CESifo Working Papers

www.cesifo.org/wp

Business Cycles, International Trade and Capital Flows: Evidence from Latin America

Guglielmo Maria Caporale
Alessandro Girardi

CESifo Working Paper No. 4006

Category 7: Monetary Policy and International Finance

November 2012

CESifo *Working Paper No. 4006*

Business Cycles, International Trade and Capital Flows: Evidence from Latin America

Abstract

This paper adopts a flexible framework to assess both short- and long-run business cycle linkages between six Latin American (LA) countries and the four largest economies in the world (namely the US, the Euro area, Japan and China) over the period 1980:I-2011:IV. The result indicate that within the LA region there are considerable differences between countries, success stories coexisting with extremely vulnerable economies. They also show that the LA region as a whole is largely dependent on external developments, especially in the years after the great recession of 2008 and 2009. The trade channel appears to be the most important source of business cycle co-movement, whilst capital flows are found to have a limited role, especially in the very short run.

JEL-Code: C320, E320, F310, F410.

Keywords: international business cycle, Latin America, VAR models, trade and financial linkages.

Guglielmo Maria Caporale
Centre for Empirical Finance
Brunel University
West London, UB8 3PH
United Kingdom
Guglielmo-Maria.Caporale@brunel.ac.uk

Alessandro Girardi
Italian National Institute of Statistics
ISTAT / Government of Italy
Rome / Italy
alessandro.girardi@ymail.com

November 2012

1. Introduction

It is well known that macroeconomic volatility generates both economic and political uncertainty with detrimental effects on investment and consumption plans and, ultimately, future economic growth (Acemoglu et al., 2003) and aggregate welfare (Athanasoulis and van Wincop, 2000). There is therefore considerable interest, among academics as well as policy-makers, in shedding light on the sources of output fluctuations, especially in the new economic environment characterised by a much greater role played by emerging market economies. Stronger international financial and trade linkages have affected the relative importance of external, regional and country-specific factors in driving national business cycles, with implications for the design of effective stabilisation policies (Fatàs and Mihov, 2006). Economic theory does not provide unequivocal predictions: stronger linkages could result either in a higher or a lower degree of business cycle co-movement depending on whether or not demand- and supply-side (as well as wealth) effects dominate over increased specialisation of production through the reallocation of capital (Baxter and Kouparitsas, 2005; Imbs, 2006; Kose et al. 2003, 2012). This cannot be established ex-ante: it is essentially an empirical question.

A knowledge of cross-country spillover effects is especially relevant for emerging countries because of their higher degree of volatility compared to more mature economies. According to Loayaza et al. (2007), both internal and external factors explain why emerging economies are so volatile: *i*) the instrinsic instability induced by the development process itself; *ii*) the lack of effective mechanisms (such as well functioning financial markets and proper stabilisation macroeconomic policies) to absorb external fluctuations; *iii*) the exposure to exogenous shocks in the form of sudden capital inflows/outflows and/or large changes in the international terms of trade.

The Latin American (LA) economies in particular have experienced a remarkable sequence of booms and busts in the last three decades. After the debt crisis of the 1980s, most countries in the region benefited from huge capital inflows (with a resulting high growth rate) until the Russian crisis in the late nineties led to their sudden drying up; then in the early years of the following decade higher liquidity, a dramatic rise in commodity prices and low risk premia created a particularly favourable macroeconomic and financial environment in the region and generated again robust growth (Österholm and Zettelmeyer, 2007; Izquierdo et al., 2008); therefore the question has been asked whether there has been a decoupling of the business cycle in the industrialised countries and the LA region respectively, the latter having become an increasingly autonoumos source of growth for the world economy.

Most of the existing literature on international business cycles focuses on the industrial countries, specifically the Group of Seven (Bagliano and Morana, 2010), Europe (Artis et al., 2004), East Asia and North America (Helbling et. al, 2007), Western Europe and North America (Mody et al., 2007). There are, however, a few studies on LA differing in the set of countries examined and the adopted econometric methodology, and providing mixed evidence. Focusing on the average behaviour of the aggregate LA region, Izquierdo et al. (2008) find that external shocks account for a significant share of the variance of regional GDP growth. Similar results are reported by Österholm and Zettelmeyer (2007) for both the LA region as a whole and its individual countries, whilst Aiolfi et al. (2010) identify a sizeable common component in the LA countries' business cycles, suggesting the existence of a regional cycle. By contrast, Hoffmaister and Roldos (1997) conclude that domestic country-specific aggregate supply shocks are by far the most important source of output fluctuations in the LA countries. Kose et al. (2003) find that country-specific factors explain the largest share of the variance of output in these countries, with the exception of Bolivia, where the world component is more important than the regional and country-specific ones. Finally, Boschi and Girardi (2011) report that domestic factors account for by far the largest share of domestic output variability in six major LA countries, and that regional factors are more important than international ones.

None of the aforementioned papers includes the great recession of 2008 and 2009. By contrast, the present study examines the last three decades to assess the relative role of country-specific, regional and external shocks in explaining business cycle fluctuations in six major LA economies (namely, Argentina, Brazil, Chile, Mexico, Peru and Venezuela) and the LA region as a whole, with the aim of shedding light on the role of bilateral trade flows and financial linkages in business cycle co-movements between the LA region and its main economic partners.

Building on the work of Diebold and Yilmaz (2012), we specify a very flexible empirical model enabling us to analyse the propagation of international business cycles without any restrictions on the directions of short- and long-run spillovers or the nature of the propagation mechanism itself. Using quarterly data from 1980:I to 2011:IV, we document a high degree of heterogeneity among the LA countries: while Argentina, Mexico and Peru appear to be increasingly dependent on external developments as a result of the great recession, Venezuela seems to be influenced mainly by the LA regional business cycle, with only Brazil showing a decreasing role of the external factors. As for the LA region as a whole, our results indicate that it can be characterised as a small open economy largely dependent on external developments. This applies especially to the the years following the great recession of 2008 and 2009, contradicting the so-called decoupling hypothesis.

In particular, our findings imply that the goods trade channel is the most important source of these linkages. Capital flows also affect business cycle co-movements, but their role is limited, especially in the very short run. The disaggregate analysis focusing on their components (debt, portfolio equity and foreign direct investment flows) reveals a negative effect of portfolio equity flows on the degree of business cycle synchronisation, as predicted by standard international real business cycle models with complete markets. By contrast, short-term capital and foreign direct investment flows reinforce in the short run the role of the trade channel and make the LA region more vulnerable to shocks from abroad, consistently with recent empirical evidence (e.g., Imbs, 2006, 2010).

The layout of the paper is as follows. Section 2 describes the methodology used to assess the propagation mechanism of international business cycles. Section 3 describes the data and presents the empirical results based on the forecast error variance decompositions for the individual LA countries and the LA region as a whole. Section 4 provides evidence on the role of financial and trade linkages. Section 5 offers some concluding remarks.

2. The Methodology

2.1. The Empirical Framework

We focus on output growth in order to analyse the dynamic relationships between the LA region and the rest of the world as well as the intra-area linkages among countries belonging to that region. Given the increasing degree of integration of the global economy, it is essential to consider possible linkages with a number of foreign economies. It is equally important to allow for time variation, since a fixed parameter model is not likely to capture possibly important changes in the business cycle propagation mechanisms resulting from globalisation.[1]

Consequently, the modelling approach chosen here differs from previous ones in two ways. First, it is flexible enough to accommodate possible nonlinear shifts in the propagation of international business cycles; second, it is based on analysing linkages with the output growth rate of various economies outside the LA region rather than a number of macroeconomic variables for a single foreign country (typically the US). Therefore we include the US as the main driving force behind business cycles co-movements in the LA region (see the literature on the US "backyard", e.g. Ahmed, 2003; Canova, 2005; Caporale et al., 2011), but also the Euro area because of its historical trade linkages with the LA region, as well as Japan (given the financial linkages documented by Boschi, 2012, and Boschi and Girardi, 2011) and China, whose trade linkages with the LA region have become much stronger in recent years (Cesa-Bianchi et al., 2011).

[1] Including additional variables (such as interest rates, exchange rates, consumption or investment) for a wide range of countries would result in a system whose dimensions would not be manageable in the standard Vector AutoRegression (VAR) approach followed here. Even advanced econometric approaches, such as the Global VAR (see Cesa-Bianchi et al., 2011, and Boschi and Girardi, 2011) or dynamic factor models (as in Kose et al. 2012, among others), would not be a fully satisfactory modelling strategy since they belong to the class of (linear) time-invariant models.

As in Diebold and Yilmaz (2012), the econometric framework is based on the following covariance-stationary Vector AutoRegression (VAR) model

$$y_t^{(k)} = \sum_{j=1}^{p} \Gamma_j^{(k)} y_{t-j}^{(k)} + u_t^{(k)} \quad (1)$$

in its moving average representation

$$y_t^{(k)} = \sum_{j=0}^{\infty} \Psi_j^{(k)} u_{t-j}^{(k)} \quad (2)$$

where $\Psi_i^{(k)} = \sum_{j=1}^{p} \Gamma_i^{(k)} \Psi_{i-j}^{(k)}$, p is the order of autoregression, the vector y includes the n endogenous variables of the system, $t = 1,...,T$ indexes time, and e is the vector of residuals, with $E[u_t^{(k)}] = 0$, $E[u_t^{(k)}, u_s'^{(k)}] = \Sigma_u^{(k)}$ if $s = t$ and $E[u_t^{(k)}, u_s'^{(k)}] = 0$ otherwise. All elements refer to the generic k-th estimation sample with window size of $\theta \le T$ observations, so that if $\theta = T$ then $k = 1$, whilst if $\theta < T$, model (1) involves $k = T - \theta + 1$ different rolling estimates, where the sample initially spans the period from the first available observation to θ, and then both its starting and ending period are shifted forward by one datapoint at a time. As pointed out by Granger (2008), linear models with time-varying parameters are actually very general nonlinear models, and therefore the chosen framework is ideally suited to analysing the issues of interest.

2.2. Innovation Accounting

Examining all the effects of the lagged variables in a VAR model is often both difficult and unnecessary for the purposes of the analysis (Sims, 1980). Rather, it is more convenient to resort to some transformations of the estimated model (1) in order to summarise the dynamic linkages among the n variables under investigation. In the business cycle literature, a useful metric often used to measure the extent of business cycle synchronisation is the sum of the variance shares of different classes of shocks such as country-specific, regional or global sources of economic fluctuations (see Kose et al, 2012, among others).[2]

[2] Note that the methodology used in Kose et al. (2012) differs from ours in that they compute the variance decomposition of the raw series of interest, while in the present paper the forecast error variance decomposition is

Since the reduced-form residuals u's are generally correlated, a common practice to obtain uncorrelated shocks is to use the Choleski decomposition of $\Sigma_u^{(k)}$. Despite its straightforward implementation, this method has the drawback that it is sensitive to the ordering of the variables in the system, and therefore all possible permutations should be considered when carrying out the dynamic simulations for a thorough assessment. A popular alternative is provided by the Generalised Forecast Error Variance (GFEV) decomposition (Pesaran and Shin, 1998). This approach estimates the percentage of the variance of the h-step ahead forecast error of the variable of interest which is explained by conditioning on the non-orthogonalised shocks while explicitly allowing for contemporaneous correlations between these shocks and those to the other equations in the system

$$GFEV_{l,m,h}^{(k)} = \frac{1}{\sigma_{m,m}^{(k)}} \sum_{q=0}^{h} (e_l' \Psi_q^{(k)} \Sigma_u^{(k)} e_m)^2 \tag{3}$$

where the selection vectors e_l and e_m have their l-th and m-th entries equal to one, respectively, with all other elements being zero, and $\sigma_{m,m}^{(k)}$ stands for the standard deviation associated to the m-th equation of the system.

Although the GFEV method does not allow a structural interpretation of the impulses, it overcomes the identification problem by providing a meaningful characterisation of the dynamic responses of the variables of interest to observable shocks. A further useful feature of this approach is its invariance to the ordering of the variables. Note, however, that owing to the possible non-diagonal form of matrix $\Sigma_u^{(k)}$, the sum over m of the elements (3) need not be unity in the original formulation provided by Pesaran and Shin (1998). In order to be able to interpret the results, we

carried out. Therefore, while we analyse the innovation (or unsystematic) part of the series represented by the residual of the estimated model, they decompose its systematic part. The limitation of their approach, namely a Bayesian dynamic latent factor model, is that it does not allow the identification of the geographical origin of the factors affecting domestic business cycles, but rather of the world, region and country-specific components of a series.

follow Wang (2002) and rescale (3) using the total variance in the generalised rather than in the orthogonal case

$$\xi_{l,m,h}^{(k)} = \frac{\frac{1}{\sigma_{m,m}^{(k)}}\sum_{q=0}^{h}(e_l'\Psi_q^{(k)}\Sigma_u^{(k)}e_m)^2}{\sum_{m=1}^{n}\frac{1}{\sigma_{m,m}^{(k)}}\sum_{q=0}^{h}(e_l'\Psi_q^{(k)}\Sigma_u^{(k)}e_m)^2} \tag{4}$$

so that $\sum_{m=1}^{n}\xi_{l,m,h}^{(k)} = 1$ (for all k and h), that is the sum of the variance decompositions in (4) are normalised to unity.

2.3. Measuring Spillover Effects at Country and Regional Level

By computing the decomposition (4) for all variables in system (1) for a given recursion k and for a given simulation horizon h, we obtain the following $n \times n$ matrix (the spillover table according to the terminology of Diebold and Yilmaz 2012),[3] which makes it possible to measure to extent to which two or more variables of the system are connected to each other:

$$\left[\begin{array}{cccc|cccc}
\xi_{1,1,h}^{(k)} & \xi_{1,2,h}^{(k)} & \cdots & \xi_{1,n_1,h}^{(k)} & \xi_{1,n_1+1,h}^{(k)} & \xi_{1,n_1+2,h}^{(k)} & \cdots & \xi_{1,n,h}^{(k)} \\
\xi_{2,1,h}^{(k)} & \xi_{2,2,h}^{(k)} & \cdots & \xi_{2,n_1,h}^{(k)} & \xi_{2,n_1+1,h}^{(k)} & \xi_{2,n_1+2,h}^{(k)} & \cdots & \xi_{2,n,h}^{(k)} \\
\vdots & \vdots & \ddots & \vdots & \vdots & \vdots & \ddots & \vdots \\
\xi_{n_1,1,h}^{(k)} & \xi_{n_1,2,h}^{(k)} & \cdots & \xi_{n_1,n_1,h}^{(k)} & \xi_{n_1,n_1+1,h}^{(k)} & \xi_{n_1,n_1+2,h}^{(k)} & \cdots & \xi_{n_1,n,h}^{(k)} \\
\hline
\xi_{n_1+1,1,h}^{(k)} & \xi_{n_1+1,2,h}^{(k)} & \cdots & \xi_{n_1+1,n_1,h}^{(k)} & \xi_{n_1+1,n_1+1,h}^{(k)} & \xi_{n_1+1,n_1+2,h}^{(k)} & \cdots & \xi_{n_1+1,n,h}^{(k)} \\
\xi_{n_1+2,1,h}^{(k)} & \xi_{n_1+2,2,h}^{(k)} & \cdots & \xi_{n_1+2,n_1,h}^{(k)} & \xi_{n_1+2,n_1+1,h}^{(k)} & \xi_{n_1+2,n_1+2,h}^{(k)} & \cdots & \xi_{n_1+2,n,h}^{(k)} \\
\vdots & \vdots & \ddots & \vdots & \vdots & \vdots & \ddots & \vdots \\
\xi_{n,1,h}^{(k)} & \xi_{n,2,h}^{(k)} & \cdots & \xi_{n,n_1,h}^{(k)} & \xi_{n,n_1+1,h}^{(k)} & \xi_{n,n_1+2,h}^{(k)} & \cdots & \xi_{n,n,h}^{(k)}
\end{array}\right] \tag{5}$$

Diebold and Yilmaz (2012) show that a synthetic measure of the spillovers received by (transmitted to) country l from (to) all other countries can be obtained by summing by columns (rows) all the off-diagonal elements in the l-th row (column). We adapt their framework by dividing the variable of system (1) into two distinct subsets (which we label regional and external groups) with dimension of $n_1 = 6$ and $n - n_1 = 4$, respectively.

We compute country-specific, $\delta_{cs,h}^{(k)}$, regional, $\delta_{rs,h}^{(k)}$, and external shocks, $\delta_{es,h}^{(k)}$, as

[3] By construction, the elements in each row of (5) sum up to unity, so that the total variance of the system is equal **to** n **.**

$$\delta_{cs,h}^{(k)} = \xi_{l,l,h}^{(k)} \tag{6}$$

$$\delta_{rs,h}^{(k)} = \sum\nolimits_{m=1}^{n_1} \xi_{l,m,h}^{(k)} - \xi_{l,l,h}^{(k)} \tag{7}$$

$$\delta_{es,h}^{(k)} = \sum\nolimits_{m=n_1+1}^{n} \xi_{l,m,h}^{(k)} \tag{8}$$

for all $l = 1,...,n_1$.

Moving from a single country to a regional perspective, we define the region-specific shocks, $\gamma_{reg,h}^{(k)}$, as

$$\gamma_{reg,h}^{(k)} = \frac{1}{n_1} \sum\nolimits_{l=1}^{n_1} \sum\nolimits_{m=1}^{n_1} \xi_{l,m,h}^{(k)} \tag{9}$$

whilst the aggregate external shocks (that is, the innovations originating outside the LA region) are computed as

$$\gamma_{ext,h}^{(k)} = \frac{1}{n_1} \sum\nolimits_{l=1}^{n_1} \sum\nolimits_{m=n_1}^{n} \xi_{l,m,h}^{(k)} \tag{10}$$

i.e., both (6) and (7) are normalised so as to lie in the [0, 1] interval.

In order to identify the direction of the linkages between the two (aggregate) blocs of countries we define the regional net spillover index, $\gamma_{net,h}^{(k)}$, as the difference between the variability transmitted to and received by the elements belonging to the external bloc of the system

$$\gamma_{net,h}^{(k)} = \sum\nolimits_{l=n_1+1}^{n} \sum\nolimits_{m=1}^{n_1} \xi_{l,m,h}^{(k)} - \sum\nolimits_{l=1}^{n_1} \sum\nolimits_{m=n_1+1}^{n} \xi_{l,m,h}^{(k)} \tag{11}$$

so that positive (negative) values for (11) indicate that the region is a net transmitter (receiver) of variability to (from) outside. Using condition (11), it is straightforward to obtain a breakdown for the individual countries forming the external bloc, so that we can define $n - n_1$ pairwise regional net spillover indexes, $\gamma_{cty,h}^{(k)}$, as

$$\gamma_{cty,h}^{(k)} = \sum\nolimits_{m=1}^{n_1} \xi_{cty,m,h}^{(k)} - \sum\nolimits_{l=1}^{n_1} \xi_{cty,m,h}^{(k)} \tag{12}$$

where $cty = n_1 + 1,...,n$.

Before discussing the empirical findings it is worth noting that both the γ's and δ's indices depend on the simulation span (through the index h) and on the estimation sample (through the index k). This is motivated by the need for a sufficiently flexible model specification to analyse the sources of business cycles in a period such as the recent one characterised by exceptionally large fluctuations.[4] Further, considering a wide range of simulation horizons enables us to obtain a dynamic picture of how cross-country business cycle linkages evolve when moving from the short to the long run through a sequence of GFEV decompositions for which the conditioning information is becoming progressively less important as the simulation horizon widens.[5]

3. Assessing Business Cycle Co-movements in the LA Bloc: Country-specific and Regional Evidence

3.1. Data and Preliminary Analysis

We use quarterly real GDP series for six major LA countries (namely, Argentina, Brazil, Chile, Mexico, Peru, and Venezuela) and for the four largest economies in the world (the US, the Euro area, Japan and China) over the period 1980:I-2011:IV.[6] The ten chosen economies represent about 75 percent of real world GDP, with the six LA countries included representing approximately 85

---

[4] Note that since the GFEVs are transformations of model parameters, allowing for time variation in the parameters of the underlying empirical model translates into time-varying nonlinear dynamic interactions among the elements in y in (1).

[5] Note that Diebold and Yilmaz (2012) focus on a selected forecast horizon rather than a continuum of simulation steps. Obtaining full information from the entire simulation horizon is therefore novel in this context.

[6] The GDP series are taken from Datastream and seasonally adjusted by using the X-12 method, as suggested by Cesa-Bianchi et al. (2011). Their codes are: AGXGDPR.C (Argentina), BRXGDPR.C (Brazil), CLI99BVPH (Chile), MXI99BVRG (Mexico), PEI99BVPH (Peru), VEXGDPR.C (Venezuela), USXGDPR.D (US), EKXGDPR.D (euro area), JPXGDPR.D (Japan), CHXGDPR.C (China). Other economies of the LA region (such as Colombia or Bolivia) are not included in the analysis because of the lack of data on GDP for the eighties. The same choice was made by Boschi and Girardi (2011) and Caporale et al. (2011), among others.

percent of real GDP in the LA region over the period 1980-2010 according to the World Development Indicator data.

As a preliminary step, we test for the presence of unit roots in the GDP series in logarithms. ADF tests are performed, both on the levels and the first differences of the series. In each case, we are unable to reject the null hypothesis of a unit root in the levels at conventional significance levels. On the other hand, differencing the series appears to induce stationarity. Standard stationarity tests corroborate this conclusion.[7]

Given the nonstationarity of the time series and the lack of an economic theory suggesting the number of long-run relationships and/or how they should be interpreted, it is reasonable not to impose the restriction of cointegration on a VAR model (Ramaswamy and Sloek, 1998). Thus, we have opted for a specification in first differences since the focus of our analysis is on (time-varying) short-run linkages rather than secular trends (as, for instance, in Bernard and Durlauf, 1995).

More specifically, we choose size 80 for the rolling windows (i.e., 20 years of quarterly observations, 80 observations in all). This can be regarded as a compromise between stability and flexibility, as it turned out that a smaller window size makes the VAR models more unstable.[8] Such a choice implies that the complete set of recursions produces 48 different sets of VAR estimates. The GFEV decomposition analysis is then conducted over a simulation horizon of 20 quarters (5 years) over the period 2000:I-2011:IV.

3.2. The Role of Country-Specific, Regional and External Factors

The γ's and δ's defined in Section 2 above are tri-dimensional structures (surfaces) whose dimensions are given by the simulation horizon, the estimation window and the strength (or

[7] These results are not reported to save space.

[8] For each rolling estimate, the VAR models are specified with two lags. Experimenting with shorter and longer lag lengths (1 lag and 3 lags, respectively) did not change much the estimation results.

direction) of the linkage among the elements of the system.[9] Figure 1 shows the decomposition of output variability of the LA countries into country-specific, regional and external sources.

Figure 1

The results reveal significant differences between countries with respect to the relative importance of the variuos factors explaining output growth volatility. Regarding the country-specific components (graph I in Panels A-F), our model captures the deep crisis hitting Argentina at the beginning of the current decade, as shown by the sharp increase in the contribution of the country-specific component in explaining output growth variability between the second half of 2011 and the first semester of 2012. Furthermore, the global downturn led to a sharp drop in the contribution of internal factors in the last part of 2008. By contrast, the relative contribution of country-specific factors was more stable over time for the remaining LA economies (even in the trough the surface plot does not exhibit dramatic changes in its shape), with their importance diminishing in the long run. Over the period 2000:I-2011:IV, country-specific shocks tend to dominate and account on average for between 75 (in Brazil, Chile and Venezuela) and 60 percent (in Mexico) of total variability in the short run. At the end of the simulation horizon, instead, their contribution drops markedly, ranging between 40 (in Argentina, Brazil and Chile) and 25 percent (in Venezuela).

Concerning regional factors (graph II in Panels A-F), our results provide evidence of a sizeable regional business cycle component in the LA countries, as also found by Aiolfi et al. (2010) and Boschi and Girardi (2011), among others. Averaging over all simulation steps and rolling estimates, we find that regional factors account from about 20 (in the case of Chile) to 40 percent (for Venezuela) of output growth variability. For the largest economies of the LA region (Argentina and Brazil) the role of regional factors is relatively stable. The same holds in Chile (and Peru) until the onset of the global downturn, after which their contribution decreases from 27 (40)

[9] In particular, each of them summarises information obtained from combining several hundred (48 times 20 = 960 to be precise) elements of matrix (5).

to 17 (20) percent after 20 quarters. Finally, a slowly declining pattern is observed in the case of Mexico, in contrast to Venezuela, for which a highly erratic evolution over time is found, with the Argentine crisis of the early noughties translating into a sizeable increase (from about 30 to 60 percent after 20 quarters) in the contribution of regional factors.

Finally, the average effect of external factors (graph III in Panels A-F) is within a similar range to the one for the regional components (as also in Aiolfi et al., 2010), its minimum and maximum values being those for Venezuela and Peru respectively. As for the individual countries, the observed pattern for Argentina mirrors that of the country-specific component: the lowest value corresponds to the Argentine crisis, whilst the highest coincides with the first symptoms of the global crisis. In all LA countries the role of external factors increases in the most recent years, the single exception being Brazil, where business cycles have become less synchronised with those in the industrialised economies during the years of the great recession, the evidence suggesting therefore some partial decoupling.

3.3. Evidence from the LA Region

The variance decomposition for the LA region is computed as an (equally-weighted) average of individual country-specific figures. According to equations (9) and (10), it is based on a synthetic economy which is an “average” LA country, as in Izquierdo et al. (2008). Figure 2 shows the decomposition of regional output variability between region-specific (Panel A) and external sources (Panel B).

Figure 2

Regarding the regional sources of fluctuations, their relative importance vis-à-vis the external ones appears to diminish over the simulation horizon. The dominant role of external factors in the long run is found for all quarters. In particular, external factors account for about 30 percent of the long-run (20-quarter horizon) variance of LA GDP growth, consistently with the evidence in Österholm and Zettelmeyer (2007) and in Aiolfi et al. (2010).

As for the evolution over time of the estimated effects, the relative contribution of the two types of factors is remarkably stable up to the first half of 2008. With the onset of the global crisis external factors appear to acquire an increasing role, especially at the very bottom of the global downturn (between mid-2008 and mid-2009), accounting for more than 50 percent of total variability in 2008:IV. Subsequently, following a partial recovery, idiosyncratic factors have regained some (but not all) of their former importance. Our findings therefore give support to previuos evidence according to which the LA region is still characterised by heavy dependence on external factors and does not carry sufficient weight to affect the international business cycle with its own growth dynamics (Calvo et al., 1993; Izquierdo, 2008; Cesa-Bianchi et al., 2011), thus contradicting the so-called “decoupling” hypothesis (Helbling et al., 2007).

Further evidence is presented in Figure 3, which shows the difference between the variability transmitted to and received from the external bloc of the system as defined by (11). There is a predominance of negative values for the rolling estimates (especially when considering long-run effects), suggesting that the LA region can be characterised as a net receiver of variability from the outside world. This applies even more strongly to the recovery period after the peak of the global crisis: the long-run net effect, after reaching a minimum of -17 percent in 2008:IV, is about -8 percent at the end of the sample.

Figure 3

However, net spillover effects vis-à-vis an aggregate “rest of the world” could hide underlying heterogeneity, which can only be detected by a more disaggregate analysis. Figure 4 presents the net pairwise spillover effects between the LA region and the US (Panel A), the Euro area (Panel B), Japan (Panel C) and China (Panel D).

Figure 4

Both short- and long-run effects appear to be very stable, especially in the case of China. In particular, the balance between volatility transmitted to and received from the outside world is negative for the LA region in most cases. This is largely true for the years of the great recession

(2007-2009), during which the LA region suffered from the recessionary impulses coming from the most advanced economies (but not from China). In the most recent years, however, the overall picture seems to have changed significantly, namely the impact of business cycle conditions in the US, the Euro area and Japan has diminished, whilst the influence of the Chinese economy has increased. Overall, the disaggregate results provide no evidence of de-coupling; they also indicate that bilateral linkages with China have become stronger, making the LA region vulnerable not only to economic hardship in the industrialised economies but also to future developments in China, as already pointed out by Cesa-Bianchi et al. (2011).

4. Determinants of the Linkages between the LA Region and the World Economy

4.1. The Role of Trade and Capital Flows

Since the study of Frankel and Rose (1998) a considerable body of empirical research (Imbs, 2006, 2010; Kalemli-Ozcan et al., 2009) has shown that bilateral trade flows (tra) and financial linkages (fin) can affect business cycles correlations (ρ) across countries and/or regions. Following this literature, a canonical regression model can be specified as

$$\rho = \psi_1 + \psi_2 tra + \psi_3 fin + \varepsilon \qquad (13)$$

The positive effect of bilateral trade flows on the degree of international business cycle synchronisation has been widely established in the literature (see Imbs, 2006 among others) and is consistent with the theoretical predictions of the model developed by Kose and Yi (2006). As for capital flows, several studies give support to the view that financial integration increases the degree of business cycle correlations in cross-sections and over time (Imbs, 2006, 2010), whilst other papers (e.g., Kalemli-Ozcan et al., 2009) find that financially integrated economies have negative co-movements, as posited by standard international real business cycle models with complete markets (Backus et al., 1994). The sign for ψ_3 in (13) is thus the object of empirical scrutiny.[10]

We follow Frankel and Rose (1998) and compute (a time variant version of) bilateral trade intensities as

$$tra_t = \frac{X_{l,e,t} + X_{e,l,t}}{Y_{l,t} + Y_{e,t}}$$

where $X_{l,e,t}$ denote total merchandise exports from the LA region (l) to the external bloc (e), $X_{e,l,t}$ are exports from the aggregate foreign economy to the LA region, $Y_{l,t}$ and $Y_{e,t}$ are the GDP nominal levels in the two economies, and t is a time index.

As for capital flows between the two blocs, they are computed as

$$fin_t = \left| \frac{NFA_{l,t}}{Y_{l,t}} - \frac{NFA_{e,t}}{Y_{e,t}} \right|$$

where $NFA_{l,t}$ and $NFA_{e,t}$ stand for the net foreign asset position in the two aggregate economies. The rationale behind such a proxy for capital movements is that capital should flow between countries or regions with different or even opposite external positions (Imbs, 2006). In particular, we compute the net foreign asset position as the sum of net positions in debt (dbt), equities (eqt) and foreign direct investment (fdi) as in Caballero (2012), among others.[11]

---

[10] In the literature additional explanatory variables for ρ, such as exchange rate arrangements and the structure of production and trade, have been suggested. However, we are interested in explaining how the degree of business cycle synchronisation has changed over time rather than across countries, and therefore time-invariant regressors or explanatory variables that only change slowly over time are ruled out from the present study. A time series analysis of the determinants of business cycle correlations is quite novel, only a limited number of studies on this topic being available at present (see, among others, Kalemli-Ozcan et al., 2009; Imbs, 2010).

[11] Bilateral trade data and statistics for capital flows are from the IMF's DoTS and IFS BoP databases, respectively. The analysis focuses on net capital flows. Since IFS BoP records outflows as negative numbers, to obtain net flows assets and liabilities are added. FDI data for China are not available for the entire sample span considered in the analysis, and

4.2. Estimation Results

Using spillover indexes rather than standard correlation coefficients makes it possible to analyse (time-varying) business cycle correlations in a much more flexible framework by distinguishing between co-movements at different forecast horizons. To see this, we start by mapping our spillover index to the (time-varying) correlation coefficients. Following Forbes and Rigobon (2002), we consider the following least square regression between output growth rates of countries a and b, $\Delta y_a = a + b\Delta y_b + u$, so that

$$\rho = \left[\frac{b^2\sigma_b^2}{\sigma_a^2}\right]^{0.5} \text{ or } \frac{\rho}{b} = \left[\frac{\sigma_b^2}{\sigma_a^2}\right]^{0.5} \tag{14}$$

The term in square brackets on the RHS of the second expression in (14) is the share of output growth variability of country a explained by b. In terms of our framework, it is expressed by γ_{ext} in (10). Condition (14) implies that $\rho^* = \rho/b = \sqrt{\gamma_{ext}}$ (for a given forecast horizon). Accordingly, equation (13) can be rewritten as follows

$$\rho_h^* = \alpha_1^* + \alpha_2^* tra + \alpha_3^* fin + \varepsilon^* \tag{15}$$

where $\alpha_i^* = \alpha_i/b$, $i = 1,...,3$, $\varepsilon = \varepsilon/b$, provided that $b \neq 0$. As γ_{ext} is computed over a number of different simulation steps, h, condition (15) can be tested at several forecast horizons in order to assess whether and how the role of trade and financial linkages varies according to h. In what follows we consider selected simulation horizons (namely, $h = 1, 2, 4, 8, 12, 20$).

The first step of the empirical analysis is based on standard correlation measures between ρ^* and its main macroeconomic determinants. Table 1 shows that the unconditional correlation coefficients for the ρ^*'s and tra variables are positive and statistically significant for all forecast horizons considered, confirming the well established finding that higher business cycle

---

therefore fdi is computed using data only for the US, the Euro area and Japan. The series have been seasonally adjusted using the X-12 method.

synchronisation is associated with stronger trade intensity. One might argue that the positive correlation is spurious owing to the existence of factors correlated to both variables. When conditioning on fin, the magnitude (and the statistical significance) of the partial correlation coefficients remains virtually unchanged. By contrast, the unconditional correlation between ρ^*'s and fin turn out to be statistically insignificant. The same conclusion holds when considering the partial measure of association (conditioned on tra), even though the sign of the relationship in general becomes negative.

Table 1

Correlations are only partially informative as they cannot gauge causality between the regressand and the explanatory covariates. In order to delve deeper into the effects of bilateral trade and capital flows on business cycle synchronisation, we estimate equation (15) by 2SLS for the chosen simulation horizons.[12] In order to control for the collapse (and the subsequent abrupt recovery) in trade flows which occurred during the 2008-2009 crisis, we augment the set of regressors by a crisis dummy (dum) taking the value of -1 in 2008:III and 2008:IV and +1 in 2009:I and 2009:II.[13]

Table 2 presents the estimation results of the baseline specification.[14] Single, double or triple asterisks denote statistically significant coefficients at the 1, 5 or 10 percent level, respectively. We

---

[12] Typical external instruments for trade intensity are spatial characteristics (e.g. geographic proximity or the presence of common borders), and for financial integration institutional variables related to legal arrangements. As most of these instruments are constant over time, they cannot be used in a time series framework. In order to address endogeneity concerns, bilateral trade intensity and capital flows are measured at the beginning of the period and are treated as pre-determined variables.

[13] The estimation results in Sections 4.2. and 4.3. are not affected by the inclusion of dum: re-estimating model (15) without it produces qualitatively similar results to those reported in the main text.

[14] After considerable experimentation, our preferred specification is based on variables expressed in year-on-year changes. For the purpose of readibility variables have been standardised.

also report robust standard errors (in parentheses) as well as some basic diagnostics for the chosen instruments (J statistics), the serial correlation of the residuals (DW) and the goodness of fit of the regression (R^2_{adj}).

Table 2

The estimation results indicate a clear dominance of trade flows over financial linkages as the main determinant of business cycle co-movements between the LA region and the foreign bloc, even controlling for the trade collapse in 2008-2009: the coefficient of bilateral trade intensity is positive and statistically significant at all simulation steps; moreover it increases almost monotonically with h. Capital flows reduce the degree of co-movement between cycles, but the coefficients of fin are generally small in magnitude and imprecisely estimated.

Overall, these findings reinforce the disaggregate results discussed in Section 3.3 and show that, in the presence of relatively weak financial linkages, propagation of the impulses from outside to the LA bloc has happened mainly through trade flows.

The apparent de-coupling of the LA bloc from the most advanced economies thus arises not only from trade being increasingly oriented towards China rather than its historical trading partners (namely the US and the Euro area – see Cesa-Bianchi et al. (2011), but also from a low degree of financial integration with the rest of the world economy.

4.3. Extensions

In this Section we present the results from a disaggregate analysis based on a breakdown of capital flows into debt, equity and FDI flows with the aim of shedding light on what type of flows are behind stronger business cycle co-movements.

We first assess the role of these components by replacing fin with disaggregated capital flows (entering the model individually). The results in Table 3 indicate that the trade channel, albeit dominant, is not the only one: capital flows can also affect the degree of international business cycle synchronisation in the short run (namely, up to the fourth simulation step). Moreover, portfolio equity flows have a negative effect on the degree of business cycle synchronisation whilst that of debt and foreign direct investment is positive.

Table 3

As a further step, we consider a specification where the three types of flows enter the model simultaneously (Table 4). Over the first year of the simulation horizon its explanatory power is higher with respect to its (nested) counterparts in Table 2 and Table 3, suggesting that debt, portfolio equity and foreign direct investment act as additional channels of transmission of shocks from abroad.

Our findings complement previous evidence for emerging markets according to which both trade and financial variables mattered prior to the global crisis (Blanchard et al., 2010), since we document that these factors largely explain business cycle co-movements over the last decade. However, our framework makes it possible to go further and to highlight the relative strength of the different transmission channels in the short and long run: the increasing explanatory power of trade flows over the entire simulation span is largely corroborated, whereas capital flows affect business cycle co-movement in the short term, as the R^2_{adj} statistics show.[15] Moreover, in the very short term debt and foreign direct investment have an opposite effect compared to equity portfolio flows. While the result for *eqt* can be rationalised within the standard international real business cycle framework with complete markets, our findings for *dbt* and *fdi* suggest that short-term capital flows and internationalisation of production through foreign direct investment may strengthen the role of trade channel making the LA region more prone to suffer from the propagation of shocks from abroad.

Table 4

[15] This also implies that the statistically significance of the coefficient on equity portfolio flows after the first four quarters of the simulation span makes only a marginal contribution to explaining how the LA bloc and the rest of the world co-move.

5. Conclusions

This paper presents a flexible framework to assess both short- and long-run linkages between business cycles. Specifically, we extend the econometric approach of Diebold and Yilmaz (2012) to analyse the extent to which business cycle developments in six LA countries (namely, Argentina, Brazil, Chile, Mexico, Peru and Venezuela) and the four largest economies in the world (the US, the Euro area, Japan and China) are connected over the period 1980:I-2011:IV.

For that purpose, we decompose macroeconomic fluctuations in domestic output growth rates into the following components: i) country-specific (idiosyncratic) factors; ii) regional factors, capturing fluctuations that are common to all countries belonging to the LA region; iii) external factors, which are related to business cycle development outside the LA region. Most importantly, we are able to determine the direction and the intensity of the propagation mechanisms and therefore establish to what extent the LA economies and LA region as a whole have been dependent on (or influenced by) external developments over time.

Overall, the business cycle of the individual LA countries appears to be influenced by country-specific, regional and external shocks in a very heterogenous way. Also, the LA region as a whole is strongly dependent on external developments. This conclusion holds especially for the years after the great recession of 2008 and 2009, ruling out any decoupling of the LA region from the rest of the world.

More specifically, we find a clear dominance of trade flows over financial linkages as a determinant of business cycle co-movements between the the LA region and the foreign bloc. The apparent de-coupling of the LA area with respect to the most advanced economies in recent years thus seems to have been determined not only by increasing trade flows towards China but also by a low degree of financial integration with its main economic partners.

The decomposition of capital flows into their components (debt, portfolio equity and foreign direct investment flows) shows a negative effect of portfolio equity flows on the degree of business cycle synchronisation, consistently with the predictions of standard international real business cycle models with complete markets. In contrast, short-term capital and foreign direct investment flows tend to reinforce in the short run the role of the trade channel and the responsiveness of the LA region to external developments.

The proposed econometric approach is of more general interest, since it does not include any variables which are highly country- or region-specific and thus can also be used to investigate the relationship between comovement across countries/regions or financial markets and their macroeconomic determinants. For instance, it could be applied to analyse the factors that have influenced integration of the real economies in the European Monetary Union after the adoption of the euro, or to assess the historical determinants of the regional convergence/divergence dynamics within countries over time, or to conduct a macro analysis of market integration in a given financial segment. These are all interesting topics for future research.

References

Acemoglu D., S. Johnson, J.A. Robinson and Y. Thaicharoen, 2003. Institutional Causes, Macroeconomic Symptoms: Volatility, Crisis, and Growth, *Journal of Monetary Economics*, 50, pp. 49-122.

Ahmed S. 2003. Sources of Economic Fluctuations in Latin America and Implications for Choice of Exchange Rate Regime, *Journal of Development Economics*, 72, pp. 181-202.

Aiolfi M., L. Catão and A. Timmermann, 2010. Common Factors in Latin America's Business Cycles, CEPR Discussion Paper 7671.

Artis M., J.H.-M. Krolzig and J. Toro, 2004. The European Business Cycle, *Oxford Economic Papers*, 56, pp. 1-44.

Athanasoulis S. and E. van Wincop, 2000. Growth Uncertainty and Risk-Sharing, *Journal of Monetary Economics*, 45, 477-505.

Backus D., P. Kehoe and F. Kydland, 1994. Dynamics of the Trade Balance and the Terms of Trade: The J-Curve?, *American Economic Review*, 84, pp. 84-103.

Bagliano F. and C. Morana, 2010. Business Cycle Comovement in the G-7: Common Shocks or Common Transmission Mechanisms?, *Applied Economics*, 42, pp. 2327-2345.

Baxter M. and M. Kouparitsas, 2005. Determinants of Business Cycle Comovement: A Robust Analysis, *Journal of Monetary Economics*, 52, pp. 113-157.

Bernard A.B. and S.N. Durlauf, 1995. Convergence in International Output, *Journal of Applied Econometrics*, 10, pp. 97-108.

Blanchard O., H. Faruqee and M. Das, 2010. The Initial Impact of the Crisis on Emerging Market Countries, *Brookings Papers on Economic Activity*, 41, pp. 263-323.

Boschi M., 2012. Long- and Short-run Determinants of Capital Flows to Latin America: A Long-run Structural GVAR Model , *Empirical Economics*, forthcoming.

Boschi M. and A. Girardi, 2011. The Contribution of Domestic, Regional and International Factors to Latin America's Business Cycle, *Economic Modelling*, 28, pp. 1235–1246.

Caballero J., 2012. Do Surges in International Capital Flows Influence the Likelihood of Banking crises?, IDB Working Paper 305.

Calvo G., L. Leiderman and C. Reinhart, 1993. Capital Flows and Real Exchange Rate Appreciations in Latin America, *IMF Staff Papers*, 40, pp. 108–151.

Canova F., 2005. The Transmission of US Shocks to Latin America, *Journal of Applied Econometrics*, 20, pp. 229-251.

Caporale G.M., D. Ciferri and A. Girardi, 2011. Fiscal Shocks and Real Exchange Rate Dynamics: Some Evidence for Latin America, *Journal of International Money and Finance*, 30, pp. 709-723.

Diebold F.X. and K. Yilmaz (2012). Better to Give than to Receive: Predictive Measurement of Volatility Spillovers, *International Journal of Forecasting*, 28, pp. 57–66.

Fatàs A. and I. Mihov, 2006. Policy Volatility, Institutions and Growth, mimeo, INSEAD.

Forbes K. and R. Rigobon 2002. No Contagion, Only Interdependence: Measuring Stock Market Co-movements, *Journal of Finance*, 57, pp. 2223-2261.

Frankel J. and A. Rose, 1998. The Endogeneity of the Optimum Currency Area Criteria, *Economic Journal*, 108, pp. 1009-1025.

Granger C.W.J., 2008. Non-Linear Models: Where Do We Go Next - Time Varying Parameter Models?, *Studies in Nonlinear Dynamics and Econometrics*, 12, pp. 1–9.

Helbling T., P. Berezin, M.A. Kose, M. Kumhof, D. Laxton and N. Spatafora, 2007. Decoupling the Train? Spillovers and Cycles in the Global Economy, *World Economic Outlook*, pp. 121–160.

Hoffmaister A.W. and J. Roldos, 1997. Are Business Cycles Different in Asia and Latin America?, IMF Working Papers 97/9.

Imbs J. 2006. The Real Effects of Financial Integration, *Journal of International Economics*, 68, pp. 296–324.

Imbs J., 2010. The First Global Recession in Decades, *IMF Economic Review*, 58, pp. 327-354.

Izquierdo A., R. Romero and E. Talvi, 2008. Booms and Busts in Latin America: The Role of External Factors, IDB RES Working Papers 4569.

Kalemli-Ozcan S., E. Papaioannou and J.L. Peydro, 2009. Financial Integration and Business Cycle Synchronization, NBER Working Papers 14887.

Kose M.A., C. Otrok and E.S. Prasad, 2012. Global Business Cycles: Convergence or Decoupling?, *International Economic Review*, 53, pp. 511-538.

Kose M.A., E.S. Prasad and M. Terrones, 2003. How Does Globalization Affect the Synchronization of Business Cycles?, *American Economic Review-Papers and Proceedings*, 93, pp. 57–62.

Kose M.A. and K.-M. Yi, 2006. Can the Standard International Business Cycle Model Explain the Relation between Trade and Comovement?, *Journal of International Economics*, 68, pp. 267-295.

Loayaza N.V., R. Rancière, L. Servén and J. Ventura, 2007. Macroeconomic Volatility and Welfare in Developing Countries: An Introduction, *World Bank Economic Review*, 21, pp. 343-357.

Mody A., L. Sarno and M.P. Taylor, 2007. A Cross-country Financial Accelerator: Evidence from North America and Europe, *Journal of International Money and Finance*, 26, pp. 149-165.

Österholm P. and J. Zettelmeyer, 2007. The Effect of External Conditions on Growth in Latin America, IMF Working Papers 07/176.

Pesaran M.H. and Y. Shin, 1998. Generalized impulse response analysis in linear multivariate models, *Economics Letters*, 58, pp. 17-29.

Ramaswamy R. and T. Sloek, 1998. The Real Effects of Monetary Policy in the European Union: What are the Differences?, *IMF Staff Papers*, 45, pp. 374-402.

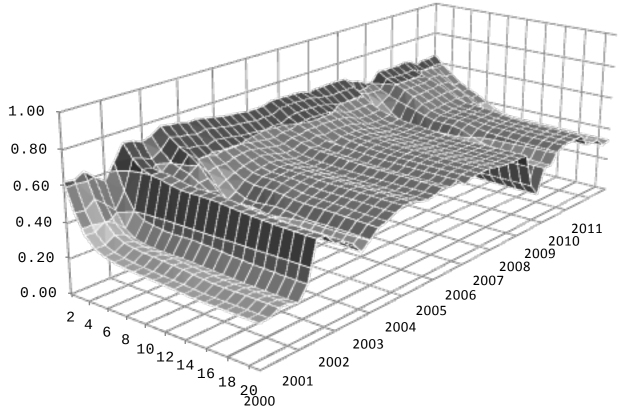
Sims C.A., 1980. Macroeconomics and reality, Econometrica, 48, pp. 1-47.

Wang P.J. (2002). *Financial Econometrics: Methods and Models*, Routledge, London.

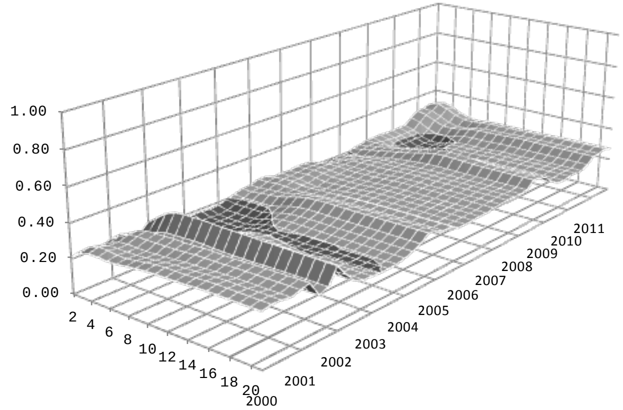
Figure 1 – LA countries: country-specific, regional and external factors (continued)

Panel A – Argentina

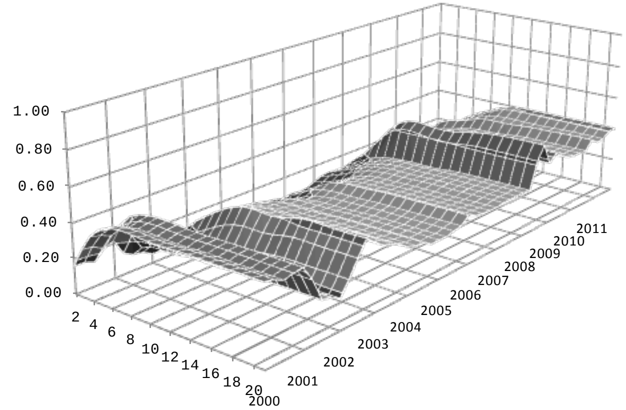
I. Country-specific component



II. Regional component

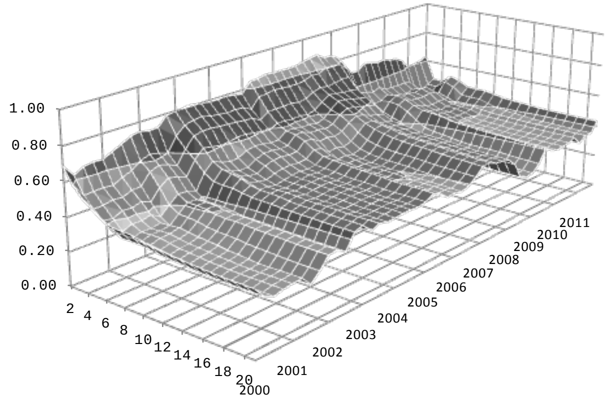


III. External component

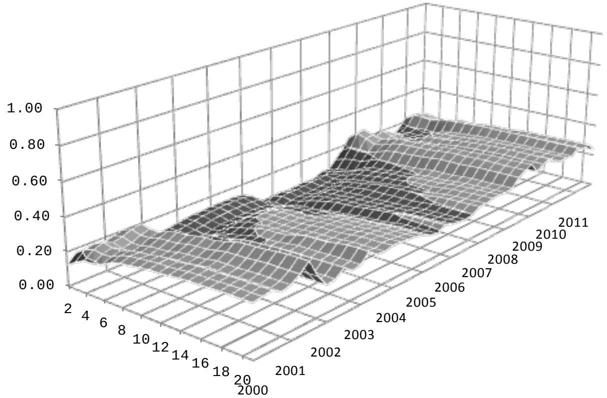


Panel B – Brazil

I. Country-specific component



II. Regional component



III. External component

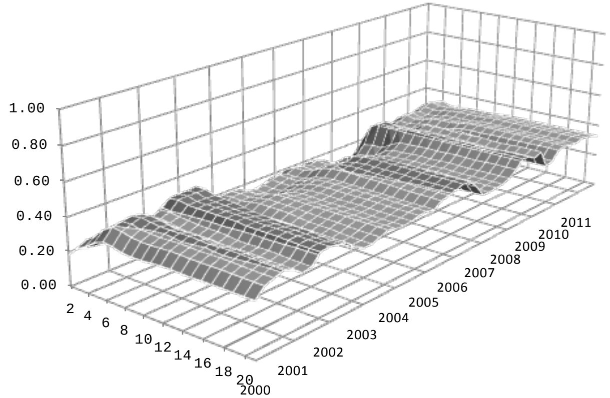
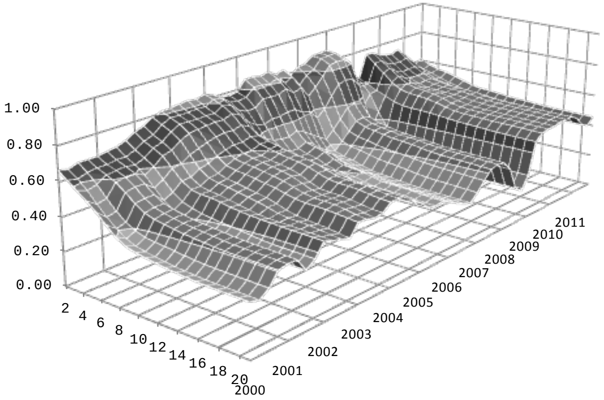


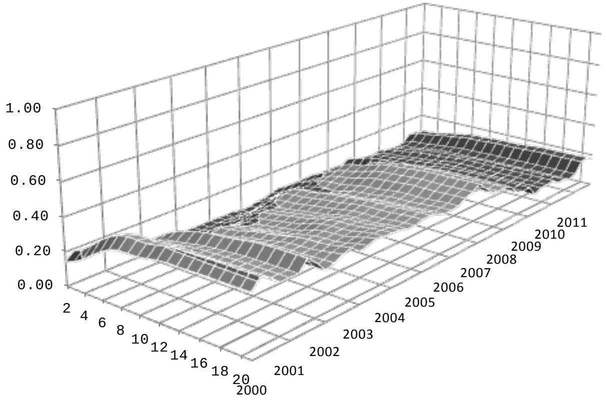
Figure 1 – LA countries: country-specific, regional and external factors (continued)

Panel C – Chile

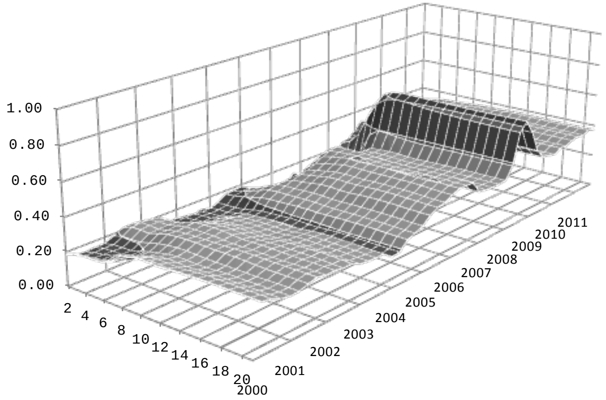
I. Country-specific component



II. Regional component

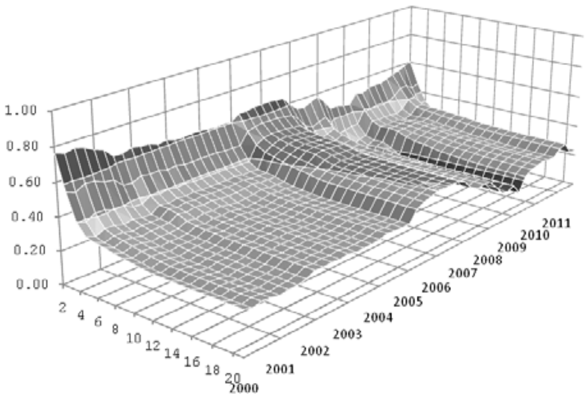


III. External component

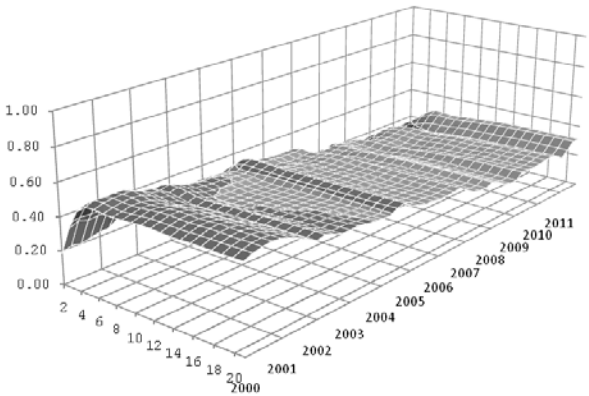


Panel D – Mexico

I. Country-specific component



II. Regional component



III. External component

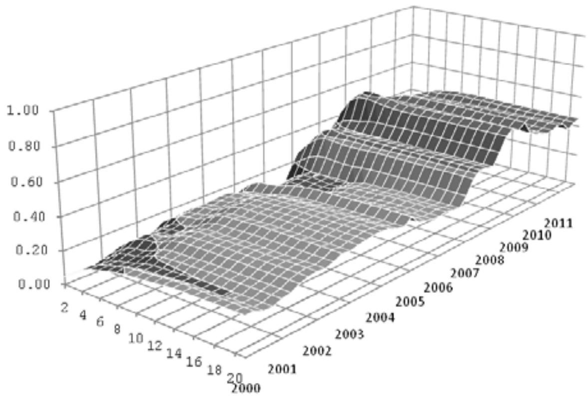
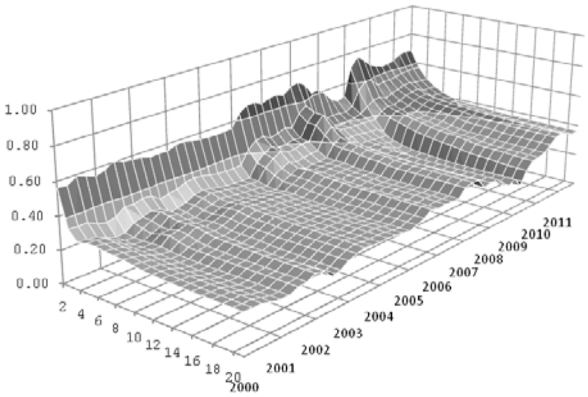


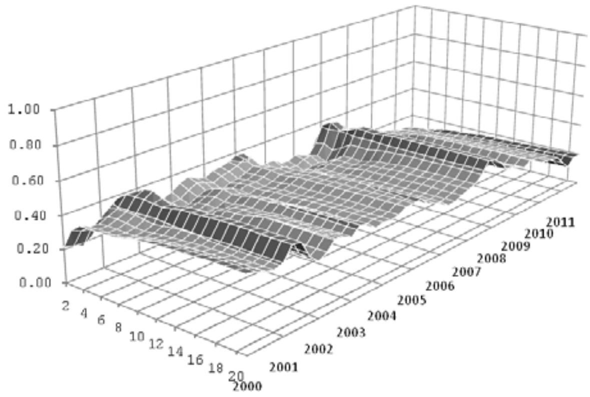
Figure 1 – LA countries: country-specific, regional and external factors (completed)

Panel E – Peru

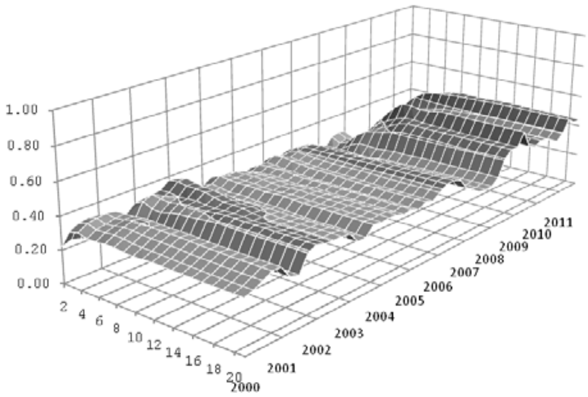
I. Country-specific component



II. Regional component

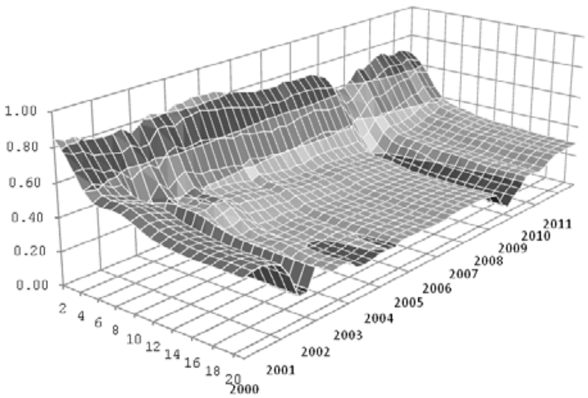


III. External component

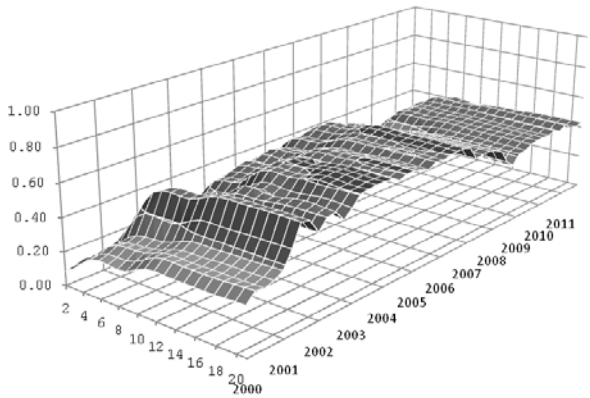


Panel F – Venezuela

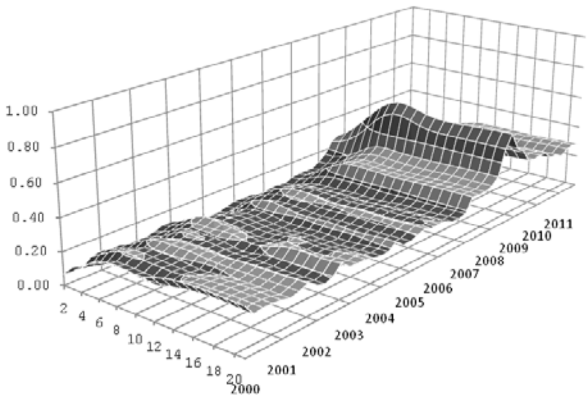
I. Country-specific component



II. Regional component



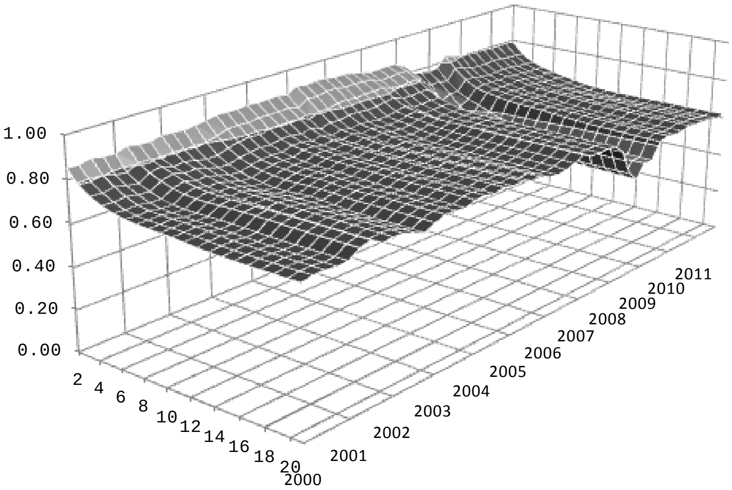
III. External component



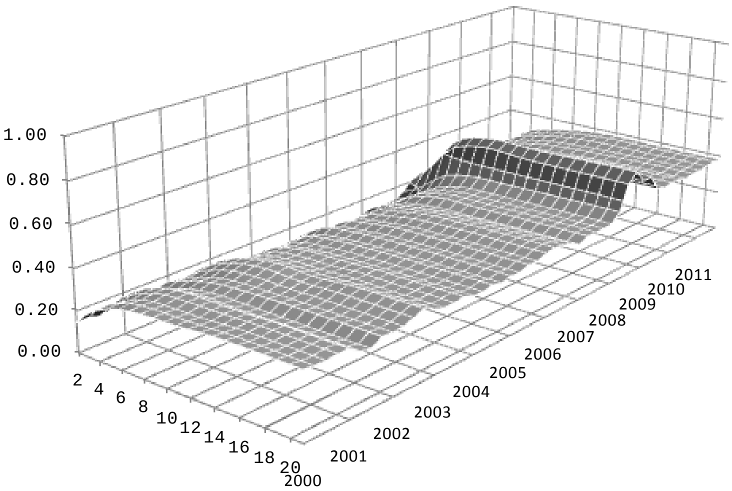
Note. In each tri-dimensional graph, the horizontal plane is spanned by the temporal horizon and the simulation steps, whilst the vertical axis measures the intensity of the indicator.

Figure 2 – LA region: region-specific versus external factors

Panel A – Region-specific component

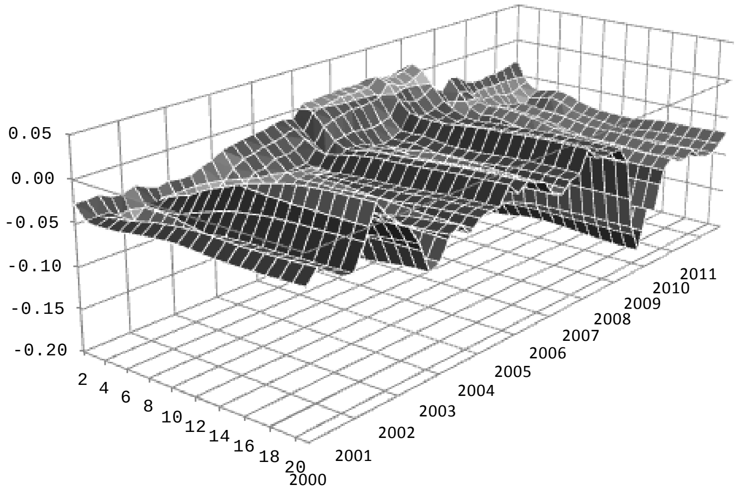


Panel B – External component



Note. See Figure 1.

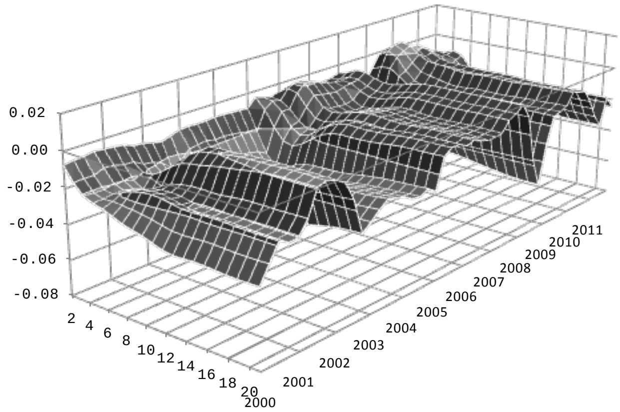
Figure 3 – LA region: net effects (region-specific minus external factors)



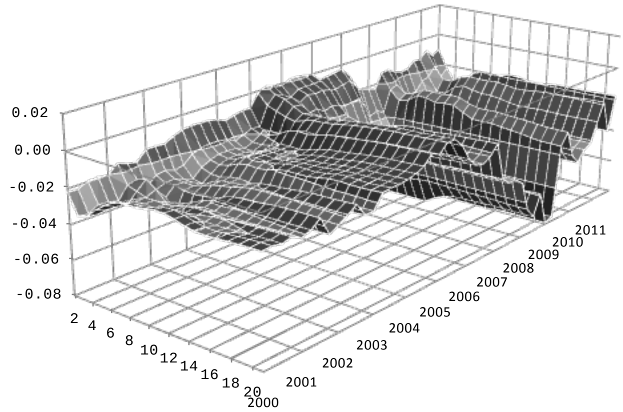
Note. See Figure 1. Positive (negative) values indicate that volatility transmitted to external countries is greater (lower) than that received from them.

Figure 4 – LA region: net effects (region-specific minus individual foreign country factors)

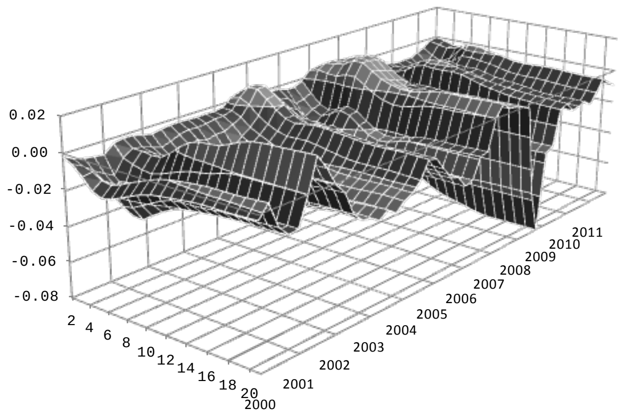
Panel A – US



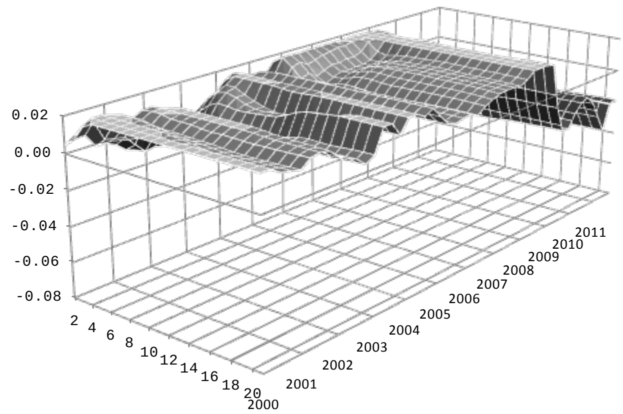
Panel B – Euro area



Panel C – Japan



Panel D – China



Note. See Figure 3.

Table 1 – Correlation analysis: business cycle co-movements vs trade and capital flows

	Unconditional correlations					
	$h=1$	$h=2$	$h=4$	$h=8$	$h=12$	$h=20$
$corr(\rho_h^*, tra)$	0.424***	0.486***	0.550***	0.538***	0.497***	0.507***
	(0.005)	(0.001)	(0.000)	(0.000)	(0.001)	(0.001)
$corr(\rho_h^*, fin)$	0.119	0.140	0.199	0.122	0.096	0.034
	(0.447	(0.370)	(0.202)	(0.435)	(0.540)	(0.831)
	Conditional correlations					
	$h=1$	$h=2$	$h=4$	$h=8$	$h=12$	$h=20$
$corr(\rho_h^*, tra \mid fin)$	0.410***	0.470***	0.524***	0.530***	0.493***	0.521***
	(0.007)	(0.002)	(0.000)	(0.000)	(0.001)	(0.000)
$corr(\rho_h^*, fin \mid tra)$	-0.010	-0.007	0.041	-0.050	-0.065	-0.145
	(0.949)	(0.963)	(0.796)	(0.753)	(0.682)	(0.359)

Note. Triple asterisks denote statistically significant coefficients at the 1 percent level. p-values are reported in parentheses.

Table 2 – Business cycle co-movements, trade intensity and aggregate capital flows

	$h=1$	$h=2$	$h=4$	$h=8$	$h=12$	$h=20$
tra	0.224***	0.267***	0.328***	0.328***	0.297***	0.321***
	(0.077)	(0.084)	(0.125)	(0.073)	(0.103)	(0.072)
fin	-0.028	-0.027	0.017	-0.065	-0.079	-0.152
	(0.095)	(0.07)	(0.154)	(0.149)	(0.159)	(0.118)
dum	1.680***	1.834***	1.801***	1.909***	1.847***	1.917***
	(0.179)	(0.126)	(0.230)	(0.123)	(0.162)	(0.104)
J	*0.86*	*0.44*	*0.96*	*0.30*	*0.41*	*0.36*
DW	*2.31*	*2.35*	*2.10*	*1.92*	*2.29*	*2.20*
R^2_{adj}	*0.35*	*0.46*	*0.52*	*0.54*	*0.47*	*0.52*

Note. The dependent variable is the measure of business cycle co-movement computed according to condition (15) of the main text for selected simulation horizons. See Sections 4.1. and 4.2. for the definition of the explanatory variables. Single, double or triple asterisks denote statistically significant coefficients at the 1, 5 or 10 percent level, respectively. Robust standard errors are reported in parentheses.

Table 3 – Business cycle co-movements, trade intensity and sub-components of capital flows

	$h=1$	$h=2$	$h=4$	$h=8$	$h=12$	$h=20$
			Debt flows			
tra	0.137**	0.224**	0.286**	0.293***	0.268***	0.257***
	(0.062)	(0.104)	(0.114)	(0.064)	(0.097)	(0.063)
dbt	0.257**	0.116	0.152	0.051	0.020	0.061
	(0.098)	(0.113)	(0.093)	(0.074)	(0.096)	(0.152)
dum	1.557***	1.777***	1.732***	1.877***	1.828***	1.869***
	(0.146)	(0.125)	(0.272)	(0.142)	(0.165)	(0.095)
J	*0.90*	*0.38*	*0.76*	*0.35*	*0.38*	*0.30*
DW	*2.24*	*2.37*	*2.18*	*1.97*	*2.34*	*2.32*
R^2_{adj}	*0.40*	*0.47*	*0.53*	*0.54*	*0.47*	*0.50*
			Equity flows			
	$h=1$	$h=2$	$h=4$	$h=8$	$h=12$	$h=20$
tra	0.322**	0.344***	0.427***	0.386***	0.317***	0.324***
	(0.139)	(0.088)	(0.124)	(0.089)	(0.093)	(0.046)
eqt	-0.262**	-0.210**	-0.232***	-0.192**	-0.108	-0.118
	(0.118)	(0.08)	(0.081)	(0.082)	(0.080)	(0.076)
dum	1.663***	1.820***	1.791***	1.891***	1.832***	1.892***
	(0.309)	(0.135)	(0.217)	(0.105)	(0.178)	(0.086)
J	*0.52*	*0.23*	*0.51*	*0.55*	*0.31*	*0.30*
DW	*2.41*	*2.40*	*2.09*	*2.00*	*2.34*	*2.30*
R^2_{adj}	*0.42*	*0.50*	*0.57*	*0.57*	*0.48*	*0.51*
			Foreign direct investment flows			
	$h=1$	$h=2$	$h=4$	$h=8$	$h=12$	$h=20$
tra	0.195**	0.237**	0.321**	0.302***	0.273***	0.282***
	(0.083)	(0.099)	(0.127)	(0.076)	(0.077)	(0.057)
fdi	0.154	0.158**	0.081	0.049	0.008	-0.047
	(0.106)	(0.061)	(0.106)	(0.129)	(0.123)	(0.148)
dum	1.657***	1.811***	1.792***	1.895***	1.836***	1.904***
	(0.201)	(0.164)	(0.257)	(0.118)	(0.143)	(0.093)
J	*0.99*	*0.57*	*0.98*	*0.31*	*0.42*	*0.35*
DW	*2.23*	*2.30*	*2.12*	*1.94*	*2.32*	*2.26*
R^2_{adj}	*0.38*	*0.48*	*0.52*	*0.54*	*0.47*	*0.50*

Note. See Table 2.

Table 4 – Business cycle co-movements, trade intensity and disaggregate capital flows

	$h=1$	$h=2$	$h=4$	$h=8$	$h=12$	$h=20$
tra	0.239**	0.301**	0.376***	0.366***	0.309**	0.306***
	(0.102)	(0.137)	(0.096)	(0.098)	(0.135)	(0.049)
dbt	0.248***	0.095	0.155	0.054	0.026	0.083
	(0.085)	(0.116)	(0.098)	(0.077)	(0.107)	(0.100)
eqt	-0.287*	-0.227**	-0.246**	-0.198*	-0.110*	-0.120**
	(0.156)	(0.087)	(0.119)	(0.114)	(0.062)	(0.050)
fdi	0.128	0.155**	0.069	0.051	0.009	-0.055
	(0.107)	(0.066)	(0.108)	(0.108)	(0.120)	(0.124)
dum	1.531***	1.756***	1.710***	1.860***	1.818***	1.860***
	(0.168)	(0.144)	(0.181)	(0.137)	(0.146)	(0.083)
J	*0.59*	*0.25*	*0.36*	*0.63*	*0.27*	*0.23*
DW	*2.31*	*2.40*	*2.19*	*2.07*	*2.36*	*2.33*
R^2_{adj}	*0.46*	*0.51*	*0.57*	*0.55*	*0.45*	*0.49*

Note. See Table 2.