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THE ROLE OF THE UNITED STATES IN THE GLOBAL ECONOMY AND ITS EVOLUTION OVER TIME

by Stéphane Dées
and Arthur Saint-Guilhem

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In 2009 all ECB publications feature a motif taken from the €200 banknote.

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CONTENTS

Abstract

This paper aims at assessing the role of the United States in the global economy and its evolution over time. The emergence of large economic players, like China, is likely to have weakened the role of the U.S. economy as a driver of global growth. Based on a Global VAR modelling approach, this paper shows first that the transmission of U.S. cyclical developments to the rest of the world tends to fluctuate over time but remains large overall. Second, although the size of the spillovers might have decreased in the most recent periods, the effects of changes in U.S. economic activity seem to have become more persistent. Actually, the increasing economic integration at the world level is likely to have fostered second-round and third-market effects, making U.S. cyclical developments more global. Finally, the slightly decreasing role of the U.S. has been accompanied by an increasing importance of third players. Regional integration might have played a significant role by giving more weights to non-U.S. trade partners in the sensitivity of the various economies to their international environment.

Keywords: International transmission of shocks, Business cycle, Global VAR (GVAR).

JEL Classification: E32, E37, F41.

NON-TECHNICAL SUMMARY

The U.S. economy is very often seen as "the engine" of the world economy. As a result, any sign of slowdown in the United States raises concerns about harmful spillovers to the other economies. The current economic recession in the United States has questioned the ability of the global economy to "decouple" from U.S. cyclical developments. While there were some signs of decoupling in the first quarters following the U.S. downturn, they disappeared rapidly towards the end of 2008, when the crisis became more global and the economic cycles turned out to be more synchronous across the world.

While the increasing economic integration at the world level and the resulting emergence of large economic players, like China, is likely to have weakened the role of the U.S. economy as a driver of global growth, the influence of the United States on other economies remains however larger than direct trade ties would suggest. Third-market effects together with increased financial integration tends to foster the international transmission of cyclical developments.

Based on a Global VAR modelling approach, this paper attempts to provide some answers by analysing how a change in U.S. GDP is transmitted to the rest of the world and to what extent such a transmission has changed during the period 1979-2006. An important caveat of this approach concerns the identification of a U.S. shock. It is clearly difficult to identify a purely U.S.-specific shock, whose nature is entirely idiosyncratic. Moreover, the nature of the shock might also alter the way the shock is transmitted to the rest of the world. While these limits would call for a more complex modeling of the international linkages, our approach has remained on purpose very agnostic, while keeping as comprehensive as possible the representation of international linkages. By including a large number of countries in the modeling of the world economy, the GVAR approach allows us to account for the complexity of global interdependencies in a transparent and coherent framework and to give some idea about the dynamics of the propagation of shocks. A more detailed modeling in terms of the nature of the shocks and their transmission channels would definitely be at the expense of both the rich geographical coverage and the time-varying dimension.

The empirical analysis shows various results. First, the economies differ as regards their sensitivity to U.S. developments. The U.S. economy is for most economies their first trading partner and has remained so during the last 25 years. Even for countries that do not trade so much with the U.S., they are influenced by its dominance through other partners' trade. Of course, the economies that trade a lot with the U.S. are most likely affected by U.S. economic shocks. At the regional level, however, such effects tend to be diluted and the transmission of U.S. cyclical developments seem to be somewhat dampened by regional integration. Moreover, while no clear trend seems to emerge, it seems that the role of the U.S. in the global economy has changed over time. Although, we are not able to identify any structural break in the sample, we can see that a time-varying estimation shows some noticeable differences in the transmission of U.S. shocks over time. Overall, it seems that for most countries, a change in U.S. GDP has weaker impacts during most recent periods than for earlier periods. However, the persistence of such shocks seem to have increased in the most recent periods. The increase in persistence of the U.S. shocks together with the increase in the impact elasticities of non-U.S. foreign activity for some regions (emerging in particular) emphasises the role of second-round and third partners' effects, making U.S. cyclical developments more global.

1 Introduction

The U.S. economy is very often seen as "the engine" of the world economy. As a result, any sign of slowdown in the United States raises concerns about harmful spillovers to the other economies. As pointed out by IMF (2007), the concerns of investors and policymakers are justified against the history of past U.S. recessions usually coinciding with significant reductions in global growth. Figure 1 shows the relatively strong correlation of U.S. real GDP growth and a common component derived from non-U.S. economies' growth rates. In addition to a large correlation (42%), it seems that in some periods, the U.S. cycle tends to lead the rest of the world one. Indeed, the correlation between the U.S. growth rates and the common component lagged one period increases to 50%.

[FIGURE 1 HERE]

While this topic has been widely studied in the literature[1], it has received renewed attention recently. The increasing economic integration at the world level and the resulting emergence of large economic players, like China, is likely to have weakened the role of the U.S. economy as a driver of global growth. For instance, Dees and Vansteenkiste (2007) note that while the U.S. business cycle still leads the world's, Asia, where China's rise is helping the region to establish business cycles largely independent of its main trading partners, is a notable exception[2]. Hence, the current economic recession in the United States has questioned the ability of the global economy to "decouple" from U.S. cyclical developments. While there were some signs of decoupling in the first quarters following the U.S. downturn, they disappeared rapidly towards the end of 2008, when the crisis became more global and the economic cycles turned out to

[1] See for instance Canova and Marriman (1998), Doyle and Faust (2002), Duarte and Holden (2003), Kim et al. (2003), Kose et al. (2003), Lumsdaine and Prasad (2003), Osborn et al. (2005), Osborn et al. (2006), Stock and Watson (2003) and Yamagata (1998).

[2] The latter results is also confirmed by ADB (2007).

be more synchronous across the world. Overall, the U.S.'s influence on other countries' economies remains larger than direct trade ties would suggest, owing to third-market effects together with increased financial integration that tends to foster the international transmission of cyclical developments.

Estimating the source and the size of spillovers across industrialised countries, Bayoumi and Swiston (2007) show that the U.S. shocks generate significant spillovers, while those from the euro area and Japan are small. They also show that financial effects tend to dominate the international spillovers. Analyzing the results for two subperiods (1970–1987 and 1988–2006), they finally show the importance of the great moderation in U.S. output fluctuations and associated financial stability in lowering output volatility elsewhere.

As the study over two subperiods might hide recent changes, this paper aims at showing the evolution over time of the role of the United States in the global economy. Based on a Global VAR modelling approach, this paper shows first that the transmission of U.S. cyclical developments to the rest of the world tends to fluctuate over time but remains large overall. Second, although the size of the spillovers might have decreased in the most recent periods, the effects of changes in U.S. economic activity seem to have become more persistent. Actually, the increasing economic integration at the world level is likely to have fostered second-round and third-market effects. Finally, the slightly decreasing role of the U.S. has been accompanied by an increasing importance of third players. Regional integration might have played a significant role by giving more weights to non-U.S. trade partners in the sensitivity of the various economies to their international environment.

Section 2 presents the modelling strategy chosen to study the international transmission of changes in U.S. economic activity. Section 3 shows the empirical results by distinguishing an analysis over the sample 1979-2006 and a time-varying analysis in order to identify any change in the degree of transmission over time. Section 4 concludes.

2 Modelling the international transmission of changes in U.S. economic activity

As in Bayoumi and Swinston (2007), we use a VAR modelling to study the international transmission of changes in U.S. economic growth. However, to avoid restricting the VAR to too few countries, we apply the modelling strategy introduced in Pesaran et al. (2004), where country-specific models in the form of VARX* structures are estimated relating a vector of domestic variables to their foreign counterparts and then consistently combined to form a Global VAR. In order to apply the GVAR modelling approach on a time-varying dimension, the dimension of the model needs to be not too large. We therefore restrict the variables of interest to real GDP and study the transmission of changes in U.S. economic activity to the rest of the world.

2.1 Modelling global interactions in real output: a GVAR approach

In the literature, Vector Autoregressions, VARs, have been largely used to study the transmission of shocks across countries. While VARs have the advantage to be easily estimated, their principal disadvantage is that they can only deal with a relatively small number of variables.

If we refer to foreign variables as "star" variables, and we extend the VAR to a VARX*, treating the foreign variables as weakly exogenous, country-specific VARX* models can be consistently combined to form a Global VAR (GVAR) in which all the variables are endogenous. The high dimensional nature of such a model is circumvented at the estimation stage by constructing country-specific foreign variables using predetermined coefficients, and by noting that for relatively small open economies such foreign variables can be treated as weakly exogenous for the parameters of the conditional model.

Using such a modelling approach, Dees et al. (2007) are able to estimate a GVAR model for 26 economies with six variables (real output, inflation, exchange rate, a short interest rate, a long interest rate, and real equity prices) over the period 1979-2003. Although the GVAR approach allows the estimation of high-dimension systems, the 6-variable reduced-form models is too large to envisage time-varying estimations. As the purpose of the present paper is to focus on the transmission of business cycles across countries over time, we restrict our global system to only one variable (i.e. real GDP).

Owing to its important role in the global economy, we treat the U.S. as a dominant economy. As shown by Chudik (2008), a GVAR model featuring a dominant economy implies some changes in the empirical modelling. More precisely, if we note the dominant country $i = 0$ and the other countries $i = 1, ..., N$, individual models for countries $i > 0$ need to be augmented by star variables $\mathbf{x}_{it}^*$ as well as variable x_{0t}. The specification of the individual models is then:

$$\mathbf{\Phi}_i \left(L, p_i\right) \mathbf{x}_{it} = \alpha_i + \mathbf{\Upsilon}_i \left(L, q_i\right) \mathbf{x}_{0t} + \mathbf{\Lambda}_i \left(L, r_i\right) \mathbf{x}_{it}^* + \mu_{it} \tag{1}$$

where $\mathbf{x}_{it}$ is real GDP in country i (with $i > 0$), $\mathbf{x}_{0t}$ is U.S. real GDP and $\mathbf{x}_{it}^*$ is real GDP in non-U.S. foreign economies. $\mathbf{\Phi}_i$, $\mathbf{\Upsilon}_i$, and $\mathbf{\Lambda}_i$ are the coefficient matrices and L the lag operator. μ_{it} is the idiosyncratic country-specific shock, with $E(\mu_{it}'\mu_{jt}) = \sum_{ij} = \sum_{ji}'$ and $E(\mu_{it}\mu_{jt'}') = 0$ for all i,j and $t \neq t'$. p_i, q_i, r_i correspond to the lag order of respectively the domestic, U.S. and non-U.S. foreign GDP, including contemporaneous effects.

The non-U.S. foreign variables, $\mathbf{x}_{it}^*$ are computed by using country-specific weights, w_{ij}. Specifically, we use for each country i:

$$\mathbf{x}_{it}^{*} = \sum_{j=1}^{N} w_{ij}\mathbf{x}_{jt}, \text{ with } w_{ii} = 0, \tag{2}$$

where w_{ij} is the weight of country j in total trade of country i, excluding the U.S. economy. The weights, w_{ij}, $j = 1, ..., N$ are expected to capture the importance of country j for country i^{th} economy. Geographical patterns of trade provide an obvious source of information for this purpose and could also be effective in removing some of the remaining spatial dependencies. The weights are allowed to be time-varying so long as they are pre-determined. This is particularly important in our case since our sample includes rapidly expanding emerging economies with their fast changing trade relations with the rest of the world.

It is important to note that the model for the dominant economy $i = 0$ (the U.S. economy in our case) has to be a separate model, in which $\mathbf{x}_{0t}$ is treated endogenously with $\mathbf{x}_{0t}^{*}$ (Chudik, 2008). The US model is therefore written as:

$$\mathbf{\Theta}_0 \left(L, p_0\right) \mathbf{z}_{0t} = \mathbf{a}_0 + \mathbf{u}_{0t} \tag{3}$$

where $\mathbf{z}_{0t} = (\mathbf{x}_{0t}', \mathbf{x}_{0t}^{*\prime})'$, $\mathbf{\Theta}_{0t} = (\mathbf{\Phi}_0', \mathbf{\Phi}_0^{*\prime})'$, $\mathbf{a}_0 = (\alpha_{0t}', \alpha_{0t}^{*\prime})'$ and $\mathbf{u}_{0t} = (\mu_{0t}', \mu_{0t}^{*\prime})'$

The country-specific models (for $i > 1$) can be written in a ECM form allowing for the possibility of cointegration between $\mathbf{x}_{it}$, $\mathbf{x}_{0t}$ and $\mathbf{x}_{it}^{*}$. The country specific models can be consistently estimated separately, by treating $\mathbf{x}_{0t}$ and $\mathbf{x}_{it}^{*}$ as weakly exogenous I(1) variables with respect to the long-run parameters of the conditional model (1). Following Johansen (1992) and Granger and Lin (1995), the weak exogeneity assumption in the context of cointegrating models implies no long-run feedback from $\mathbf{x}_{it}$to $\mathbf{x}_{0t}$ and $\mathbf{x}_{it}^{*}$, without necessarily ruling out lagged short-run feedback between the two sets of variables. The weak exogeneity of these variables can then be tested in the context of each of the country-specific models.

The dominant-economy model ($i = 0$) can take the form of a VECM. After consistent estimation of this US VECM featuring two endogenous variables $\mathbf{x}_{0t}$ and $\mathbf{x}^*_{0t}$, a conditional ECM model for $\mathbf{x}_{0t}$ is derived. This conditional model is subsequently added to the construction of the GVAR.

Such modeling framework is to some extent close to the one proposed by Gianonne and Reichlin (2006), who study the relationship between the U.S. and the euro area real GDP growth in a bivariate VAR model. By extending to a large number of countries, we should be able to enrich the modeling and capture additional, indirect effects that go through third partners.

2.2 Solution of the GVAR model

Once the individual country models are estimated, all the endogenous variables of the global economy need to be solved simultaneously. We first re-write (1) as

$$\mathbf{A}_i(L, p_i, q_i, r_i)\mathbf{z}_{it} = \boldsymbol{\varphi}_{it}, \text{ for } i = 0, 1, 2, ..., N \tag{4}$$

where

$$\mathbf{A}_i(L, p_i, q_i, r_i) = [\boldsymbol{\Phi}_i(L, p_i), \ -\boldsymbol{\Upsilon}_i(L, q_i), \ -\boldsymbol{\Lambda}_i(L, r_i)], \mathbf{z}_{it} = \begin{pmatrix} \mathbf{x}_{it} \\ \mathbf{x}_{0t} \\ \mathbf{x}^*_{it} \end{pmatrix}, \ \boldsymbol{\Upsilon}_0(L, q_0) = 0$$

$$\boldsymbol{\varphi}_{it} = \alpha_i + \mu_{it}.$$

Let $p = \max(p_0, p_1, ..., p_N, q_0, q_1, ..., q_N, r_0, r_1, ..., r_N)$ and construct $\mathbf{A}_i(L, p)$ from $\mathbf{A}_i(L, p_i, q_i, r_i)$ by augmenting the $p - p_i$, $p - q_i$, or $p - r_i$ additional terms in powers of L by zeros. Also note that

$$\mathbf{z}_{it} = \mathbf{W}_i \mathbf{x}_t, \quad i = 0, 1, 2, ..., N, \tag{5}$$

where $\mathbf{x}_t = (\mathbf{x}'_{0t}, \mathbf{x}'_{1t}, ..., \mathbf{x}'_{Nt})'$ is a vector that collects all the endogenous variables of the system, and $\mathbf{W}_i$ is a matrix defined by the country specific weights, w_{ij}.

With the above notations (4) can be written equivalently as $\mathbf{A}_i(L,p)\mathbf{W}_i\mathbf{x}_t = \boldsymbol{\varphi}_{it}$, $i = 0, 1, ..., N$, and then stack to yield the VAR(p) model in $\mathbf{x}_t$:

$$\mathbf{G}\left(L{,}p\right)\mathbf{x}_t = \boldsymbol{\varphi}_t, \tag{6}$$

where

$$\mathbf{G}\left(L{,}p\right) = \begin{pmatrix} \mathbf{A}_0(L,p)\mathbf{W}_0 \\ \mathbf{A}_1(L,p)\mathbf{W}_1 \\ \vdots \\ \mathbf{A}_N(L,p)\mathbf{W}_N \end{pmatrix}, \ \boldsymbol{\varphi}_t = \begin{pmatrix} \boldsymbol{\varphi}_{0t} \\ \boldsymbol{\varphi}_{1t} \\ \vdots \\ \boldsymbol{\varphi}_{Nt} \end{pmatrix}. \tag{7}$$

The GVAR(p) model (6) can now be solved recursively, and used for forecasting or generalized impulse response analysis in the usual manner.

Chudik and Pesaran (2007) show that such approach is optimal to deal with the "curse of dimensionality" in the case of large linear dynamic systems, by showing that under restrictions on the coefficients of an unrestricted VAR, an infinite-dimensional VAR can be arbitrarily well characterized by a large number of finite-dimensional models such as the GVAR model.

3 Empirical results

The empirical analysis is conducted for 26 economies. The dataset includes quarterly data for real GDP on a sample from 1979 to 2006. Before presenting the estimation results, we provide in Section 3.1 some details about the data used and about the construction of foreign output series. The empirical results have been conducted in two different steps. First, we estimate the model over the whole sample and give impact elasticities of shocks to U.S. activity to the other economies as well as impulse response functions (Section 3.2). Second, to account for possible changes in the sensitivity of the economies to U.S. cyclical developments, we estimate the same model on a rolling window (Section 3.3). Finally, we discuss the results in Section 3.4.

3.1 Data

The dataset spans over a period of 112 quarters (from 1979Q1 to 2006Q4) and covers 33 countries with 25 of these modeled separately and the remaining countries grouped into a single euro area economy comprising 8 of the 11 countries that joined the euro in 1999. The real GDP series for the 33 countries of the GVAR model come mainly from the IMF International Financial Statistics (IFS) database in order to update the Dees et al. (2007) database (which ended in 2003Q4). For cases where the IFS data were either too volatile relative to the original dataset or not available, the original dataset was used and we extrapolated forward using the growth rate of the latest IFS data. Seasonal adjustment was performed for countries for which seasonal adjusted series are not provided by the IFS. Finally, to make the dataset complete, we had to interpolate for some countries (over some periods) from annual to quarterly series using the procedure described in Supplement A of Dees et al. (2007).

For each country, we have computed a non-U.S. foreign GDP series, by applying Eq. (2). The weights used (w_{ij}) are time varying bilateral trade weights (3 year moving average) derived from the IMF Direction of Trade Statistics database. Table 1 gives the trade weights used for selected countries in the first and the last year of our sample (i.e. in 1979 and 2006). This gives an idea of important changes in the trade structure of the various economies. For instance, the share of Japan in Chinese trade has almost halved during the period while trade between China and the "Rest" group has almost doubled, representing the sharp increase in intra-regional trade with non-Japan Asia neighbours. At the same time, the share of China in the other economies' trade has increased (multiplied by 2 in the case of Japan and Canada and by around 4 for the euro area, the U.K. and the U.S.). Also, trade with the euro area remains relatively high and even slightly increased for China, Japan and the U.K..

[TABLE 1 HERE]

While these shares represent the structure of trade within countries, excluding the U.S., the U.S. economy remains dominant in terms of its weight within each country's trade, justifying its singling out in our modeling strategy. To give an idea of this dominance, Figure 2 gives the average weight of selected economies in their partners' trade. The U.S. is first (with around an average share of 18%), followed by the euro area (16%), Japan (11%) and the U.K. (8%). Among the following countries, it is worth noting the increasing importance of trade relationships with China, South Korea and Mexico over the sample horizon.

[FIGURE 2 HERE]

Before estimating the GVAR equations, we check for the presence of unit roots in the series. Table 2 indicates that we cannot reject the presence of unit roots in the real GDP series for all countries while we reject non-stationarity for their first log-differences.

[TABLE 2 HERE]

3.2 Estimation over the whole sample

We start estimating the country-specific models described in Eq. (1) over the whole sample. After testing that there is cointegration between $\mathbf{x}_{it}$, $\mathbf{x}_{0t}$ and $\mathbf{x}^*_{it}$ and that country-specific foreign variables are weakly exogenous, we use the estimation results to compute the contemporaneous effects of foreign activity on domestic GDP To assess the dynamics of the propagation of a shock to U.S. GDP to the rest of the world, we also compute generalized impulse response functions. These results give us the general picture over the sample, which will be later on put into perspective by a time-varying approach.

3.2.1 Cointegration and weakly exogeneity tests

As real GDP series have a unit root, we individually estimate each country-VARX* model in its vector error-correcting form using Johansen's trace statistics and the critical values obtained in MacKinnon et al. (1999). As reported in Table 3, test results suggest that there is one cointegration relationships between $\mathbf{x}_{it}$, $\mathbf{x}_{0t}$ and $\mathbf{x}^*_{it}$.

The main assumption underlying our estimation strategy is the weak exogeneity of $\mathbf{x}_{0t}$ and $\mathbf{x}^*_{it}$ of each country i (with $i > 0$). After estimating the individual ECM country models, weak exogeneity was formally tested according to the approach in Johansen (1992). In particular, F-tests for the joint significance of the error-correction terms taken for the individual models in the partial model for the supposed weakly exogenous variable were conducted. Results of these tests are reported in Table 3. Except in 3 cases out of 50, weak exogeneity assumption was not rejected at the 5% level, confirming the weak exogeneity of US and foreign variables.

3.2.2 Contemporaneous Effects of Foreign Activity on Domestic GDP

The order of the country-specific VARX*(p_i, q_i, r_i) models is fixed to 2 lags. Evidence from information criteria tend to indicate this is a reasonable choice in order to capture most of the dynamics at stake.

To summarize the estimates, Table 4 presents the contemporaneous effects of foreign activity on domestic GDP. These estimates can be interpreted as impact elasticities of domestic GDP with respect to foreign (U.S. and non-U.S.) GDP. Most of these elasticities are significant and have a positive sign, as expected. They are particularly informative as regards the international linkages between the domestic economies and their international environment. These elasticities tend to be large for very open economies and the impact elasticity with U.S. GDP seem to depend from the trade proximity of the economies with the U.S.. For example, the elasticities of domestic GDP to U.S. GDP are large and significant for Canada, Mexico, Chile and Australia. For other countries, the non-U.S. foreign components seem to be more important, like for the euro area, the U.K., most other European countries and most of the Asian countries. This component is also relatively large and significant for the U.S. (a 1% change in foreign GDP in a given quarter leads to an increase of 0.2% in U.S. GDP within the same quarter).

[TABLE 4 HERE]

3.2.3 Generalized Impulse Response Functions

Although the contemporaneous effects give a good indication of how an economy react to its international environment, the transmission of shocks does not occur immediately and the analysis of the dynamics of the transmission is necessary. Figure 3 gives the Generalized Impulse Responses (GIR) of a 1% shock to U.S. GDP on the other economies. Of course, the shock has here no structural interpretation. We use the GIR approach as proposed in Koop et al. (1996), which considers - unlike the Orthogonalized Impulse Responses (OIR) of Sims (1980) - shocks to individual errors and integrates out the effects of the other shocks using the observed distribution of all the shocks without any orthogonalization. Also, unlike the OIR, the GIR is invariant to the ordering of the variables and the countries in the GVAR model. In our case, this is particularly important since no theory is able to give us a relevant ordering of countries within the global economy.

An important caveat of this approach concerns the identification of a U.S. shock. It is clearly difficult to identify a purely U.S.-specific shock, whose nature is entirely idiosyncratic. Moreover, the nature of the shock might also alter the way the shock is transmitted to the rest of the world. Another possibility would have been to distinguish the shocks according to their nature (demand or supply shocks), requiring the inclusion of additional variables (such as prices). However, such a modeling of the international linkages would have prevented us from performing the time-varying analysis, owing to too large a dimension of the system. Instead, our approach has remained on purpose very agnostic, while keeping as comprehensive as possible the representation of international linkages. By including a large number of countries in the modeling of the world economy, the GVAR approach allows us to account for the complexity of global interdependencies in a transparent and coherent framework and to give some idea about the dynamics of the propagation of shocks. A more detailed modeling in terms of the nature of the shocks and their transmission channels would definitely be at the expense of both the rich geographical coverage and the time-varying dimension.

To assess the degree of uncertainty surrounding the impulse response functions, we compute bias-corrected bootstrap confidence intervals based on the methodology proposed in Kilian (1998). Finally, we aggregate country-specific impulse responses by region in order to summarize the large set of information available. This aggregation features three geographic areas, in addition to the main developed economies, namely Other Developed Economies (composed of Australia, New Zealand, Sweden, Norway and Switzerland), Latin America (Argentina, Brazil, Chile, Mexico, Peru) and Emerging Asia (China, India, Indonesia, Malaysia, Thailand, Philippines, South Korea and Singapore).

[FIGURE 3 HERE]

The shock on U.S. GDP is temporary on growth (i.e. permanent on real GDP level). In the U.S., the effect dies out quickly. The same pattern can be observed for countries where the effect on impact is relatively large. For instance, the 1% increase in U.S. real GDP increases euro area GDP by 0.2% on impact on average (with a range of bootstrap estimates comprised between 0.05% and 0.3%), by around 0.4% in Canada and Other Developed Economies. U.K. GDP increases by 0.2% although the impacts is almost insignificant, as it is also the case for Japan. For these economies, the effect is absorbed after 5 quarters. Concerning emerging economies, the U.S. shock has larger impacts on Latin America compared with Emerging Asia. In both regions, the U.S. shock is absorbed after 3 years. The responses are however subject to uncertainty as pointed out by the bootstrap confidence intervals. For the aggregates, the confidence intervals hide some heterogeneity within the region. In Emerging Asia, for instance, as the GIR functions are not significant for China, whose weight is very large in the region, this tends to widen the regional confidence intervals.

3.2.4 Stability tests

We consider structural stability tests that are based on the residuals of the individual equations of the country-specific error correction models. More precisely, we use the test proposed by Ploberger and Krämer (1992). Table 5 shows that in all cases we reject the presence of a structural break in the sample.

[TABLE 5 HERE]

3.3 Evidence on rolling regressions

While the findings reported above do not show any structural break during the sample, this does not mean that the sensitivity of economies to U.S. economic activity has not been subject to any gradual changes over time. This leads us to re-estimate our model on a moving window of ten years, starting first with the estimation of the time-varying contemporaneous effects of foreign output before computing time-varying GIR[3].

3.3.1 The changing role of foreign variables over time

Figure 4 reports the time-varying estimates of the contemporaneous impacts of U.S. and non-U.S. foreign GDP on domestic GDP, together with 95% bootstrap confidence intervals. The estimation has been realised using a ten-year rolling window. In Figure 4, the date reported corresponds to the end of the window. The graph starts therefore in 1989Q1 (i.e. estimation over 1979Q1-1989Q1) and ends in 2006Q4 (i.e. estimation over 1996Q4 to 2006Q4).

[FIGURE 4 HERE]

Starting with the United States, the impact elasticity with respect to foreign GDP has remained very close to the value resulting from the whole sample estimation (around 0.2). It seems however that this impact has gradually decreased in the most recent periods.

For the euro area, the impact elasticity with respect to U.S. GDP (0.1 on

[3] Another way of allowing for a time-varying effect might have been through using the product of U.S. output and a time-varying trade weight as the explanatory variable in the model of the non-U.S. economies. The difficulty with this approach is that it makes the strength of the linkage solely depend on trade, whereas it might be related to financial integration.

average - see above) has varied over time (from 0 to 0.3) without displaying any particular trend. The most recent years exhibits however some decrease in the impact elasticity. The impacts of non-U.S. foreign GDP has continuously declined from the 1980s to the most recent years (from 0.6 to 0.2), featuring at the same time some large uncertainty. The time-varying estimation for the U.K. and Japan shows large swings in the impact of U.S. GDP, and remains overall subject to large uncertainty (as indicated by the confidence intervals). This is mostly due to particular events these economies faced during the period. For the U.K., while it seems that the economy was completely disconnected from the U.S. in the 1980s-1990s, the non-U.S. foreign influences (mostly the other European economies) remained relatively strong and significant (with an impact elasticity ranging between 0.2 and 0.4). For Japan, the "lost decade" seems also to feature a complete disconnection with the U.S. economy, while the non-U.S. component (mostly the other Asian economies) gained both importance and significance. It is worth noting that this apparent disconnection reflects only contemporaneous influences. Only the analysis of the dynamics of the transmission (see below) will allow us to identify possible lagged impacts and/or impacts through third partners.

In Canada, the contemporaneous role of the U.S. in domestic activity seems to gradually decrease (from almost 1 in the period 1982-1992 to 0.2 in the most recent period). A similar pattern can be noticed for Other Developed Economies. However, while the non-U.S. foreign GDP seems to become more important for the latter group, it is not significant for Canada, confirming that the U.S. economy remains the main player in Canada's international environment.

Finally, for emerging economies, the role of non-U.S. foreign GDP seems to have increased, possibly reflecting the strengthening in regional integration and the growing importance of South-South trade. Conversely, the role of the U.S. (on impact) seems to have lost importance and is in most cases insignificant.

3.3.2 The changing dynamics of transmission of U.S. cyclical developments over time

Figure 5 shows the the time-varying profiles of the GIR functions of a 1% increase in U.S. GDP. Similarly to the impact elasticities, the date reported corresponds to the end of a 10-year period.

[FIGURE 5 HERE]

For the euro area, confirming the impact elasticities, the importance of U.S. shocks seem to have decreased over time. However, it seems also that the shocks take more time to fade away. While at the beginning of the sample, a U.S. shock died out after a year, the impacts remain above zero for more than 2 years for the most recent periods. Another interesting observation concerns the shape of the responses. The profiles seem more volatile in the earlier periods while they tend to exhibit smoother dynamics at the end of the sample.

Most of the comments for the euro area are also valid for the other advanced economies. For the U.K. and Japan, in particular, the profiles were rather bumpy in the nineties, becoming more even thereafter.

Regarding emerging economies, the impacts of the U.S. shocks have increased and have become more persistent for Latin America, while for Asia, although the impacts remain smaller, their persistence has also increased. Lagged effects seem also to have become larger in the most recent period for the latter region, with a maximum impact after 6 quarters.

Overall, the time-varying GIR functions show that despite the relatively limited (or declining) role the U.S. economy has contemporaneously on the rest of the world, its importance remains very large. This underlines the fact that the U.S. influences might have become more indirect (going more through third partners and creating snow-ball effects). No clear trend emerges from the time-varying analysis, although some slight decline in the responses might be noticed in some economies. More importantly, it seems that the impacts have become more persistent compared to earlier periods. This might indicate that the increasing trade and financial integration worldwide might have strengthened the transmission of shocks. The U.S. shocks might have therefore become more global as they travel from the U.S. to the rest of the world, reenforcing the persistence of their impacts.

3.4 Discussion of the results

Our empirical analysis has shown various results. First, the economies differ as regards their sensitivity to U.S. developments. Second, the role of the U.S. in the global economy has changed over time while no clear trend seems to emerge. Finally, the increasing economic integration at the world level together with the importance of regionalisation has definitely changed the way shocks are transmitted.

Differences in the role of the U.S. economy across countries

The share of the U.S. in the global economy remains very high, not only in terms of its size in global activity, but also in terms of its dominance for the other economies. The U.S. economy is for most economies their first trading partner and has remained so during the last 25 years. Even for countries that do not trade so much with the U.S., they are influenced by its dominance through other partners' trade. Of course, the economies that trade a lot with the U.S. are most likely affected by U.S. economic shocks. A change in U.S. GDP affects relatively more Canada or Other Developed Economies, while the European economies or Japan seem less affected - at least - on impact. Among emerging markets, the countries that have strong trade relationships with the U.S., like

Mexico or Korea are also more affected. At the regional level, however, such effects tend to be diluted and the transmission of U.S. cyclical developments seem to be somewhat dampened by regional integration.

Changes in the role of the U.S. economy over time

The degree of transmission of U.S. cyclical developments varies over time. Although, we are not able to identify any structural break in the sample, we can see that a time-varying estimation shows some noticeable differences in the transmission of U.S. shocks over time. Overall, it seems that for most countries, the impacts of a change in U.S. GDP has less impacts during most recent periods than for earlier periods. This is particularly visible in the impulse responses for the euro area, the U.K. and Canada. For Other Developed Economies and Latin America, while their sensitivity to U.S. economic activity increased during the 1990s, it seems that it has decreased in the most recent periods. The dynamics of the transmission seem to have become smoother, likely resulting from increasing trade and financial integration. Overall, while a shock originating from the U.S. might have the same cumulated impacts, this shock appears to be transmitted in a more dampened way.

The increasing role of third partners in the transmission of cyclical developments

While there is some evidence that the impacts of U.S. shocks have decreased over time, the persistence of such shocks seem to have increased in the most recent periods. The increase in persistence of the U.S. shocks together with the increase in the impact elasticities of non-U.S. foreign activity for some regions (emerging in particular) emphasises the role of second-round and third partners' effects. At the same time however, the time-varying impact elasticities of GDP to foreign GDP have decreased in the U.S. and the euro area. The decrease of impact elasticities does not necessarily mean a decrease in the sensitivity of the economies to their international environment. It might indicate instead that these economies face more idiosyncratic shocks and that foreign influences might take a few quarters before materialising on economic growth. The decrease over time might indicate that during the sample period, while the economies have become more integrated and more sensitive to their international environment, they are so in a less synchronous way than in the past. This result is also shown in Kose et al. (2008b).

4 Concluding remarks

The current economic recession in the United States has questioned the ability of the global economy to "decouple" from U.S. cyclical developments. While there were some signs of decoupling in the first quarters following the U.S. downturn, they disappeared rapidly towards the end of 2008, when the crisis became more global and the economic cycles turned out to be more synchronous across the world.

While the increasing economic integration at the world level and the resulting emergence of large economic players, like China, is likely to have weakened the role of the U.S. economy as a driver of global growth, the influence of the United States on other economies remains however larger than direct trade ties would suggest. Third-market effects together with increased financial integration tends to foster the international transmission of cyclical developments.

This paper attempts to provide some answers by analysing how a change in U.S. GDP is transmitted to the rest of the world and to what extent such a transmission has changed over time. The empirical analysis shows various results. First, the economies differ as regards their sensitivity to U.S. developments. The U.S. economy is for most economies their first trading partner and has remained so during the last 25 years. Even for countries that do not trade so much with the U.S., they are influenced by its dominance through other partners' trade. Of course, the economies that trade a lot with the U.S. are most likely affected by U.S. economic shocks. At the regional level, however, such effects tend to be diluted and the transmission of U.S. cyclical developments seem to be somewhat dampened by regional integration. Moreover, while no clear trend seems to emerge, it seems that the role of the U.S. in the global economy has changed over time. Although, we are not able to identify any structural break in the sample, we can see that a time-varying estimation shows some noticeable differences in the transmission of U.S. shocks over time. Overall, it seems that for most countries, a change in U.S. GDP has weaker impacts during most recent periods than for earlier periods. However, the persistence of such shocks seem to have increased in the most recent periods. The increase in persistence of the U.S. shocks together with the increase in the impact elasticities of non-U.S. foreign activity for some regions (emerging in particular) emphasises the role of second-round and third partners' effects, making U.S. cyclical developments more global.

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Tables and Figures

Table 1: Trade weights based on direction of trade statistics

	1979						2006					
	China	EA	Jap.	Can.	U.K.	Rest[a]	China	EA	Jap.	Can.	U.K.	Rest[a]
China	0	0.20	0.46	0.06	0.04	0.24	0	0.21	0.27	0.02	0.05	0.45
EA	0.01	0	0.07	0.03	0.26	0.62	0.04	0	0.08	0.02	0.30	0.55
Jap.	0.07	0.13	0	0.05	0.05	0.70	0.14	0.19	0	0.03	0.04	0.59
Can.	0.03	0.27	0.22	0	0.14	0.33	0.06	0.26	0.15	0	0.11	0.42
U.K.	0.00	0.60	0.04	0.03	0	0.31	0.03	0.64	0.04	0.03	0	0.26
U.S.	0.01	0.19	0.16	0.22	0.07	0.35	0.05	0.17	0.11	0.25	0.05	0.38

Note: Trade weights are computed as shares of exports and imports displayed in rows by region such that a row, but not a column, sums to one.
[a] Rest gathers the remaining countries. The complete trade matrix used can be obtained from the authors on request. Source: Direction of Trade Statistics, 1979-2006, IMF.

Table 2: ADF-GLS test with intercept and trend, Schwarz criterion: (GDP in level and in log-diff.)

	level	log-diff.
Argentina	-2.29	-5.03*
Australia	-2.03	-3.24*
Brazil	-1.41	-7.14*
Canada	-2.21	-5.44*
China	-3.44*	-3.22*
Chile	-2.10	-7.42*
Euro area	-1.84	-3.43*
Indonesia	-1.44	-10.09*
India	-1.27	-7.77*
Japan	-1.10	-3.29*
Malaysia	-1.56	-7.43*
Mexico	-2.26	-4.58*
Norway	-1.83	-19.50*
New Zealand	-2.03	-12.02*
Peru	-1.61	-7.05*
Philippines	-1.46	-9.22*
Saudi Arabia	-2.07	-1.68*
Sweden	-1.00	-16.37*
Singapore	-1.67	-8.11*
South Korea	-1.12	-11.41*
South Africa	-1.14	-5.49*
Switzerland	-2.04	-6.94*
Thailand	-1.00	-6.08*
Turkey	-2.24	-9.65*
United Kingdom	-2.78	-3.56*
United States	-2.05	-4.84*

Note: *, # indicate significance at 1% and 5% respectively. The critical values of the test is equal to -3.57 at 1% and -3.02 at 5% under the null hypothesis of unit root.

Table 3: F-statistics for testing the weak exogeneity of the country-specific foreign variables and Trace statistics for testing cointegration

	Weak exogeneity tests		Cointegration tests
	$\mathbf{x}_{0t}$	$\mathbf{x}^*_{it}$	Trace Stat
Argentina	1.03	0.49	54.22
Australia	0.06	0.05	47.85
Brazil	0.19	0.10	36.85
Canada	0.01	2.50	47.14
China	1.97	-3.22	42.21
Chile	2.05	3.27	40.70
Euro area	0.25	1.75	40.14
Indonesia	0.12	0.07	41.15
India	0.03	0.25	41.51
Japan	0.69	0.25	45.84
Malaysia	2.02	0.28	48.65
Mexico	1.61	2.13	41.90
Norway	5.37*	0.88	55.76
New Zealand	6.01*	3.30	48.68
Peru	0.00	0.28	41.43
Philippines	0.00	0.78	35.27
Saudi Arabia	2.94	0.60	47.76
Sweden	0.00	10.91*	48.82
Singapore	1.64	0.08	45.12
South Korea	0.80	1.10	42.82
South Africa	0.00	0.83	33.32
Switzerland	2.17	0.69	49.65
Thailand	0.09	0.21	36.36
Turkey	4.33	2.52	48.93
United Kingdom	2.24	0.09	56.06
United States	-	-	32.79

Notes: * indicates significance at 5% for weak exogeneity tests. For cointegration tests, the 5% critical values for Trace (McKinnon et al., 1999) are 35.19 for all countries except the United States (with 3 variables) and 20.26 for the Unites States (with 2 variables).

Table 4: Contemporaneous effects of foreign GDP (US and non-US) on domestic growth

	Impact elasticities	
	U.S. GDP	Non-U.S. foreign GDP
Argentina	0.33	0.29
Australia	0.41**	0.01
Brazil	-0.19	0.73
Canada	0.45**	-0.02
China	0.05	-0.02
Chile	0.66#	0.74**
Euro area	0.07#	0.35**
Indonesia	0.18	0.71
India	0.24	-0.14
Japan	-0.02	0.18
Malaysia	-0.16	1.04**
Mexico	0.35*	0.24
Norway	0.33	0.66#
New Zealand	-0.08	0.96#
Peru	-0.60#	0.76#
Philippines	-0.36	0.39*
Saudi Arabia	0.12	0.06
Sweden	0.35	0.73**
Singapore	0.32	0.51
South Korea	-0.17#	0.76#
South Africa	0.04	0.07
Switzerland	0.08**	0.67**
Thailand	0.00	0.57**
Turkey	0.54	0.60
United Kingdom	0.15	0.27*
United States	-	0.19*

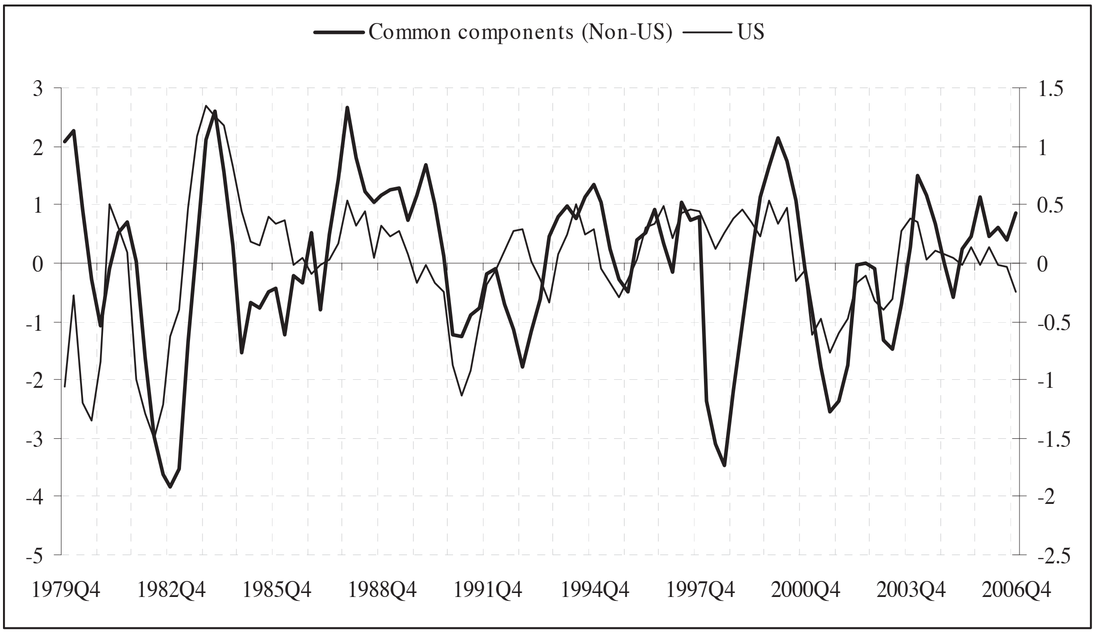
Note: **, *, # indicate significance at 1%, 5% and 10% respectively.

Table 5: Stability Tests (Ploberger and Krämer)

	dy
Argentina	0.157**
Australia	0.320**
Brazil	0.595**
Canada	0.411**
China	0.615**
Chile	0.380**
Euro area	1.305*
Indonesia	0.843**
India	0.138**
Japan	1.299*
Malaysia	0.908**
Mexico	0.398**
Norway	0.331**
New Zealand	0.803**
Peru	0.079**
Philippines	0.060**
Saudi Arabia	0.151**
Sweden	0.331**
Singapore	0.728**
South Korea	1.564#
South Africa	0.362**
Switzerland	0.632**
Thailand	1.544#
Turkey	0.428**
United Kingdom	0.516**
United States	1.047**

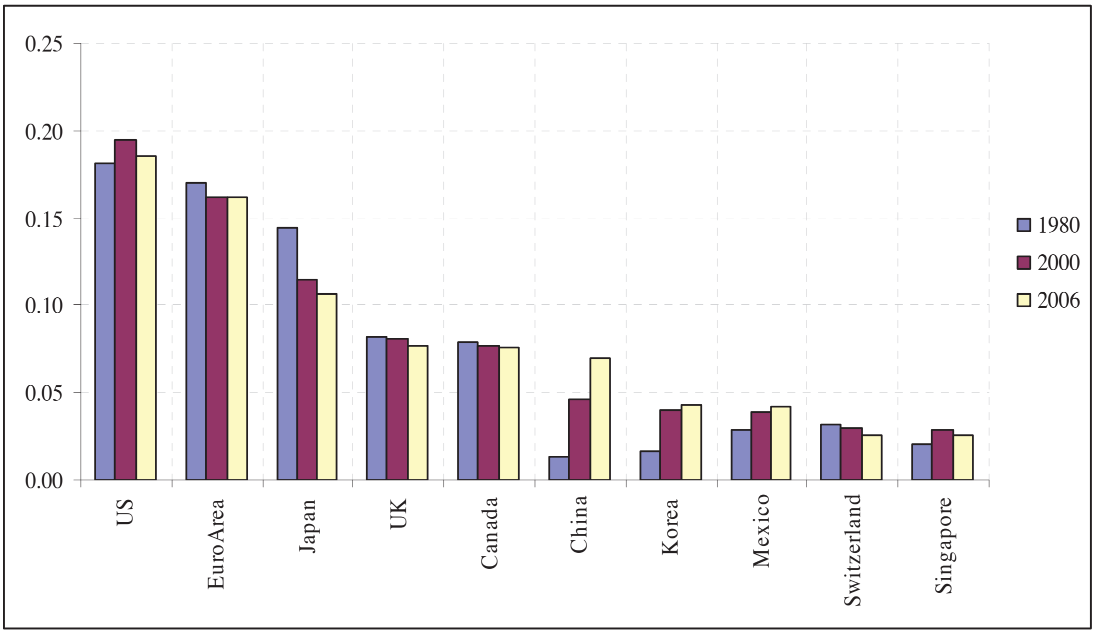
Note: **,*, # indicate significance at 1%, 5% and 10% respectively. The critical value of the Ploberger-Krämer test is equal to 1.22, 1.36 and 1.63 at 1%, 5% and 10% respectively, under the null hypothesis of no structural break.

Figure 1 – US real GDP growth rates (detrended) and common component of rest of the world growth rates (detrended)
(Quarterly growth rates – 3 year moving average)



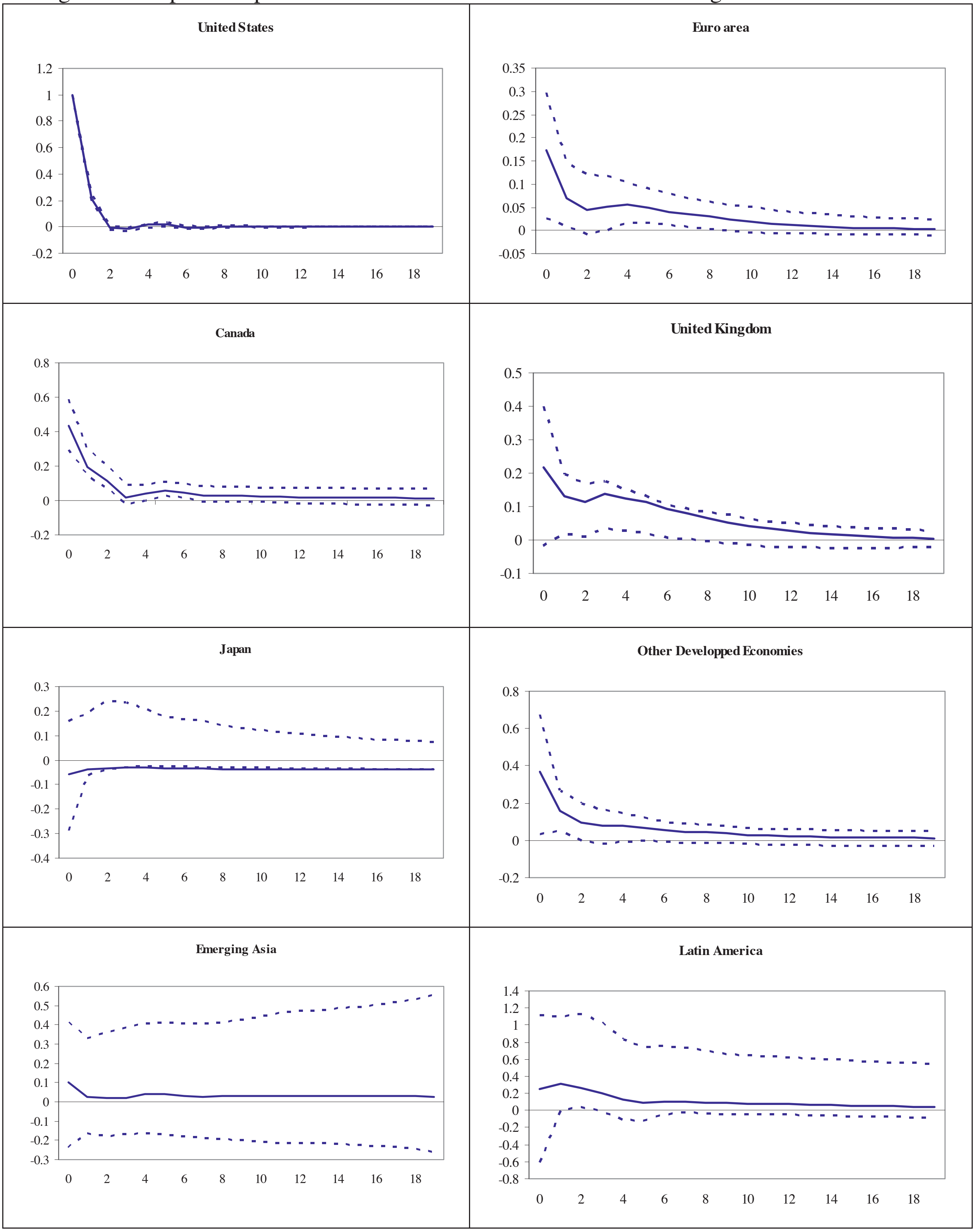
Source: Authors' computation
Note: Common component is the first principal component derived from a pool of 25 non-US economies

Figure 2 – Ranking of selected economies according to their average weight in partners' trade.



Source: IMF Direction of Trade Statistics.

Figure 3 – Impulse response functions of a 1% shock to US real GDP growth



Note: Dotted lines indicate 95% bias-corrected bootstrap confidence intervals.

Figure 4 – Time-varying estimates of impact elasticity of real GDP to US and foreign real GDP

Note: Dotted lines indicate 95% bootstrap confidence intervals.

Figure 5 - Impulse response functions of a 1% shock to US real GDP on US and euro area real GDP growth

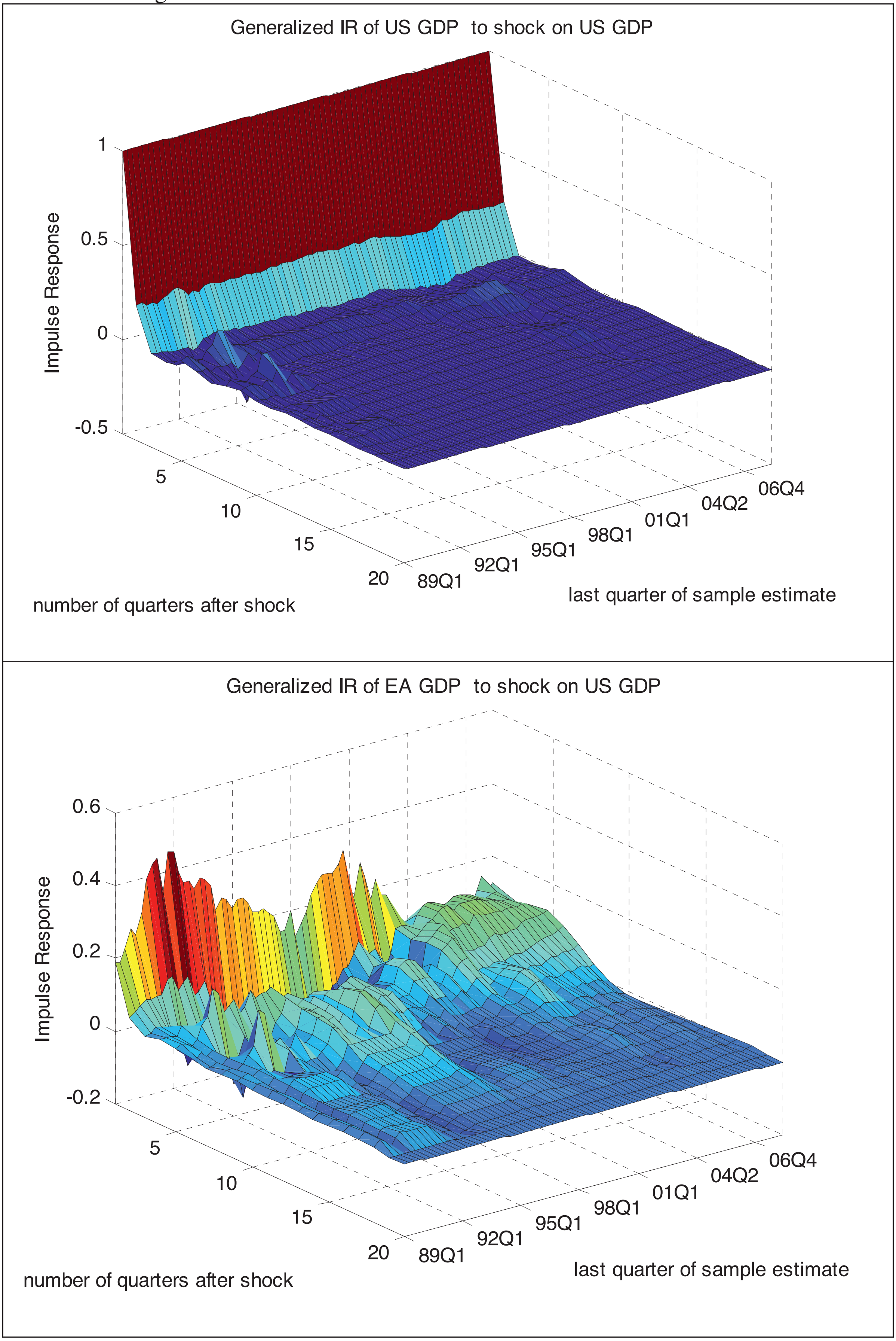
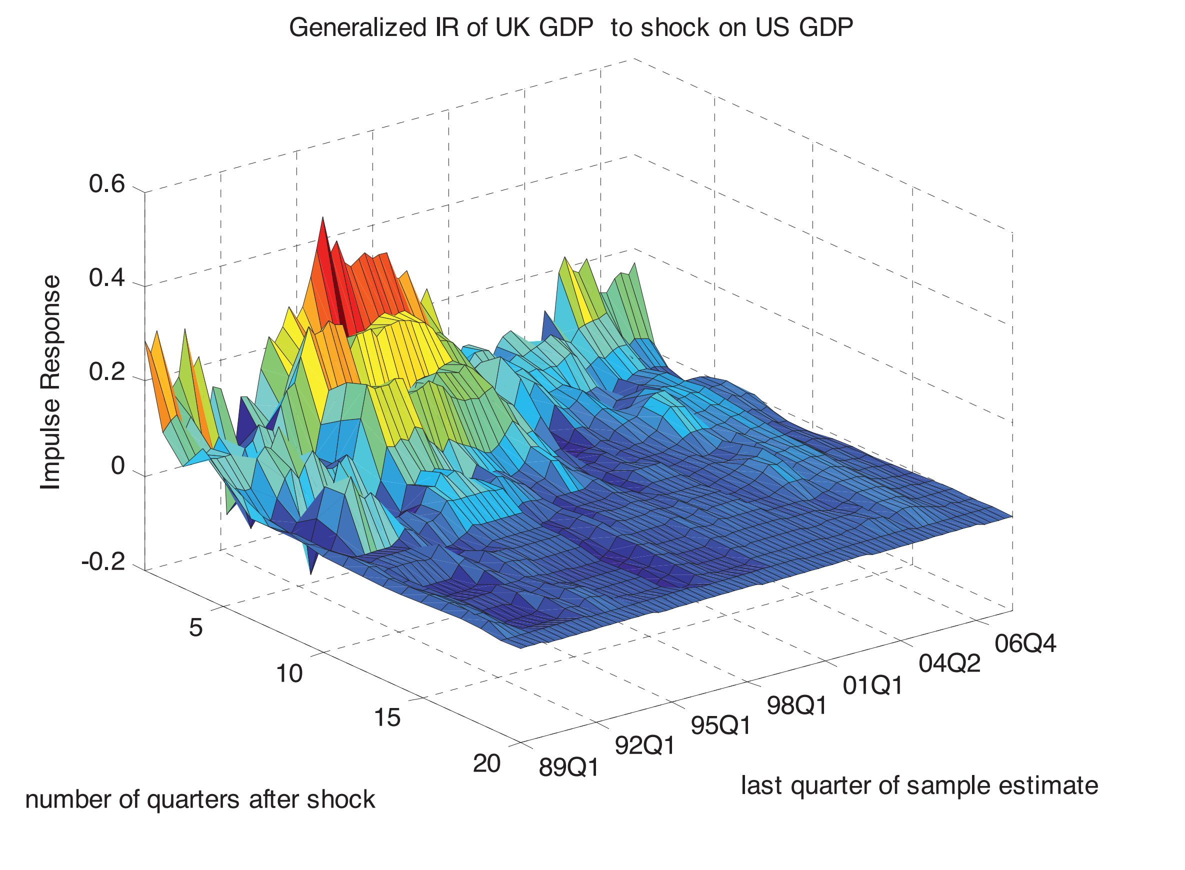


Figure 5 (cont'd) - Impulse response functions of a 1% shock to US real GDP on UK and Japan real GDP growth



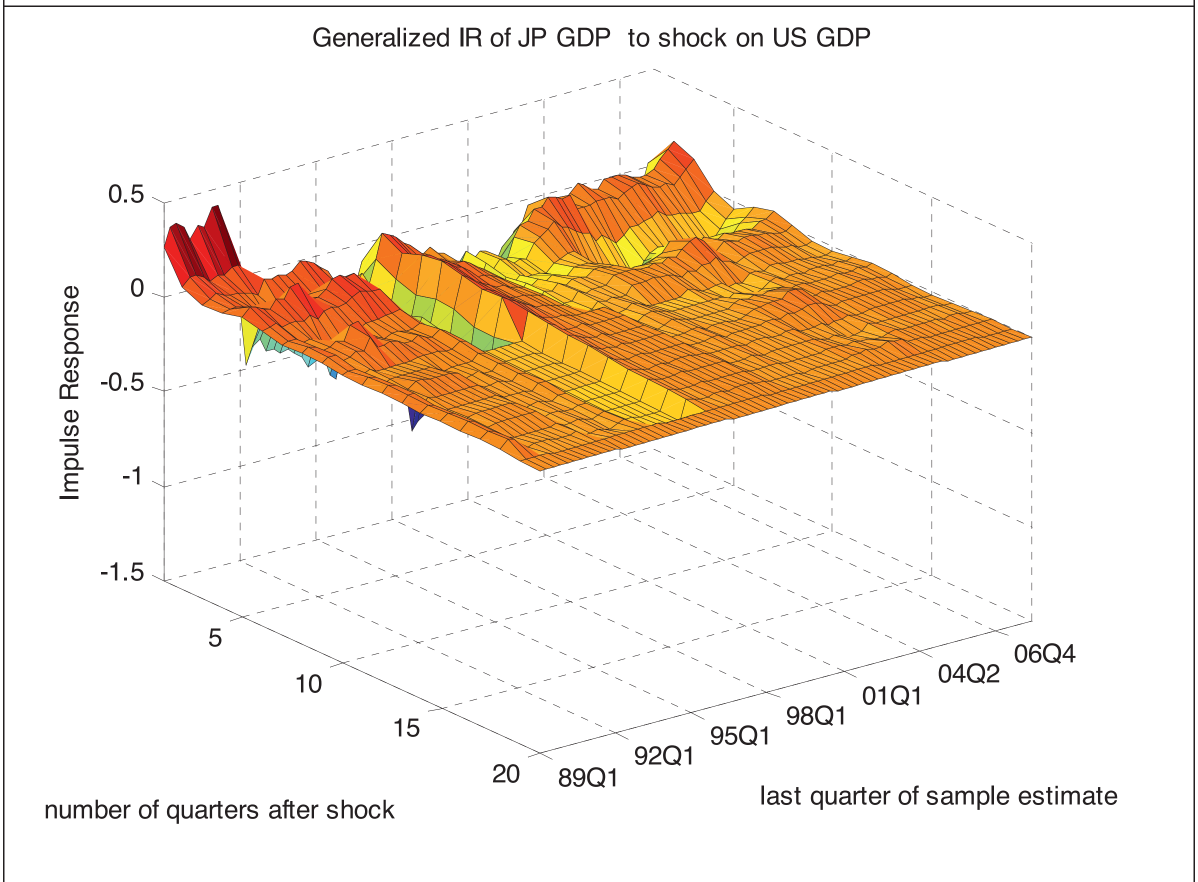
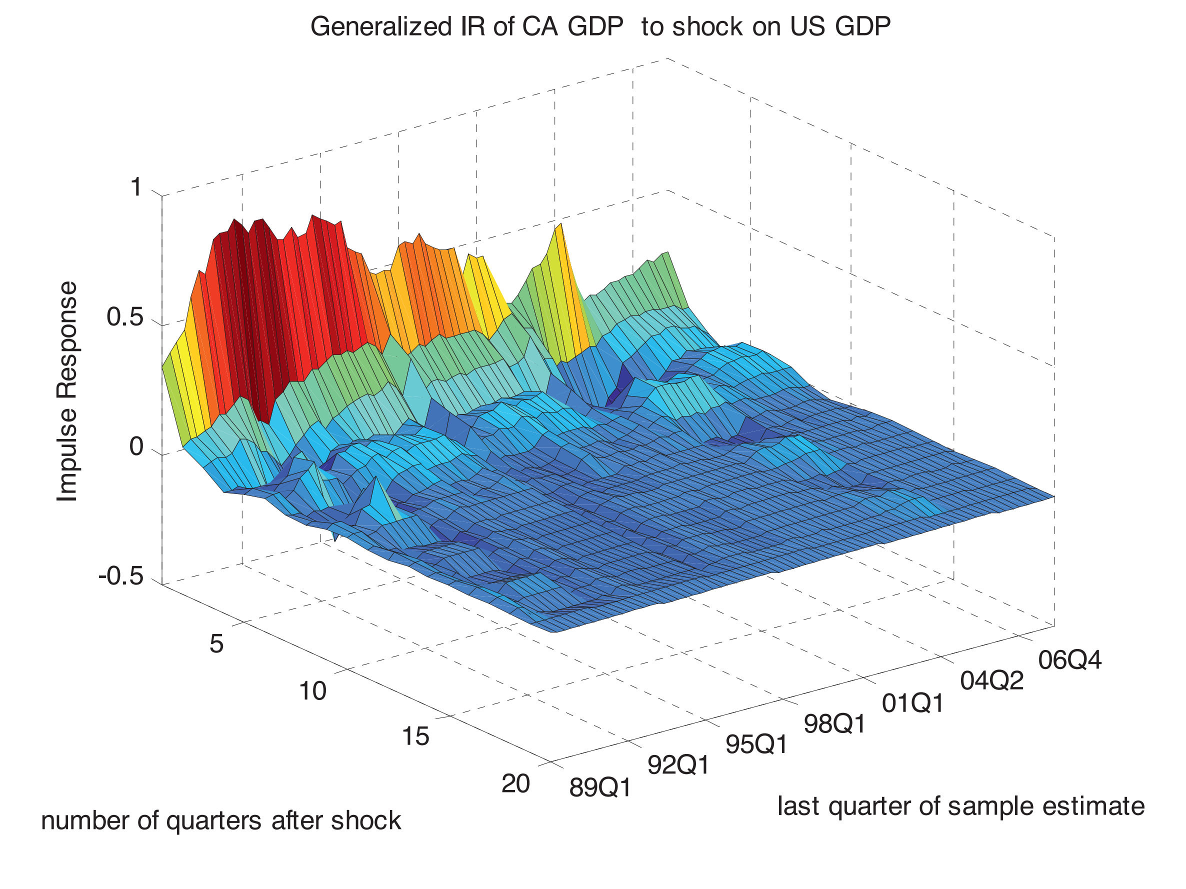


Figure 5 (cont'd) - Impulse response functions of a 1% shock to US real GDP on Canada and Other Developed Economies real GDP growth



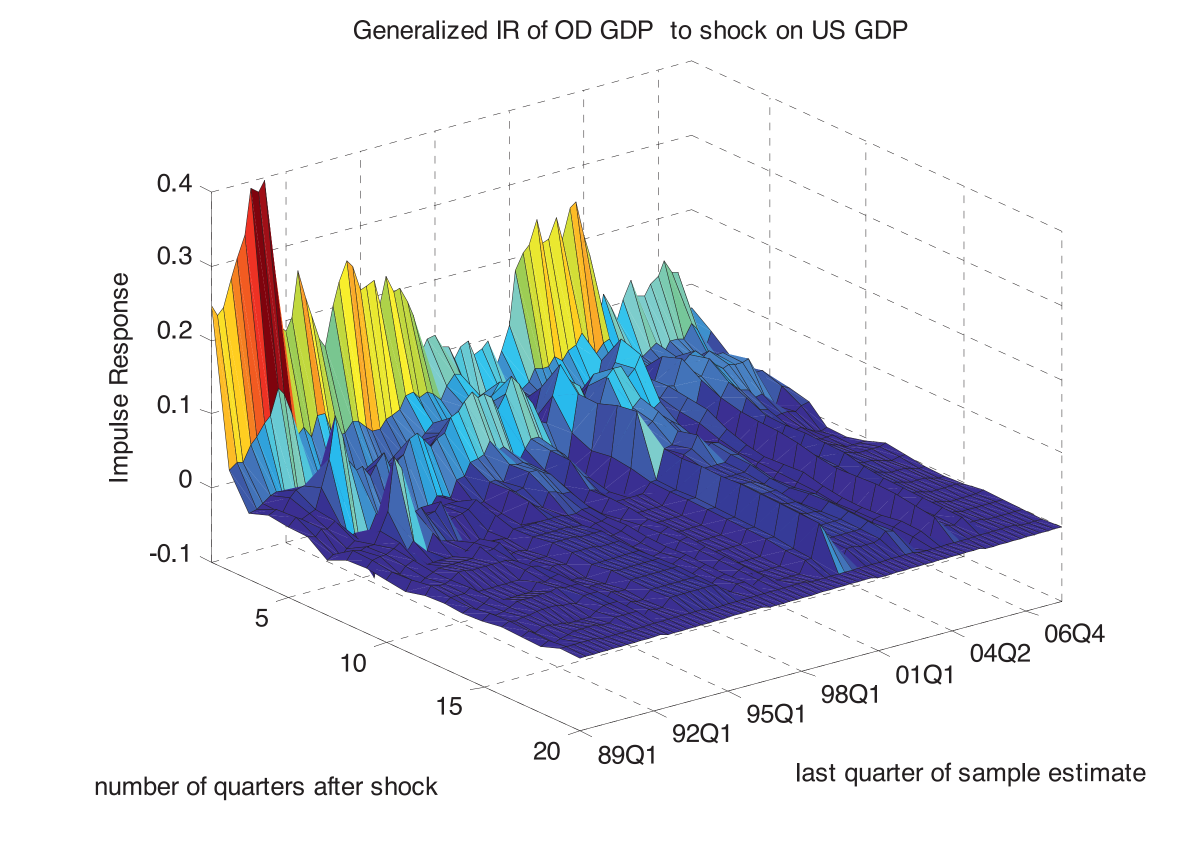
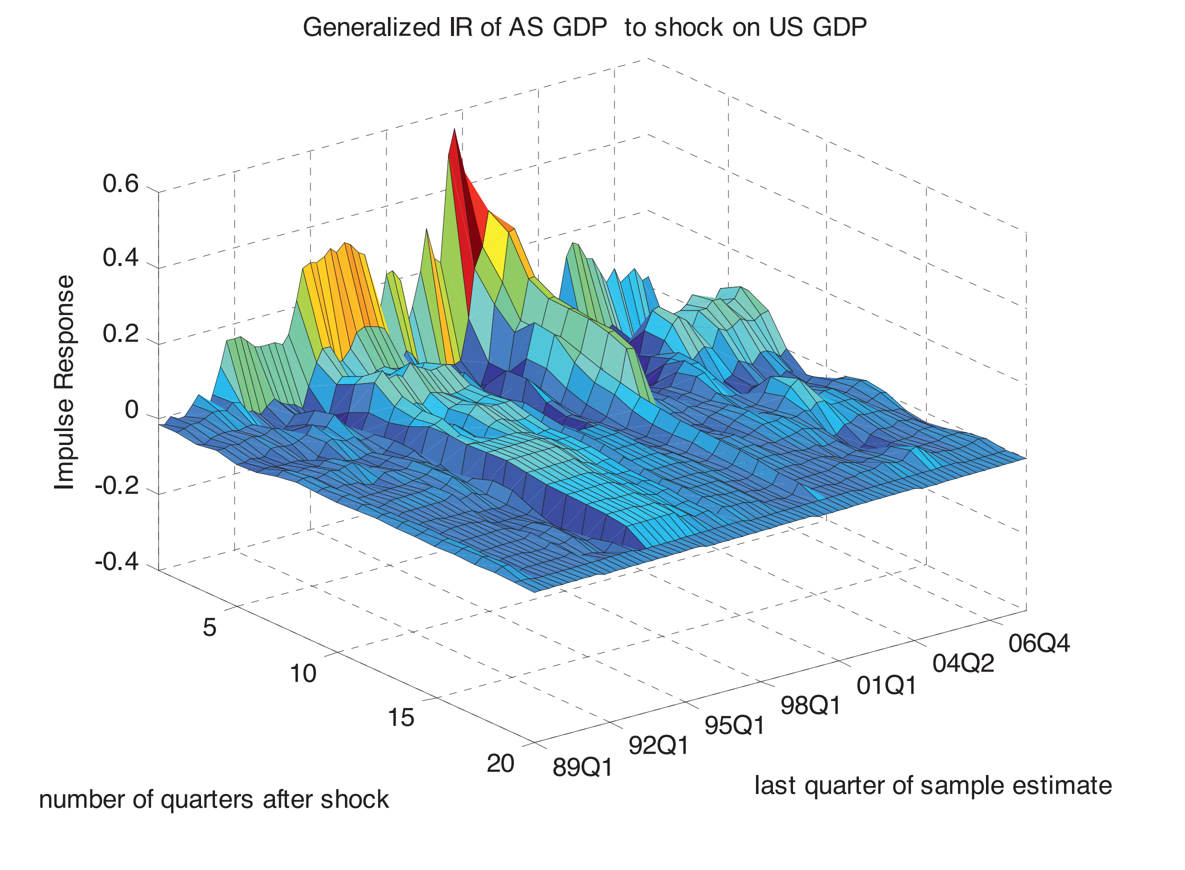
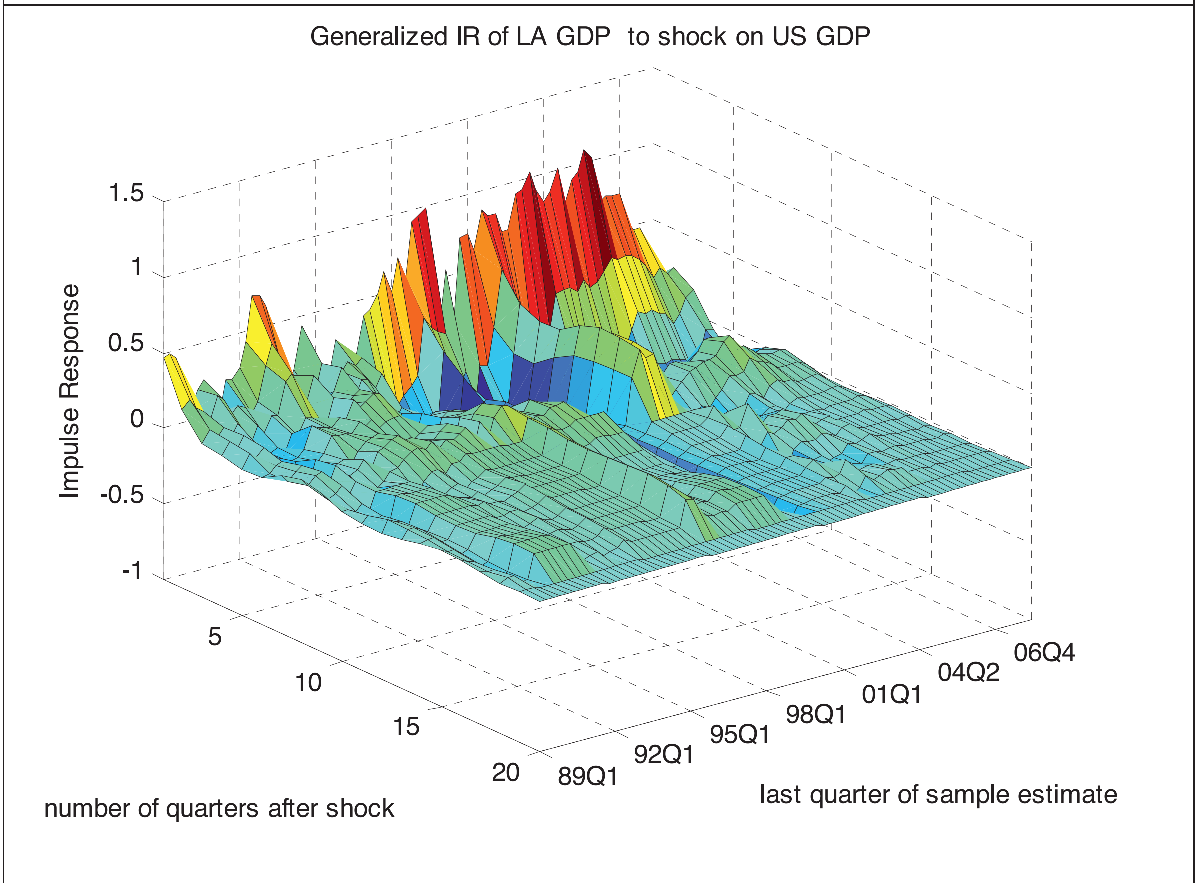


Figure 5 (cont'd) - Impulse response functions of a 1% shock to US real GDP on Emerging Asia and Latin America area real GDP growth





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9 771561 081005