External Shocks and Macroeconomic Volatility in Latin America

Claudio Raddatz*
The World Bank

March, 2008

Abstract

This paper using a panel VAR methodology to determine whether the differences in output volatility between Latin America and other regions result from the volatility of its external shocks(exposure), or from its response to these shocks (vulnerability) . The results indicate that Latin America is more vulnerable to external shocks than other middle income countries but no more vulnerable than richer countries. Developed countries are less volatile because of their lower exposure. A parametric version of the panel VAR model shows that differences in trade and capital account openness, financial development, labor and firm entry flexibility, and the degree of domestic liability dollarization. can explain many of the qualitative and quantitative differences of vulnerability between Latin America and other regions.

*Development Economics Research Group, World Bank; e-mail: craddatz@worldbank.org. I am grateful for the support of the Office of the Chief Economist of Latin America, and to Cesar Calderon, Tito Cordella, Eduardo Levy-Yeyati, Andrew Powell, and participants of the conference on country insurance organized by this office for valuable comments. The remaining errors are of course my responsibility. The views expressed in this paper are the author's only and do not necessarily represent those of the World Bank, its executive directors, or the countries they represent.

1 Introduction

The Latin America and the Caribbean region (henceforth Latin America), as well as other emerging market economies, have endured significantly higher macroeconomic volatility than industrial economies. A simple look at the data shows that output volatility (measured as the standard deviation of real GDP per capita) among Latin American countries has been almost twice as large as that in industrial countries in the last 20 years (see Table 1).

Many explanations have been ventured to account for the higher volatility of Latin American countries. Broadly speaking, the available theoretical accounts fall into two categories. The first is that developing countries are subject to larger shocks than developed countries (Mendoza, 1995; Koren and Tenreyro, 2006; Imbs and Wacziarg, 2003; Uribe and Yue, 2006). The second is that these countries are more vulnerable to these shocks because government policy or structural characteristic (such as the degree of financial development or labor regulations) tend to amplify the real effects of shocks in developing countries whereas in developed countries they help to mitigate aggregate instability (Caballero and Krishnamurty, 2001; Fatas and Mihov, 2006).

This paper looks at the ability of these two types of explanations to account for differences in volatility between Latin America compared and other groups of countries. Its main purpose is to determine the contribution of the volatility of external shocks (exposure)and of the responsiveness of output to these shocks (vulnerability) to the level of output volatility observed in Latin America and other regions.

To this end this paper quantifies the impact of a comprehensive set of real and financial external shocks that includes shocks to the state of the world economy (as measured by the GDP of high income OECD countries), terms of trade, international financial conditions (as captured by an international real interest rate and the high yield spread), real exchange rate, and natural disasters, in Latin America and other regions (East Asia and Pacific and Western Europe) and income groups (Other Middle Income and High Income countries) by separately estimating the parameters of a semi-structural panel VAR for each of these groups.

The results indicate that, the higher output volatility of Latin America relative to countries in East Asia and Pacific, Western Europe, or High Income countries in general is mainly driven by a higher volatility of external shocks (i.e. a higher exposure), and not by a higher vulnerability to them. In fact, conditional on the volatility of the shocks, Latin American countries are no more vulnerable than its more developed counterparts, and even less vulnerable to some shocks (such as the World Business Cycle). Only compared to (the more similar) other middle income countries, Latin American countries are more vulnerable to various external shocks, especially to those to terms of trade and real interest rate or high yield spread.

After establishing the main differences in vulnerability to external shocks between Latin America and other groups of countries, this article explores whether these differences can be explained by various structural characteristics that have been argued to potentially amplify or mitigate the impact of external shocks, such as the degree of trade and capital openness, financial development, labor and firm entry flexibility, and domestic dollarization. To this end I estimate a different panel

VAR model that pools all country groups together and allows a country's response to the various external shocks to depend on these structural characteristics. The estimates from this model are used to document the role of these structural features for the amplification/mitigation of shocks, reproduce the predicted responses of output to the various external shocks in Latin America and other groups of countries, and compare the predicted differences in responses across groups with the actual differences estimated with the first model.

The results indicate that structural differences across groups can account for the qualitative and some quantitative differences in vulnerability between Latin America and other groups. In particular, the higher vulnerability to shocks to the terms of trade of Latin American countries compared to countries in other regions can be partly explained by Latin countries lower degree of labor flexibility, and their smaller response to shocks to the world business cycle and real exchange rate, than that of Western European and High Income countries in general to Latin American countries smaller degrees of capital and financial markets development.

The rest of the paper is structured as follows. Section 2 presents a brief theoretical framework used to clarify the concepts of exposure and vulnerability covered throughout the paper and illustrate why a structural empirical approach is needed to determine countries' differences in exposure and vulnerability. Section 3 describes the data and takes a first look at the differences in volatility across the various groups of countries considered in the paper. Section 4 discusses the empirical methodology used to estimate the impact and relative importance of the various external shocks for the different groups of countries, reports the main results, and establishes the differences in exposure and vulnerability across groups. Section 5 presents the empirical methodology used to determine the role of structural characteristics on a country's vulnerability to external shocks, presents these results, and compares the actual and predicted differences in vulnerabilities for different specifications. Section 6 concludes.

2 A simple theoretical framework

Consider a country whose macroeconomic behavior is described by the following structural model

$$\mathbf{x}_t = \mathbf{\Psi}(L)\varepsilon_t,$$

where $\mathbf{x} = (x_1, \ldots, x_N)$ is a vector that includes the country's GDP and all other relevant macroeconomic variables, both internal and external to the country, $\mathbf{\Psi}(L)$ is a matrix of distributed lags coefficients, and ϵ is a vector that comprises all fundamental, orthogonal shocks that affect this economy, which may also be internal or external to the country. The index t denotes the time period.

This is a very general description of the macro behavior of an economy. The only assumptions required to obtain this kind of expression are that the macroeconomic variables considered are stationary, and that the relations among the variables are linear.[1]

It is straightforward to show that, in this kind of framework, the variance of any variable included in the vector $\mathbf{x}$ corresponds to a linear combination of the variances of the fundamental shocks. In particular, the variance of the country's GDP, denoted by σ_Y^2, can be written as

$$\sigma_Y^2 = \alpha_1 \sigma_1^2 + \ldots + \alpha_K \sigma_K^2 + \beta_1 \sigma_{K+1}^2 + \ldots \beta_{N-K} \sigma_N^2,$$

where σ_i^2 represents the variance of the i-th structural shock, and α and β capture the sensitivity of output variance to each one of those shocks. This expression assumes, without loss of generality, that the first K shocks correspond to "external shocks" (i.e. shocks to variables outside of a country's control) and the other $N-K$ to "internal shocks". Thus, the α coefficients measure output's sensitivity to different external shocks and the β coefficients its sensitivity to various internal shocks.

This expression shows that differences in output volatility across countries can result from differences in the variances of their fundamental shocks and from differences in their output volatility response to these various shocks.

A simple example with only one external and internal shock is useful to define and clarify the concepts of exposure and vulnerability used throughout the paper. In this case, output variance corresponds to

$$\sigma_Y^2 = \alpha \sigma_X^2 + \beta \sigma_I^2.$$

Thus, controlling for the role of internal shocks ($\beta \sigma_I^2$), differences in volatility across countries result from differences in the variance of the external shocks that hit them (σ_X^2), i.e. their degree of *exposure* to these external shocks, and from differences in their *vulnerability* to those shocks (α).

3 A first look at the data

The main stylized facts on output volatility and external shocks in Latin America and other regions and income groups are reported in Table 1. There are three regional groups. The group labeled *Latin America* (henceforth *LAC*) comprises countries in Latin America and the Caribbean; *East Asia and Pacific*, and *Western Europe* are also geographically defined (henceforth *EAP* and *WE* respectively); with the only exception that Canada (which belongs to North America) is included in the Western Europe group. There are also two additional groups defined according to their income level: *Other Middle Income* (hereafter *OMI*) includes all upper- and lower-middle-income countries that are not part of the Latin America group, and *High Income* countries are analogously defined. The various groups are non-inclusive in the relevant dimension, but not across dimensions. That is, the Other Middle Income Countries group does not include any High Income or Latin American country, but it does include countries from East Asia and Pacific that are in the relevant income bracket. All these groups include only countries that are not members of the G7, that have at least

[1]Of course, the linearity may come from a log linearization of a non-linear model.

20 years of continuous data on real per capita GDP, terms of trade, and real exchange rate, and do not qualify as small states (average population below one million people).[2] The detailed list of countries included in each group is reported in Appendix 1. Among these groups, the Other Middle Income group is the closest benchmark for Latin America for several reasons. First, the number of countries included in each group is similar (18 and 21 respectively). Second, average income per-capita during the period 1974-2004 is also alike (2800 for Latin America and 2200 for Other Middle Income). Finally, the distribution of countries by income levels within each group is similar, although the fraction of lower-middle income countries in the OMI group is slightly higher than in LAC. On the contrary, income differences between LAC and EAP are much larger (2800 and 6300 respectively).

For each of these groups of countries, the table reports the cross-country median standard deviation of real per-capita GDP growth for the periods 1974-2004 (Panel A) and 1986-2004 (Panel B) in the *Output Volatility* section. The first period corresponds to the post Bretton-Woods era and the second period to the post Debt Crisis era.The *Input Volatility* section of each panel presents the median standard deviation of the growth of terms of trade and real exchange rate, and the incidence of various types of natural disasters.

Disasters are grouped into three categories: Geological disasters (earthquakes, volcano eruptions, land slides, and tidal waves), Climatic disasters (floods, droughts, wind storms, and extreme temperatures), and Human disasters (epidemics and famines).[3] The criteria used to classify these disasters are based in International Monetary Fund (2003) and is described in detail in Raddatz (2006). The measure of incidence reported corresponds to the cross-country average of the frequency of occurrence of disasters in each category (measured as number of disasters per year). The detailed description of each of these variables and their source is presented in Appendix 2. For space reasons, the Input Volatility section of the table excludes external shocks that are common to all countries, such as the state of the World Business Cycle and the international financial conditions, which are considered and discussed in detail in the next section.

The table shows that output volatility in Latin America is typically higher than in the High Income and Western Europe countries but similar to that observed in Other Middle Income countries and in the somewhat richer countries of the East Asia and Pacific region. Latin America does not seem particularly volatile when compared to non-industrial countries. In contrast, output volatility in Sub-Saharan Africa (not reported) is much larger than any other group.

The *input volatility* section of each panel shows that the volatility of terms of trade and real

[2]The reason to exclude these countries is that they may be differently affected by some types of external shocks, such as natural disasters, and that the data coverage in small states varies importantly across regions. Thus, by including them could result in wrongly attribute differences in coverage of small states across regions to differences in vulnerability. Nevertheless, results including small countries are in most cases no significantly different from those reported below.

[3]There are important sampling issues in the computation of the variation in real per-capita aid flows. The reason is that many higher income countries within each groups were re-paying multilateral institutions during this period and therefore registering negative aid flows. These observations were dropped from the sample because of the problems of computing growth rates over negative values. As it will be discussed later, aid flows are not very relevant among these groups of countries and will be dropped from the analysis.

exchange rates is higher in Latin America than in other groups. Geological and Human disasters are also more frequent in Latin America. These observations are just based on the point estimates, but it seems safe to conclude that there is no strong evidence at this level that Latin America is exposed to smaller external shocks than other reference groups of countries, and some evidence that its exposure may be actually higher. Taken face value, these figures indicate that despite having a higher exposure Latin America is not significantly more volatile than other regions.

The bottom part of both panels of Table 1 summarizes the findings discussed above by reporting the relative output volatility with respect to each input (external) shock for the different country groups. With some minor exceptions, the results show that Latin American countries have a lower relative volatility than those in other regions, when controlling for the size of the shocks that hit them.

These results suggest that LAC is less vulnerable to the impact of external shocks than other country-groups , but this interpretation could be misleading because it is necessary to consider the role of other sources of fluctuations. For instance, similar output volatility across groups would be consistent with a higher vulnerability in LAC, despite its higher exposure, if internal shocks were much larger in Other Middle Income countries than in Latin America, . This can be easily seen in the two-shock example described in section 2, where the ratio of volatilities across groups is

$$\left(\frac{\sigma_{Y,LAC}}{\sigma_{Y,OMI}}\right)^2 = \frac{\alpha_{LAC}\sigma^2_{X,LAC} + (\beta\sigma^2_I)_{LAC}}{\alpha_{OMI}\sigma^2_{X,OMI} + (\beta\sigma^2_I)_{OMI}},$$

so that if $(\beta\sigma^2_I)_{LAC} \ll (\beta\sigma^2_I)_{OMI}$, and $\sigma_{X,LAC}$ is not much larger than $\sigma_{X,OMI}$ α_{LAC} must be larger than α_{OMI} to for this ratio to be close to one. Another relevant consideration is the presence of composition issues. A group of countries may simultaneously be more resilient to some types of shocks and more vulnerable to other. For instance, if LAC were more resilient to terms of trade shocks than OMI their similar output volatility could be consistent with a higher vulnerability to fluctuations in international financial conditions or other sources of shocks. This discussion highlights that determining whether LAC is more or less vulnerable to some types of external shocks than other regions requires going beyond these simple summary statistics and taking a more structural look at the data.

4 A semi-structural approach

4.1 The empirical model

Assessing the relative vulnerability of Latin American countries to various external shocks vis-à-vis other regions and income groups requires identifying these shocks, their variances, and their dynamic output response across country groups. To this end I use a panel vector auto-regression (panel VAR). For a given country, in a particular group defined according to income level or region, the baseline structural model is:

$$A_0 x_{i,t} = \sum_{j=1}^{q} A_j x_{i,t-j} + \varepsilon_{it},$$

where $x_{i,t} = (z_{i,t}^{'}, y_{i,t}^{'})'$,

$$z_{i,t}^{'} = (GDPO_t, TT_{i,t}, R_t, HYS_t, GEO_{i,t}, CLIM_{i,t}, HUM_{i,t})$$

is a vector of exogenous variables including the (growth of) GDP of OECD countries ($GDPO$), the (growth of) terms-of-trade index (TT), the (growth of) international real interest rate (R), the (growth of) the high yield spread (HYS) (included only when looking at the post 1985 period because of data availability) and three indicator variables capturing the occurrence of geological, climatic, or human disasters (GEO, $CLIM$, and HUM respectively), as described in the previous section. The vector $y_{i,t}^{'} = (RER_{i,t}, GDP_{i,t})$ includes the endogenous variables, which in the benchmark specification correspond to GDP, the (growth of) real GDP per capita (in constant 2000 US dollars), and RER, the (growth of) real exchange rate.

The main identification assumption of this paper is that the variables in z do not respond to the y variables at any lags, which is equivalent to imposing a block diagonal structure in all the A matrices. This assumption implies that the terms of trade faced by a country, the GDP of rich countries, the incidence of natural disasters, and the international interest rate are not affected by the present or past economic performance of any particular country, but all this variables probably have a contemporaneous and lagged effect on this performance. For the developing and small developed countries included in this study, these assumptions are probably appropriate. The real exchange rate is included in the vector y because it is likely to respond to a country's economic performance.[4]

Given that prices of commodities that constitute the main export products of developing countries are set in international markets, and that neither the economic performance of rich countries nor the state of the global financial markets are likely to be affected by events occurring in any particular small country, these identification assumptions should not be very controversial for most groups under analysis. Although some concerns could be raised regarding the exogeneity of terms-of-trade shocks for some countries in the sample, a standard Granger causality cannot reject the hypothesis that output fluctuations do not Granger-cause terms of trade fluctuations. Perhaps the most controversial assumption is the exogeneity of the GDP of OECD countries to the output of small countries of Western Europe, or small High Income countries in general. This assumption was maintained in this group of countries for comparability purposes and the results were checked using World GDP instead of the GDP of OECD countries obtaining similar conclusions. In the case of natural disasters, although the manner in which these events are recorded could induce some

[4]Notice that by including the real exchange rate among the y assumes that these variables do not affect a country's terms of trade, the occurrence of natural disasters or the conditions of the international economy, but all these variables do affect the real exchange rate.

correlation between their frequency and a country's income, as discussed in section 2, this potential correlation is immaterial for the identification strategy, which comes from the time dimension of the data.

The block-diagonality assumption identifies the effect of the whole vector of z variables on each y variable, but identifying the individual impact of each z variable or the output effect of real exchange rate shocks (which are part of the y vector) requires further, sometimes more controversial assumptions. I first assume that the occurrence of natural disasters is fully exogenous, that is, unrelated not only to the y variables but also to the rest of the z variables. For the rest of the z variables, I follow the standard practice of imposing a lower-triangular structure on the matrix of their contemporaneous relations. In the benchmark case I assume that the contemporaneous causal order runs from the GDP of rich countries to the terms of trade of the sample countries, and to the international interest rate. This ordering permits the international interest rate to react contemporaneously to the state of the global economy, but imposes that the feedback from the international interest rate to global output operates only with a lag. As pointed out by Ahmed (2003), this assumption is standard in studies of country-region U.S. monetary policy that use quarterly or monthly data, but may be overly strong when using annual data, as in this case. Placing terms-of-trade below the GDP of rich countries assumes that changes in the demand for commodities resulting from variations in the state of the international economy translate into changes in the relative price of these products contemporaneously, but fluctuations in commodity prices affect rich countries' output only with a lag. This assumption is also common in VAR studies of U.S. monetary policy that control for the price puzzle by including indexes of commodity prices (see, for example, Christiano et al., 1998, and references therein). The ordering of the terms-of-trade index and the international interest rate also follows the typical arrangement of commodity price indexes and interest rates in these studies. Nevertheless, I also determined the impact of several alternative orderings on the results and found no effect on the main conclusions. For the case of the real exchange rate, I follow Ahmed (2003) and impose a block triangular structure on the matrix of contemporaneous relations among the y variables, which assumes that output responds contemporaneously to changes in the real exchange rate, but the latter responds to changes in a country's economic conditions only after a year.

A second important aspect of the model is that it assumes symmetry and linearity in the response of the VAR variables to positive and negative structural shocks, which rules out the possibility that an economy may respond differently to good and bad news and that the response to large shocks may differ from that to small shocks. This paper does not address these possibilities because it would require of a state dependent model that, given its complexity, would call for a narrower focus (e.g. one type of shock only).

The model described in equation (1) corresponds to a panel VAR that assumes that the dynamics, represented by the A matrices, are common across the different cross-sectional units (countries) included in the estimation (indexed by i). This is a standard assumption in this literature (see Broda, 2001, 2004; Ahmed, 2003; Uribe and Yue, 2006) because, given the length of the time series dimension of the data (around 30 annual observations), it is not possible to estimate country-specific dynamics without reducing importantly the set of exogenous shocks, the number of lags, or both. However, as noticed by Pesaran and Smith (1995), this assumption may lead to obtaining coefficients that underestimate (overestimate) the short (long) run impact of exogenous variables if the dynamics differ importantly across countries. This concern is unlikely to be important for the results because the scope for parameter heterogenity is reduced by grouping similar countries in the estimation.

The baseline version of the VAR includes variables in growth rates (first differences of the log) for several reasons. First, standard tests suggest the presence of a unit root in the series. The results of those tests are summarized in Table 2, whose different columns summarize the results of the ADF tests performed on a country-by-country basis. For each panel series, the first half of the table reports the fraction of countries within each group (corresponding to each row) in which the null of a unit root could not be rejected. It is clear that in most cases the test cannot reject the null of a unit-root for any series. The second half of the table presents the panel based unit-root test suggested by Levin, Lin, and Chu (2002) for each group and series , and also shows that the null of a unit root cannot be rejected at standard confidence levels against the alternative of a common auto-regressive coefficient.[5] Second, previous empirical papers in this literature (e.g. Ahmed, 2003, Broda, 2004, Loayza and Raddatz, 2006) have estimated difference stationary models, so this specification has the advantage of being more directly comparable with the existing results. Finally, on a more pragmatic note, the estimated impulse responses are better behaved in the model in differences than in alternative models specified in levels. Nevertheless, the model was also estimated in levels in the robustness section because of the well known low power of unit root tests.

Checking for the possibility of cointegration among the series in the panel VAR is important because the model is estimated in first differences. This is done using Pedroni (1999) test for co-integration in panels. The results of this test, which are reported in the last column of Table 2, cannot reject the hypothesis of no-cointegration at standard levels of confidence, except for the Western Europe region. Therefore, the baseline estimation will consider a standard VAR in differences for comparison purposes because the tests suggest estimating this type of model for all but one group of countries. Standard lag selection tests (Schwartz information criterion) indicate using two annual lags in the benchmark specification, both when considering the whole period or only the post 85 years.

The parameters of the model are separately estimated for each group of countries (Latin America, East Asia and Pacific, Western Europe, Other Middle Income, and High Income countries) for the periods 1974-2004 and 1986-2004. The model is separately estimated for the post Debt-Crisis subsample to look for changes in the dynamic response to shocks of the various country groups of countries in the latter part of the sample, but this comes at the cost of reducing importantly the time series dimension of the data and the variation of the exogenous variables (which experienced

[5] The results reported correspond to those obtained by augmenting the underlying Dickey-Fuller regressions used in the test with two lags for all the countries in a group (see Levin, Lin, and Chu. (2002)).

wider fluctuations during the 70s and early 80s), which are crucial for the identification of impulse-responses. Thus, the post Debt-Crisis estimates will most likely be less precise and have to be taken with caution, especially in those groups where the number of countries is small and the cross-sectional dimension cannot compensate for the short time dimension. The parameters of the model are estimated using a two-step procedure that first estimates the reduced form coefficients by OLS equation-by-equation, and next recovers the impulse-response functions (IRF) to each of the structural shocks using the reduced form coefficients and the estimated variance-covariance matrices of reduced form errors. The confidence bands for the IRF were estimated by parametric bootstrapping assuming normally distributed reduced form errors.[6]

4.2 Results

This section presents the results of the estimation of the panel VAR model for Latin America and the other groups of countries described above. It first shows and briefly discusses the impulse response functions of GDP per capita to the various external shocks for Latin American countries. Then it compares the relative ability of external shocks to account for output volatility across groups and performs a series of counterfactual experiments in every group of countries is hit by the "same" shock to compare their vulnerabilities.

4.2.1 The dynamic response of output in Latin America

The dynamic responses of output to the different external shocks in Latin American countries are depicted in Figures 1 and 2, for the periods post 73 and post 85 respectively. The different panels of this figure show the cumulative impulse-response functions (IRF) of the growth of real per capita GDP (GDP) to all the structural shocks obtained under the benchmark identification assumptions. Since the model was estimated in growth rates, the cumulative IRF show the cumulative output effect of each of these shocks. The continuous line depicts the point estimate of the IRF and the broken lines show the 90% confidence bands obtained from the empirical distribution.

Figure 1 shows that during the period 1974-2004 none of the disaster indicators seem to have a significant long run impact on output, although Climatic and Geological disasters show a small temporary negative effect. The rest of the shocks have the expected sign. A shock to the international real interest rate has a significantly negative impact on output, shocks to terms of trade has a significantly positive effect, and a shock to the GDP of rich countries has a positive albeit insignificant output impact. Shocks to the real exchange rate initially have a negative effect on output but on the long run generate a small expansion. Depreciations induce a short run contraction (consistent with

[6] The procedure can be briefly described as follows: (i) a random realization of the perturbations is simulated using the estimated variance-covariance matrix of the reduced form errors ; (ii) the initial values of the different variables, the baseline coefficients, and the simulated perturbations are used to simulate a new set of observations for the variables in the VAR; (iii) a new set of coefficients is estimated using these simulated observations ;(iv) the previous steps are repeated 100 times; (v) the IRF for each set of coefficients is obtained by bootstrapping; (vi) a 90% confidence interval for the IRF is constructed by taking the 5^{th} and 95^{th} percentile of the empirical distribution of the IRF on a point-by-point basis.

the balance-sheet view of their impact) and a long run Keynesian expansion. Notice, however, that even when looking at the shocks that have significant output effects, the magnitudes are typically small, never surpassing a 2 percent output movement.

The different panels of Figure 2 show that things are different post 1985. In particular, shocks to the real interest rate and the GDP of rich countries reverse their role, although only the real interest rate have a significant effect. This is most likely due to the inability of the model to separately identify the two shocks in a short time span. Shocks to terms of trade still have the significant positive effect documented in Figure 1. The estimation in this period also includes the high yield spread as an additional measure of the financial conditions faced by Latin American countries and emerging markets in general, which only becomes available in 1986. Shocks to this variable have a significantly negative output impact, which parallels the effect of the international real interest rate in the earliest period. However, the positive insignificant effect of the international real interest rate in this subsample is not driven by the inclusion of the spread in the model because excluding it yields similar results (not reported). Finally, the cumulative IRF of output with respect to real exchange rate shocks still exhibits the short run decline observed in Figure 1, but there is now no positive long run effect. For space reasons the detailed responses of the other groups of countries are not reported but only their differential response with respect to Latin America.[7]

4.2.2 The relative importance of external shocks across groups

Determining the ability of external shocks as a whole to account for the long run variance of output and the relative importance of each shock across the different groups of countries requires performing a variance decomposition exercise for the variables contained in the panel VAR.The results of this decomposition are separately reported for the post Bretton-Woods and post Debt Crises periods to compare their differences

Panel A of Table 3 reports the results for the whole 1974-2004 period. The different columns of the table report the fraction of the long run variance of output growth that can be attributed to each particular shock for each group of countries described in the rows, except for column (9) that adds the contribution of all external shocks, and column (10) that reports fraction of the long run variance unexplained by the model. Column (9) shows the following broad patterns. First, the fraction of the long-run variance of output that can be explained by the shocks included in this set is typically small, rarely exceeding 25 percent. This is consistent with Raddatz (2006) who documented even smaller magnitudes when looking at Low Income Countries. Second, external shocks in Latin America are relatively more important than in Other Middle Income countries, and typically less important than among countries in East Asia and Pacific, Western Europe, or High Income Countries.

The differences between Latin American, Western Europe, and High Income countries seem largely driven by the larger role of shocks to the GDP of OECD countries on the latter two groups. The importance of other external shocks in Latin America is actually larger than in the richer

[7]The different impulse-response functions estimated are available upon request.

countries of Western Europe and the High Income groups. Despite excluding from the sample the largest G7 OECD countries that largely dominate the GDP of OECD it is not surprising that the remaining rich countries included in the sample are highly synchronized with this indicator of the World business cycle.[8] The largest importance of external shocks in East Asia and Pacific than in Latin America mainly because of the importance of shocks to the real interest rate in the former group. Finally, the larger role of external shocks in Latin America than in Other Middle Income countries is a widespread phenomenon that is not concentrated on a particular type of shock.

Terms of trade shocks are particularly important in Latin America, followed by shocks to the real exchange rate. Shocks to the real interest rate are the most prominent in East Asia and Pacific, and shocks to the GDP of OECD countries are the main sources of fluctuations in Western Europe and High Income countries, although shocks to the real exchange rate are also important for Western European countries. In the case of Other Middle Income countries, shocks to the real interest rate play a larger role than other shocks, but all of them have a modest impact.

Panel B of Table 3 presents the variance decomposition for the period 1986-2004. External shocks explain a larger fraction of the variance in this period for three reasons, two statistical and one economic. The statistical reasons are the following: first, there is a mechanical effect resulting from the fewer degrees of freedom in this sample because the number of parameters is larger (due to the inclusion of the high yield spread) and the number of observations is smaller than in the full sample. Second, the impulse response functions underlying the variance decomposition are less precisely estimated in this sub-sample and more unstable, which increases the forecast errors associated with each shock and its contribution to output variance. The economic reason is that the high yield spread conveys useful information on the financial conditions faced by countries not captured on the other two common shocks; excluding the high yield spread from the estimation does not increase the explanatory power of the other common shocks (not reported).

Despite the higher importance of external shocks in this sub-sample, the broad patterns across groups are similar to those reported for the whole post Bretton-Woods period. External shocks are more important in Latin America than in Other Middle Income countries but less important than in East Asia and Pacific, Western Europe or High Income countries for the same reasons described above. The most salient differences with the overall sample are in the larger roles of terms of trade shocks in Latin America (which is now twice as large as in Panel A) and of shocks to the real interest rate in East Asia and Pacific (which increases in five percentage points). Another important difference is that the shocks to the high yield spread play an important role across all income groups.

Taking stock of the results reported in Table 3, the findings indicate that external shocks in Latin America are more important, in terms of their contribution to the long run output variance, than in Other Middle Income countries, but equally or somewhat less important than in richer countries such as those of East Asia and Pacific, Western Europe, or High Income countries because of the larger role of shocks to the international business cycle in these groups. This is a robust pattern

[8] Similar results are obtained if I use World's GDP instead of the GDP of OECD countries.

of the data present across sub-samples. This pattern is also observed in numerous unreported robustness exercises , such as estimating the models in levels instead of differences, adding aid flows, excluding the high yield spread, changing in the number of lags included in each type of model (levels and differences), changing the contemporaneous causal order among exogenous and endogenous variables (e.g. placing terms of trade before the GDP of rich countries in the VAR), controlling for hyperinflation episodes, using World GDP as a measure of the World Business Cycle instead of the GDP of rich countries, and using the U.S. CPI instead of the PPI to deflate the international real interest rate.

What does this pattern imply for the vulnerability and exposure of Latin American countries to external shocks vis-à-vis other regions and income groups? First, they suggest that Latin American countries may be more vulnerable to these shocks than the reference group given by Other Middle Income countries. This can be easily seen in equation (2). The higher importance of external shocks in Latin America than in Other Middle Income Countries means that the residual variance, associated with internal shocks, is larger in the latter group ($(\beta\sigma_I^2)_{LAC} \ll (\beta\sigma_I^2)_{OMI}$). As the two groups have similar output variance ($\sigma_{Y,LAC} \approx \sigma_{Y,OMI}$) and the variance of external shocks is also similar in LAC and OMI, ($\sigma_{X,LAC} \approx \sigma_{X,OMI}$) the higher importance of external shocks in LAC comes from a higher sensitivity to them ($\alpha_{LAC} > \alpha_{OMI}$). On the other hand, Latin American countries may be less vulnerable to external shocks than richer countries in East Asia and Pacific. In this case the fraction of variance explained by internal shocks is at best similar for the two groups ($(\beta\sigma_I^2)_{LAC} \approx (\beta\sigma_I^2)_{EAP}$), the variance of output is also similar ($\sigma_{Y,LAC} \approx \sigma_{Y,EAP}$), and the exposure to shocks is a bit higher in LAC ($\sigma_{X,LAC} > \sigma_{X,OMI}$). Simple algebra shows that in this case the vulnerability of LAC to external shocks has to be smaller than in EAP ($\alpha_{LAC} < \alpha_{EAP}$).

Still, the broad differences in vulnerability suggested by the discussion above may hide different degrees of vulnerability across shocks between LAC and other regions. This is probably the case considering the evidence presented that some of the overall differences across groups can be traced to the role of specific shocks. The next section explores these differences.

4.2.3 Estimating Differences in Vulnerability

Differences in the fraction of output variance explained by external shocks in a particular set of countries can result from differences in the typical size and persistence of these shocks or differences in the output response to these shocks. This section presents a series of counterfactual exercises aimed to isolate the differences in vulnerability across groups. This requires estimating the dynamic response of output to exactly the same shock across groups, which means that differences in size and persistence of structural shocks need to be controlled for.

Table 4 shows the estimated standard deviations of the various structural shocks for Latin America and the other groups of countries. Columns (1) and (2) show the standard deviations of the country-specific external shocks (terms of trade, and real exchange rate) and columns (3) to (5) the standard deviations of the global shocks. The results show that, except for the shocks to the real exchange rate in the post 1985 period, the estimated standard deviations of shocks in Latin

America are almost identical to those in Other Middle Income countries, and always higher than in East Asia and Pacific, Western Europe, and High Income Countries. Thus. controlling for the size of shocks is especially important to compare Latin America to other groups of countries, except for Other Middle Income countries.

Of course, even for similar shock sizes, differences in persistence can make shocks more important for some groups of countries. Figure 3 shows that this is unlikely to be the case. It shows the dynamic responses of terms-of-trade and the real-exchange-rate to their own shocks after controlling for shock size for different regions.. Each serie's pattern of decay shows the persistence of every shock across regions (i.e. the speed of decline). The patterns of persistence are almost identical across regions, which means that the shocks' dynamics are also similar and controlling for them is unlikely to change the results. The figures obtained for the post 85 period are similar (not reported).

The differences in vulnerability across groups of countries were estimated as follows.First, I computed the impulse response functions of output growth in each group of countries after hitting it with external shocks of the size and persistence observed in Latin America. With these counterfactual impulse-responses, I calculated the long-run output effect of each shock in every group and compare them to Latin America's. This provides a first measure of the differences in vulnerability; a group of countries with a larger output response to a given shock can be considered more vulnerable to that shock. A second measure of vulnerability that follows more closely the previous discussion compares the long run output variances resulting from a given shock across groups of countries (as determined by the variance of the 20 year ahead forecast error resulting only from that specific shock). If the pattern and sign of the output response were the same across groups and the only differences were in the size of the responses, this second measure would be equivalent to the one obtained from the differences in long run effects. Since this is not the case, this second measure provides a different characterization of vulnerability.[9]

The differences in the long run output effect of the various shocks between every group of countries and Latin America are presented in Table 5. Panel A reports the results for the 1974-2004 period, and Panel B those for the post-1985. In all cases, the table reports the level of significance of the estimated difference obtained from the bootstrapped empirical distributions of the underlying long run effects.[10] The most salient results are the following. First, terms of trade shocks have a larger output impact in Latin America than in other countries, although the differences are significant at the 10 percent level only in the post 85 period.[11] This is consistent with the results discussed in the previous section, and indicates that Latin America is more vulnerable to these shocks. Second, real exchange rate shocks increase output relatively more in Western Europe and

[9]This point can be clarified with the following example. Assume that in country A output first grows by 1 percent in response to a shock and then declines in 1 percent resulting in a zero long run output effect, while in country B output grows by 1 percent and then does not grow any more, resulting in a one percent long run increase. In this case, the long run effect will be higher in country B, but given the more erratic behavior of output in country A, the variance of the forecast error will be higher for country A.

[10]The bootstrapping procedure assumes independence of the residuals between Latin America and other groups because the models for different groups were separately estimated.

[11]The difference with High Income countries is marginally significant in the whole sample.

High Income countries than in Latin America. The differences cannot be easily related to variations in vulnerability because the sign of the output impact differs across groups, but since the long run effect in Latin America is small, this region is probably less vulnerable than the other two groups. Third, Western Europe and High Income countries are more vulnerable to shocks to the GDP of OECD countries than Latin America. Fourth, East Asia and Pacific and Other Middle Income countries are more vulnerable to Geological disasters than Latin America. High income countries also seem more vulnerable to these shocks for the whole sample period. Finally, during the post 85 period, shocks to the real international interest rate reduce output relatively more in East Asia and Pacific and Other Middle income countries than in Latin America but differences in vulnerability cannot be directly inferred from this finding because it partly comes from an insignificantly positive impact of real interest rate shocks in Latin America. Nevertheless, looking only at the association between vulnerability and the size of the output response (irrespective of the sign), only East Asia and Pacific seems to be more vulnerable than Latin America during this period.[12]

Table 6 presents the second measure of differences in vulnerability that corresponds to the ratio of the output variances resulting from a given shock across groups of countries. This measure follows from the discussion in section 2, and corresponds to the case described in equation (2) when $\sigma_I^2 = 0$ in both regions. The entries in the table correspond to the ratio of the long run (20 year ahead) variance of the forecast error associated with each shock (of common size across groups) in a given group of countries to the corresponding variance in Latin America. Since all the variance components are positive, there is no ambiguity coming from differences in signs. A value larger (smaller) than one indicates that a particular group is more (less) vulnerable than Latin America. The entries in the table also indicate the level of significance of the test of the hypothesis that the reported ratios are equal to one obtained under the same assumptions than in Table 5 and using the delta method.[13]

The salient features of the table are the following. Other Middle Income countries are less vulnerable to terms of trade shocks than Latin America. The other groups appear equally or less vulnerable, but the ratios estimated in all other cases are not significantly different from one. Latin American countries are also more vulnerable to shocks to the real exchange rate than Other Middle Income countries but less vulnerable than other groups, especially during the post 1985 period. A similar result emerges for the vulnerability to the shocks to the GDP of OECD countries; only Other Middle Income counties are less vulnerable to them than Latin America, although most of the ratios are not significantly different from one. Western Europe and High Income countries are less vulnerable than Latin America to shocks to the international real interest rate. On the contrary, East Asia and Pacific is significantly more vulnerable to these shocks. Finally, in the post debt crisis period Latin America is more vulnerable to shocks to the high yield spread than both, Other Middle Income and High Income countries, although the results are only marginally significant. The evidence for natural disasters does not show significant differences in vulnerability between Latin

[12] Figure 2 shows that the long run effect of the shock in Latin America is about 0.46 percent. Thus the effect on East Asia and Pacific is minus 1.48 percent.

[13] Assuming that $cov(x, y) = 0$, $var(x/y) = var(x)/y^2 + (x/y^2)^2 var(y)$.

America and other regions, except for the case of Geological disasters, to which countries in East Asia Pacific are more vulnerable.

Overall, the results from Tables 5 and 6 indicate that Latin American countries are more vulnerable to terms of trade shocks than all other groups, less vulnerable to shocks to the GDP of OECD and the real exchange rate than richer groups of countries, more vulnerable to almost all shocks than Other Middle Income countries, and less vulnerable to shocks to the real interest rate and geological disasters than East Asia and Pacific.

The last two columns of Table 6 present a summary measure of the proportional differences in vulnerability across regions. They show the ratios of the total variance of output growth that would result from hitting every group of countries with a common set of external shocks, both including and excluding natural disasters. The conclusion is consistent with the results from individual shocks: Latin American countries are more vulnerable to external shocks than Other Middle Income countries and less vulnerable than countries in East Asia and Pacific. There is no significant evidence of differences in vulnerability between Latin American countries, High Income countries, and those in Western Europe.

5 The role of structural characteristics

The previous sections established various stylized facts regarding the relative volatility of Latin American countries vis-à-vis other comparable groups and the ability of differences in exposure and vulnerability to external shocks to accounting for these differences. This section explores whether structural differences among groups of countries can explain their heterogeneous vulnerabilities to external shocks.

Several recent papers stress the role of factor and product market rigidities for the amplification of shocks at the macroeconomic level, the relevance of institutional development in the control of crises and management of shocks,[14] and the impact of the composition of the balance sheets of firms and banks in terms of currency denomination on the amplification of external shocks. Based on these theoretical linkages this section formally tests whether differences along these dimensions across countries can qualitatively and quantitatively explain their documented differences in vulnerabilities. This is done by allowing the dynamic responses estimated in the panel VAR model to depend on the degree of trade and capital flow openness, financial development, labor market flexibility, firm entry flexibility, and domestic deposit dollarization.

5.1 Empirical model

To estimate the role of various structural characteristics on the vulnerability of output to external shocks I modify the empirical model described in equation (1) to allow the dynamics represented by

[14] For the relation between factor market rigidities and amplification see, for example, Kiyotaki and Moore (1997), Bernanke and Gertler (1989), Caballero and Hamour (1994, 1996, 1998), Caballero and Krishnamurty (2001), Caballero et al. (2005), and Arellano and Mendoza (2002). For the role of institutional development, see Acemoglu et al. (2003), and for the role of liability dollarization see Levy-Yeyati (2005) and Bleakley and Cowan, (2005)

the A matrices to depend on these characteristics. The structural panel VAR can be now described as

$$A_{i,0}x_{i,t} = \sum_{j=1}^{q} A_{i,j}x_{i,t-j} + \varepsilon_{it}$$

where the notation is the same as above, except that the $A_{i,j}$ matrices vary across countries in a parametric way. In addition, I exclude natural disasters from this part of the analysis to reduce the number of parameters. Considering their small role they in explaining output volatility this should not be a major issue.[15] The identification assumptions are also the same as above, but I estimate a single model for the whole pool of countries instead of a different model per region because A matrices can now parametrically vary across countries.

The baseline model corresponds to a panel VAR that assumes that part of the coefficients in the A matrices are common across cross-sectional units. Under the identification assumptions the $A_{i,j}$ matrices have the following structure

$$A_{i,j} = \begin{bmatrix} a_{11}^{i,j} & 0 \\ a_{21}^{i,j} & a_{22}^{i,j} \end{bmatrix}$$

where the size of the different $a_{k,l}$ matrices conforms to the dimensions of the $z_{i,t}$ and $y_{i,t}$ vectors. The matrix $a_{21}^{i,j}$ captures the dynamic responses of the endogenous variables (RER and GDP) to changes in the exogenous ones. Since the interest lies in testing how a country's structural characteristics affect the output of various external shocks, which is captured on the $a_{21}^{i,j}$ coefficients, these coefficients are allowed to vary across countries according to

$$\begin{aligned} a_{21}^{i,j} &= \beta_0^j + \beta_1^j \times OPEN_i + \beta_2^j \times FDEV_i + \beta_3^j \times CAOPEN_i + \beta_4 \times LABOR_i + \beta_5 \times ENTRY_i \\ &\quad + \beta_6^j \times DOLLAR_i \end{aligned}$$

where $OPEN_i$, $FDEV_i$, $CAOPEN_i$, $LABOR_i$, $ENTRY_i$, and $DOLLAR_i$ are measures of trade openness, financial development, capital account openness, labor flexibility, firm entry flexibility, and domestic liability dollarization for country i (see Appendix 2 for a description). The rest of the coefficients that capture the dynamics of the exogenous and endogenous variables (the $a_{11}^{i,j}$ and $a_{22}^{i,j}$ coefficients respectively) are assumed common across countries. Considering the evidence shown above on the similarity of the persistence of shocks across regions this is a reasonable assumption.[16]

Following the specification estimated in section 4.2, this model also assumes symmetry in the role of structural characteristics on the amplification or dampening of positive and negative shocks. This is a non-trivial assumption because some of these characteristics may be more important in

[15] Including them does not affect importantly the results reported below.

[16] A previous version of the paper considered variables measuring the maturity composition of debt, but this resulted in a large reduction in the sample, which did not include any high income country.

the dampening of negative shocks than in the amplification of positive ones, as documented by Loayza and Raddatz (2006) for the case of terms of trade shocks. Thus, the interpretation of the estimated effects of each characteristic must proceed with caution. A variable that in the symmetric specification appears to increase the impact of a given shock may do so because it amplifies the positive realizations, which would be better from a welfare perspective than a variable that amplifies the impact of negative shocks. Nevertheless, the symmetric specification is appropriate because of the descriptive nature of this exercise.

5.2 Results

Making a detailed characterization of the structural determinants of external vulnerability is beyond the scope of this paper. Other papers have investigated in detail the role of structural characteristics on the amplification of external shocks, such as Loayza and Raddatz (2006) for terms of trade. This paper focuses on describing the impact of a wider set of shocks and requires imposing more controversial identification assumptions. Thus, the results reported here are not directly comparable with those of Loayza and Raddatz (2006), although they share the main patterns documented in that paper. This paper also restricts the sample of countries to the groups described above to improve the fit of the parametric model to the non-parametric differences in vulnerabilities documented above.[17] This comes at the cost of reducing the variation of exogenous shocks and structural characteristics in the sample, therefore, reducing the power of the estimation. Since the main purpose of this part of the analysis is to determine whether structural characteristics can explain the differences in vulnerabilities among the specific groups described above, it trades-off power and generality for an improved model fit. The rest of this section describes the estimated role of each structural characteristic in the baseline model, presents and discusses the results obtained under different specifications, and quantifies the ability of these characteristics to explain the estimated differences in sensitivity across groups of countries.

5.2.1 The Role of Structural Characteristics

Panels A and B of Table 7 report the results obtained from the estimation of the parameters of equations (2) and (3) in the post Bretton-Woods and post Debt-Crisis periods. Each entry displays the long run cumulative output effect of the shock described in that column, obtained when the various structural characteristics take the values described in that row. The structural characteristics are evaluated at their sample median, except that indicated in the respective rows. For instance, the row labeled Percentile 25 below Trade Openness displays the cumulative impulse responses obtained when all characteristics are taken at their median value except Trade Openness, which is evaluated at its 25^{th} sample percentile. Only the rows labeled Difference deviate from this rule and show the

[17]The model described in equation (2) exploits the country-by-country variation in responses and characteristics to identify the role of the latter in the amplification of shocks, not the average differences in responses across groups of countries. Restricting the sample to include only the "relevant" countries (i.e. those that belong to one of the groups) ensures that the model uses the variation among these countries only for identification and increase the ability of the model to match the average differences across groups.

difference between the impulse response obtained when each characteristic is evaluated at its 75 and 25 percentile levels. This difference measures the importance of that particular characteristic for the impact of each shock. The standard deviation of these differences obtained from their empirical distribution and their significance level are reported in parentheses.

Panel A shows that, for the post 73 period, terms of trade shocks have a positive and significant cumulative output effect when evaluated at the medians. Shocks to the international real interest rate and the real exchange rate have a negative significant effect. Shocks to the GDP of OECD countries have a positive but non-significant effect. The results reproduce the qualitative findings of Loayza and Raddatz (2006) that trade openness and firm flexibility amplify the output impact of terms of trade shocks (albeit the former non-significantly), and labor market flexibility and capital openness dampen it. This indicates that those findings are robust to including other shocks and reducing the sample. For shocks different from terms of trade the main findings are the following: (i) countries that are more open to capital flows are more synchronized with the international business cycle, (ii) financial development reduces, and labor market flexibility increases, the negative effect of real interest rate shocks, (iii) trade openness and labor flexibility make depreciations more contractive, while financial development, capital openness, and entry flexibility make them (relatively) more expansive. In this sample, the level of dollarization does not importantly affect the impact of any shock; the results obtained excluding dollarization are similar to those including it. However, dollarization is maintained as a characteristic because it will be shown next that it becomes relevant after 1985.

The results are somewhat different when only looking at the period after 1985 (see Panel B). The main contrast is that most of the long run effects evaluated at the median values of the variables are no significant because of the precision loss resulting from the reduction of the sample. Only the output impact of real exchange rate shocks is significant at standard confidence levels. The effect of shocks to the GDP of rich countries and the real interest rate change signs in this period, which is not surprising considering the shapes of the impulse responses to these shock documented in Figure 2 for Latin America, which is close to the median country in the sample. Most of the differential effects maintain their sign during this sub-period but there are important changes in their magnitude and significance. Capital openness now have little effect on the impact of shocks to the GDP of rich countries, while domestic financial development plays an amplifying role and the dampening effect of labor flexibility becomes significant (at the 20 percent level). With respect to terms of trade shocks, labor flexibility maintains its dampening effect but the amplifying impact of firm flexibility is smaller and non significant. No structural characteristic has a significant differential effect on shocks to the real interest rate, and only capital account openness seems to make countries more vulnerable to shocks to the high yield spread. Shocks to the real exchange rate are again amplified by trade openness and dampened by capital openness , but labor and entry flexibility do not significantly affect the output impact of these shocks in this period. However, domestic liability dollarization plays now a significant role in making depreciations more contractive, consistently with the presence of balance sheet effects and in contrast with its irrelevance in the estimation for the whole period, probably because the data on domestic dollarization used to build this variable comes precisely from the post debt crisis period. [18]

5.2.2 Robustness

The results reported in Table 7 are robust to several changes to the sample and specification. Excluding the degree of domestic dollarization. yields results similar to those reported in Table 7. All significant characteristics maintain their sign and in most cases also their significance (7 out of 8 characteristics in the whole period, and 3 out of 4 in the 1986-2004 sample). The only important difference is that in this new specification trade openness significantly reduces the transmission of terms of trade shocks in the 1986-2004 period. Other similar changes, such as including natural disasters (with a common effect across countries to maintain a reasonable number of degrees of freedom) or including measures of the exchange rate regime produces similar results to the baseline model.

The model was also estimated using all countries with available data instead of restricting the sample to countries in the groups described in section 3. The results are qualitatively similar; most of the characteristics that are significant at the 20 percent level in Table 7 maintain their sign (63 percent in the whole period and 89 percent in the 1986-2004 sub-sample), and most of the those that are significant at the 10 percent level also maintain their level of significance (63 percent in the whole period and 60 percent in the 1986-2004 sample). No significant characteristic experiences a significant change in its sign.

Overall, these checks indicate that the results from the baseline specification are very robust to changes in the specification and small changes in the sample (such as those that occur when one characteristic is dropped or added), and moderately robust to large changes in the sample, such as adding the whole set of low income countries.

5.2.3 How Well Does the Model Predict Differences in Vulnerability Across Regions?

The model estimated in Table 7 can be used to determine whether differences in structural characteristics across groups can account for the differences in vulnerability between Latin America and other groups of countries documented in section 4. This is achieved by computing the long-run output response of each group's typical country (i.e. a country with the within group median value of each characteristic) to every shock, calculating the difference with the predicted response of the typical Latin American country, and comparing these differences with those reported in Table 5.

Figure 4 summarizes the results of this exercise. Panel A plots the differences between every group and Latin America obtained from the non-parametric model of Table 5 (y-axis) against those resulting only from their differences in structural characteristics during the 1974-2004 period (x-axis). Panel B does the same for the 1986-2006 period. Each figure includes a 45-degree line for comparison (broken line) and a regression line displaying the relation between the parametric

[18] This is less likely to be an issue for highly persistent variables such as the degrees of labor and firm entry flexibility.

and non-parametric differences. The non-parametric differences that are statistically significant in Table 5 are indicated with a triangle. The two panels show that the model fits qualitatively well the differences in vulnerability across groups of countries, and in many cases also quantitatively well. The R-squares from regressing the parametric differences against the non-parametric ones are 0.58 for the whole period and 0.56 for the post 85 period, and the slope coefficient is close to one in both cases.

5.2.4 What drives the differences in vulnerability?

Having established that the parametric model is able to match some qualitative and quantitative differences in vulnerability between Latin America and other groups of countries, this section describes the characteristics that account for the most salient features of the statistically significant differences in vulnerability across groups. The role of each individual characteristic in explaining these differences is illustrated in Figure 5.

The figure has 8 panels, labeled A to H, each decomposing, for each significant difference documented in Table 5, the predicted differences in vulnerability to a given type of shock between a group of countries and Latin America.Because of the similitude of the results for Western Europe and High Income Countries, the figure reports the results for only one of these groups in each sample for reasons of space; for the period 1974-2004, it reports the results for Western Europe, and for 1986-2004 the results for High Income countries.

The leftmost point of each plot shows the predicted (long-run) output response of a typical Latin American country and each following point to the right is the predicted response after changing one of the structural characteristic to its median value in the group of countries indicated in the title of each plot.Therefore, the rightmost point is the predicted response of a typical country in that group and the distance between two consecutive points shows the marginal effect of each characteristic.

Panels A and B report the decomposition of the significant differences in the period 1974-2004. The higher levels of trade openness, capital openness, and financial development of Western European countries than in Latin America drive the higher output response to the World Business Cycle of the former (Panel A). These shocks, therefore, become more important the more integrated to the global economy a country is. The higher degrees of capital and financial development of Western Europe relative to Latin America also seem to explain the expansive effect of depreciations in the former during this period, as is shown in Panel B.

Panels C to H report the relevant cases for the period 1986-2004. The most salient feature of these figures is the important role of labor market flexibility for the predicted regional differences in vulnerabilities. Differences in this characteristic explains the larger impact of shocks to the real interest rate in East Asia and Pacific and Other Middle Income countries (Panels C and D), and the lower sensitivity of Other Middle Income and High Income countries to terms of trade shocks (Panels E and F). Finally, the higher response of output to shocks to the World Business Cycle and the real exchange rate in High Income countries again seems largely associated to their higher degrees of capital openness and financial development (Panels G and H).

Taking stock, these results show that differences in the degree of openness to trade and capital flows, financial development, flexibility in firms entry and labor markets, and the degree of domestic dollarization can explain several of the qualitative and quantitative differences in vulnerability between Latin America and other groups of countries. Therefore, these differences are at least partly driven by differences in fundamentals across regions. In particular, the higher vulnerability of Latin American countries to terms of trade shocks compared to other regions during recent years can be partly explained by their lower degree of labor market flexibility, and their weaker response to shocks to the world business cycle and real exchange rate compared to rich countries, to their smaller degrees of capital openness and financial underdevelopment. Regrettably, the results do not say much about differences in vulnerability to shocks such as those to the high yield spread. In some cases this is because their non-parametric estimates are insignificant, and in other cases because the parametric model does not match the impact of these shocks with precision. Surprisingly, the large differences on the degree of domestic dollarization across groups play little role in explaining their differences in vulnerabilities. They only explain part of the differences in vulnerability to real exchange rate shocks between Latin America and High Income countries, but their contribution is smaller than those associated with the degree of financial development and integration.

6 Conclusion

This paper has documented in detail the patterns of output volatility in Latin America and other comparison groups of countries, and explored the extent to which these patterns result from differences in exposure and vulnerability to external shocks across groups. The results show that Latin American countries are more vulnerable to several external shocks is than other middle income countries, but contrary to expectations and common wisdom, it is not significantly more vulnerable than the richer countries of East Asia and Pacific, Western Europe, or High Income countries in general. If these richer countries were exposed to the type of shocks that frequently hit Latin American countries, they would probably suffer higher output fluctuations than Latin America.

Regarding the sources of the high relative vulnerability of LAC than Other Middle Income countries, an important part can be explained by Latin America's lower level of labor flexibility, especially in the last 20 years. On the other hand, Latin America's small degree of capital account openness and financial development partly account for its smaller output response to fluctuations in the world business cycle or the real exchange rate, compared to richer groups of countries that are more integrated to the world economy. Somewhat surprisingly, differences in the currency composition of debt play only a minor role in explaining differences in vulnerability, although it might be argued that they affect a country's vulnerability only when in conjunction with an underdeveloped financial system.

Overall, the results suggest that the higher volatility of Latin America (and other emerging markets) compared to industrial countries is mainly driven by differences in their exposure to external shocks and not in their vulnerability to them. Of course, exposure may itself be associated with structural characteristics. For instance, Loayza and Raddatz (2006) show that the main role of financial development in the reduction of the output volatility resulting from terms of trade shocks comes from reducing the fluctuations in terms of trade rather than from smoothing the response to these shocks. This is consistent with explanations that attribute differences in volatility across countries to differences in the structure of production (see Koren and Tenreyro, 2006). However, since changing a country's exposure to external shocks is probably harder than lowering its vulnerability to them (think for instance on what would be required to change a country's structure of production), it might be necessary for countries in LAC to take measures to achieve an even lower vulnerability than in richer countries to compensate for their higher exposure. Thus, although there is no evidence that Latin America is too vulnerable to external shocks, in the short run it might still need to increase its resilience to compensate for its higher exposure.

7 References

Acemoglu, D., Johnson, S., Robinson, J, and Thaicharoen, Y. (2003). “Institutional Causes, Macroeconomic Symptoms, Volatility, Crises and Growth.” Journal of Monetary Economics 50: 49-123.

Ahmed, S. (2003). “Sources of Macroeconomic Fluctuations in Latin America and Implications for Choice of Exchange Rate Regime,” Journal of Development Economics, 72: 181-202.

Arellano, C., and Mendoza, E, G. (2002). “Credit Frictions and ‘Sudden Stops in Small Open Economies: An Equilibrium Business Cycle Framework for Emerging Markets Crises.” NBER Working Papers 8880.

Beck, T., A. Demirguc-Kunt, and R. Levine (2000). “A New Database on Financial Development and Structure.” World Bank Economic Review 14(3): 597-605.

Bernanke, B., Gertler, M., 1989. “Agency Costs, Net Worth, and Business Fluctuations”. American Economic Review 79, 14-31.

Bleakley, H., and Cowan, K., 2005. “Corporate Dollar Debt and Depreciations: Much Ado about Nothing?” Mimeo, University of Chicago.

Botero, J., S. Djankov, R. La Porta, F. Lopez-de-Silanes, and A. Shleifer (2004). “The Regulation of Labor.” Quarterly Journal of Economics (119): 1339-1382.

Broda, C. (2001). “Coping with Terms-of-trade Shocks: Pegs versus Floats.” American Economic Review 91(2):376-80.

Broda, C. (2004). “Terms-of-trade and Exchange Rate Regimes in Developing Countries.” Journal of International Economics 63(1): 31-58.

Caballero, R.J., Cowan, K., Engel, E.M.R.A., and Micco,A. (2005). “Effective Labor Regulation and Microeconomic Flexibility” NBER Working Paper 10744.

Caballero, R.J. and M.L.Hammour (1994). “The Cleansing Effect of Recessions.” American Economic Review 84(5): 1350-1368.

Caballero, R.J. and M.L.Hammour (1996). “On the Timing and Efficiency of Creative Destruction.” Quarterly Journal of Economics 111(3):805-852.

Caballero, R.J. and M.L.Hammour (1998). “The Macroeconomics of Specificity” Journal of Political Economy 106(4):724-767.

Caballero, R.J. and Krishnamurthy, A. (2001). “International and Domestic Collateral Constraints in a Model of Emerging Market Crises.” Journal of Monetary Economics 48(3): 513-548

Chang, R., Kaltani, L., and Loayza, N., 2005. “Openess Can be Good for Growth: The Role of Policy Complementarities”, Policy Research Working Paper No.3763 . The World Bank.

Chinn, M. and Ito, H. (2002) “Capital Account Liberalization, Institutions and Financial Development: Cross Country Evidence.” NBER Working Paper 8697.

Christiano, L., Eichenbaum, M., and Evans, C., 1998. "Monetary Policy Shocks: What Have We Learned and to What End?," NBER Working Papers 6400.

Fatas, A., Mihov, I., 2006. Policy Volatility, Institutions and Economic Growth. INSEAD, manuscript

Im, Kyung So., Pesaran, M. Jashem., and Shin, Y. (2003). "Testing for Unit Roots in Heterogeneous Panels." Journal of Econometrics (115):53-74.

Imbs, J., and Wacziarg, R. 2003. "Stages of Diversification", American Economic Review, vol. 93, no.1, March 2003.

International Monetary Fund, 2003. "Fund Assistance for Countries Facing Exogenous Shocks", Policy Development and Review Department, International Monetary Fund.

Kiyotaki, N., Moore, J., 1997. "Credit cycles". Journal of Political Economy 105, 211-248.

Koren, M., and Tenreyro, S. (2006). "Volatility and Development", Quarterly Journal of Economics, forthcoming.

Levin, A., Lin, Chien-Fu., and Chu, Chia-Shang J (2002). "Unit Root Tests in Panel Data: Asymptotic and Finite-Sample Properties." Journal of Econometrics (108):1-24

Levy-Yeyati, E., 2005. Financial Dollarization: Evaluating the Consequences. Economic Policy 21 (Issue 45), 63-118

Levy-Yeyati, E. and Sturzenegger, F., 2003. "A de facto Classification of Exchange Rate Regimes: A Methodological Note," American Economic Review, Vol. 93, No. 4, September 2003

Loayza, N.V., Raddatz, C., 2006. The Structural Determinants of External Vulnerability. World Bank Policy Research Working Paper.

Mendoza, E.G., 1995. The Terms of Trade, the Real Exchange Rate, and Economic Fluctuations. International Economic Review 36, 101-137.

O'Driscoll, G., E. Feulner, and M. A. O'Grady (2003). 2003 Index of Economic Freedom. The Heritage Foundation and the Wall Street Journal.

Pesaran, M., and Smith, R. (1995). "Estimating Long-run Relationships from Dynamic Heterogeneous Panels." Journal of Econometrics 68(1): 79-113.

Raddatz, C., (2006). "Are external shocks responsible for the instability of output in low-income-countries?" Journal of Development Economics, forthcoming.

Rose, A., 2005. "Does WTO Make Trade More Stable?", Open Economies Review, 16 (1), 7-22.

Skidmore, M., and Toya, H., 2002. "Do Natural Disasters Promote Long-Run Growth?," Economic Inquiry, vol. 40(4), 664-687.

Uribe, M., and Yue, V. (2006). "Country Spreads and Emerging Countries: Who Drives Whom?." Journal of International Economics, 69, 6-36

World Bank (2003). Doing Business. Washington, D.C.: The World Bank.

A Data description and sources

The main variables used in the paper are the following. Real GDP per-capita corresponds to the GDP per capita in constant 2000 U.S. dollars obtained from WDI. The terms-of-trade index is the ratio of export prices to import prices computed using the current and constant price values of exports and imports from the national accounts component of the Penn World Tables (version 6.1) and updated using the terms-of-trade data from WDI. All data is for the post Bretton-Woods period, 1974-2000. The real GDP of high-income countries corresponds to the real GDP per capita of high income OECD countries in constant 2000 U.S. dollars from WDI. The real international interest rate is the six-month LIBOR in US dollars minus the change in the U.S. Producers Price Index (PPI), both \ from the IFS. The High Yield Spread corresponds to the spread between the Merrill Lynch U.S. Corporate High Yield (yield to maturity) and the yield of US Generic Government Bond 10 years (that is 10 years T-bill). Data on these spread was obtained from Bloomberg. The real exchange rate correspond to the real effective exchange rate of the countries, computed by the author based on the bilateral trade flows data of Rose (2005) and the relative CPI and nominal exchange rates of each country with respect to all its trading partners, and complemented with data from the IFS.

The variables capturing the incidence of natural disasters are non-standard and deserve further discussion. Data for natural disasters were obtained from the Emergency Disasters Database (EM-DAT) maintained by the Center for Research on the Epidemiology of Disasters (CRED). This is a comprehensive database that includes data on the occurrence and effects of over 12,800 mass-disasters in the world since 1900, compiled from a diversity of sources. As a general principle, to enter into the database an event has to meet any of the following conditions: there are ten or more people reported killed; there are 100 or more people reported affected; a state of emergency is declared; or there is a call for international assistance. As in Skidmore and Toya (2002), disasters are classified into three categories. Geological disasters include earthquakes, land slides, volcano eruptions, and tidal waves. The second category is climatic disasters, which includes floods, droughts, extreme temperatures, and wind storms (e.g. hurricanes). The final category is "humanitarian disasters", and includes famines and epidemics. For each category, the incidence of disasters is the number of events in a given year that classify as large disasters according to the following criteria established by the International Monetary Fund (see IMF, 2003): the event affects at least half a percent of a country's population, or causes damages of at least half a percent of national GDP, or results in more than one fatality every 10,000 people.

The structural characteristics of the countries are captured in the following variables. Trade openness is measured as the (log) of the ratio of total trade to GDP. Financial development corresponds to the (log) of the ratio of the private credit provided by banks and other financial institutions to GDP, obtained from Beck, Demirguc-Kunt, and Levine (2000). When not available data on domestic credit to private sector (as a fraction of GDP) from WDI is used instead. Openness in capital account transactions is captured by the Chinn and Ito (2002) index.[19] The index is such

[19] The Ito-Chin index corresponds to the first principal components of the following 4 binary variables reported in

that a higher value indicates a higher degree of openness. The index of labor market flexibility is calculated from data in World Bank (2003) and is a weighted average of three indicators –flexibility of hiring, conditions of employment, and flexibility of firing– as in Botero et al. (2004). The original index was rescaled to range between 0 and 1, with higher values indicating more flexible labor markets. The index measuring the ease of firm entry was calculated from data in World Bank (2003) and O'Driscoll, Feulner, and O'Grady (2003), and is a weighted average of four indicators –registration procedures, cost of registration, days to registration, and burden entry regulations—as in Chang, Kaltani, and Loayza (2005). Data on domestic deposit dollarization comes from Levi-Yeyati (2005) and the exchange rate regime classifications used in robustness checks was obtained from Levy-Yeyati and Sturzenegger (2003).

the IMF's Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER): existence of multiple exchange rates, restrictions on current account, capital account transactions, and the existence of requirements to surrender exports proceedings.

Table 1. Output volatility and external shocks in Latin America and Other Regions

The reported volatilities correspond to the standard deviations of the growth rates of the underlying variables, except for the disasters, where they correspond to the average frequency of occurrence (disasters per year). For each region, the entries correspond to the median value across countries that belong to that group, except for the disaster variables where they correspond to the mean across countries. The standard deviation of each measure across countries is reported in parenthesis below each entry. Relative volatilities correspond to the ratio of the volatility of GDP per capita growth to each one of the input volatilities, except in the case of the disasters where they are the ratio of the volatility of GDP per capita growth to the implied standard deviation obtained by assuming that the occurrence of disasters follows a Bernoulli process.

	Post Bretton-Woods Period (1974-2004)					Post Debt Crisis Period (1986-2004)				
	LAC (1)	EAP (2)	WE (3)	OMI (4)	HIGH (5)	LAC (6)	EAP (7)	WE (8)	OMI (9)	HIGH (10)
Output volatility										
GDP per capita Growth	3.77	3.88	1.85	3.81	2.21	2.98	3.92	1.56	4.22	2.05
	(1.44)	(0.85)	(0.55)	(1.55)	(0.91)	(1.69)	(1.40)	(0.65)	(1.62)	(1.13)
Input Volatility										
Terms of Trade Growth	10.88	5.21	2.98	7.67	2.98	8.57	4.71	2.00	5.09	2.28
	(5.50)	(3.16)	(1.74)	(6.96)	(1.68)	(6.11)	(2.53)	(2.11)	(7.29)	(1.92)
Geological disasters	3.13	3.15	1.20	4.36	1.22	3.25	3.23	1.15	4.20	1.11
	(3.79)	(3.48)	(4.33)	(7.45)	(3.73)	(4.94)	(4.14)	(4.16)	(6.50)	(3.66)
Climatic Disasters	22.50	42.38	4.09	27.67	5.90	25.00	55.12	4.23	33.68	6.94
	(15.19)	(60.29)	(5.90)	(44.10)	(12.17)	(17.24)	(79.01)	(4.49)	(52.42)	(15.06)
Human Disasters	0.63	–	–	0.69	–	1.00	–	–	1.11	–
	(1.63)	–	–	(2.95)	–	(2.62)	–	–	(4.71)	–
Real Exchange Rate Growth	13.80	6.83	4.80	11.40	5.02	12.28	7.57	4.62	8.82	4.96
	(64.18)	(5.05)	(1.40)	(12.86)	(1.45)	(19.10)	(4.78)	(1.90)	(15.91)	(1.86)
Relative Volatilities of GDP growth with respect to										
Terms of trade	0.35	0.74	0.62	0.50	0.74	0.35	0.83	0.78	0.83	0.90
Geological Disasters	1.24	1.27	1.56	0.91	1.84	0.95	1.25	1.37	1.05	1.87
Climatic Disasters	0.22	0.16	0.47	0.19	0.40	0.16	0.16	0.38	0.19	0.32
Real Exchange Rate	0.27	0.57	0.39	0.33	0.44	0.24	0.52	0.34	0.48	0.41

Table 2. Unit Root Tests

The table shows the results of country-by-country and panel unit root tests performed for the main series used in the paper. The first half of the table (columns (1) to (3)) shows, for each region and group of countries, the fraction of countries in that region in which a standard, country-by-country augmented Dickey Fuller test could not reject the null of a unit root. The second half (columns (4) to (6)) shows the p-values of the Levin-Lin-Chu (2002) panel unit root test obtained for each variable within each region. The tests allow for an intercept and trend, use two lags in the augmentation of the ADF regression for each country, and use the Newey-West bandwith selection with the Bartlett kernel for the estimation of the long run variance of the series. Column (7) reports the p-value obtained for the panel-rho statistic of Pedroni's panel cointegration test.

	Fraction of countries that cannot reject UR in ADF test			P-values of Levin-Lin-Chu UR test			Pedroni's Cointegration test (panel-rho)
Groups	GDP per capita (1)	Terms of Trade (2)	Real Exchange Rate (3)	GDP per capita (4)	Terms of Trade (5)	Real Exchange Rate (6)	(7)
Regions							
Latin America and Caribbean	0.67	0.62	0.90	0.34	0.95	0.73	0.13
East Asia and Pacific	0.82	0.82	0.64	0.93	0.44	0.89	0.37
Western Europe	0.60	0.70	0.50	0.87	0.50	0.15	0.05
Income Groups							
Other Middle Income	0.95	0.80	0.72	0.97	0.45	0.90	0.44
High Income	0.67	0.73	0.53	0.74	0.53	0.17	0.15

Table 3. The contribution of external shocks to the variance of GDP per capita. Latin America and Other Regions.

Each entry of the table in columns (1) to (8) corresponds to the fraction of the variance of the 20 year ahead forecast error that can be explained by each external shock. Column (9) adds up the contribution of all external shocks and column (10) is the complement. The top half of the table repors the estiamtes for the period 1974-2004 and the bottom half the estimates for the 1986-2004 period.

	GDP OECD	Terms of Trade	Internat. Real Int. Rate	Real Exchange Rate	High yield spread	Geological Disaster	Climatic Disaster	Human Disasters	Total External Shocks	Rest
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1974-2004										
Latin America and Caribbean	0.37	5.38	2.31	4.93	–	0.48	0.81	0.12	14.39	85.61
East Asia and Pacific	2.80	1.04	9.65	3.05	–	1.65	0.38	–	18.57	81.43
Western Europe	15.71	0.83	1.05	5.41	–	0.33	0.95	–	24.27	75.73
Other Middle Income	0.56	0.71	1.62	0.98	–	0.55	0.34	–	4.76	95.24
High Income countries	8.40	0.30	2.28	2.67	–	0.45	0.89	–	14.99	85.01
1986-2004										
Latin America and Caribbean	2.09	11.30	2.12	3.67	4.81	0.35	0.24	0.25	24.83	75.17
East Asia and Pacific	6.06	1.34	14.36	6.03	6.24	2.90	0.22	–	37.14	62.86
Western Europe	10.49	0.95	2.98	7.63	7.19	0.74	0.74	–	30.71	69.29
Other Middle Income	0.44	0.08	3.59	0.21	4.24	1.07	0.11	–	9.72	90.28
High Income countries	9.95	1.38	0.69	2.41	5.91	0.27	0.83	–	21.43	78.57

Table 4. The variances of structural shocks across country groups

The reported figures correspond to the estimated standard deviations of the structural shocks described in the columns in each of the models and regions or groups of countries described in the rows. Panel A reports the values estimated for the 1974-2004 period, and Panel B those estimated for the 1986-2004 period.

Subperiods/Groups	Std. dev shocks to Terms of Trade (1)	Std. dev shocks to Real Exchange Rate (2)	Std dev. Shocks to GDP OECD (3)	Std. dev. Shocks to Int. Real Int. Rate (4)	Std. Dev. Shocks to High Yield Spread (5)
A. Whole period (1974-2004)					
Regions					
Latin America and Caribbean	0.13	0.20	0.01	0.02	–
	(0.004)	(0.006)	(0.000)	(0.001)	–
East Asia and Pacific	0.06	0.10	–	–	–
	(0.002)	(0.004)	–	–	–
Western Europe	0.03	0.05	–	–	–
	(0.001)	(0.002)	–	–	–
Income Groups					
Other Middle Income	0.12	0.20	–	–	–
	(0.004)	(0.006)	–	–	–
High Income	0.03	0.05	–	–	–
	(0.001)	(0.002)	–	–	–
B. Post 1985 period					
Regions					
Latin America and Caribbean	0.10	0.13	0.01	0.02	0.22
	(0.004)	(0.005)	(0.000)	(0.001)	(0.011)
East Asia and Pacific	0.04	0.09	–	–	–
	(0.003)	(0.004)	–	–	–
Western Europe	0.02	0.04	–	–	–
	(0.001)	(0.002)	–	–	–
Income Groups					
Other Middle Income	0.09	0.21	–	–	–
	(0.004)	(0.009)	–	–	–
High Income	0.03	0.05	–	–	–
	(0.001)	(0.002)	–	–	–

Table 5. Estimated differences in long run output effect between various groups of countries and Latin America

The numbers reported in the table correspond of the difference between the 20 year cumulative output effect of the various shocks in each of the groups of countries indicated in the rows and Latin America. The top of the table reports the estimates for the 1974-2004 period, and the bottom half the estimates for the 1986-2004 period.

* = significant at 10 percent level, ** = significant at 5 percent level.

Estimated differences in long run effects	GDP OECD	Terms of Trade	Internat. Real Int. Rate	High yield spread	Real Exchange Rate	Geological Disaster	Climatic Disaster
	(1)	(2)	(3)	(5)	(6)	(7)	(8)
1974-2004							
East Asia and Pacific	-0.21	-0.44	-0.16	–	-1.01	-5.81*	-0.30
Western Europe	0.99*	-1.06	0.43	–	3.32**	-4.39	-0.72
Other Middle Income	-0.83	-0.11	0.29		-0.66	-6.04**	-0.08
High Income	0.80	-1.40	0.35	–	2.53**	-5.53**	0.21
1986-2004							
East Asia and Pacific	1.15	-0.47	-1.93**	0.35	-0.16	-8.23*	-0.07
Western Europe	0.99**	-2.62*	-0.03	-0.34	3.01**	-0.11	-1.19
Other Middle Income	0.59	-1.22*	-0.83*	0.49	-0.31	-5.73*	-0.16
High Income	1.31**	-2.09*	-0.38	0.06	2.50**	-0.66	0.05

Table 6. Estimated vulnerabilities of various groups of countries with respect to Latin America

The numbers reported in the table correspond of the ratio of the long run output variance attributed to the various shock in each of the groups of countries to that estimated for Latin America. The top of the table reports the estimates for the 1974-2004 period, and the bottom half the estimates for the 1986-2004 period. * = significant at 10 percent level, ** = significant at 5 percent level.

Period / Income Group	GDP OECD	Terms of Trade	Internat. Real Int. Rate	High yield spread	Real Exchange Rate	Geological Disaster	Climatic Disaster	Total	Total without disasters
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Panel A: 1974-2004									
Regions									
East Asia and Pacific	5.86	0.72	3.35**	–	2.06	2.29	0.27	1.84	1.84
Western Europe	8.89*	0.49	0.09**	–	4.28**	0.37	1.44	2.10	2.10
Income Groups									
Other Middle Income	0.95	0.27*	0.65	–	0.10**	1.42	0.25	0.29**	0.29**
High Income	7.01	0.27	0.31*	–	2.81	0.72	1.24	1.40	1.43
Panel B: 1986-2004									
Regions									
East Asia and Pacific	4.73**	1.02	11.50**	2.72	4.48**	11.88**	1.07	3.32**	3.22**
Western Europe	1.45	0.42	0.41	0.60	3.56**	1.63	5.20	1.21	1.16
Income Groups									
Other Middle Income	0.29	0.03**	2.47	0.15	0.26	5.29	0.53	0.40**	0.33**
High Income	2.46	1.01	0.17*	0.34	4.88**	1.02	6.46	1.77	1.74

Table 7. The Role of Structural Characteristics

Different columns describe the various shocks considered and different rows indicate the values taken by the structural characteristics included in the model (parameter configurations). The figures correspond to the long-run (20 year) cumulative output effect of each shock under each parameter configuration. The *Cumm. Effect at the Medians,* row displays the effects obtained when all structural characteristics are evaluated at their sample medians. The following rows show the effects obtained when each individual characteristic is allowed to vary between its 25th and 75th sample percentile levels in turn. The structural characteristic that is varying is indicated in underlined typeface. The rows labeled *Difference* show, for each characteristic, the difference between the impulse response obtained when that characteristic is evaluated at its 75 and 25 percentile levels.

+ = significant at 20 percent level ; * = significant at 10 percent level; ** = significant at 5 percent level.

	A. Post Bretton Woods Period (1974-2004)				B. Post Debt Crisis Period (1986-2004)				
Structural Characteristic	Shock to GDP OECD (1)	Shock to Terms of Trade (2)	Shock to Int. Real Int. Rate (3)	Shock to Real Exchange Rate (4)	Shock to GDP OECD (5)	Shock to Terms of Trade (6)	Shock to Int. Real Int. Rate (7)	Shock to High yield Spread (8)	Shock to Real Exchange Rate (9)
Cumm. effect at the medians									
	0.11	1.07**	-0.79**	-0.64**	-0.58+	0.32	0.21	-0.11	-0.66**
	(0.35)	(0.35)	(0.28)	(0.27)	(0.38)	(0.43)	(0.34)	(0.38)	(0.30)
<u>Trade</u>									
Percentile 25	0.06	1.02	-0.94	-0.23	-0.89	0.16	0.46	-0.33	-0.37
Percentile 75	0.06	1.20	-0.53	-1.14	-0.19	0.45	-0.04	0.27	-1.04
Difference	0.00	0.19	0.42	-0.92**	0.70	0.29	-0.50	0.60	-0.66**
	(0.50)	(0.53)	(0.39)	(0.25)	(0.51)	(0.57)	(0.44)	(0.59)	(0.33)
<u>Financial development</u>									
Percentile 25	-0.23	0.95	-1.12	-0.89	-1.20	0.02	0.22	-0.04	-0.94
Percentile 75	0.54	1.20	-0.44	-0.30	0.18	0.77	0.23	-0.16	-0.28
Difference	0.77	0.26	0.68+	0.59*	1.38+	0.74	0.01	-0.12	0.66
	(0.76)	(0.66)	(0.57)	(0.39)	(0.86)	(0.83)	(0.66)	(0.90)	(0.48)
<u>Capital Openness</u>									
Percentile 25	-0.18	1.11	-0.67	-0.91	-0.63	0.34	0.33	0.16	-1.05
Percentile 75	0.51	0.94	-0.91	-0.27	-0.51	0.27	0.10	-0.58	-0.18
Difference	0.68+	-0.16	-0.24	0.64**	0.12	-0.07	-0.23	-0.74+	0.87**
	(0.46)	(0.40)	(0.32)	(0.27)	(0.45)	(0.50)	(0.40)	(0.51)	(0.30)
<u>Labor Flexibility</u>									
Percentile 25	0.31	1.27	-0.61	-0.52	-0.34	0.75	0.34	-0.15	-0.64
Percentile 75	-0.24	0.71	-1.09	-0.83	-0.98	-0.39	0.01	-0.03	-0.69
Difference	-0.55	-0.56*	-0.48+	-0.31+	-0.65+	-1.14**	-0.33	0.12	-0.05
	(0.50)	(0.43)	(0.33)	(0.23)	(0.46)	(0.48)	(0.40)	(0.52)	(0.30)
<u>Firm Flexibility</u>									
Percentile 25	0.10	0.71	-0.90	-0.92	-0.54	0.15	0.14	-0.14	-0.68
Percentile 75	-0.08	1.44	-0.55	-0.25	-0.64	0.56	0.32	-0.05	-0.62
Difference	-0.17	0.73+	0.34	0.66*	-0.09	0.41	0.18	0.10	0.06
	(0.76)	(0.66)	(0.52)	(0.39)	(0.76)	(0.67)	(0.54)	(0.75)	(0.54)
<u>Dollarization</u>									
Percentile 25	0.25	1.21	-0.81	-0.65	-0.37	0.47	0.20	0.01	-0.51
Percentile 75	-0.08	0.87	-0.77	-0.63	-0.86	0.15	0.24	-0.26	-0.86
Difference	-0.33	-0.34	0.04	0.02	-0.49	-0.32	0.04	-0.27	-0.35*
	(0.35)	(0.34)	(0.29)	(0.20)	(0.44)	(0.38)	(0.36)	(0.45)	(0.18)

Table A1. Sample Description

The different columns of the table describe the values of the structural characteristics of the set of countries included in the paper by region and income group.

Group and Country Name	Trade openness	Financial development	Capital Openness	Labor Market Flexibility	Firm Entry Flexibility	Domestic Dollarization	Income
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
East Asia and Pacific							
Australia	3.57	-0.65	1.36	0.64	0.89		High
China	3.47	-0.05	-1.23	0.53	0.61	7.17	
Hong Kong, China	5.48	0.40	2.68	0.73	0.94	48.98	High
Indonesia	3.98	-1.24	1.99	0.43	0.45	19.72	
Korea, Rep.	4.18	-0.16	-0.55	0.49	0.70		OMI
Malaysia	4.98	-0.15	1.51	0.75	0.77	2.67	OMI
New Zealand	4.07	-0.41	1.81	0.68	0.93	3.70	High
Papua New Guinea	4.57	-1.72	-0.34	0.74	0.67	5.15	OMI
Philippines	4.24	-1.11	-0.47	0.40	0.63	25.37	OMI
Singapore		-0.05	2.16	0.80	0.92		High
Thailand	4.35	-0.26	-0.04	0.39	0.75	0.52	OMI
Latin America and Caribbean							
Argentina	2.95	-1.77	-0.15	0.34	0.69	33.63	LAC
Bolivia	3.91	-1.27	0.75	0.34	0.52	58.46	LAC
Brazil	2.99	-1.25	-1.49	0.22	0.45		LAC
Chile	4.02	-0.77	-0.92	0.50	0.78	9.87	LAC
Colombia	3.51	-1.32	-1.48	0.41	0.65	0.33	LAC
Costa Rica	4.36	-1.64	-0.36	0.37	0.64	38.71	LAC
Dominican Republic	4.22	-1.32	-1.42	0.51	0.60	16.04	LAC
Ecuador	4.01	-1.52	0.00	0.45	0.51	23.60	LAC
El Salvador	4.09	-1.20	-0.29	0.31	0.59	4.69	LAC
Guatemala	3.75	-1.86	0.80	0.35	0.56	0.79	LAC
Haiti	3.73	-2.13	0.52	0.40	0.32	33.53	LAC
Honduras	4.33	-1.18	0.07	0.44	0.56	22.73	LAC
Jamaica	4.55	-1.39	-0.03	0.66	0.76	23.06	LAC
Mexico	3.67	-1.69	0.83	0.23	0.66	7.28	LAC
Nicaragua	4.16	-1.20	0.28	0.39	0.62	61.75	LAC
Panama	5.05	-0.54	2.68	0.21	0.78		LAC
Paraguay	4.06	-1.70	-0.43	0.27	0.50	45.19	LAC
Peru	3.53	-1.92	0.38	0.27	0.59	46.60	LAC
Trinidad and Tobago	4.44	-0.87	0.48		0.50	23.22	LAC
Uruguay	3.71	-1.18	1.14	0.61	0.68	77.17	LAC
Venezuela, RB	3.90	-1.16	0.65	0.25	0.55	0.83	LAC
Western Europe							
Austria	4.30	-0.22	1.80	0.70	0.74	1.90	High
Belgium	4.91	-0.80	1.63	0.52	0.80		High
Canada	4.10	-0.20	2.68	0.66	0.94		High
Denmark	4.23	-0.72	1.32	0.75	0.91	3.44	High
Finland	4.09	-0.54	1.71	0.45	0.85	3.18	High
Greece	3.84	-0.97	-0.23	0.33	0.63	22.95	High
Ireland	4.82	-0.38	0.83	0.51	0.88		High
Netherlands	4.68	0.10	2.62	0.46	0.80	5.16	High
Norway	4.31	-0.12	0.77	0.59	0.82	3.72	High
Portugal	4.15	-0.20	0.38	0.21	0.65		High
Spain	3.71	-0.25	0.58	0.30	0.68	1.82	High
Sweden	4.20	-0.03	1.70	0.58	0.84	1.45	High
Switzerland	4.25	0.32	2.68	0.64	0.79	0.25	High
Other Middle Income Countries not included in regional groups							
Algeria	4.04	-1.24	-1.37	0.54	0.66		OMI
Botswana	4.64	-2.14	0.07	0.65	0.62		OMI
Egypt, Arab Rep.	3.99	-1.11	-0.70	0.41	0.59	34.69	OMI
Hungary	4.54	-1.20	-0.10	0.46	0.76	20.20	OMI
Iran, Islamic Rep.	3.68	-1.29	-0.83	0.48	0.63		OMI
Jordan	4.79	-0.48	0.11	0.40	0.69	22.42	OMI
Mauritius	4.77	-0.99	-0.13		0.55	7.28	OMI
Morocco	4.06	-1.14	-1.22	0.49	0.82	0.45	OMI
South Africa	3.93	-0.17	-1.15	0.64	0.77	2.37	OMI
Sri Lanka	4.29	-1.65	-0.40	0.58	0.74	19.96	OMI
Syrian Arab Republic	4.04	-2.64	-1.65	0.55	0.65	5.62	OMI
Tunisia	4.43	-0.50	-0.93	0.43	0.78		OMI
Turkey	3.59	-2.14	-0.94	0.45	0.77	40.77	OMI
High Income Countries not included in regional groups							
Israel	4.50		-0.19	0.62	0.83	29.36	High

Figure 1. Cumulative Impulse Response Functions of GDP to External Shocks in Latin America, 1974-2006.

The different figures show the cumulative output effect of a time zero, one standard deviation orthogonal shock to the variable indicated at the top of the figure, except for the cases of Climatic, Geological, and Human disasters, which report the cumulative impulse response to the occurrence of one of these events. The time horizon is in years.

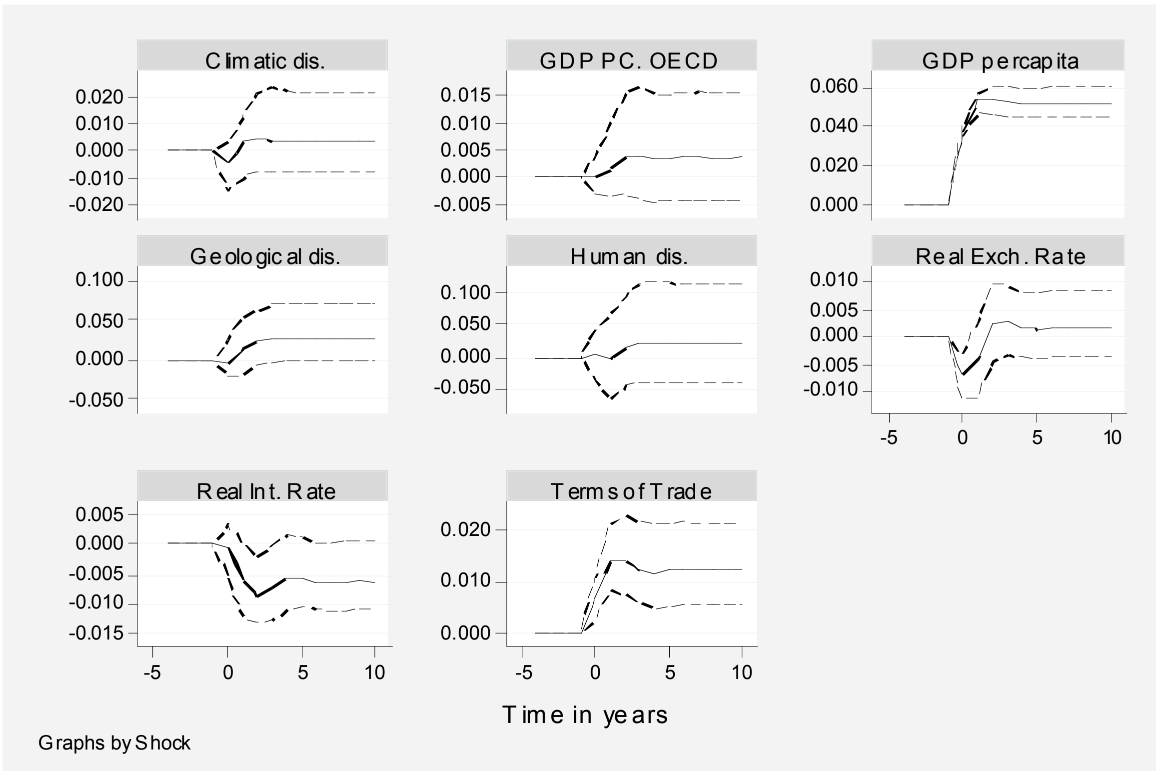


Figure 2. Cumulative Impulse Response Functions of GDP to External Shocks in Latin America, 1986-2004

The different figures show the cumulative output effect of a time zero, one standard deviation orthogonal shock to the variable indicated at the top of the figure, except for the cases of Climatic, Geological, and Human disasters, which report the cumulative impulse response to the occurrence of one of these events. The time horizon is in years.

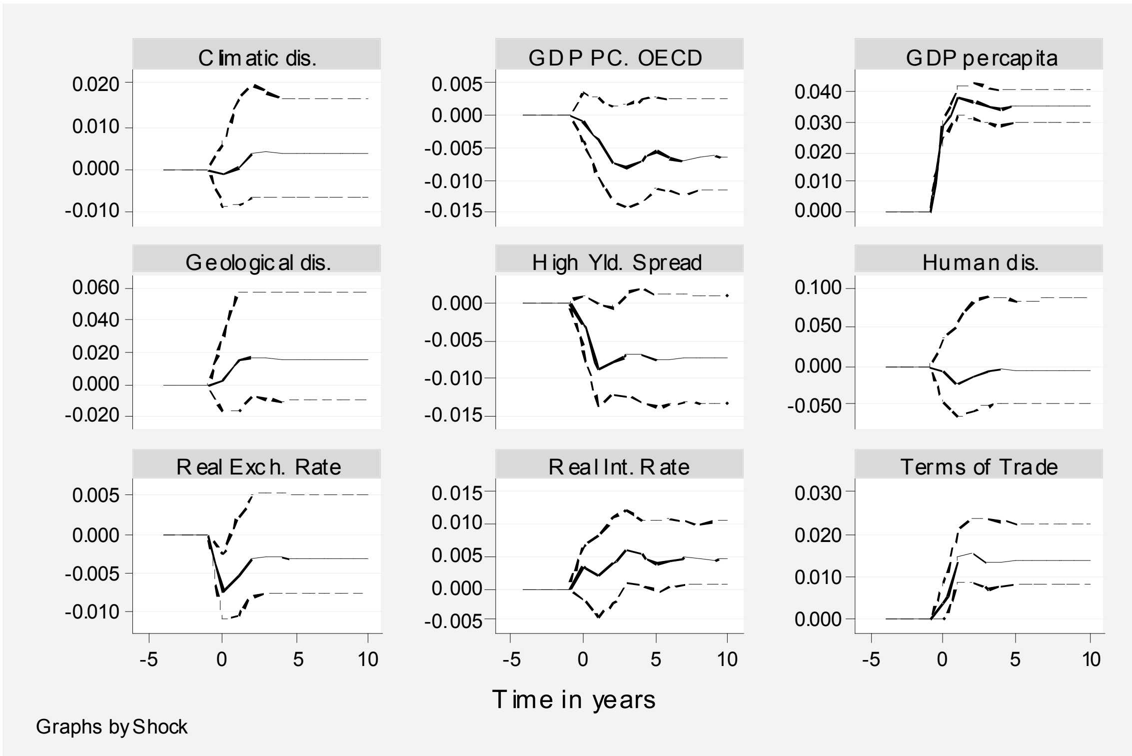
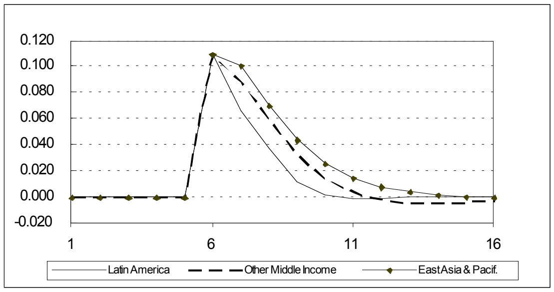


Figure 3. The persistence of shocks is similar across groups of countries

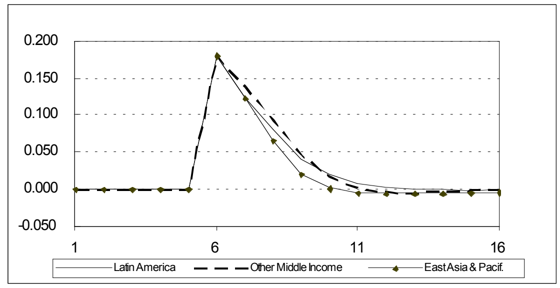
The different panels of the figure plot the dynamic response of shocks to terms of trade and the real exchange rate to their own perturbation (i.e. the pattern of persistence of each shock) after normalizing by differences in the size of the perturbation across groups of countries. The top half shows the dynamics obtained in the model in levels and the bottom half the dynamics obtained in the model in differences.

3 Lags in Levels

Terms of trade shocks

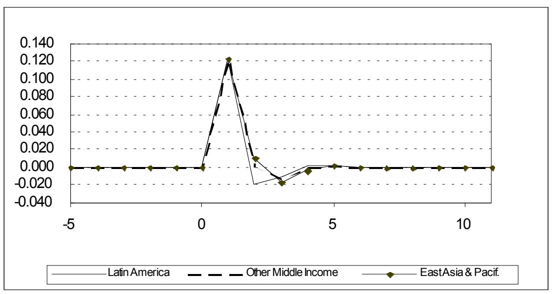


Real Exchange Rate shocks



2 Lags in Differences

Terms of trade shocks



Real Exchange Rate shocks

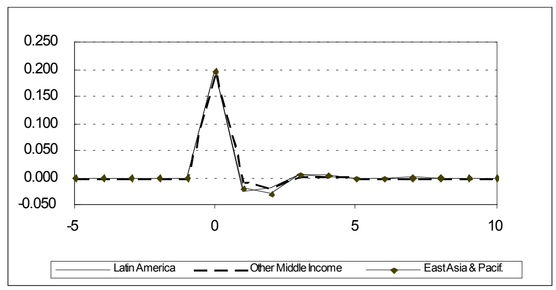
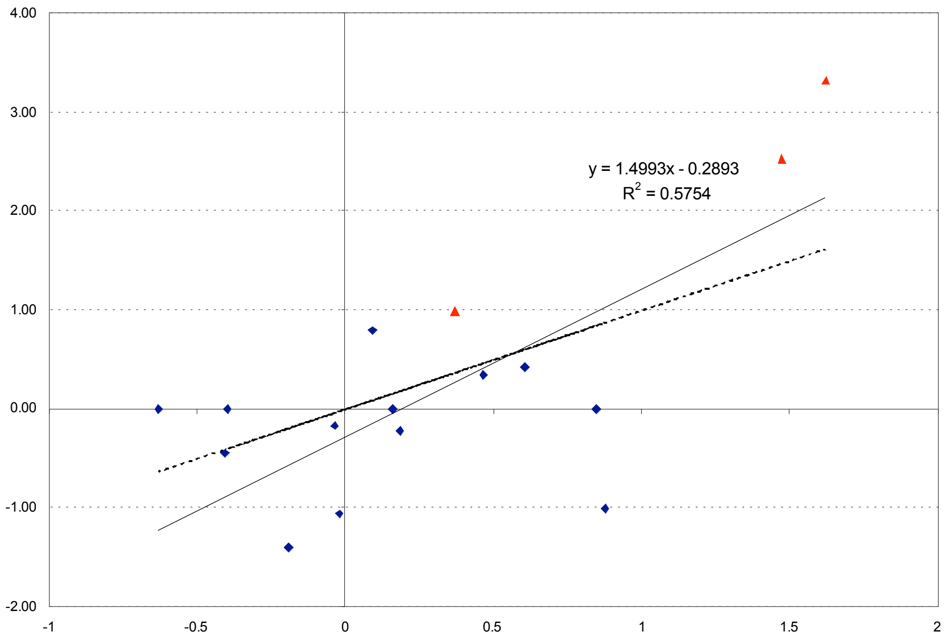


Figure 4. Parametric and Non-parametric Differences in Vulnerability Across Regions

The figures compare the differences in the long-run output response of various regions relative to Latin America obtained from non-parametric (y-axis) and parametric estimates. The points labeled with a triangle are those differences that are significant in the non-parametric estimation. The broken line is a 45-degree line. The continuous line is from a fitted OLS regression, whose coefficients and R2 are displayed in each figure. Panels A and B show the figures for the period 1974-2004, and 1986-2004 respectively.

A. Period 1974-2004



B. Period 1986-2004

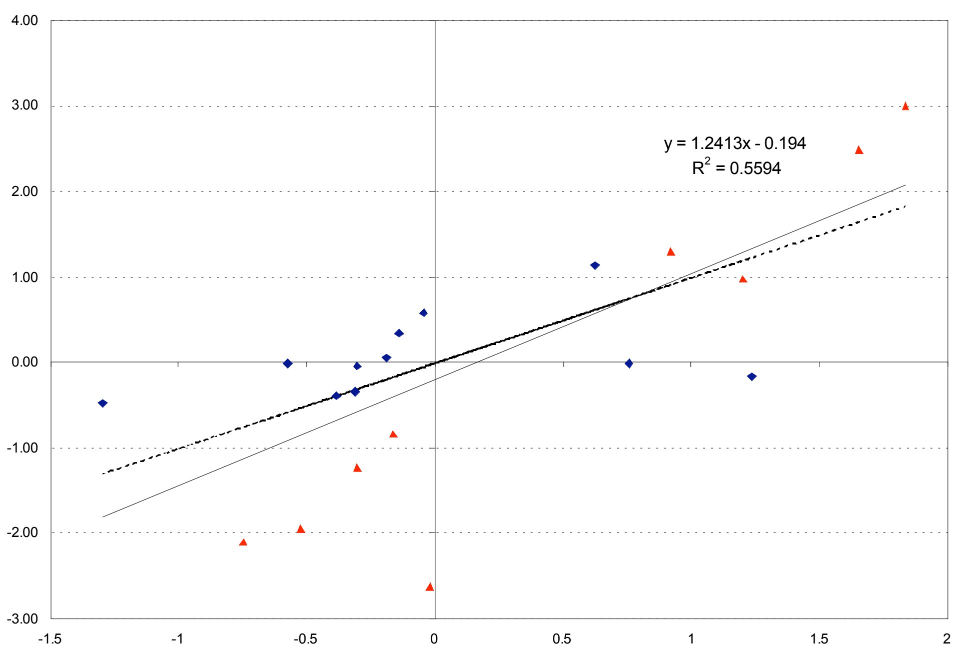


Figure 11. The role of structural factors explaining the differential responses of Latin America, Other Middle Income Countries, and East Asia and Pacific

The various panels of the figure show the role of trade openness, financial development, capital openness, labor flexibility, firm entry flexibility, and domestic dollarization in explaining the significant differential responses documented for different groups of countries relative to Latin America to various external shocks. Each figure shows first (on the left, labeled Lac) the estimated long run output effect of each shock with the structural characteristics of Latin American countries. Each additional point to the right shows the output effect of the shock described in the title of each panel when an additional structural characteristic takes the median value observed in the group of countries described in the title of each panel. Thus, the distance between two consecutive points shows the marginal contribution of each characteristic to the overall difference between a group of countries and Latin America, and the rightmost point shows the estimated response for the corresponding group. The period over which the difference is estimated is also indicated in the title of each panel. Panels A and B report decompositions estimated for the period 1974-2004, and Panels C to H for the period 1984-2004.