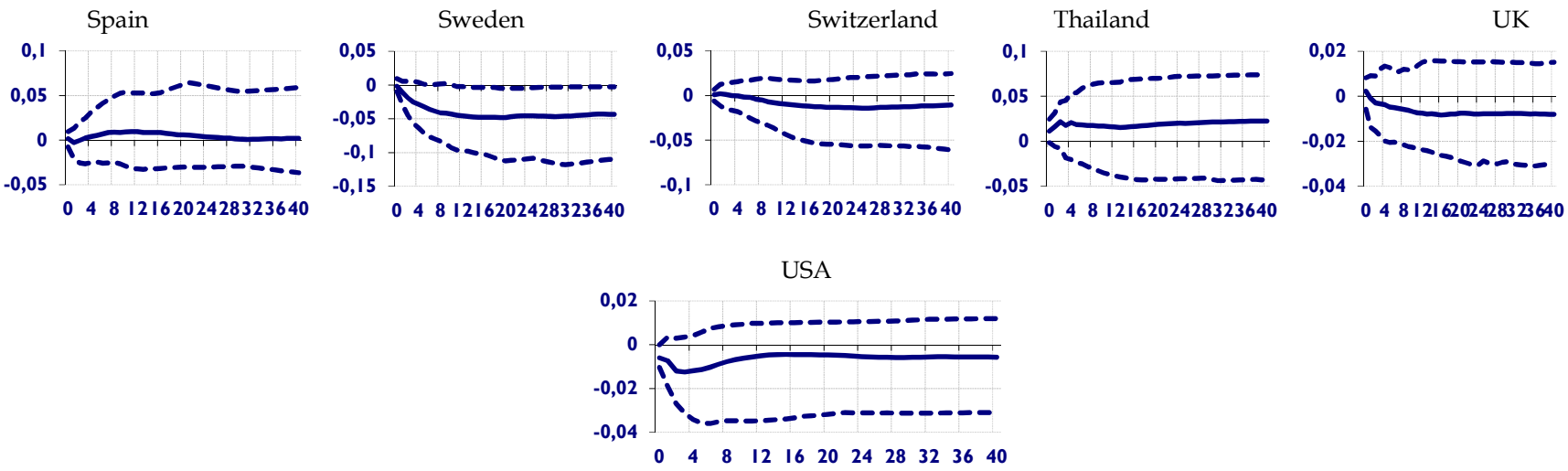
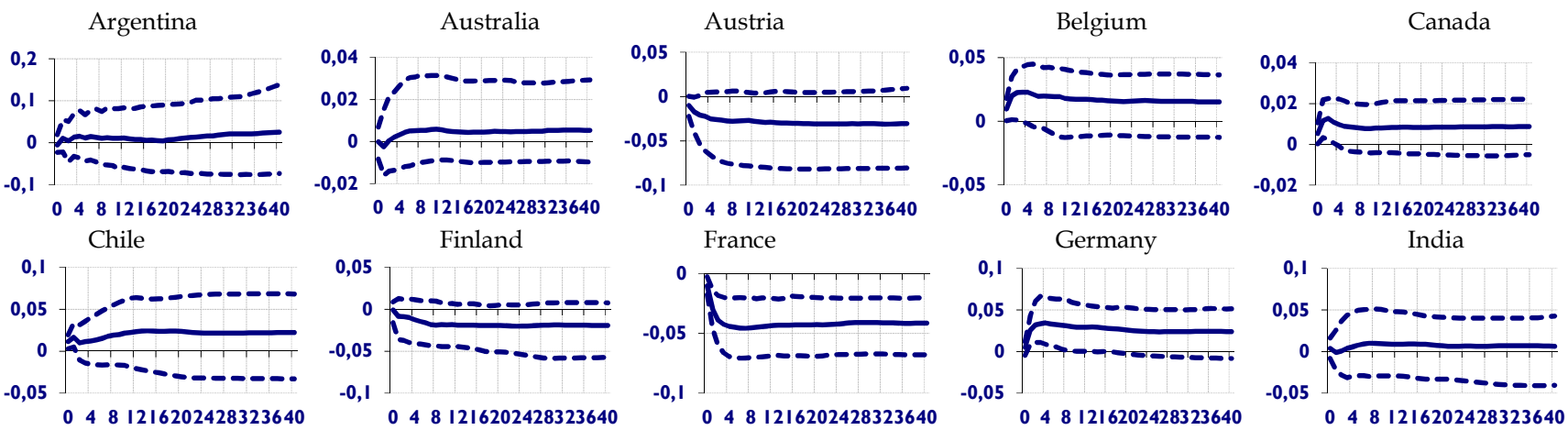
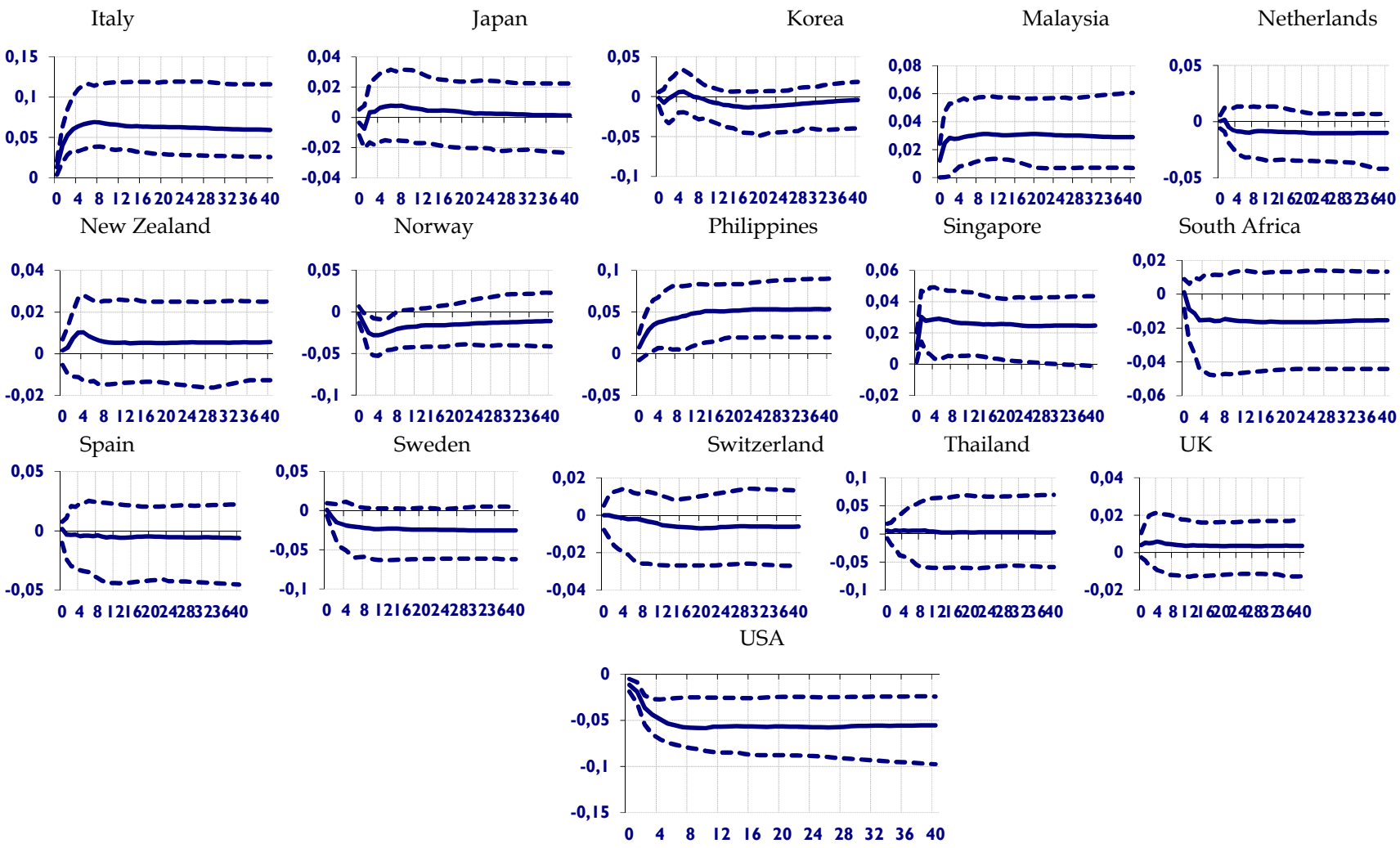


Figure A2: Country-Specific Impulse Response Functions of Real Equity Prices to a One Standard Deviation Positive US Uncertainty Shock under the Low GFCy-Regime

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