GLOBAL ECONOMY DYNAMICS?
PANEL DATA APPROACH TO SPILLOVER EFFECTS

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Abstract

Over the past year, there has been considerable debate about how the slowing of the United States and other major developed economies affects output growth across the world. The main purpose of this paper is to establish relevant conclusions on how the U.S., Euro Area and Japan gross domestic product growth affect international business cycle fluctuations, with the objective of identifying the main factors that influence spillovers into other countries. Using panel data regression, we conclude that output growth in the U.S. and Euro area are significant in explaining output growth across countries. Depending on the specifications, trade linkages play a significant role while financial linkages with respect to the three regions does not (except in one particular specification). There are signs of potential omitted variable bias in some regression indicating that some relevant variables have not been taken into account. There is also clear evidence of a structural change in the transmission mechanism of shocks after 1985 – since when shocks have become more country-specific.

Keywords: Output Growth, Trade and Financial Linkages, Structural Break, Cross-Section Panel Data.

JEL Classification: C23, F40

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1. Introduction

Since the end of World War II, the United States has been described as the motor of the world economy. It is widely believed that a slowdown of its economic growth means that the rest of the world would suffer the same fate. However, in recent years, new potential global economic drivers have emerged such as the Newly Industrialized Economies (NIE) in East Asia, China and India, and more recently the "emerging economies". In addition the Euro zone is taking a growing place at the forefront of economic leadership.

It is within this framework that this paper establishes relevant conclusions on how U.S., Euro Area and Japan economies affect international business cycle fluctuations. Using panel data regressions and data provided by Nikola Spatafora of the International Monetary Fund[1], our objective is to identify the major factors that influence economic spillovers from the three regions into countries across the world. Market spillovers result when market trading causes some economics benefits or losses to other market participants. We will focus mainly on trade and financial linkages as well as on the existence of a structural change in the transmission mechanism of shocks after 1985.

2. Motivation

In trying to understand the current economic linkages between the United States and the Euro area and Japan, one might find it useful to examine past economic data. Studying

[1] This study uses the data set from the recent IMF study: "Decoupling the Train?: Spillovers and Cycles in the Global Economy" , *World Economic Outlook, I MF*, 2007, April, (Helbing, T. *et al*.). The approach to our paper is however different in its specifications and results differ.

past recessions and slowdowns will prove insightful in understanding the mechanisms of current international business cycle linkages (Zarnowitz, 1992). Using the National Bureau of Economic Research (NBER) definition of economic recession[2] and slowdown[3], the IMF compiles the change in GDP growth consequent to a recession or slowdown in the U.S. since 1974 (Table 1.1). It is very interesting to note that all recessions and slowdown have not had the same impact in magnitude or geographic spread. For instance, the 1982 recession lead to a substantial GDP growth declines in Latin America, the Middle East and North Africa and East Asia while it did not lead to a reduction of GDP growth in industrialized countries. Conversely, the 1991 recessions affected industrialized countries negatively while the regions mentioned here above still had a positive GDP growth change. However, despite these variations across time, on average GDP recessions have reduced GDP growth in all the regions examined. In light of these observations, it would be crucial to find out the major elements which can explain economic divergence between countries. For this purpose, it will be relevant to examine the two primary channels through which U.S. recessions and slowdowns have affected other regions: trade linkages and financial linkages (IMF, World Economic Outlook, 2007, April).

3. Procedure

To assess the existence of economic decoupling, we will examine global economic data covering a wide range of variables. Using Panel Data Ordinary Least Squares

[2] NBER definition: "[…] a significant decline in economic activity spread across the economy, lasting more than a few months, normally visible in real GDP, real income, employment, industrial production, and wholesale-retail sales".

[3] IMF definition: "[…] periods during which the U.S. output was below potential (as determined by Hodrick-Prescott filter) and which were not considered as recessions by the NBER".

Regressions (OLS), we estimate how the U.S., Euro area and Japan output growth affect other countries' GDP growth. We will use real GDP per capita growth (measured in Purchasing Power Parity terms) as the dependant variable. The independent variables will be:

- real GDP per capita growth in the U.S., Euro area, Japan*;
- trade linkages of each country with respect to the U.S., Euro and Japan;
- financial linkages of each country with respect to the U.S., Euro and Japan;
- governments debt as a percentage of GDP;
- **output gap as an indicator of a country's potential weaknesses.*
- ** fuel exports as a percentage of total exports;*
- **a proxy of a consumer confidence index, using consumption spending as a percentage of GDP;*
- **an Asian crisis dummy representing the 1997-1998 Asian crisis.*
- **a dummy for the pre-post 1985 period.*

The above list includes variables that were already present in the original study as well as a large series of **new variables** (see *italic) that we have added to the IMF study[4]. We shall now provide an a priori rationale for each variable. First, it seems relevant to include real GDP per capita growth of the U.S., Euro area and Japan as world economic drivers. Our intuition is that their growth (or lack thereof) can have large effects on economic growth in the rest of the world. Second, trade linkages and financial linkages are the two major transmission channels for economic shocks. Both play an important role in interconnecting the world markets as we will elaborate in the next section. An unexpected shock in a large market (like the U.S. market) will have consequences that

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[4] Helbing *et al.*: "Decoupling the Train?: Spillovers and Cycles in the Global Economy", *World Economic Outlook, IMF*, 2007, April.

span beyond the borders of that market. Third, government debt is an indicator of a country potential weakness. A country with large government debt is likely to be more affected by an adverse shock and hence we expect debt to be negatively correlated with output growth. Fourth, we consider output gap to be a variable of importance. Output gap[5] indicates whether a country is above or below its potential output and therefore might be another indicator of a country's unstable situation. We would therefore expect its coefficient to be negative. Fifth, we choose fuel exports as a percentage of total export as a proxy to indicate whether a country might be insulated from negative shocks to the U.S., Euro area or Japan economy. A large exporter of fuel would tend to use its fuel export to protect itself against economic downturns. We have examined the possibility of multiplying this variable "fuel exports" with the Crude Oil price index to reveal increased insulation in times of rising oil prices but this proved insignificant. Sixth, we come up with a proxy for consumer confidence using the consumption percentage of GDP. It is extremely hard to gather information on a homogeneous consumer confidence index for all countries since 1970. Hence, we believe that final consumption expenditure relative to GDP would be an appropriate proxy of a consumer confidence index. Seventh, we include a dummy for the Asian crisis of 1997-1998. We believe that including this dummy will be relevant in the world and Asian groups. Eighth, we include another dummy to differentiate the pre-post 1985 periods. According to the literature, shocks prior to 1985 were "global" shocks in contrast with more country-specific shocks after 1985. Although we are conscious that this date is arbitrary, there seems to be a consensus on the structural break happening between 1984 and 1987. Finally, we think it might be judicious to run different panel data regressions for different regions. Indeed, an Asian country will not be influenced in the same manner

[5] This was calculated using the Hodrick-Prescott filter.

by a U.S. recession than a North American economy, although this remains to be shown.

4. Trade Linkages

In general, a country's economic growth is expected to be positively influenced by growth in its trading partners. Fast growth in partner countries helps to get a larger market for a country exports[6].

Three main factors seem to fit in order to explain the transmission of negative growth shocks in the U.S., Euro area and Japan to the rest of the world: exports exposure to the U.S., exchange rates and "economic vulnerabilities" (i.e. external debt). The first of these three factors is related to the idea that a country for which exports to the U.S. represent an important share of total export will be strongly dependent of U.S. imports from abroad. If the U.S. were to suffer a recession, this could lead to a reduction of spending, a possible cut in U.S. imports from abroad and a potential reduction of export revenues for the country. At a more subtle level, trade linkages also imply technology transfer and spillovers: less trade with the U.S. could reduce benefits from these spillovers (Arora and Vamvakidis, 2001). The second trade linkage factor is the evolution of the U.S. dollar exchange rate. A depreciation of the U.S. dollar relative to other currencies leads to reduce the competitiveness for those currencies. The trading partners might therefore suffer a "double blow". In contrast, if the U.S. dollar appreciates, as it was the case in the 1982 recession, then there is an "insulation phenomenon" due to increased competitiveness for those trading partner states.

[6] Trade is not the unique channel which the above effects may operate, although is one of the most important, (Arora and Vamvadikis, 2006).

Furthermore, it seems that countries with a flexible exchange rate have been better able to mitigate the impacts of a U.S. recession (Helbling *et al.,* 2007). The third channel for trade linkages is related to a country's vulnerabilities. Countries' that have "bad balance sheets" run the risk of being more severely affected by U.S. economic downturns. A high level of public or external debt weakens the country and exposes it to more perils.

5. Financial Linkages

With financial markets becoming increasingly integrated, financial market linkages are also believed to be an increasingly important mechanism for the transmission of shocks across countries. Starting from the early 90s, there has been a tremendous increase in financial liberalization in developing countries and a substantial increase in financial interdependence of these with respect to the United States (and, lately with the Euro area and other major markets). This process turns in to raising the question of whether increased financial liberalization and interdependence have magnified the spillovers of financial shocks from the United States, Euro Area or Japan to the rest of emerging areas.

Financial linkages play an important role in determining how much of an economic shock will be transmitted from one country to another. There exists a large literature that comments on the increase in financial linkages throughout the world (Bordo and Helbling, 2003; Kose and Yi, 2002; Imbs, 2004 and 2006; Benelli and Ganguly, 2007). In his recent study, Imbs (2006) explains that there are two competing views that explain the effect of financial integration on output comovement. The first view stipulates that financially integrated countries would be "less synchronized". Financial markets allow for consumption to be less correlated with production and thus it lets to economies to specialize differently according to their comparative advantages. Backus, Kehoe and Kydland (1994), use a different approach based on return differentials: financial flows usually go to the country experiencing a positive technology shock from the unaffected country and hence, leading to negatively synchronized outputs. The alternative explanation, based on Obstfeld (1994), shows that similar activities necessitate financial investments. Hence financially integrated countries will tend to have more synchronized output, as their funding requirements are similar. Imbs shows that empirical data points towards the second explanation as the dominant one.

Using the magnitude of gross financial assets, Helbling *et al.* (2007) illustrate that, since 1970, both developed and emerging economies have increased their financial linkages: gross external assets of industrial countries have risen from 28 percent to 155 percent of GDP in 2004. The authors further point out towards a positive relation between output growth correlation (with the U.S.) and correlation between stock market indices. This indicates that financial linkages should be an integral part of any study on comovement.

In trying to understand how financial linkages affect output growth comovement, one must distinguish two main channels: asset prices and price volatility. First, equity prices across countries have had a tendency to become more correlated over the last decade. According to Peter Berezin (IMF, 2007), the median stock market correlation coefficient among G7 economies has risen from 0.55 to 0.69 while the long-term bond yield correlation rose from 0.54 to 0.8 between the 1995-99 and 2000-06 periods. Second, as Engle and Susmel (1993) show, volatility of prices across countries has generally follows a similar trend of increased correlation. The intuition behind this phenomenon is that volatility reflects uncertainty about future asset prices. Hence, greater uncertainty about the policy of a large economy will generate similar uncertainty among economies interlinked with this country.

6. The Model

The model can be formally described as follows:

$$Y_{i,t} = \alpha_{i,t} + \gamma_{i,t} + Y_{U.S.,t} + Y_{EU,t} + Y_{JP,t} + Y_{CHN,t} + Trade_{us,t} + Trade_{EU,t} + Trade_{JP,t} + Fin_{U.S.,t} + Fin_{EU,t} + Fin_{JP,t} + Ngap_{i,t} + Pop_{i,t} + Fuel_{i,t} + Confi_{i,t} + Libor + Tt\_gr_{i,t} + Dbt_{i,t} + D_1 + Asia_{(0.1)} + u_{i,t}$$

Where, $u_{i,t} = \mu_i + v_{i,t}$ for $t = 1,\ldots,36$ (N = 36 years)

In the above equation:

i. $Y_{xx,t}$ represents the per capita growth of the GDP of country "xx".

ii. $Trade_{xx,t}$ represents the trade linkage of country i with respect to the area "xx" (U.S., Euro area or Japan). This variable is computed as the sum of imports and exports to the designated area as a percentage of GDP.

iii. $Fin_{xx,t}$ represents financial linkages between the country i and the area "xx". Three different approaches were used to estimate the latter. We first used total net portfolio flows with each region (U.S., Euro area and Japan) as a percentage of GDP. This approach yielded insignificant results. An alternative way to model the financial linkages was found in Imbs (2004) where the financial linkages are modelled as : $| NFA_i/GDP_i - NFA_{xx}/GDP_{xx} |$. In this specification NFA is the net foreign assets. This methodology reflects the fact that 2 countries with important (positive or negative) foreign asset positions will generally have more intense capital flows and hence more financial linkages. Finally, we computed averages between periods of the above specification to capture a bigger part of *financial flow* changes.

iv. Ngap is the output gap calculated as deviation of the output from its trend using the Hodrick-Prescott filter.

v. Pop is the population growth rate.

vi. Fuel represents fuel exports as a percentage of total exports.

vii. Confi is a proxy for a consumer confidence index calculated as consumption as a percentage of GDP.

viii. Libor is the London Interbank Offered Rate used as an interest rate indicator.

ix. Tt_gr is the growth rate in terms of trade.

x. Dbt is the central government debt as a percentage of GDP.

xi. D_1 is a dummy variable for the pre/post 1985 period. It is equal to 1 for the post 1985 period.

xii. Asia is a dummy for the Asian crisis. It is equal to 1 for the countries affected in 1997[7].

xiii. $\alpha_{i,t}, \gamma_{i,t}$ are the constant and the temporary factor respectively.

7. Results

The data used is a cross-sectional panel data – two-dimensional data - containing observations on multiple economic variables for the annual time period 1970-2005. The data corresponds to U.S., Euro Area, Japan and different countries classified in several

[7] Indonesia, South Korea, Thailand, Hong Kong, Malaysia, Laos and the Philippines

world areas depending on economic level growths. As in all cross-sectional data sets, the *values* of the data points have meaning, but the *ordering* of the data points does not.

The approach has been applied to a broad cross-section of countries and a series of panel regressions estimated, relates growth in domestic output per capita to various combinations of variables of U.S. growth, euro area growth, and Japanese growth. The coefficients on these foreign growth variables provide a measure of the importance of spillovers.

Finally, table I on the appendix shows up all the different countries included in the panel data which have been classified by economic areas.

1. Structural Change after 1985

The literature reviewed on the subject of output comovement seems to indicate the existence of a structural change in the transmission of output shocks after 1985. The generally accepted view is that prior to 1985, these shocks were more often worldwide shocks (i.e. the Oil crises). In contrast, output shocks since 1985 have tended to be more country specific shocks.

In order to test the existence of a structural change for the period after 1985, we computed a “Chow break test”. This test concluded to the existence of a structural change. We therefore decided to include a dummy indicating the pre/post 1985 period.

2. Hausman Test

The generally accepted way of choosing between fixed and random effects is running a Hausman test. After a brief review of the existing literature on panel data, we concluded to the necessity of running a Hausman test for each regression.

3. World Analysis

In order to assess the impact of the United States, the Euro area and Japan on the rest of the world, we first examined a regression including all the variables defined in equation (1.1). The inclusion of all variables serves as a benchmark for the subsequent analysis. The results for this first regression are illustrated in column A1 of Table.1.

First, these show that the GDP growth of the U.S. and Euro area have significant effects on economic growth across countries. In a somewhat surprising way, our results show (and these results are consistent throughout) that the Euro area seems to have a bigger impact on economic growth across the World. GDP growth declines of 1 percent in the region lead to a 0.62 percent decline average across countries. Overall Japan's GDP growth rate is not significant in explaining changes in output growth in other countries. Second, the results reveal that trade linkage with the U.S. and the Euro area have positive but not significant growth effects while linkages with Japan seem to have a positive significant effect impact on gross domestic product growth in the rest of the world. Given Japan's "lost decade" and its limited output growth recovery since then, this result might reflect that all of Japan's spillover effects are channelled through trade linkages (given the specification of our model). Third, none of the financial linkages are significant and the signs are negative for the U.S. and Euro area. This gives credence to the theory of Backus, Kehoe and Kydland (1994) according to which, more financial integration leads to less output comovement. We will later use an alternative approach (A6 and A7) by using averages of financial linkages between periods in view of obtaining more significant results. Fourth, the three other significant variables are population growth that has a negative effect on GDP growth, the confidence index which has a negative coefficient and the constant term. All other variables are not significant.

In a subsequent regression we get rid of variables which overall seem to have a negligible effect in explaining GDP growth rates across countries. The results of this regression are exposed in column A2 of Table 1. Although the R-squared for this equation is much less than the preceding, interesting clearer results appear. First, growth in the U.S. and Euro area are significant and have effects that are closer in magnitude, with a one percent GDP growth decline having respectively a 0.22 and 0.42 percent effect on growth across countries. This results that the Euro area output growth has a dominating effect over the U.S output growth on GDP growth across the world goes against the popular belief that the U.S. economy is the most important and influence one in terms of potential worldwide spillover effects. One potential explanation could be that we have omitted some significant variable (related to linkages with the Euro area or the U.S.) that has explanatory power for output growth across countries and that is correlated with the variables in our model. This phenomenon would lead to omitted variable bias – and hence give us surprising coefficients. Furthermore, although the Japan coefficient is still not significant, its sign is now positive. Second, trade linkages with respect to the three areas display significant positive coefficients. The U.S. and Euro area have similar effects while again, Japan has substantially larger spillover effects. Again, this might be due to the specification of our model. As in A1, the financial linkages variables are insignificant.

In order to have a better insight on the respective effects of trade linkages, financial linkages and the pre/post 1985 dummy variable, we run three regression including only the GDP growth rates of the three regions (A3), the GDP growth rates and the trade linkages with the three regions (A4) and the GDP growth rates and the financial linkages (A5). In all regressions, we include the dummy variable for the pre/post 1985 period.

In regression A3, the results are consistent with the previous ones. They show a 0.23 and 0.47 percent growth declines in the case of U.S. and Euro area growth slowdowns of one percent. Again population growth is significant and has a negative impact on growth. The LIBOR rate appears to be significant and positive (although very close to zero). The pre/post 1985 dummy variable is also significant and positive, (0.006).

To illustrate the effects of trade linkages, we run a regression excluding financial linkages (A4). The results are similar to the ones obtained in A2. GDP growth rates in the three regions have positive effects on output growth accross countries although only the U.S. and Euro area rates are significant. The trade linkages are significant in all three cases with the effects of the U.S. and the Euro area being almost identical and the Japan coefficient being much larger. The 1985 period dummy variable coefficient is very close to zero and non significant.

Finally, we run a regression excluding trade linkages and including financial linkages (A5). This is done in order to verify whether financial linkages might have a relation with production growth rates across the world. Financial linkages only play a minor role in explaining output growth rate across countries. The R-squared for this regression is 0.05 which is much lower than the R-squared obtained in the previous regressions.

Furthermore, we observe that none of the financial linkages with our regions of interest are significant. It is important to mention at this point that in order to obtain significant results for trade linkages, two different measures were used. As mentioned in the methodology section, we use total net portfolio flows with each region (U.S., Euro area, Japan) as a percentage of GDP in one instance and, $| NFA_i/GDP_i – NFA_{xx}/GDP_{xx} |$ where NFA is the net foreign assets in another instance. Unfortunately, these specifications result in non-significant results.

In pursue of better results for financial linkages, we adopt a new approach (A6 and A7). This approach consists in taking the average between two periods of the above described indicator: $| NFA_i/GDP_i – NFA_{xx}/GDP_{xx} |$. In using this methodology, our aim is to better encompass the notion of financial flows. The previous variable is indeed a static one that might not be adequate in reflecting the dynamics of financial linkages across countries.

In the regression A6, we repeat the estimation process of A2 (a benchmark for our results). At a first glance, the estimates are consistent with the one obtained in A2. However, we observe that financial linkage with respect to U.S. are now significant though the sign of the coefficient is surprising since financial linkage with U.S. have negative effects on growth of GDP across countries. In A7, where we exclude trade linkages, this negative coefficient is still significant and negative. A logical conclusion is that financial linkages with the U.S. lead to decreased output growth. As mentioned above, these results thus lean in favour of Backus, Kehoe and Kydland (1994) in saying that more financial ties lead to desynchronized output growth.

4. Advanced Economies

Regression B1 shows the results obtained when taking into account all relevant variables. Several coefficients turn out to be significant namely GDP growth for the U.S. and the Euro area, trade linkages with the three regions and financial linkages with the U.S. Concerning output growth effects, a 1 percent shock to the Euro area GDP growth rate has a spillover effect of 0.61 percent across advanced economies. As we will elaborate in the next section this might be due to a large percentage of countries from the Advanced Economies group being Euro area countries or having strong linkages with it. Moreover, in specifications B1 and B2, we notice that although all three trade linkages coefficients are significant, the Japanese one dominates the other two areas, US and Euro. This leads us to think that there may be a specification omission: we might have omitted a significant variable for growth across advanced economies that is related to the Japanese economy (trade or financial linkages). If this is the case, then it might just be that the Japanese trade linkage variable incorporates other spillover effects not specifically related to trade.

In the specification B3, we include only financial linkages as $| NFA_i/GDP_i - NFA_{xx}/GDP_{xx} |$. The results confirm, as expected, that growth in the U.S. and Euro area significantly explain output growth across advanced economies. We observe that Japan's GDP growth also has significant explanative power. One must however ponder upon the quantitative interpretation of these results. As previously observed, Euro area's output growth has larger effects on growth of advanced economies, U.S. GDP growth which, appear surprising and counterintuitive. However, given the composition of the advanced economies group (see appendix), these results become understandable. Indeed, our specification of the advanced economies includes all countries that make up the Euro area. It is therefore not surprising to obtain such results. Taking out the Euro area countries from this group proves difficult as we would only have about ten countries left in the group (which would not yield convincing panel data interpretation). Concerning the negative coefficient of Japan's output growth, one has to take into account that none of the advanced economies are Asian countries. Hence, obtaining a coefficient close to zero and slightly negative should come as no surprise.

5. <u>Asia</u>

Similarly to the world analysis, six types of regressions have been run to explain whether a 1 percentage point decline in US, Euro Area and Japan growth causes spillovers. Table C shows the results on these regressions (C1, C2, C3, C4, C5 and C6) where these last two regressions use average financial linkages. All six regressions are random-effects regressions, and display statistical significance at 5 percent level.

In regression C1, all variables are included except for Fuel Exports/ Total Exports and Government Debt/GDP which were deemed insignificant. First, we observe that output growth in the three regions does not play a significant role in explaining output growth across countries. Second, trade linkages coefficients are significant in all three cases. Growth in Asian economies is positively related to trade linkages of with US and Japan while negatively related to the Euro Area. The population gap, the Libor rate, the Asian crisis dummy all have significant coefficients of the similar magnitude to the world regressions.

Regression C2 is run excluding the financial linkages variables. In this case, both GDP and Trade linkages variables turn out to be significant. We observe that one percent output declines in the U.S. and in Japan similar effect of the order of 0.35 percent declines in growth rates across Asian economies. In contrast with the previous regression, Japanese trade linkage are now insignificant. Furthermore, these results show that trade linkages with the Euro area as well as its output growth have a negative correlation with GDP growth across countries. This would indicate that a negative shock to the Euro area economy would positively influence Asian growth, a surprising result.

In regression C3, we exclude trade linkages. In this specification, the coefficients have the same signs as previously but their magnitudes are larger. This might be a sign of omitted variable bias in which the trade linkages (not included) influence the error term and are correlated with output growth – the same conclusion can be made for regression excluding financial linkages.

Regression C4 relates excludes trade and financial linkages. The output growth coefficients indicate that declines in US and Japan GDP growth would have a 0.5 percent impact on growth across Asian economies. This is a larger magnitude with respect to coefficient obtained in C1. It is also relevant the coefficient of 0.70 in the output gap and therefore, C4 might indicate again the presence of omitted variable bias. Population growth is negatively correlated with output growth and its coefficient is measured by a -0.81 coefficient.

Financial average linkages are included for C5 and C6 estimations. Both regressions show similar results in terms of U.S. and Euro trade. However, the new specification does not improve the significance of financial linkages in explaining output growth across Asian economies.

6. <u>Latin America</u>

Specification D1 shows that only GDP growth in the U.S. has significant effects on economic growth across Latin America. On average, 1 percent decrease in U.S. output growth would lead to a 0.2 percent decrease in GDP growth rate across Latin America. We further observe that financial linkages with all three regions are significant although the signs of the coefficients for the U.S. and Japan are negative. As mentioned previously this lends credence to the view that financial linkage lead to output disynchronization. All other variables display consistent results with previous regressions.

When we exclude financial linkages (specification D2) only Japanese output growth has a significant effect in explaining growth across Latin American economies. As we have seen in the Asian regressions, this could evidence of omitted variable bias. Indeed, in specification C1, financial linkages with the U.S. display negative coefficients. If these were to be correlated with output growth – which is possibly the case – excluding these would tend to reduce the importance of growth spillovers and might lead to insignificance. A second observation in this regression is that trade linkages with Japan have a larger effect on output growth than trade linkage with the U.S. It turns out to be surprising. In this sense, and regarding to Latin America, Japan is the second largest trading partner after the United States.

In the specification D3, we include only financial linkages. As expected, these results confirm that growth in the U.S. significantly explains output growth across Latin America. Besides, Latin America is also strongly financial interdependent in U.S. and Euro Area. In specification D4, we exclude financial and trade linkages. We find both U.S. and Japan GDP growth have significant explanative power since the coefficient is positive and significant. Japan economics affects Latin America economies through output growth and trade linkages. On the other side, the U.S economy affects Latin America economies through growth, trade and financial linkages.

8. Conclusions

Throughout our specifications, our results are consistent in magnitude and signs of the coefficients. This indicates that the general specification of our model is reasonable. Growth of output in the U.S. and in the Euro are significant in explaining growth differences across countries while gross domestic growth rates in Japan are significant only for Asia. The overall results show that a one percent drop in output growth in the U.S., Euro area and Japan respectively lead to – on average – reductions between 0.15 and 0.5 percent, between 0.4 and 0.65 percent and between 0 and 0.5 percent in output growth across countries. These general results overshadow two key surprising findings. First, overall growth in the Euro area dominates the spillover effects of growth in the U.S. Second, in the Asian regression Euro area output growth produces negative effects for growth across countries. These results may originate from omitted variable bias in the sense that our specification might have omitted some variable(s) relevant in explaining GDP growth across the studied regions and correlated with the Euro area's output growth.

We observe the predominance of trade linkages over financial linkage in term of explanative power. Indeed, trade linkages are significant in almost every regression – although the coefficients differ across regions. In contrast, financial linkages are only occasionally significant.

Furthermore, despite using three different formulations to try and encompass financial linkages, we have not managed to yield overall significance (similar to that of trade linkages). We believe that this does not refute the importance of financial linkages. On the contrary, it illustrates the need for an adequate specification of the financial linkages that would fully grasp their growth spillover effects.

We conclude to the existence of a structural break in the transmission of growth spillover in 1985. Although this date is arbitrary, our test for structural change and the literature reviewed on the matter gives credence to the existence of a shift from worldwide shocks to more country specific shocks around the period 1985-1987.

Finally, in the light of current events, this study shows that shocks in major economies can potentially have important spillover effects across the world. Although these effects differ in magnitude – and sometimes in directions – it is undeniable that they exist. The extent to which they are channelled through the rest of the world then depends on country specific characteristics such as macroeconomic policies, exchange rate systems and "economic vulnerabilities".

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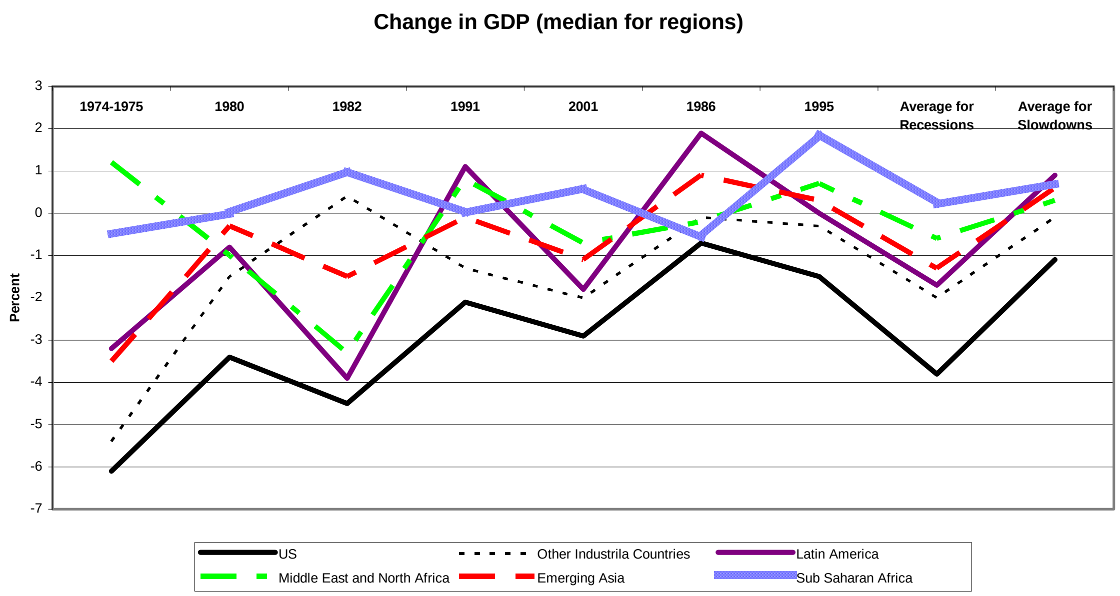
	Advanced Economies	Other Advanced Economies	Emerging Asia	Emerging Europe	Other Emerging Economies	Rest of the World	Others
United States	United States						
Japan	Japan						
Euro Area	Austria, Belgium, France, Germany, Italy, Luxembourg, Finland, Netherlands, Greece, Ireland, Portugal, Spain, Slovenia						
Latin America					Argentina, Brazil, Chile, Colombia, Mexico, Uruguay	Bolivia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Guatemala, Haití, Honduras, Nicaragua, Panama, Paraguay, Peru, Venezuela, Barbados, The Bahamas, Antigua & Barbuda, Dominica, Grenada, Guyana, Belize, Jamaica, Netherlands Antillas, St. Kitts & Nevis, St. Lucia, St. Vincent & Grenadia, Suriname, Trinidad & Tobago	
Africa					South Africa	Djibouti, Algeria, Angola, Botswana, Burundi, Cameroon, Cape Verde, Central African Republic, Chad, Comoros, Congo, Benim, Equatorial Guinea, Ethiopia, Gabon, Ghana, Gambia, Guinea Bissau, Cóte d´Ivoire, Kenya, Lesotho, Madagascar, , Malawi, Mali, Rwanda, Mauritania, Mauritius, Morocco, Mozambique, Niger, Nigeria, Zimbawee, Zambia, Burkina Faso, Ugand, Tunisia, Togo, Tanzania, Swaziland, Sudan, Namibia, Sierra Leone, Senegal, Seychelles, St. Tome Principe, Rwanda	
Asia			Bangladesh, Bhutan, China, Myanmar, Cambodia, Sri Lanka, Mongolia, Taiwan, Hong Kong, India, Indonesia, Korea, Lao, Malaysia, Maldives, Nepal, Pakistan, Philippines, Syngapore, Thailand, Vietnam, Salomon Islands, Fiji, Kiribati, Vanutau, Papua New Guinea, Samoa, Tonga				
Middle East		Israel, Cyprus			Egypt, Jordan	Bahrain, Iran, Kuwait, Lebanon, Oman, Qatar, Saudi Arabia, Syrian Rep., United Arab Emirates, Republic of Yemen, Libya	
Others		UK, Denmark, Norway, Sweden, Switzerland, Canada, Iceland, Australia, New Zealand		Turkey Malta, Poland, Macedonia, Albania, Bulgaria, Czech Republic, Slovak Republic, Estonia, Latvia, Hungary, Lithuania, Croatia, Romania		Bosnia-Herzegovina, Croatia, Georgia, Kazakhastan, Kyrgyz Republic, Moldavia, Russia, Tayikistan, Turkmenistan, Ukraine, Serbia, Uzbekistan, Armenia, Azerbayian, Belarus	Afghanistan, Brunei, Eritrea

Table I. Countries by Economic Areas

Graph 1.1.: US economic recessions and slowdown



World	TABLE A					Financial average	
	A1	**A2**	**A3**	**A4**	**A5**	**A6**	**A7**
Observations	712	596	758	621	732	686	706
Fixed/Random Effects	RE	FE	**FE**	**FE**	**FE**	FE	**FE**
GDPus growth	**0.18 (0.001)**	**0.22 (0.000)**	**0.23 (0.000)**	**0.19 (0.000)**	**0.20 (0.000)**	**0.19 (0.000)**	**0.20 (0.000)**
GDPeu growth	**0.62 (0.000)**	**0.42 (0.000)**	**0.47 (0.000)**	**0.46 (0.000)**	**0.51 (0.000)**	**0.47 (0.000)**	**0.53 (0.000)**
GDPjp growth	-0.02 (0.723)	0.024 (0.679)	0.044 (0.422)	**0.03 (0.561)**	0.04 (0.517)	0.009 (0.883)	**0.005 (0.930)**
Trade_us	0.006 (0.755)	***0.045 (0.078)***		**0.05 (0.036)**		**0.045 (0.083)**	
Trade_eu	0.007 (0.567)	**0.047 (0.016)**		**0.05 (0.003)**		**0.06 (0.007)**	
Trade_jp	**0.14 (0.001)**	**0.33 (0.000)**		**0.33 (0.000)**		**0.35 (0.000)**	
Financial_us	-0.012 (0.414)	-0.023 (0.126)			-0.016 (0.292)	**-0.01 (0.006)**	**-0.16 (0.000)**
Financial_eu	-0.006 (0.735)	0.017 (0.388)			0.014 (1.000)	0.008 (0.766)	0.05 (0.842)
Financial_jp	0.008 (0.248)	-0.002 (0.819)			0.038 (0.482)	0.008 (0.780)	-0.1 (0.718)
Output Gap	0.005 (0.459)	0.002 (0.657)	0.003 (0.478)	0.002 (0.670)	0.02 (0.620)	0.001 (0.785)	0.02 (0.651)
Population Growth	**-0.53 (0.005)**	**-0.89 (0.000)**	**-0.53 (0.000)**	**-0.75 (0.000)**	**-0.69 (0.000)**	**-0.87 (0.000)**	**-0.687 (0.000)**
Fuel exports/Total Exports	0.000 (0.441)						
Confidence Index	**-0.085 (0.000)**						
Libor	0.000 (0.598)	0.000 (0.194)	**0.000 (0.037)**	0.000 (0.526)	0.000 (0.504)	0.000 (0.560)	0.000 (0.401)
Terms of Trade growth	0.002 (0.927)	0.005 (0.576)	0.006 (0.702)	0.005 (0.724)	0.006 (0.727)	0.003 (0.852)	0.007 (0.685)
Central Governement Debt/GDP	0.006 (0.173)						
1985 Dummy	-0.003 (0.312)	0.000 (0.950)	**0.006 (0.020)**	-0.004 (0.127)	0.001 (0.700)	0.004 (0.141)	0.001 (0.590)
Asia Crisis Dummy	-0.001 (0.956)	-0.01 (0.514)	-0.019 (0.235)	-0.007 (0.641)	0.006 (0.239)	-0.008 (0.609)	-0.018 (0.270)
Constant	**0.07 (0.000)**	**-0.02 (0.000)**	0.004 (0.330)	-0.002 (0.001)	**0.016 (0.001)**	**-0.016 (0.017)**	**0.018 (0.000)**
R-squared	0.29	0.19	0.09	0.17	0.05	0.18	0.05
Wald Test (pvalue)	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Bold denotes significance at 0.05

Bold Italic denotes significance at 0.10

Advanced Economies	TABLE B			
	B1	B2	B3	B4
Observations	587	631	607	651
Fixed/ Random Effects	RE	RE	RE	RE
GDPus growth	**0.13 (0.006)**	**0.14 (0.003)**	**0.14 (0.004)**	**0.15 (0.004)**
GDPeu growth	**0.61 (0.000)**	**0.58 (0.000)**	**0.66 (0.000)**	**0.63 (0.000)**
GDPjp growth	-0.072 (0.210)	-0.040 (0.443)	**-0.011 (0.057)**	-0.073 (0.159)
Trade_us	**0.042 (0.017)**	**0.042 (0.007)**		
Trade_eu	**0.027 (0.010)**	**0.022 (0.014)**		
Trade_jp	**0.35 (0.000)**	**0.27 (0.000)**		
Financial_us	**-0.008 (0.061)**		-0.005 (0.217)	
Financial_eu	0.000 (0.994)		0.009 (0.737)	
Financial_jp	-0.001 (0.953)		0.005 (0.860)	
Output Gap	0.000 (0.902)	0.000 (0.877)	0.001 (0.761)	0.001 (0.754)
Population Growth	**-0.94 (0.000)**	**-0.91 (0.000)**	**-0.75 (0.000)**	**-0.73 (0.000)**
Fuel exports/Total Exports				
Confidence Index				
Libor	0.000 (0.197)	0.000 (0.341)	**0.000 (0.009)**	0.000 (0.197)
Terms of Trade growth	-0.008 (0.593)	-0.007 (0.607)	0.008 (0.616)	-0.08 (0.597)
Central Governement Debt/GDP				
1985 Dummy	-0.000 (0.744)	0.000 (0.953)	**0.004 (0.100)**	**0.004 (0.080)**
Asia Crisis Dummy				
Constant	-0.007 (0.175)	-0.006 (0.214)	0.007 (0.15)	0.006 (0.116)
R-squared	0.24	0.2178	0.20	0.19
Wald Test (pvalue)	0.000	0.000	0.000	0.000

Bold denotes significance at 0.05
Bold Italic denotes significance at 0.10

Asia	TABLE C					
	C1	C2	C3	C4	C5	C6
Observations	100	107	100	107	94	94
Fixed/ Random Effects	RE	RE	RE	RE	RE	RE
GDPus growth	0.24 (0.152)	**0.35 (0.044)**	**0.53 (0.003)**	**0.52 (0.004)**	0.14 (0.398)	0.33 (0.065)
GDPeu growth	**-0.50 (0.058)**	**-0.59 (0.029)**	**-0.60 (0.048)**	**-0.57 (0.055)**	-0.41 (0.129)	-0.33 (0.273)
GDP jp growth	-0.065 (0.751)	**0.34 (0.060)**	**0.50 (0.013)**	**0.51 (0.007)**	0.10 (0.607)	**0.47 (0.017)**
Trade_us	**0.23 (0.001)**	**0.17 (0.011)**			**0.26 (0.001)**	
Trade_eu	**-0.54 (0.000)**	**-0.35 (0.000)**			**-0.44 (0.000)**	
Trade_jp	**0.18 (0.036)**	0.072 (0.347)			0.064 (0.488)	
Financial_us	**-0.08 (0.095)**		**-0.10 (0.058)**		-0.007 (0.326)	**-0.10 (0.061)**
Financial_eu	0.045 (0.460)		**0.11 (0.096)**		0.023 (0.847)	-0.097 (0.467)
Financial_jp	**0.043 (0.072)**		-0.021 (0.379)		0.011 (0.926)	0.12 (0.349)
Output Gap	**1.03 (0.000)**	**0.87 (0.000)**	**0.69 (0.000)**	**0.70 (0.000)**	**0.99 (0.000)**	**0.73 (0.000)**
Population Growth	-0.93 (0.061)	**-0.78 (0.043)**	**-0.80 (0.045)**	**-0.81 (0.012)**	-1.20 (0.017)	-0.49 (0.188)
Fuel Exports/ Total Exports						
Libor	**-0.002 (0.031)**	-0.001 (0.266)	-0.000 (0.971)	0.000 (0.517)	**-0.003 (0.004)**	**-0.003 (0.014)**
Terms of Trade Growth	0.059 (0.429)	0.14 (0.066)	0.15 (0.076)	0.17 (0.032)	0.11 (0.145)	0.10 (0.225)
Central Government Debt/GDP						
1985 Dummy	0.016 (0.082)	0.010 (0.286)	0.009 (0.358)	0.006 (0.519)	-0.006 (0.483)	**-0.025 (0.007)**
Asia Crisis Dummy	**-0.042 (0.019)**	**-0.037 (0.054)**	**-0.045 (0.031)**	-0.041 (0.051)	-0.034 (0.071)	0.034 (0.097)
Constant	**0.042 (0.006)**	**0.046 (0.002)**	**0.054 (0.001)**	**0.041 (0.011)**	**0.076 (0.000)**	**0.095 (0.000)**
R-squared	0.6150	0.5392	0.4637	0.4267	0.6144	0.5115
Wald-test (grades)	0.000	0.000	0.000	0.000	0.000	0.000

Bold denotes significance at 0.05
Bold Italic denotes significance at 0.10

Latin America	TABLE D			
	D1	**D2**	**D3**	**D4**
Observations	619	850	624	884
Fixed/ Random Effects	RE	FE	RE	RE
GDPus growth	***0.2 (0.073)***	0.15 (0.117)	***0.21 (0.059)***	**0.22 (0.018)**
GDPeu growth	-0.02 (0.901)	0.007 (0.96)	-0.03 (0.849)	0.02 (0.895)
GDPjp growth	0.06 (0.644)	**0.35 (0.001)**	0.06 (0.65)	**0.28 (0.006)**
Trade_us	-0.001 (0.913)	**0.07 (0.000)**		
Trade_eu	-0.048 (0.524)	-0.03 (0.568)		
Trade_jp	**0.54 (0.000)**	**0.28 (0.01)**		
Financial_us	**-0.15 (0.001)**		**-0.165 (0.000)**	
Financial_eu	**0.22 (0.001)**		**0.25 (0.000)**	
Financial_jp	**-0.08 (0.003)**		**-0.099 (0.000)**	
Output Gap				
Population Growth	**-1.22 (0.000)**	**-1.1 (0.000)**	**-1.17 (0.000)**	**-0.83 (0.000)**
Fuel exports/Total Exports				
Confidence Index				
Libor	**-0.002 (0.014)**	**-0.002 (0.002)**	**-0.002 (0.01)**	**-0.001 (0.03)**
Terms of Trade growth	0.02 (0.119)	**0.036 (0.004)**	***0.023 (0.078)***	**0.035 (0.006)**
Central Governement Debt/GDP				
1985 Dummy	0.003 (0.570)	-0.001 (0.798)	0.003 (0.559)	0.003 (0.413)
Asia Crisis Dummy				
Constant	**0.041 (0.000)**	0.009 (0.337)	**0.05 (0.000)**	**0.02 (0.007)**
R-squared	0.17	0.14	0.15	0.12
Wald Test (grades)	0.000	0.000	0.000	0.000

Bold denotes significance at 0.05
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