

# The Financial US Uncertainty Spillover Multiplier: Evidence from a GVAR Model

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## Abstract

This study examines the role of the Global Financial Cycle (GFCy) in the propagation of uncertainty shocks from the U.S. to global economies. Specifically, we construct a large-scale global vector autoregressive (GVAR) model of 33 countries and analyze the response of real Gross Domestic Product (GDP) to uncertainty shocks associated with the U.S. as well as the domestic economy, conditional on the state of the Global Financial Cycle. While our findings confirm the dominant role of U.S. uncertainty over global economic dynamics, we show that the global financial cycle plays a moderating role over the spillover effects of such shocks. U.S. uncertainty shocks, compared to own domestic uncertainty shocks, are found to have a more prominent negative impact on output, during overstressed financial markets implied by the low values of the GFCy, while the impact turns largely insignificant during high global financial cycle states. The effects are particularly evidence in the case of the European and other G7 economies, highlighting the strong connection across these developed economies compared to their emerging counterparts. Overall, the findings provide evidence in favor of a U.S. uncertainty spillover multiplier, suggesting that the design of expansionary monetary policy as a response to U.S. uncertainty needs to be contingent on the state of the integrated global financial markets, captured by the global financial cycle.

**Keywords:** Uncertainty Shocks, Global Financial Cycle, Real GDP, Global Vector Autoregressive Model

**JEL Codes:** C32, D8, E32, G15

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## 1. Introduction

The post-World War II period has seen the U.S. play an increasingly dominant role in global economic and geopolitical developments. As the world's economic and military powerhouse, U.S. policy decisions are closely watched by policy makers across the world capitals. Recent studies suggest that U.S. monetary policy actions serve as a driving factor behind a Global Financial Cycle (GFCy) that drives financial market dynamics across global economies (Miranda-Agrippino and Rey, 2020) and that U.S. related shocks are propagated via their effects on global asset prices and capital flows (Miranda-Agrippino, et al., 2020). Quite a few empirical studies have also highlighted the role of market states in the propagation of uncertainty shocks to the economy, suggesting that uncertainty has a larger negative effect on output in periods of financial distress than in tranquil times (see for example, Caldara et al., (2016), Lhuissier and Tripier (2016), Popp and Zhang (2016), Alessandri and Mumtaz (2019), Caggiano et al., (forthcoming)).<sup>1</sup> Alfaro et al., (2018) further provide the theoretical argument in this regard, arguing that greater uncertainty alongside financial frictions induces the standard real options effects on investment and hiring and leads firms to hoard cash, further reducing investment and hiring, resulting in what is called the “the finance uncertainty multiplier”. In this paper, we contribute to this discussion by examining the role of the global financial cycle in the propagation of uncertainty shocks from the U.S. to global economies via a large-scale global vector autoregressive (GVAR) model of 33 countries that allows us to capture the transmission of local and global shocks, while simultaneously accounting for individual country peculiarities.

The Global Financial Crisis (GFC) that originated in the U.S. due to the subprime mortgage crisis has led to a flurry of academic studies that highlight the negative spillover effects of U.S. uncertainty on the output of the world economies via various channels associated with trade, financial markets, and exchange rates (see for example, Carrière-Swallow and Céspedes (2013), Colombo (2013), Jones and Olson (2015), Cheng et al., (2016), Stockhammar and Österholm (2016), Choi (2018), Gupta et al., (2019, 2020), Trung (2019a,b), Bhattarai et al., (2020), Caggiano et al., (2020), Kang et al., (2020)). These studies, however, have largely ignored the role played by the global financial cycle as a potential amplifier (or moderator) of such shocks over

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<sup>1</sup> Interestingly, applying the nonlinear framework of Alessandri and Mumtaz (2019) to South African data, Balcilar et al., (2020), find that while the deterioration of output following an uncertainty shock is much more prominent during normal periods than during stressful periods, it is much more persistent during the latter regime.

global output patterns. From an economic standpoint, one can argue that cross-border capital flows and improved funding conditions captured by the global financial cycle can alleviate the real options effects suggested by Alfaro et al., (2018) and moderate the effect of uncertainty shocks, while the deterioration of the global financial cycle can amplify the effect of such shocks. If this is indeed the case, then policy makers and investors should not only be mindful of potential uncertainty shocks emanating from the U.S., but also monitor the sensitivity of their economies to global financial conditions captured by the GFCy. Against this backdrop, we aim to analyze whether the adverse output-effects of uncertainty shocks originating from the U.S. indeed exhibit conditional patterns due to the global financial cycle by updating the common GVAR database with uncertainty indicators from a set of 33 countries as well as the global financial cycle proxy. In the process, we aim to establish a link between the financial uncertainty multiplier and the U.S. uncertainty spillover literatures for the first time, and introduce “the financial U.S. uncertainty spillover multiplier”.

From a policy making perspective, whether or not the negative spillover effect of U.S. uncertainty on global output patterns is conditional on the state of the integrated global financial cycle, is of high importance for the implementation and effectiveness of monetary policy actions. Considering that policy makers often cite uncertainty associated with U.S. policy decisions as a major reason for revising their economic forecasts downward, if the financial uncertainty spillover multiplier indeed exists, the monetary policy response of the other developed and emerging market economies will need to be contingent on the state of global cycle defined by bearish or bullish phases of financial markets worldwide. This is especially important for most developing nations as U.S. financial conditions, in part driven by U.S. monetary policy, could have significant effects on emerging and developing economies that rely heavily on external financing (Kose et al., 2017). Furthermore, considering that international portfolio flows serve as a key channel of transmission between the U.S. and the emerging market economies (Anaya et al., 2017), an increase in the volatility of international capital flows driven by U.S uncertainty shocks can further amplify the impact of such shocks on global economies. Clearly, such a scenario would not only be of interest for policy makers, but for global investors as well since the effect of such shocks would not be limited to the real economy, but will also have spillover effects on capital markets.

To conduct our analysis econometrically, we rely on the Global Vector Autoregressive (GVAR) framework, originally proposed by Pesaran et al., (2004), which accounts for international

macroeconomic transmission of shocks (in our case U.S. uncertainty) based on a large panel of economic data involving 33 countries that cover 90% of the world Gross Domestic Product (GDP), as well as global exogenous variables (such as commodity prices). Note that the original data set included in the GVAR database includes GDP, the rate of inflation, short and long-term interest rates, (U.S. dollar-based) real exchange rate, and real equity prices. In our application, we then augment the data set with a metric of macroeconomic uncertainty for each of the 33 countries in the sample. To that end, we use the uncertainty index, developed by Ahir et al., (2018), based on frequency counts of the term “uncertainty” (and its variants) in the quarterly Economist Intelligence Unit (EIU) country reports. In order to capture the state of the global financial markets, we augment the exogenous variables (oil prices, agricultural raw material prices, and metals prices), 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. The GFCy is a single global factor that explains an important share of the variation in risky asset (equities, commodities excluding precious metals and corporate bonds) returns around the world. This procedure allows us to distinguish between the output effects of uncertainty shocks during various markets states that characterize the global financial market conditions.

The analysis of quarterly data over 1980:1–2019:2 (as determined by data availability) confirm the dominant role of U.S. uncertainty over global economic output patterns. Interestingly, however, we find that the global financial cycle plays a moderating role over the spillover effects of U.S. driven shocks. While U.S. uncertainty shocks are found to have a more prominent negative effect on global output patterns compared to own domestic uncertainty shocks, we find that the effect is stronger during overstressed financial markets implied by the low values of the GFCy, while the impact turns largely insignificant during high global financial cycle states. The asymmetry in the response of output patterns with respect to the global financial cycle is particularly evident in the case of the European and other G7 economies, highlighting the strong policy and financial connections across these developed economies compared to their emerging counterparts. Overall, the findings provide evidence in favor of a U.S. uncertainty spillover multiplier, suggesting that the design of expansionary monetary policy as a response to U.S. uncertainty needs to be contingent on the state of the integrated global financial markets, captured by the global financial cycle.

The remainder of the paper is organized as follows: Section 2 outlines the methodology, while Section 3 discusses the data, with Section 4 presenting the results, and Section 5 concluding the paper.

## 2. Methodology

In this section, we construct a GVAR model for the propagation of the shock spillover of U.S. uncertainty to developed and emerging market economies, conditional on the state of the global financial cycle. The GVAR model allows us to capture the transmission of local and global shocks, while simultaneously accounting for individual country peculiarities. In terms of GVAR modelling, we consider  $N + 1$  countries in the global economy including 33 countries, indexed by  $i = 0, 1, 2, \dots, N$ . All  $N$  countries except the U.S., considered as the reference country and labelled as 0, are modelled as small open economies. The GVAR modelling framework involves constructing individual VARX\* models where X\* denotes foreign variables in order to capture the inherent characteristics of these countries where interest rates, inflation, exchange rate and asset prices, besides uncertainty, have a prominent role to play. The individual VARX\* models are then aggregated bearing in mind their inter-linkages with the U.S. economy (including uncertainty) to build the GVAR model. To the end, we follow Pesaran et al., (2004) and Dees et al., (2007) to construct a VARX\*( $p_i, q_i$ ) model for country  $i$  and relate a  $k_i \times 1$  vector of domestic macroeconomic variables (strictly endogenous),  $x_{it}$ , to a  $k^* \times 1$  vector of country-specific foreign variables (weakly exogenous),  $x_{it}^*$ . The specification is formally presented as:

$$\begin{aligned} \partial_i(L, p_i)x_{it} &= \alpha_{i0} + \alpha_{i1}t + \delta_i(L, q_i)x_{it}^* + u_{it} \\ t &= 1, 2, 3, \dots, T. \end{aligned} \quad (1)$$

where  $\partial_i(L, p_i) = I - \sum_{i=1}^{p_i} \partial_i L^i$  and  $\delta_i(L, q_i) = \sum_{i=0}^{q_i} \delta_i L^i$  are the matrix lag polynomial of the coefficients associated with the domestic and foreign variables, respectively;  $\alpha_{i0}$  and  $\alpha_{i1}$  are  $k_i \times 1$  vectors of time invariant intercepts and coefficients on the deterministic time trends, respectively, and  $u_{it}$  is a  $k_i \times 1$  vector of country-specific shocks, with the assumption of non-serially correlated

with zero mean and a non-singular covariance matrix,  $\Sigma_{ii}$ , namely  $u_{it} \sim iid(0, \Sigma_{ii})$ . Note that the lag orders of  $p_i$  and  $q_i$  are selected on a country-by-country basis, therefore,  $\partial_i(L, p_i)$  and  $\delta_i(L, q_i)$  are allowed to differ across countries. The country-specific foreign variables are constructed as cross-sectional averages of the domestic variables using data on bilateral trade flows as the weights,  $w_{ij}$ :

$$x_{it}^* = \sum_{j=0}^N w_{ij} x_{jt} \quad (2)$$

where  $j = 0, 1, 2, \dots, N$ ,  $w_{ii} = 0$ , and  $\sum_{j=0}^N w_{ij} = 1$

Similarly, for the empirical application, trade weights are computed as follows:

$$w_{ij} = \frac{\sum_{t=1}^T Tr_{ij,t}}{\sum_{t=1}^T Tr_{i,t}} \quad (3)$$

where  $Tr_{ij,t}$  is the measure of bilateral trade flows between country  $i$  and country  $j$  during a given year  $t$ , computed as the average of exports and imports of country  $i$  with country  $j$ . Similarly,  $Tr_{i,t}$  is the trade volume of country  $i$  at a given period  $t$ . Having estimated the individual VARX\* ( $p_i, q_i$ ) model for each country independently, all endogenous variables, captured in the  $k_i \times 1$  vector  $x_t = (x'_{0t}, x'_{1t}, x'_{2t}, \dots, x'_{Nt})$ , are then solved simultaneously using the link matrix defined in terms of the country-specific weights.<sup>2</sup> The VARX\* model in Equation (1) is then reformulated as:

$$\xi_i(L, p_i, q_i) z_{it} = \psi_{it}; \quad i = 0, 1, 2, \dots, N. \quad (4)$$

where  $\xi_i(L, p_i, q_i) = [\partial_i(L, p_i) - \delta_i(L, q_i)]$ ;  $z_{it} = (x'_{it}, x'^*_{it})'$ ; and  $\psi_{it} = \alpha_{i0} + \alpha_{i1}t + u_{it}$ .

Given Equation (2),  $z_{it}$  can be expressed as:

$$z_{it} = w_i x_t \quad (5)$$

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<sup>2</sup> There has been an illustration of the solution of the GVAR model using VAR\* (1,1) in the work of Pesaran et al., (2004). Similarly, Chudik and Pesaran (2016) have documented new developments in GVAR modelling along with its empirical applications.

such that  $w_i = (w_{i0}, w_{i1}, w_{i2}, \dots, w_{iN})$ , and  $w_{ii} = 0$  are the  $(k_i + k_i^*) \times k$  weight matrix for country  $i$  which represent the country-specific weights ( $w_{ij}$ ). Thus, invoking Equation (5), Equation (4) can be written as:

$$\xi_i(L, p_i, q_i)w_i x_t = \psi_{it} \quad (6)$$

Setting  $p = \max(p_0, p_1, p_2, \dots, p_N; q_0, q_1, q_2, \dots, q_N)$  and augmenting the  $p - p_i$  or  $q - q_i$  additional terms in the power of the lag operator by zeros, Equation (6) above then becomes:

$$\xi_i(L, p)w_i x_t = \psi_{it} \quad (7)$$

Stacking Equation (7), the Global VAR (p) model can be obtained for the domestic variables:<sup>3</sup>

$$G(L, p)x_t = \psi_t \quad (8)$$

where

$$G(L, p) = \begin{pmatrix} \xi_0(L, p)w_0 \\ \xi_1(L, p)w_1 \\ \xi_2(L, p)w_2 \\ \cdot \\ \cdot \\ \cdot \\ \xi_N(L, p)w_N \end{pmatrix}, \psi_t = \begin{pmatrix} \psi_{0t} \\ \psi_{1t} \\ \psi_{2t} \\ \cdot \\ \cdot \\ \cdot \\ \psi_{Nt} \end{pmatrix} \quad (9)$$

Following Chudik and Pesaran (2013), we extend the GVAR model to accommodate common / global variables, such as prices of agricultural commodities, oil and precious metals, besides the global financial cycle, in the conditional country models. This step is underscored by the evidence of connections of these factors with the financial markets (Demirer et al., 2020; Salisu et al., 2020). Therefore, including these additional global variables in Equation (1) yields:

$$\partial_i(L, p_i)x_{it} = \alpha_{i0} + \alpha_{i1}t + \delta_i(L, q_i)x_{it}^* + \tau_i(L, r_i)G_t + u_{it} \quad (10)$$

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<sup>3</sup> The GVAR( $p$ ) model obtained by stacking Eq. (8) can be solved recursively and used for a number of purposes, such as forecasting or impulse response analysis (Cashin et al., 2017).

where  $\tau_i(L, r_i) = \sum_{i=0}^{r_i} \tau_i L^i$  is the matrix lag polynomial of the coefficients associated with the common variables,  $G_t$ , which are recognized as weakly exogenous for ease of estimation. The marginal model for the dominant variables can be estimated with or without feedback effects from  $x_t$  (Cashin et al., 2017). Thus, to allow for feedback effects from the variables in the GVAR model to the dominant variables via cross-sectional averages, we define the following model for  $G_t$ :

$$G_t = \sum_{l=1}^{p_w} \partial_{Gl} G_{i,t-l} + \sum_{l=1}^{p_w} \partial_{Gl} x_{i,t-l}^* + \varepsilon_{Gt} \quad (11)$$

Note that the contemporaneous values of the foreign variables do not feature in Equation (11) and the vector of dominant / global variables,  $G_t$  are causal. Thus, conditional and marginal models, i.e., Equations (10) and (11) respectively, can be combined and solved as a complete GVAR model.

### 3. Data

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. The macroeconomic variables include 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,  $eq_{it}$ , as well as commodity prices (oil prices,  $poil_t$ , agricultural raw material,  $pmat_t$ , and metals prices,  $pmetal_t$ ), over the quarterly period of 1979:Q2 to 2019:Q4.<sup>4</sup> As a novelty of our empirical application, we augment this data set by including the uncertainty index of each of these 33 countries as well as several exogenous variables including the commodity prices and the GFCy index.

One must realize that, uncertainty is a latent variable, and hence, requires ways to measure it. In this regard, besides the various alternative metrics of uncertainty associated with financial markets (such as the implied-volatility indices like the VIX, realized volatility, idiosyncratic

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<sup>4</sup> The data is available at: <http://www.econ.cam.ac.uk/people-files/emeritus/mhpl/GVAR/GVAR.html>. Further details regarding the description of its compilation, revision and updates are discussed in Mohaddes, and Raissi (2020).



volatility of equity returns, corporate spreads), there are primarily three broad approaches to quantify uncertainty (Gupta et al., 2018): (1) A text-based approach that builds on searches of major newspapers or country-reports for terms related to (economic 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, we use the first-type of approach outlined by Ahir et al. (2018), primarily because this approach to measuring uncertainty does not require any complicated estimation of a large-scale model to generate it in the first place, and hence, is a model-free estimate of uncertainty. Besides, the data is available publicly for download from: [http://policyuncertainty.com/wui\\_quarterly.html](http://policyuncertainty.com/wui_quarterly.html).

Ahir et al., (2018) construct quarterly indices of economic uncertainty for 143 countries (37 countries in Africa, 22 in Asia and the Pacific, 35 in Europe, 27 in the Middle East and Central Asia, and 22 in the Western Hemisphere) using frequency counts of “uncertainty” (and its variants) appeared in the quarterly Economist Intelligence Unit (EIU) country reports. Note that in our application, we use 33 countries out of this list based on their availability in the GVAR database. The EIU reports discuss significant political and economic developments in each country, along with analysis and forecasts of political, policy and economic conditions, created by country-specific teams of analysts and a central EIU editorial team. To make the uncertainty indexes comparable across countries, the raw counts are scaled by the total number of words in each report. Note that, while other metrics of U.S. uncertainty are available, we rely on the uncertainty measure of Ahir et al. (2018) as this uncertainty index is also available for the other 32 countries, hence providing uniformity in how we define uncertainty.<sup>5</sup>

Finally, the data for the monthly global financial cycle, GFCy, series, which we add to the set of common shocks (i.e., the commodity prices and the precious metal prices mentioned above), is obtained from the website of Professor Silvia Miranda-Agrippino at: <http://silviamirandaagrippino.com/code-data>, and covers the monthly period of January, 1980 to

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<sup>5</sup> Another alternative is the newspaper-based measure of economic policy uncertainty (EPU) index, developed by Baker et al., (2016). However, the use of the EPU indexes would limit us to only 22 instead of the 33 countries, in addition to the fact that the starting point of the data would now be 2003 rather than 1980. In other words, the use of the EPU index would lead to loss of valuable information both in terms of countries and sample period covered.

April, 2019. The GFCy index is based originally on the work of Miranda-Agrippino and Rey (2020), and was available until 2012, but has now been updated by Miranda-Agrippino et al., (2020) to 2019, by extending the cross-section of risky assets included in the computation of the index from 858 to 1,004 to reflect a compositional change addressing greater visibility of Eastern (Chinese) markets, in line with the composition of the S&P Global index (<https://us.spindices.com/indices/equity/sp-global-1200>). The GFCy index is essentially generated as the common global factor extracted from a dynamic factor model (DFM) that involves a comprehensive panel of global 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.

Based on the availability of the GFCy index series, our analysis covers 1980:1 to 2019:2. Furthermore, since the GVAR database is available at a quarterly frequency, we take the three-month average of the GFCy index to convert it into quarterly values. Finally, as our goal is to examine the role of the global financial cycle in the effect of uncertainty shocks over global economies, we capture the high and low states of the global financial cycle with a dummy variable that takes the value of one when the GFCy index is greater (less) than the median value (equal to 68.75), and zero otherwise.

#### **4. Empirical Results**

Figure 1 presents the impulse response functions of real GDP to a one standard deviation positive U.S. uncertainty shock. The median response is represented in solid lines and the (5%-95%) lower and upper bootstrapped error bands are shown as dotted lines. We observe the largest negative effects on output in the case of the developed G7 and European economies, while the effect on emerging economies (aggregated into one group) is found to be largely insignificant. The significant effect of U.S. uncertainty on the developed economies highlights the integration of these economies, both in terms of policy actions and financial markets. However, the insignificant result observed in the case of the emerging economies could be a manifestation of the heterogeneity in the response of these economies to U.S. uncertainty shocks. Indeed, the country-specific results presented in Figure A1 in the Appendix provide a clearer picture of the

heterogeneity observed across the emerging economies in the sample. While the advanced economies generally exhibit a statistically significant and negative response to U.S. uncertainty shocks, consistent with the group-based results observed in Figure 1, several developing nations including Brazil, China, Indonesia, Korea, Malaysia, Mexico and Singapore also stand out in terms of a significantly negative response in their real GDP values to U.S. uncertainty shocks. Clearly, the country-based results imply a great deal of heterogeneity in how emerging economies respond to shocks emanating from the U.S. Interestingly, examining the impulse-response graphs for the response of output to its own country-specific uncertainty shocks, presented in Figure A4, we observe largely insignificant effects. This is indeed in line with the finding in Kose et al., (2017) that U.S. financial conditions, in part driven by U.S. monetary policy, have significant effects on global economies and confirms the dominance of U.S. uncertainty over local uncertainty shocks over domestic output patterns.

Figures 2 and 3 present the impulse response functions of real GDP to a one standard deviation positive U.S. uncertainty shocks, contingent on the high- and low-regimes of the global financial cycle index respectively. In Figure 2, although U.S. uncertainty shocks contingent on the bullish global financial cycle regime produce a negative impact in most cases (barring Argentina, Japan and New Zealand), the effect is found to be statistically insignificant in all country groups. In comparison, when we examine the results in Figure 3 contingent on the low GFCy regime, the effect of U.S. uncertainty shocks is found to be negative and statistically significant, particularly for the developed G7 and European economies. Clearly, the state of the global financial cycle plays a critical role in the response of global economies to U.S. driven shocks. Comparing the results in Figures 2 and 3, it can thus be argued that the global financial cycle plays a moderating role over the effect of uncertainty shocks emanating from the U.S., likely due to improved funding conditions and global sentiment implied by the high values of the GFCy index.

The asymmetry in the response of real GDP to U.S. uncertainty shocks due to the global cycle is further supported by the country level results, presented in Figure A2 and A3 in the Appendix. We observe in figure A2 that all of the countries in the sample, even those that are classified as developed economies, exhibit an insignificant response to U.S. uncertainty shocks during the high GFCy regime. This is in stark contrast with the results for the low GFCy regime presented in Figure A3. Indeed, we observe that a large majority of the countries, barring several cases including Argentina, Japan, Peru, Saudi Arabia, Thailand and Turkey, exhibit a negative and

statistically significant response to U.S. uncertainty shocks, along with weak significance observed for Australia, Germany, and New Zealand. The strongest average impact over the 41 quarters studies following the shock is observed for some of the largest trading partners including South Korea and Mexico; however, the insignificant effects observed for Canada, China, Germany and Japan suggest that the effect of U.S. uncertainty shocks are not necessarily transmitted by the trade channel.

Interestingly, some of the Latin American and East Asian economies seem to be insulated from the increased uncertainty in the U.S., irrespective of the state of the financial markets. While the heterogeneity in the effect of U.S. uncertainty shocks on output patterns across the different emerging markets is consistent with the finding of a heterogeneous pattern in the reaction and recovery rates observed across emerging economies following the global financial crisis (Didier et al., 2012), Bhattarai et al. (2020) note that Latin American emerging market economies suffer less (compared to other emerging economies) from U.S. uncertainty shocks in terms of a decrease in output as they experience a persistent reversal in capital flows and increase in net exports. Trung (2019b) further argues that U.S. policy uncertainty shocks hinders the growth prospects of the U.S. economy, forcing investors to switch capital flows to other developing economies. Therefore, it is possible that the capital flows out of the U.S. driven by U.S. uncertainty shocks can explain the insignificant output response of the Latin American and East Asian emerging economies to these shocks. This argument is indeed supported by the finding of a positive and significant effect (in a delayed manner) observed for China in Figure A3. Trung (2019b) shows that capital flows into some economies including China, Japan and Korea increase immediately following a U.S. policy uncertainty shock. Therefore, the positive effect on Chinese output in response to U.S. uncertainty shocks can be driven by the capital flow channel in which investors shift funds from the U.S. into certain promising developing economies, thus resulting in a positive and delayed effect on output in those nations.

As an additional analysis, in Figures A5 and A6 in the Appendix, we present the effect of a domestic uncertainty shock of each country on real GDP, under the high- and low regimes of the GFCy index respectively. These additional results confirm the role of the global financial cycle regime as moderator of uncertainty shocks over output patterns. Consistent with the results obtained for the U.S uncertainty shocks contingent on the bullish global financial cycle state, uncertainty shocks fail to have a significant impact on output of all the economies considered, as

observed in Figure A5. However, as seen in Figure A6, significant negative effects are detected for several economies including Canada, India, Mexico, Norway, South Korea, Sweden and the US, hence confirming the finance uncertainty multiplier effect proposed in the literature. Nevertheless, compared to Figure A2, the results highlight the importance of the US uncertainty shock relative to domestic innovations of uncertainty, in line with the international evidence that US tends to drive the uncertainties of both developed and developing countries (Klößner and Sekkel, 2014; Yin and Han 2018; Antonakakis et al., 2018). The results are also consistent with the finding by Truong (2019b) that global economies tend to be more vulnerable to U.S. driven shocks than those associated with the domestic economy. In sum, the findings provide support for the financial US uncertainty spillover multiplier rather than the financial uncertainty multiplier and the moderating role of the global financial cycle over the effect of uncertainty shocks on output patterns.

## 5. Conclusion

A recent line of research suggesting the presence of a finance uncertainty multiplier effect has shown that uncertainty has a larger negative effect on economic output in periods of financial distress than in tranquil times. The argument follows a long line of earlier studies in the investments literature that focus on the real options effect on investment and hiring decisions where uncertainty raises the real option value of prospective, irreversible investment opportunities, prompting decision makers to adopt a “wait and see” approach, thus creating a multiplier effect on investment and subsequent output patterns. At the same time, there exists a large literature that highlights the negative spillover effect of U.S. uncertainty on the outputs of global economies (e.g. Bhattarai et al., 2020) and a trend towards greater synchronization across the world economies, with global shocks serving as the main driver (e.g. Bordo and Helbling, 2001). This paper aims to establish a link between the financial uncertainty multiplier and the U.S. uncertainty spillover literatures for the first time by analyzing whether the adverse output effects of uncertainty shocks originating in the US are amplified in a set of 32 other countries, besides the US, during periods of heightened global financial frictions, which we refer to as the financial US uncertainty spillover multiplier.

The econometric analysis relies on a large-scale global vector autoregressive (GVAR) model of 33 countries that allows us to capture the transmission of local and global shocks, while

simultaneously accounting for individual country peculiarities. To that end, we augment the common GVAR data set with a metric of macroeconomic uncertainty for each of the 33 countries in the sample using the country specific uncertainty indexes, developed by Ahir et al., (2018), based on frequency counts of the term “uncertainty” (and its variants) in the quarterly Economist Intelligence Unit (EIU) country reports. Also included in the model is the Global Financial Cycle (GFCy) index of Miranda-Agrippino and Rey (2020), used as a proxy for the state of the global financial markets, allowing us to examine the role of the global financial cycle in the propagation of uncertainty shocks from the U.S. to global economies.

Based on the quarterly sample period of 1980:1 to 2019:2, we find that U.S. uncertainty shocks tend to have a more prominent negative effect on global output patterns compared to own domestic uncertainty shocks, highlighting the dominant role of US driven uncertainty over global economic activity. We also find that the effect is stronger during overstressed financial markets implied by the low values of the GFCy, while the impact turns largely insignificant during high global financial cycle states. The findings thus provide evidence in favor of a financial U.S. uncertainty spillover multiplier, rather than an uncertainty multiplier associated with the domestic market. From a policy making perspective, our findings imply that policy authorities need to worry more about US uncertainty than domestic uncertainty, and in particular during periods characterized by the low global financial cycle. This also implies that the design of expansionary monetary policy as a response to U.S. uncertainty needs to be contingent on the state of the integrated global financial markets, captured by the global financial cycle. Specifically, policymakers need to respond more strongly with an expansionary monetary policy to prevent domestic recession in the wake of heightened US uncertainty compared to an increase in own uncertainty shock, and in particular when the global financial markets are overstressed. Hence, the design of monetary policy as a response to US uncertainty needs to be contingent on the state of the integrated global financial markets, suggesting that policy makers should not only be mindful of potential uncertainty shocks emanating from the U.S., but also monitor the sensitivity of their economies to global financial conditions captured by the global financial cycle.

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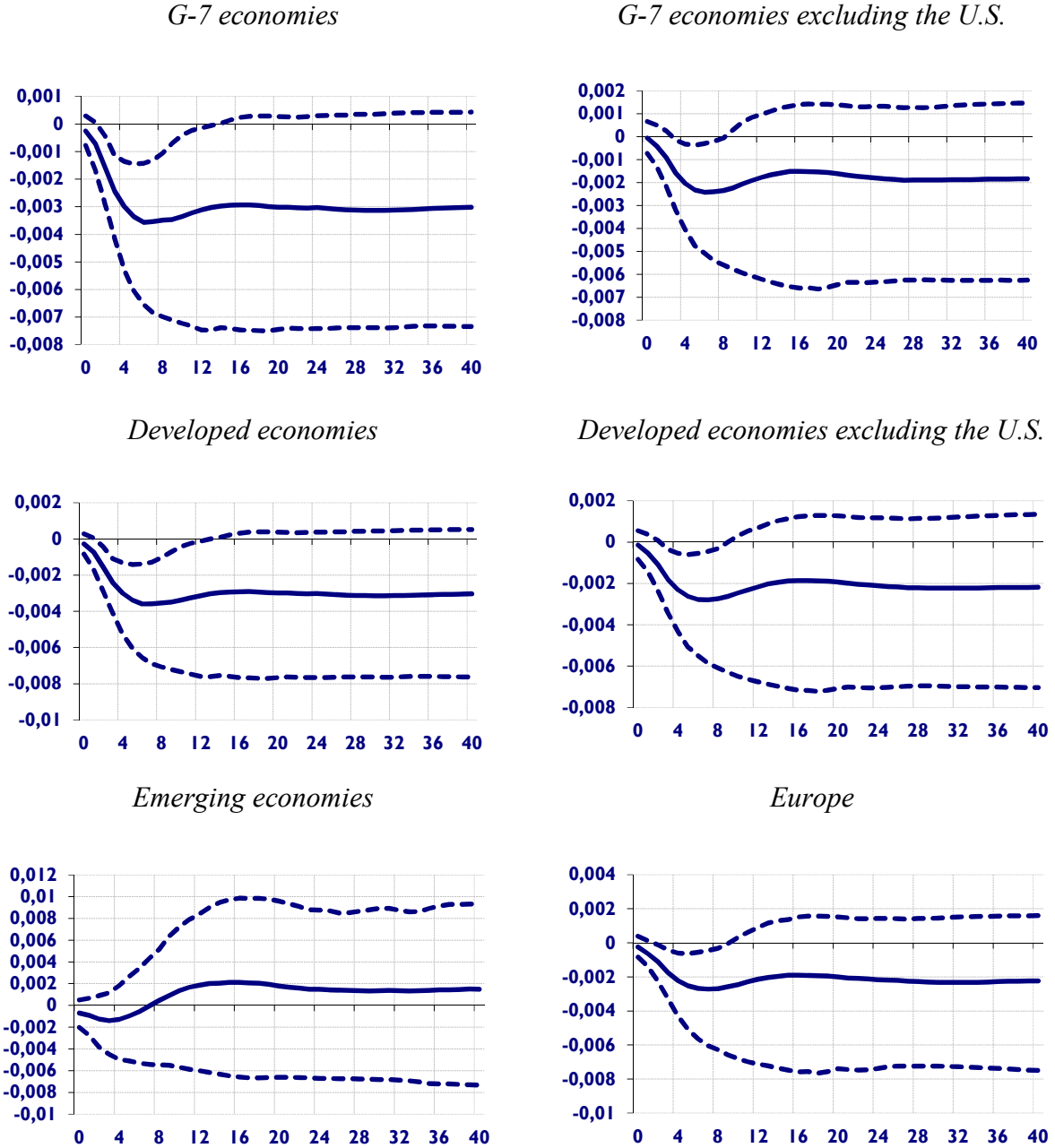
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**Figure 1: The effect of U.S. uncertainty shocks on real GDP.**

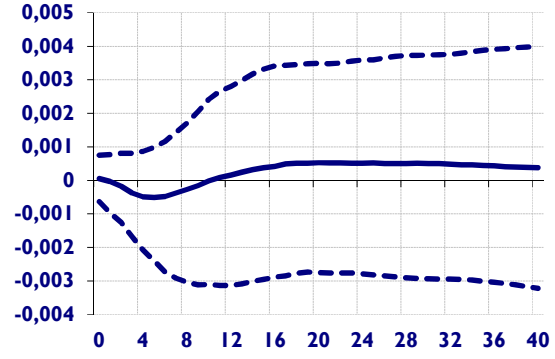
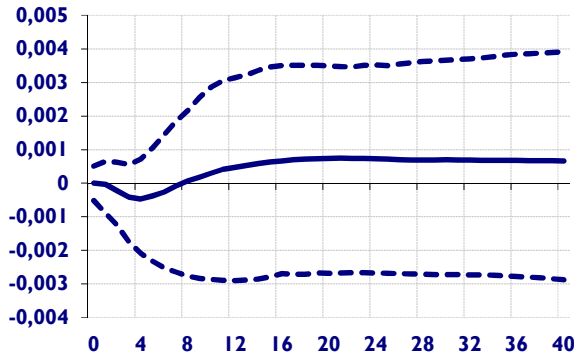


*Note:* The figure presents the impulse response functions of real GDP to a one standard deviation positive U.S. uncertainty shock. The median response is represented in solid lines and the (5%-95%) lower and upper bootstrapped error bands are shown as dotted lines.

**Figure 2: The effect of U.S. uncertainty shocks on real GDP – high GFCy regime.**

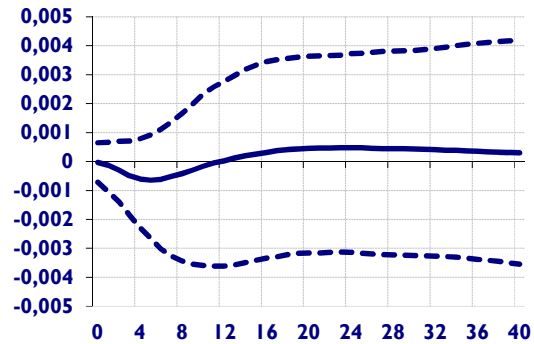
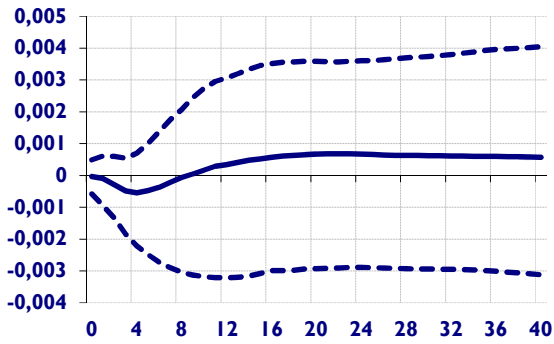
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*G-7 economies excluding the U.S.*



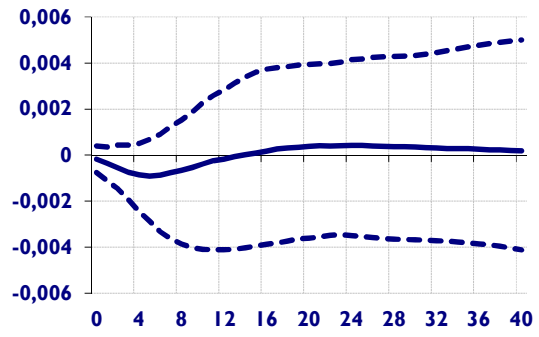
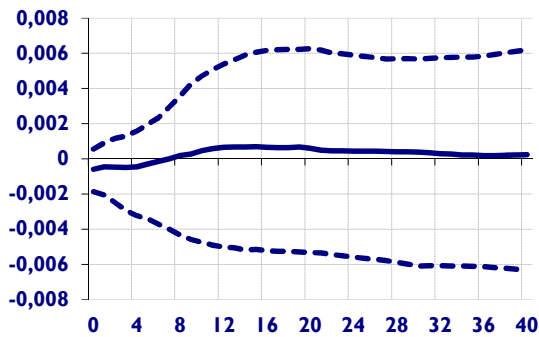
*Developed economies*

*Developed economies excluding the U.S.*



*Emerging economies*

*Europe*

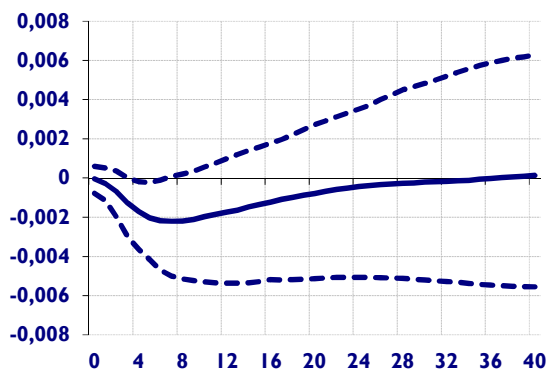
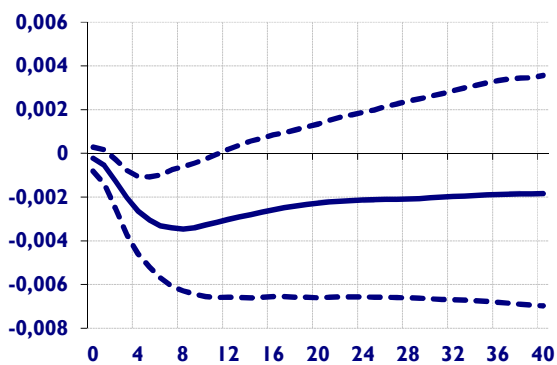


*Note:* The figure presents the impulse response functions of real GDP to a one standard deviation positive U.S. uncertainty shock under the high GFCy regime. The median response is represented in solid lines and the (5%-95%) lower and upper bootstrapped error bands are shown as dotted lines.

**Figure 3: The effect of U.S. uncertainty shocks on real GDP – low GFCy regime.**

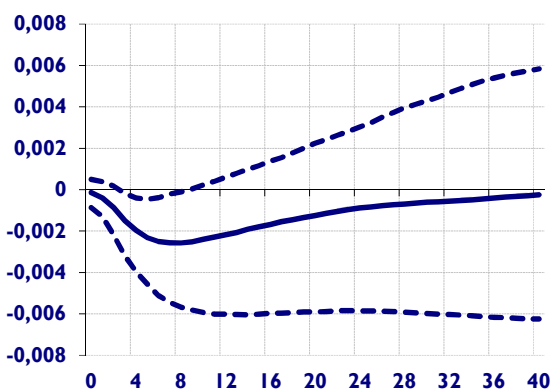
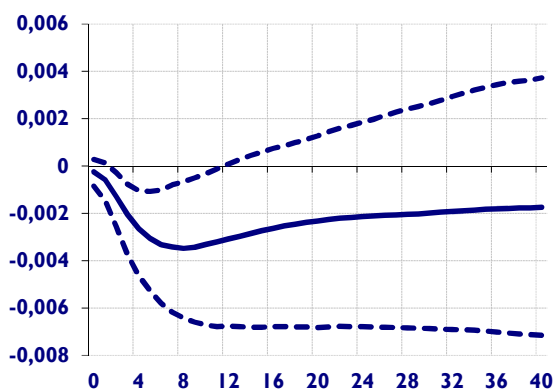
*G-7 economies*

*G-7 economies excluding the U.S.*



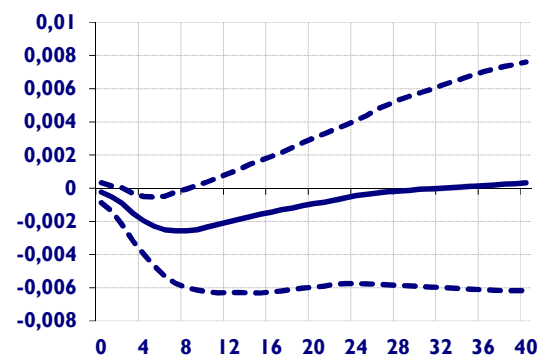
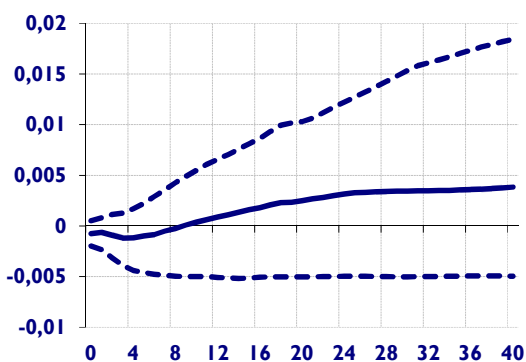
*Developed economies*

*Developed economies excluding the U.S.*



*Emerging economies*

*Europe*



*Note:* The figure presents the impulse response functions of real GDP to a one standard deviation positive U.S. uncertainty shock under the low GFCy regime. The median response is represented in solid lines and the (5%-95%) lower and upper bootstrapped error bands are shown as dotted lines.

APPENDIX.

Figure A1: The effect of U.S. uncertainty shocks on country level real GDP

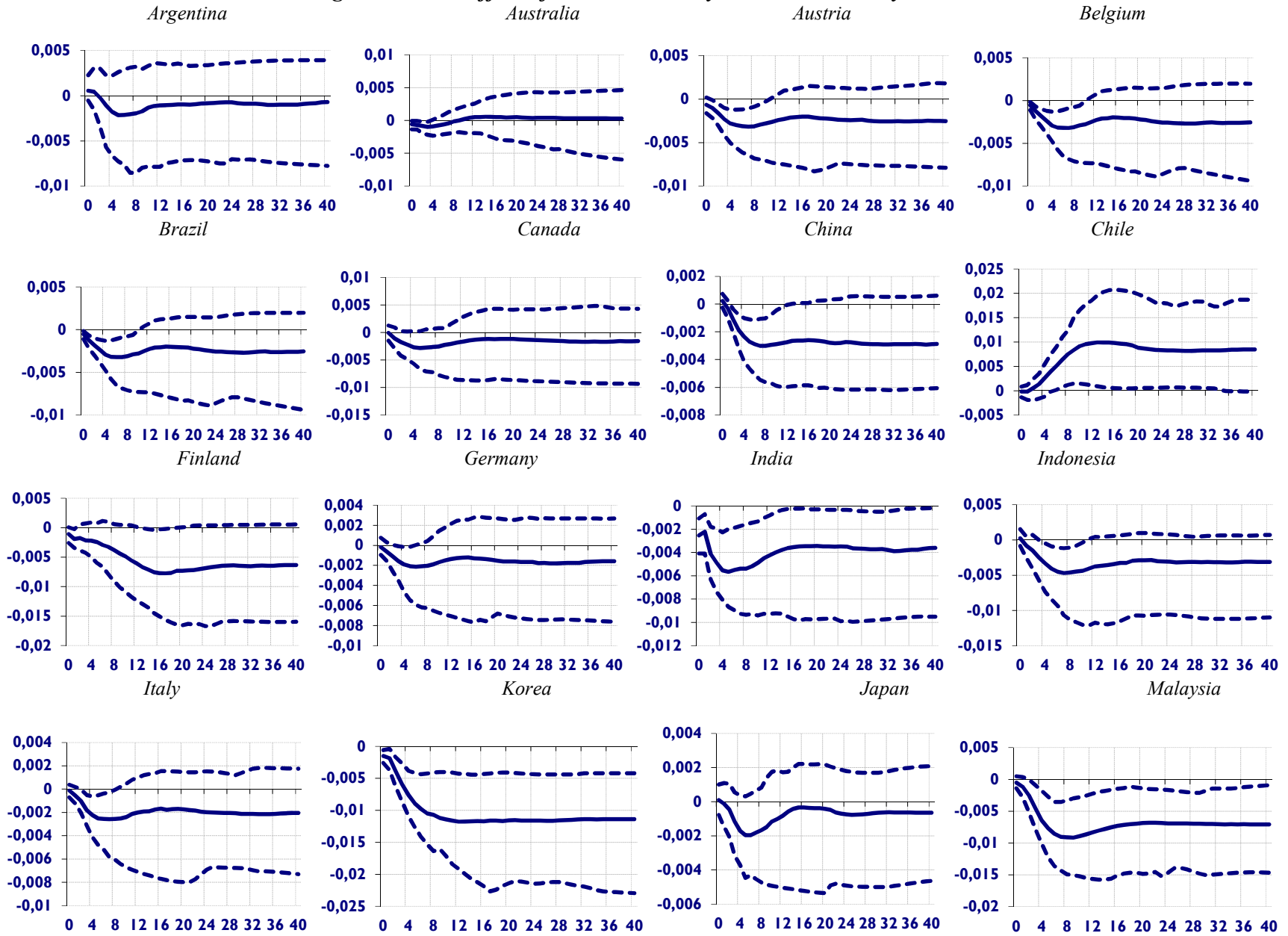


Figure A1 continued

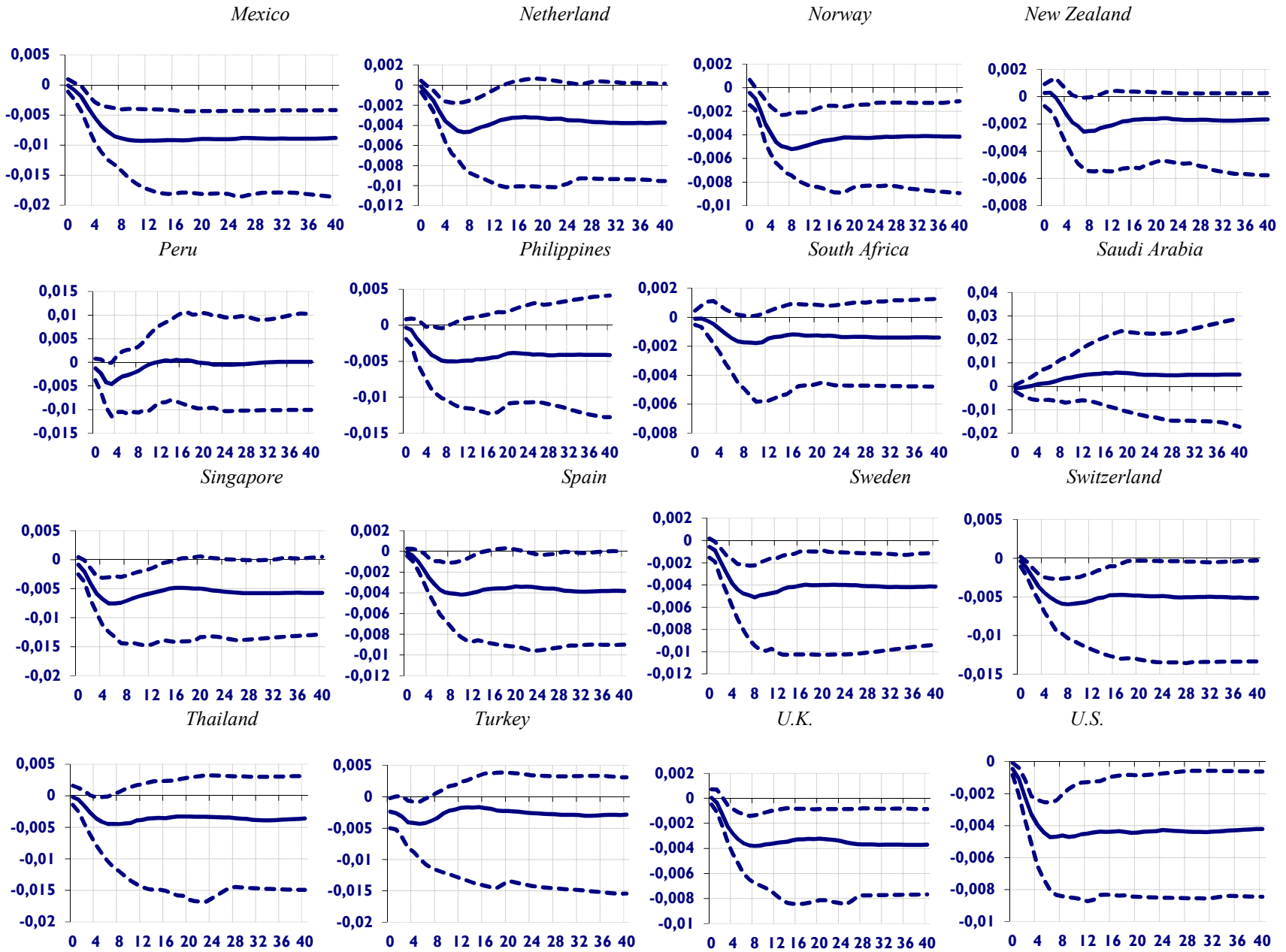


Figure A2: The effect of U.S. uncertainty shocks on country level real GDP – high GFCy regime

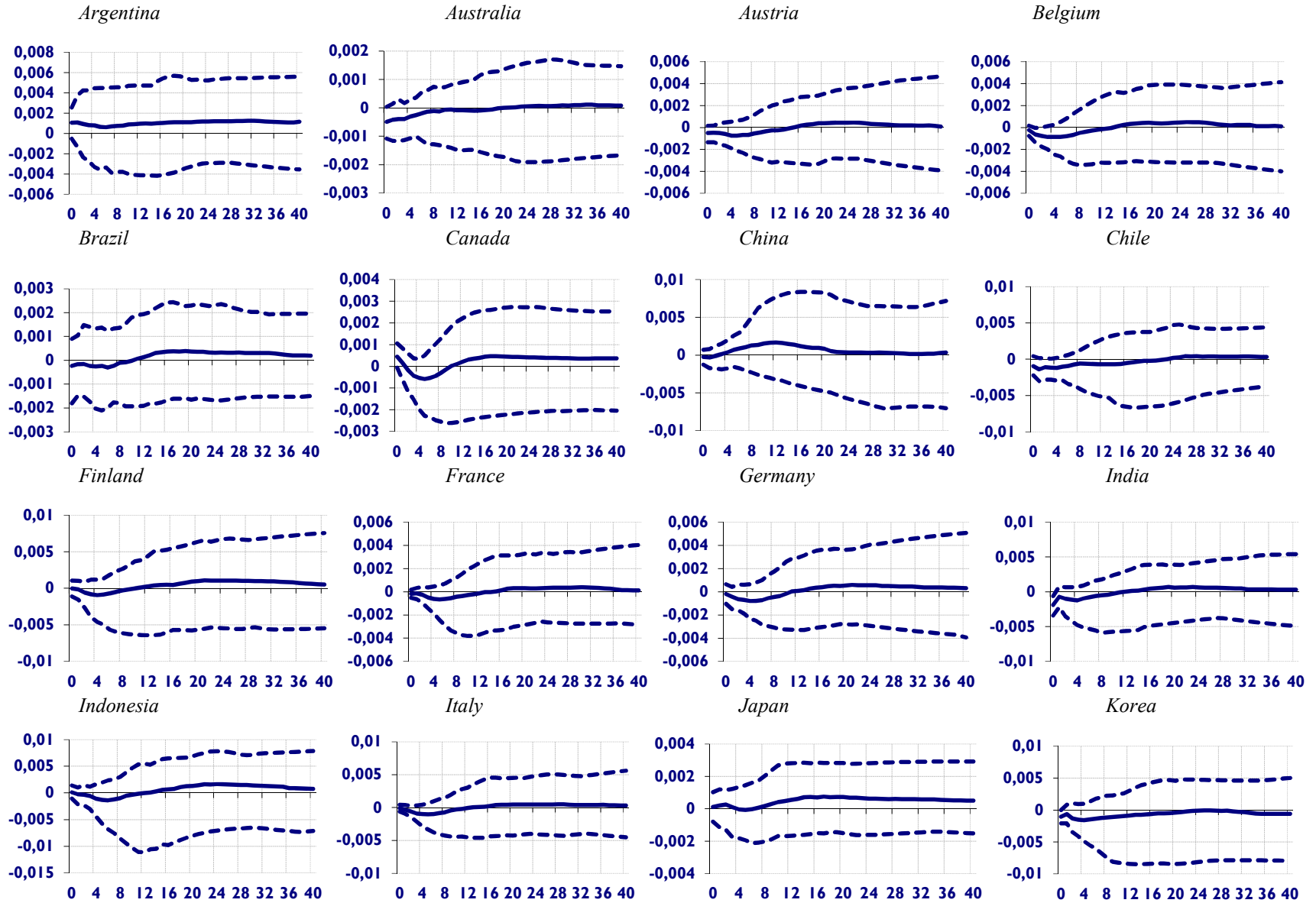
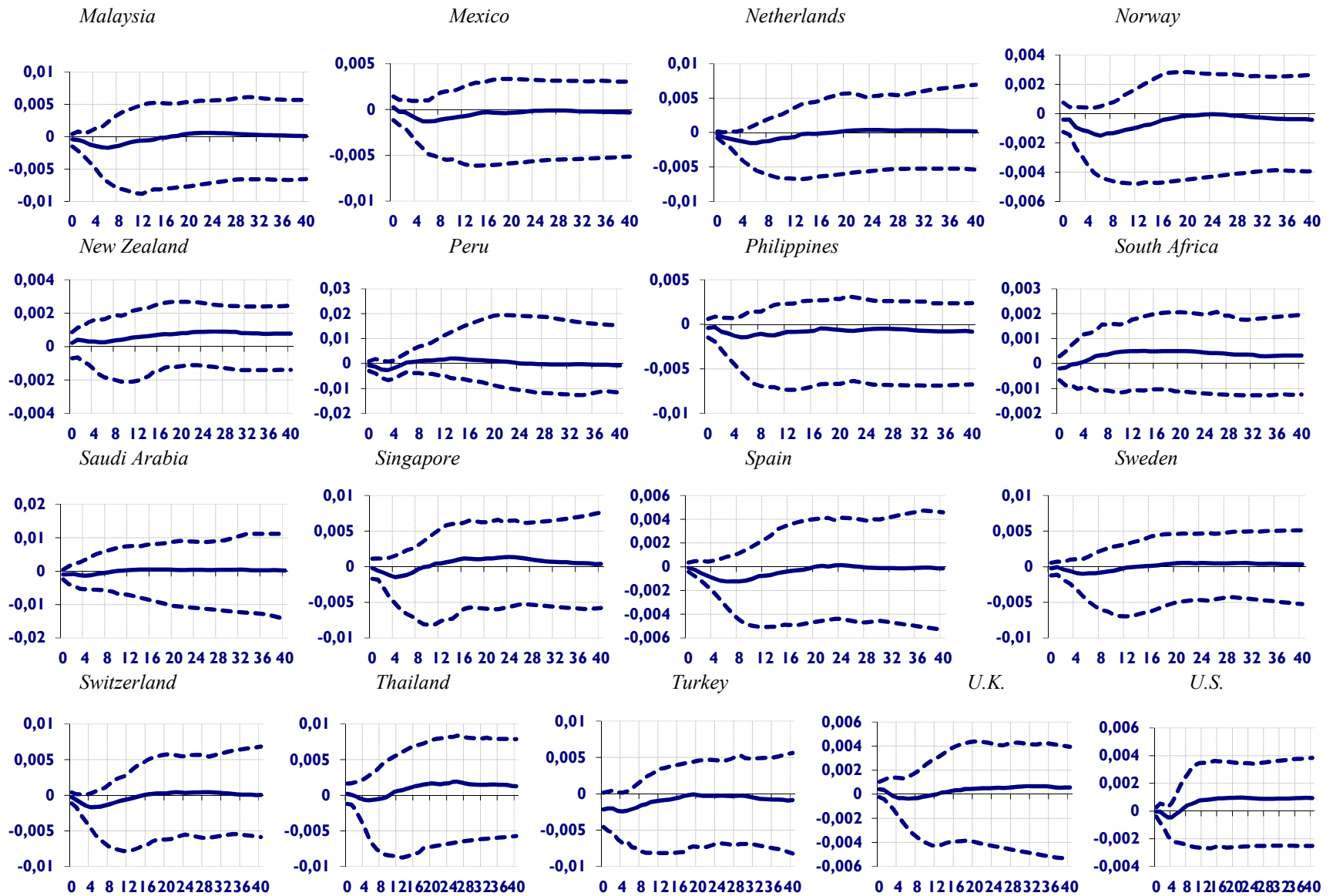


Figure A2 continued





**Figure A3: The effect of U.S. uncertainty shocks on country level real GDP – low GFCy regime**

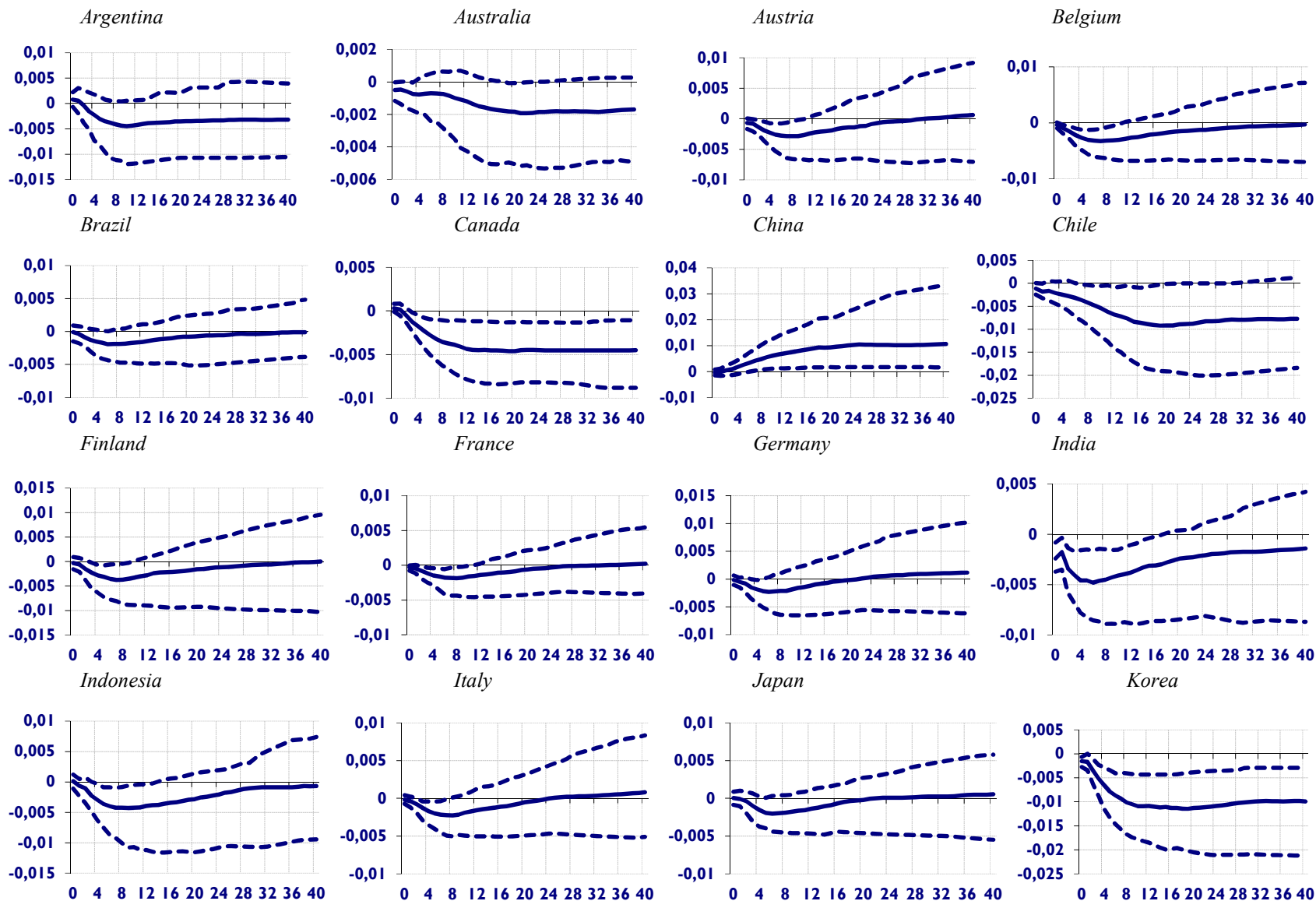
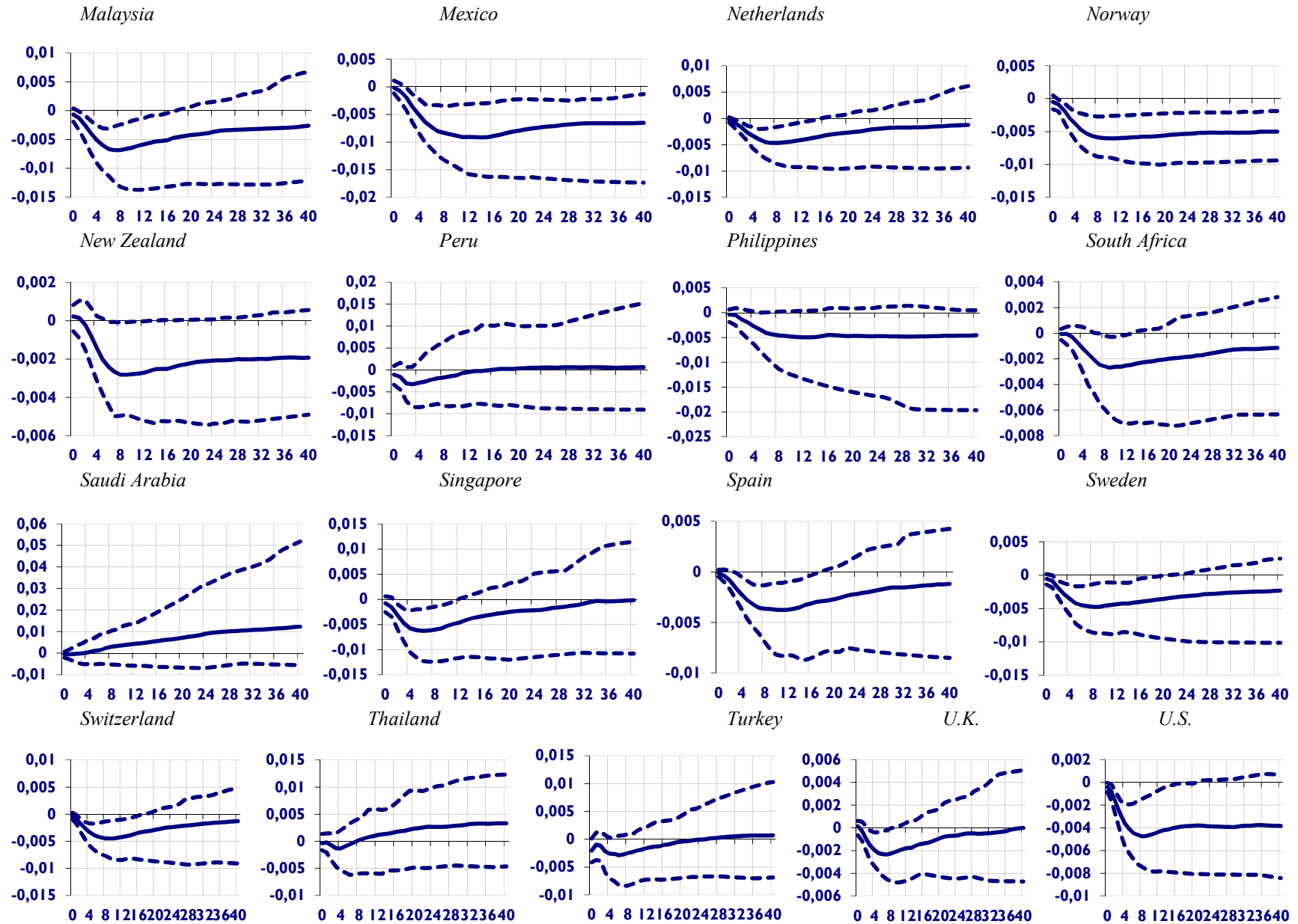


Figure A3 continued



**Figure A4: The effect of own uncertainty shocks on country level real GDP**

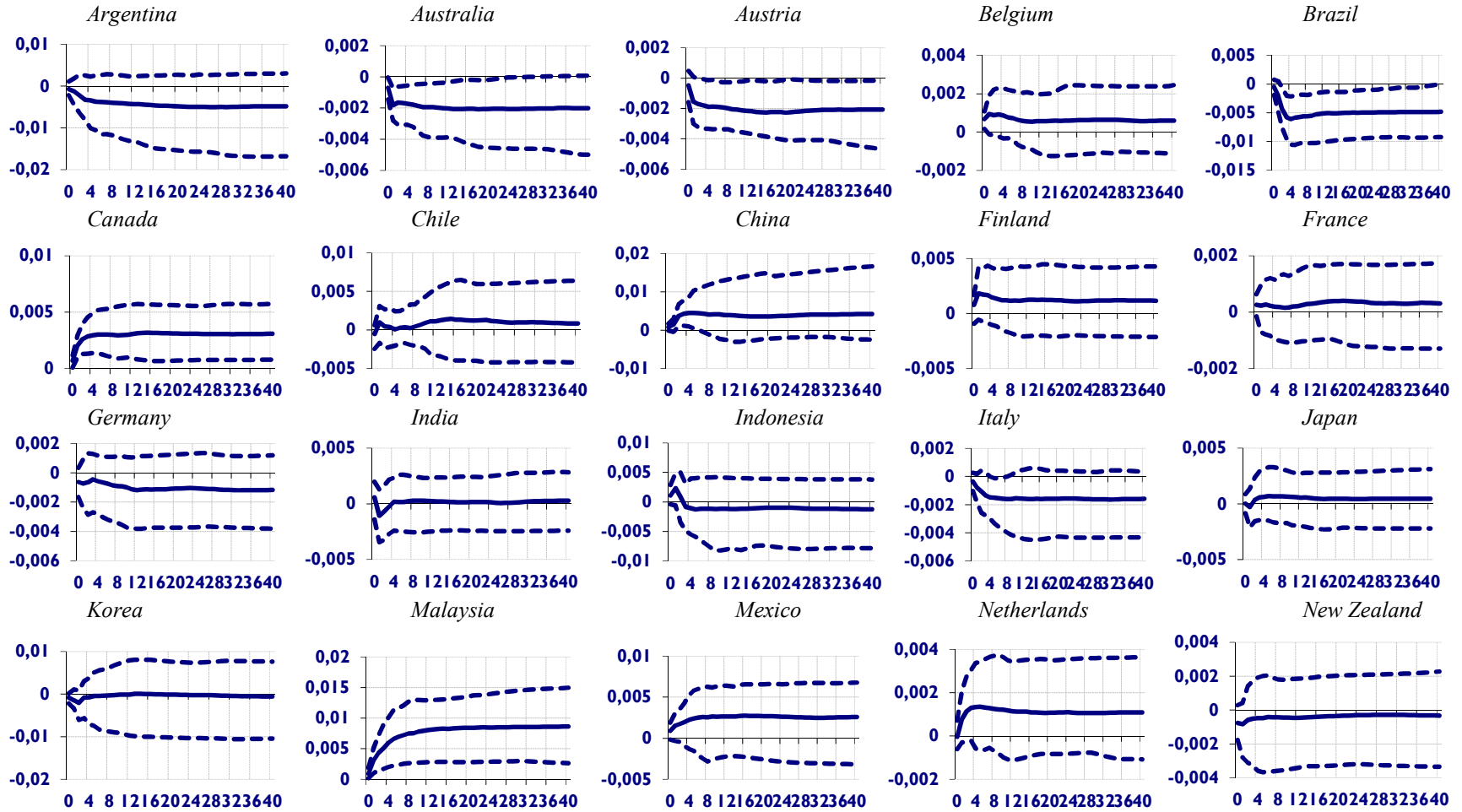
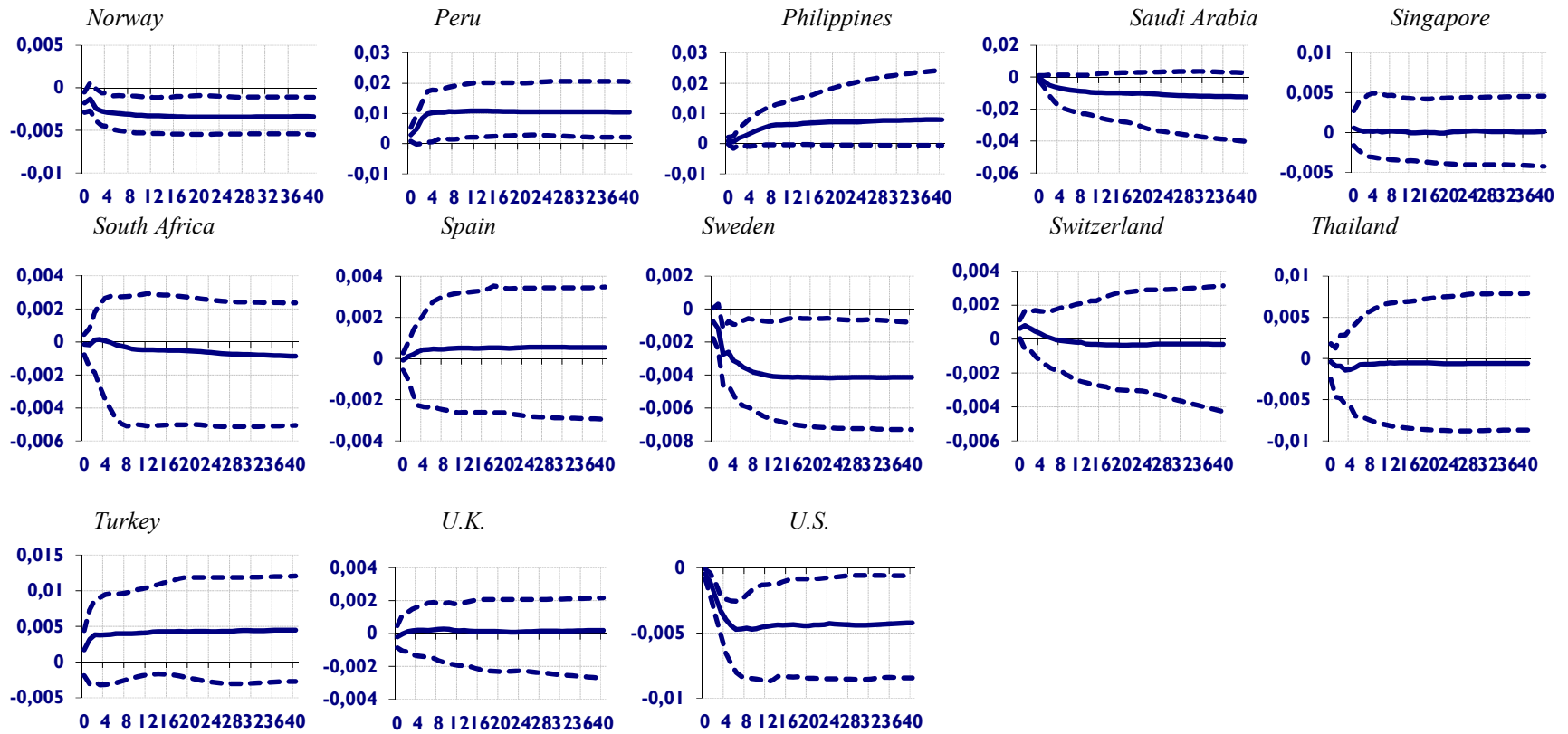


Figure A4 continued



*Figure A5: The effect of own uncertainty shocks on country level real GDP – high GFCy regime*

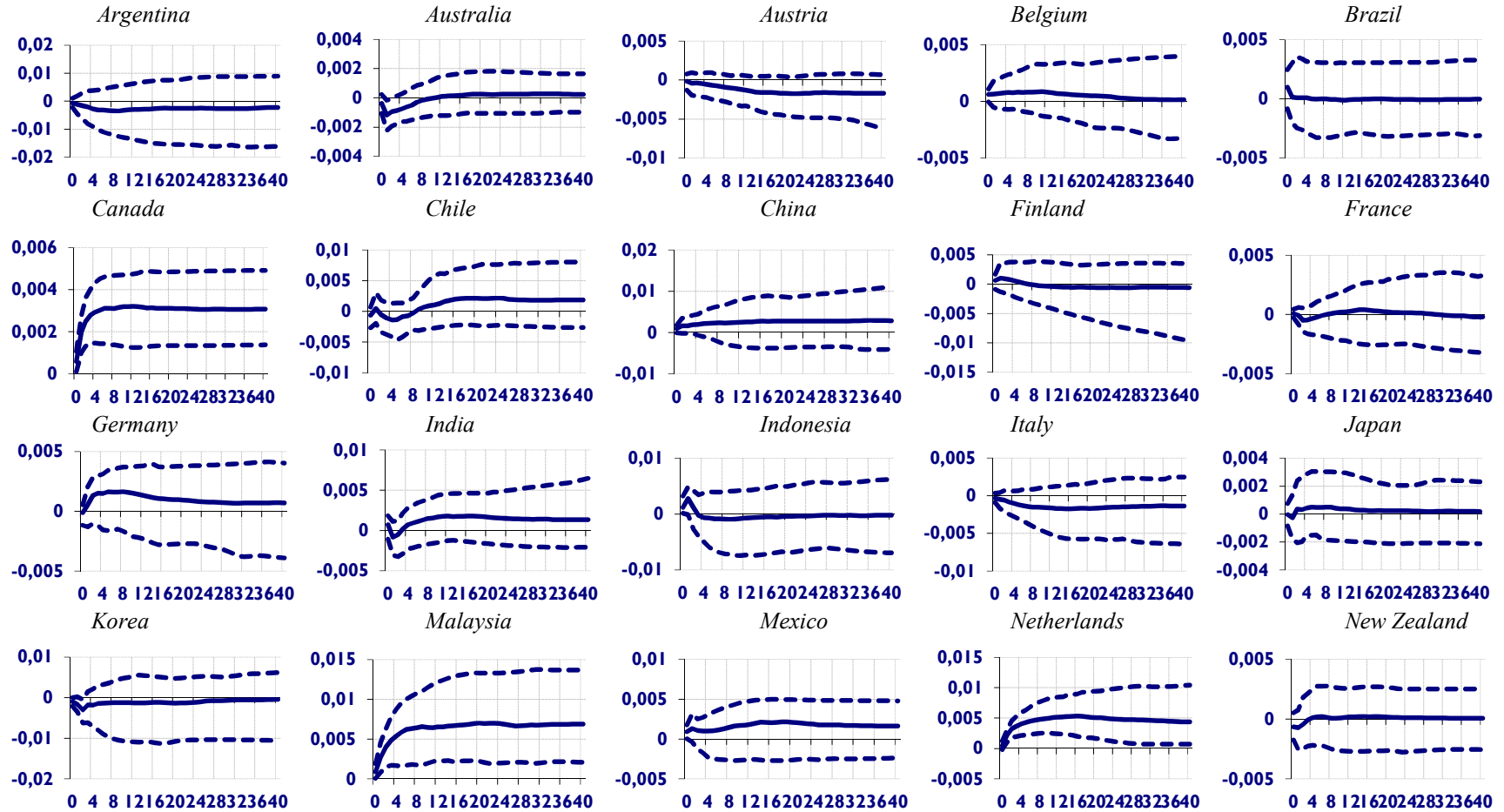
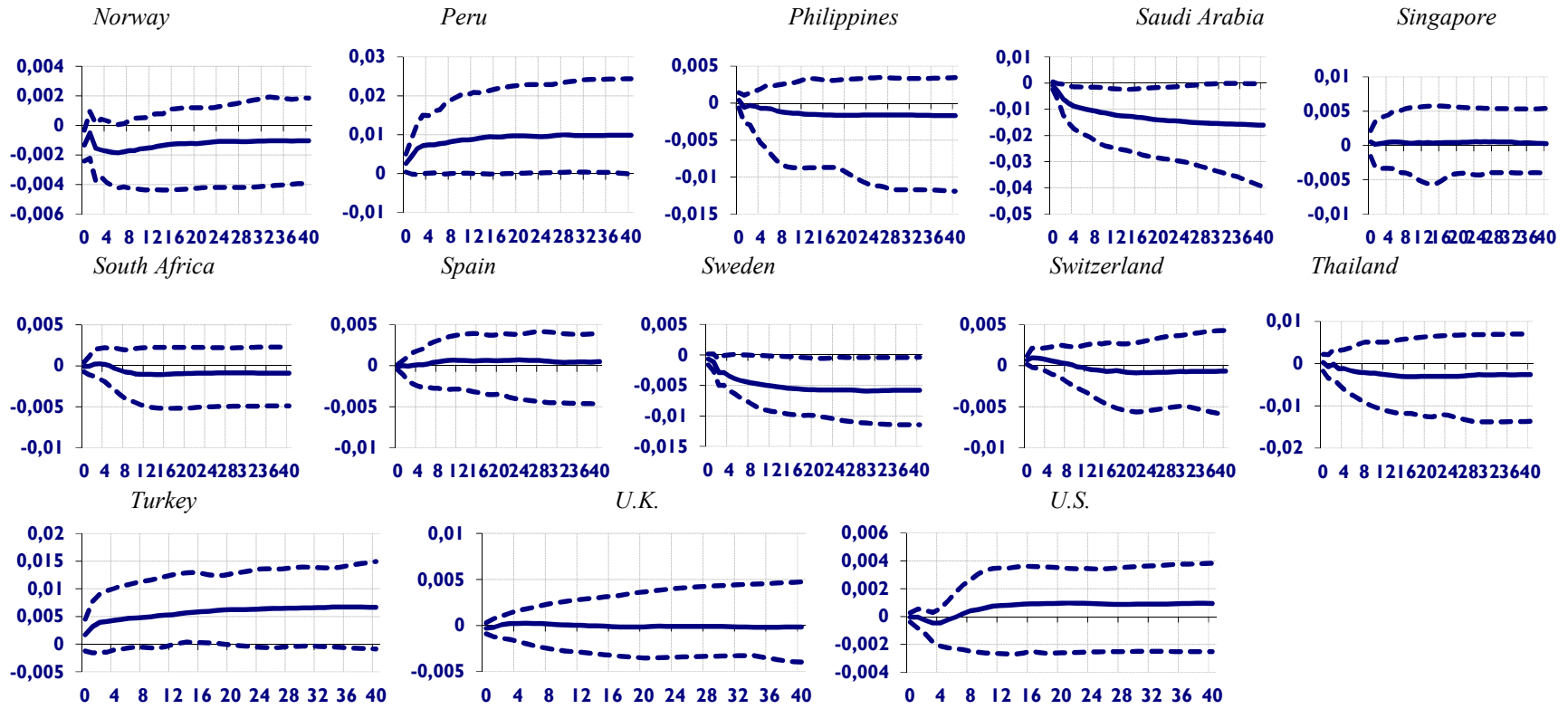


Figure A5 continued



**Figure A6: The effect of own uncertainty shocks on country level real GDP – low GFCy regime**

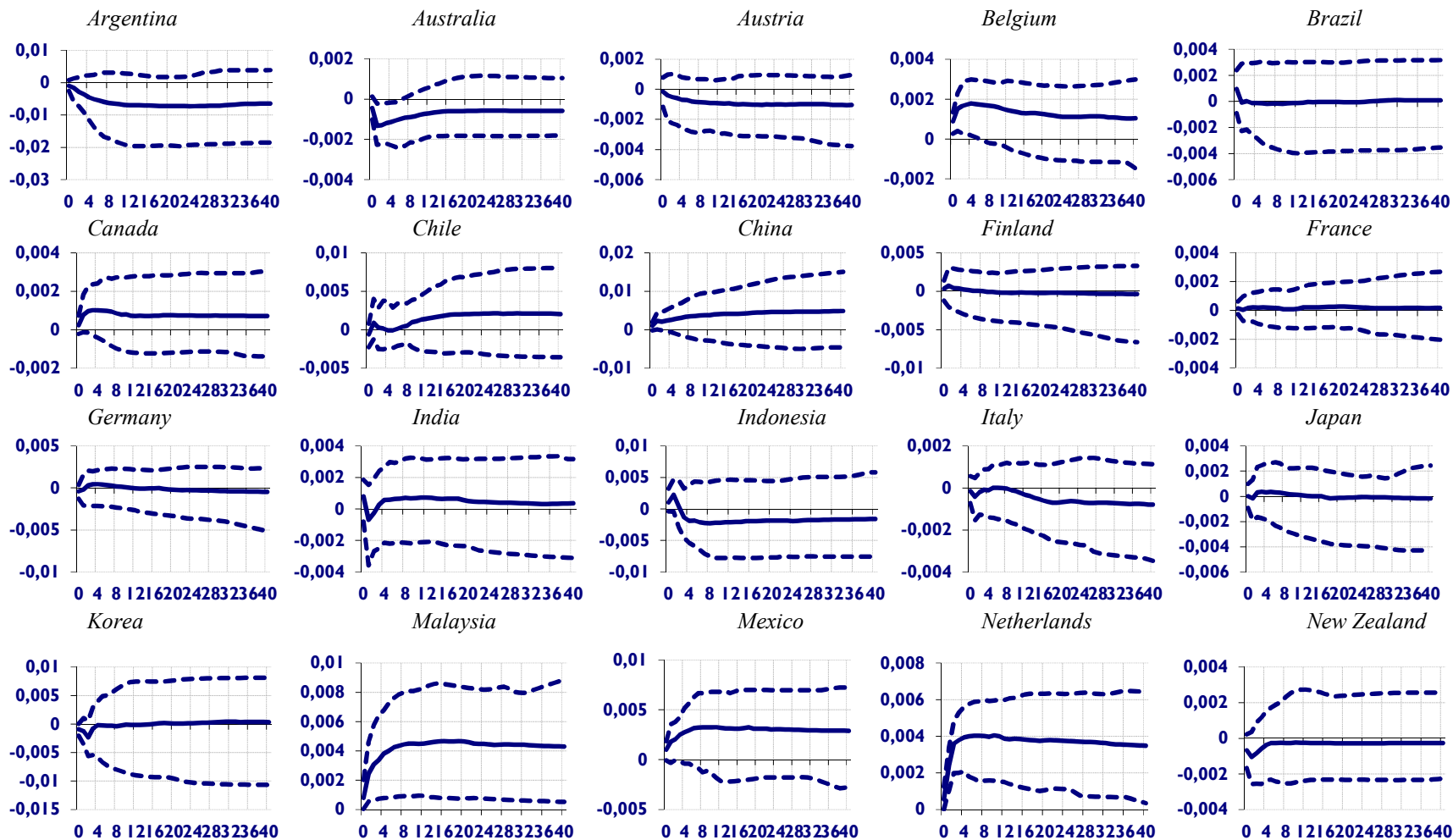


Figure A6 continued

