The Transmission of US Shocks To Latin American Economies

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Abstract: This paper studies the transmission properties of US shocks to six Latin American countries. US shocks are extracted using the new two-step procedure of Canova and De Nicolo' (1999) and treated as exogenous with respect to Latin American economies. We show that US shocks explain variable but significant proportion of the fluctuations in inflation, money and the trade balance. The effect on output, however, depends on the country. Both terms of trade and interest rate channels play a role in transmission but their relative importance depends on the type of shocks. Furthermore, while comovements of output in response to US shocks are small, comovements of inflation and nominal balances in response to US shocks are large and positive. Finally, neither the exchange rate regime nor the degree of dollarization matter for the transmission of US shocks to Latin America. Few policy implications are drawn in the conclusions.

Keywords: Structural Shocks, Business Cycles, Transmission, Exchange Rate Regimes.

JEL Classifications: C68, E32, F11.

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1 INTRODUCTION

1 Introduction

In the last 20 years several researchers have examined sources of cyclical movements in US economic activity using a variety of techniques. The findings, however, have often been contradictory, see e.g. Blanchard (1989), King, Plosser, Stock and Watson (1991), Cooley and Ohanian (1991), Christiano and Eichenbaum (1992), Gali (1992) and (1999) among others. Interest in the sources of cyclical fluctuations stems from two different angles. First, researchers engaged in constructing models of the business cycle are interested in knowing whether a small number of disturbances is sufficient to capture the dynamics of the actual data, and in characterizing their typology. Second, policymakers care about what drives the cycle when making day to day decisions about the conduct of monetary and fiscal policy. If, as widely perceived, fluctuations are undesirable and demand shocks are largely responsible, there may be a role for aggregate Keynesian-type policies cushioning the economy. On the other hand, as often emphasized in the real business cycle literature, if cyclical fluctuations in economic activity are the optimal response to unforeseen disturbances, rather than mitigating fluctuations per se, a more appropriate role for the government is to reduce economically relevant uncertainties.

For open and/or interdependent economies the question of what generates cyclical movements in economic activity becomes more complicated, since internal and external shocks maybe at work simultaneously and international transmission may occur via trade in goods or financial assets. Several authors have tried to distinguished among these factors in the G-7 or OECD economies (see e.g. Amhed, et. al. (1993), Canova and Marrinan (1998), Prasad (1999), Canova and De Nicolò (2000)) but the conclusions appear to depend on underlying assumptions.

For LDC countries the question of which source (internal vs. external) and which transmission mechanism (common shocks, goods or asset markets) is responsible for cyclical fluctuations becomes crucial in two respects. First, when discussing the sustainability of exchange rate regimes, the literature has often emphasized that asymmetric shocks (both in the sense of being idiosyncratic and of not showing any lagged spillover across countries) can make the task hard, if not impossible. Hence, detecting whether shocks are common and, if they are not, whether internal or external shocks dominate and through which channels are transmitted, may indicate whether the lack of monetary independence would create imbalances leading to the abandonment of the currency arrangement. Second, in the 1970 and early 1980's, LDC countries typically had autharkic financial markets and transmission, if any, occurred via changes in the terms of trade and through adjustments in the current account balance. The last 10 years have witnessed a remarkable process of liberalization of domestic financial markets in many LDC countries and a substantial increase of the financial interdependencies with the US. Hence, one would like to know whether it is still the goods markets or it is financial markets which transmit foreign shocks.
1 INTRODUCTION

In this paper we study the extent and the features of the transmission of structural US shocks to Mexico, Panama, Ecuador, Argentina, Uruguay and Peru. We chose these six countries for several reasons. First, they include both large and small countries in the continent which have both large and small trading ties with the US. Second, they are among the small number of Latin American countries for which it was possible to construct a consistent and coherent data set for macroeconomic variables for a sufficiently long period of time. Third, these countries provide a wide spectrum of experiences as far as monetary arrangements are concerned, covering situations with flexible rates and no dollarization (Mexico) at one extreme, with complete dollarization (Panama, and starting from the year, 2000 Ecuador) at the other extreme, and intermediate cases (Argentina, Uruguay and Peru) with partial dollarization and different exchange rate arrangements.

Our work is interested in answering four questions. First, we would like to know what is the contribution of US shocks to domestic fluctuations in Latin America. While this question is not new, most of the results currently available are derived identifying external shocks in a non-structural way. Second, we would like to know whether the transmission of US shocks occurs, if any, via goods "nancial markets. Third, we would like to construct a set of stylized facts about the comovements of continental macroeconomic variables in response to US shocks. Fourth, we would like to know if the exchange rate regime and the degree of dollarization of the economy matters for the transmission of the shocks. We are particularly concerned here with the transmission of US monetary disturbances and with whether partial or total absence of national monetary policy results in destabilizing movements of other domestic macrovariables.

We identify structural shocks in the US using the two-step procedure of Canova and De Nicolo' (1999) which rst extract orthogonal innovations from a reduced form residuals and then studies their informational content using aggregate macroeconomic theory. We attempt to identify three types of shocks: shock that move the aggregate supply, shocks that move the aggregate demand because of changes in the real side of the economy and shocks that move the aggregate demand because of changes in the monetary side of the economy. The basic intuition used to identify structural disturbances is that (temporary positive) supply shocks should generate positive transitory output responses, negative transitory responses in ination and a positive transitory responses in real balances; (temporary positive) real demand disturbances should generate positive transitory responses in output and ination and negative transitory responses in real balances; (temporarily positive) nominal demand disturbances should generate positive temporary responses of output, ination and real balances. For the sample 1983:1-1999:4 our approach extracts one supply disturbance, two monetary disturbances and one shock which is clearly of demand type, but depending on the assumptions made, can be nominal or real. We show that these shocks generate reasonable responses in the variables of the system and that they have easily interpretable time paths. We then feed these shocks as exogenous into VARs for each of the Latin American economy.
and examine each of the questions of interest in turn.

Four major conclusions can be drawn from our analysis. First, US shocks are important in accounting for the variability of several domestic variables, including inflation, money supplies and the trade balance. The effect on output depends on the countries and foreign shocks explain between 4 and 46% of its variability. Second, both the terms of trade channel and the interest rate channel play a role in transmitting US shocks to Latin American economies. Their relative importance however depends on the type of shocks: supply shocks are primarily transmitted through terms of trade movements, while demand and monetary disturbances appear to feed into Latin American economies primarily through their effect on domestic interest rates. Third, the sign, the magnitude and the persistence of the responses of macroeconomic variables to US shocks depends on the type of disturbances we are considering. In general, while Latin American output responses to US shocks are small, inflation and nominal balances positively comove with US inflation and nominal balances in response to US shocks. We interpret this finding as suggestive of the lack of common output cycles across the continent. Fourth, the exchange rate regime and/or the degree of dollarization of the economy appear not to matter for transmission. The response of domestic nominal balances to US monetary shocks is more persistent for economies which are either partially or totally dollarized, but apart from this it is hard to find regularities which would set apart the two groups of countries. Whether this is due to data problems, short samples, mixture of different exchange regimes or to the presence of a Latin American factor dominating other features we can not tell. Overall, our results suggest the that prospect of full dollarization of certain Latin American countries will not be particularly costly, given the current pattern of transmission, and that the sustainability of the arrangement may well depend on the type of shocks which hit the US economy.

Several papers have partially addressed some of the issues we discuss here. For example Agenor, McDermott and Prasad (1999) have documented the properties of cyclical fluctuations in developing countries and compared them to those of developed ones, while Fackler and Roger (1995), Hoomaister and Roldos (1997), Prasad (1999), Amhed (1999) and Amhed and Loungani (1999) study the relative importance of foreign sources of shocks for cyclical fluctuations in selected developing countries. On the other hand, Arora and Cerisola (2000) examine whether and how changes US interest rates affect spreads and real variables in developing economies, while Frankel, Schmukler and Serven (2000) and Borensztein, Zettelmeyer, Philippin (2000) examine whether variations in US interest rates are transmitted to domestic interest rates in developing countries and whether the transmission properties depend on the exchange rate regime. Similarly, Goldfajn and Olivares (2000) study whether Costa Rica, Panama and Argentina, three countries with different exchange rate regimes, react differently to financial and real foreign shocks. The issues surrounding the dollarization of the economy are well summarized in Berg and Borensztein (2000) who also provide some rough calculations of the magnitude of welfare costs and benefits (for calculations based on
specify dynamic general equilibrium models see also Cooley and Quadrini (2000), Schmitt-Grohe and Uribe (2000), Mendoza (2000)). Relative to this literature our work improves in several dimensions. First, we identify external (US) shocks in a more structural way, attempt to extract multiple sources of structural disturbances and thoroughly study their transmission properties to a number of Latin American economies. Second, we simultaneously examine the importance of trade and financial channels are relevant in transmitting US shocks to Latin America. Third, instead of reporting simple unconditional correlations, we construct stylized facts on the comovement of macrovariables within the continent exploiting the causal link running from US variables to Latin American ones.

The reminder of the paper is organized as follows. The next section presents the specification of the reduced form model, the procedure used to extract US shocks and the issues connected with the specification of the model for each country. Section 3 discusses the results of our investigation. Section 4 draws some policy implication and concludes.

2 The specification of the empirical model

To thoroughly address the question of the transmission of shocks, it would be necessary to specify international models where contemporaneous and lagged feedbacks could be simultaneously accounted for. Although there are attempts in this direction (see Canova and Ciccarelli (1999), Ciccarelli and Rebucci (2000)) the task is unfeasible in our context for several reasons. First, the quality of the data for Latin America countries is debatable and it is only in the 1990's there has been an effort to harmonize the collection and the definitions with OECD standards. Second, hyperinflations, currency and exchange rate crises are common episodes in Latin America and this makes some domestic time series not only non-stationary but also hardly representative of those situations one would like to examine in discussing the international transmission of shocks. Third, a robust examination of existing interdependencies requires somewhat "regular" cycles and, given the short time series of data available, degrees of freedom restrictions prevent any reasonable multicountry specification.

For all these reasons we proceed on bilateral basis with the US on one side and one Latin American country at a time on the other, eschewing from the analysis any possible interdependence within Latin American economies. In this setup any correlation between US and Latin American variables is likely to be unidirectional, going from the US to the other country. If this is the case, the specification and the estimation of the statistical model could be significantly simplified. To verify this hypothesis we run a VAR for each of the country-US pair and examine whether the US block is exogenous with respect to the block of domestic variables. Confirming a-priori expectations, the null hypothesis that current and lag values of Latin American variables have zero
coefficient in the US block is not rejected. Given this result, we proceed in two steps. First, we estimate a reduced form model with US variables and identify structural shocks. Here we employ the procedure recently developed by Canova and De Nicolò (1999) which employs sign restrictions to sort out the informational content of reduced form residuals. Second, we estimate a reduced form model for each of the countries under consideration, taking as exogenous the time series for the US structural shocks we have constructed. The interest is in measuring the magnitude, the direction and the persistence of the response of domestic variables to identified US shocks and in comparing these responses across the countries in the American continent.

2.1 Measuring US Shocks

The reduced form model for the US economy we use is an unrestricted VAR including a measure of real activity (IP), of inflation (INF), of the slope of the term structure of the nominal interest rates (TERM) and of real balances (M/P). The sample covers quarterly data from 1983:1 to 1999:4; all series are seasonally adjusted and are obtained from the IFS tape.

Reduced form VAR models, which include real activity, inflation and measures of interest rates and money have been frequently used in the literature (see e.g. Sims (1980); Farmer (1997)). In addition to a standard measures of industrial production and CPI inflation, here we employ the slope of the term structure, because of its higher predictive power for real activity and inflation relative to a single measure of short-term interest rates, and real balances. This variable is used because it allows us to distinguish monetary from other types of real demand disturbances. Note also that the slope of the term structure has information about nominal impulses that other important macroeconomic variables, such as unemployment or real wages, may not have. Visual inspection of the linearly detrended time series shows that there is no compelling evidence of non-stationarities in the four variables. For a VAR model with (detrended) log output, inflation, slope of the term structure and real balances, both the Akaike and Schwarz criteria indicate that the dynamics are well described by a VAR(1).

To identify structural shocks from reduced form residuals we proceed in two steps. First, we construct innovations having the property of being serially and contemporaneously uncorrelated. Second, we use economic theory to tell us whether any of the components of the orthogonal innovation vector has a meaningful economic interpretation. Canova and De Nicolò (1999) argued that economic theory provides important sign restrictions on the dynamic cross correlations of certain pair of variables in response to structural shocks and that this information is generic, in the sense of being common to macro theories with different microeconomic foundations. For example, a large class of models imply that a shock that shifts the aggregate supply curve will move output

\footnote{Faust (1998) and Uhlig (1999) have proposed identification approaches which also use sign restrictions to catalogue shocks. Differences are highlighted in Canova and De Nicolò (1999).}
and in\textsuperscript{ation} in the opposite direction, while a shock that shifts the aggregate demand curve will move output and in\textsuperscript{ation} in the same direction. Furthermore, real demand shocks are expected to produce negative joint comovements of in\textsuperscript{ation} and real balances while monetary disturbances produce positive joint comovements of in\textsuperscript{ation} and real balances. Hence, the process of identifi\textsuperscript{cation} requires computing the pairwise cross correlation function of the variables of interest in response to the uncorrelated shocks we have constructed and checking if the sign restrictions imposed by theory are satisfied. Appendix A describes in detail the technical issues involved with the approach. Notice that it is possible that not all the shocks are identifi\textsuperscript{ed} (i.e. the three sign restrictions are not simultaneously verifi\textsuperscript{ed}) or that more than one shock is of one type. This re\textsuperscript{flect} the fact that sign restrictions provide only bounds in the identifi\textsuperscript{cation} process and that in a small VAR system identifi\textsuperscript{cation} may be incomplete, in the sense that with four variables may be impossible to distinguish between say, money demand or money supply shocks, or shocks that affect Federal Funds Market or T-bill market.

There are several difference between the identifi\textsuperscript{cation} approach used here and the one commonly used in structural VARs (SVAR). In SVAR one typically imposes "economic" or "sluggish" zero restrictions on impact coefficients or on the long run multipliers of shocks and interprets the resulting long run (short run) dynamics. The imposition of economically or informationally motivated zero restrictions achieves two goals at once: disentangle the reduced form shocks and make them structurally interpretable. The two-step approach we propose separates the statistical problem of producing orthogonal shocks from the economic one of interpreting them. Furthermore, instead of imposing zero restrictions on the contemporaneous impact of shocks, restrictions which may be inconsistent with a large class of general equilibrium models (see Canova and Pina (1998)), or on their long run effects, for which small sample biases may be substantial (see Faust and Leeper (1997)), we use sign restrictions on a vector of cross correlations to assign a structural interpretation to orthogonal disturbances.

Figures 1-3 present, respectively, the estimated cross correlation function for in\textsuperscript{ation} and industrial production, in\textsuperscript{ation} and real balances and real balances and industrial production, conditional on the four orthogonalized VAR innovations for \( r = -4, \ldots, 0, 1; \ldots; 4 \); the impulse response of the variables of the system to each orthogonal innovations; and the time path of the four disturbances. The orthogonalization we have selected satisfies the sign restrictions on the contemporaneous cross-correlation for a wide range of leads and lags and allows us to identify all four shocks.

Figure 1 shows that the first and the third orthogonal shocks generate positive pairwise contemporaneous cross correlations functions over the relevant range and therefore qualify as "monetary" disturbances. The second orthogonal shock produces cross correlation functions for in\textsuperscript{ation} and output and in\textsuperscript{ation} and real balances with negative contemporaneous values, and a positive contemporaneous cross correlation function for real balances and output. Hence, this shock quali\textsuperscript{fies}
as a "supply" disturbance. The informational content of the fourth orthogonal shock is less clear: it produces a positive cross correlation function between industrial production and inflation and therefore qualifies as a demand disturbance. However, the sign of the cross correlation function for the other two pairs of variables depends on whether contemporaneous, leads or lags values are used and there is a range of values for which the cross correlation function of real balances with output or inflation is not significantly different from zero. Lacking any better way to call it, we label it "demand" disturbance.

Figure 2 shows that the two identified monetary disturbances have distinct effects on real activity, inflation and the slope of the term structure. The first monetary shock produces sizable responses of industrial production (median contemporaneous impact 0.80) and of real balances. These increases are associated with temporary increases in inflation and in the slope of the term structure (which increase by 300 basis points on impact). The second monetary disturbance does not have significant short run real effects, but the impact response of inflation is strong. Furthermore, this disturbance makes the slope of the term structure decline for about two years after the shock. Since also output declines over this interval (through level is -0.08), it may be reasonable to suspect that long term rates have increased relative to short term ones, suggesting the presence of strong expected inflation effects.

The second orthogonal (supply) shock produces a small increase in industrial production accompanied by a decline in inflation on impact, but this tendency is quickly reversed with inflation increasing and output declining for about four years. Real balances increase in response to the disturbance and long term rates increase relative to short term ones. Over the adjustment path there is some overshooting and eventually inflation falls relative to its trend and industrial production increases. The adjustments produced by the fourth orthogonal shock appear to be those typically associated with a real demand shock: contractionary shocks of this type make industrial production, inflation and real balances decline on impact and the long term rate falls relative to the short term one.

Figure 3 shows that the volatility of the first shock (monetary) is approximately constant over the sample except for two large movements in 1984 and 1987. This shock also displays significant negative movements at the so-called Romer and Romer dates, periods where the Fed pursued contractionary monetary policy actions. The third shock (monetary) shows a period of higher volatility between 1983 and 1990. In particular, we observe a negative spike at the time of the plaza agreement (1985) and in the last quarter of 1986. After that date the volatility seems to decline even though the persistence appears to increase. The second shock also displays a decline in volatility after 1990, but no tendency for serial correlation to increase. Fluctuations larger than usual in this series occur in 1985 and 1987 (positive) and end of 1986 and 1989 (negative). Note that this last negative effect occurred in conjunction with a major stock market crash. The fourth
orthogonal shock has one large positive spikes around 1984 and a negative one in 1986, both of
which seemed to be associated with substantial changes in consumer and government spending.
Also this shock displays a decline in volatility after 1990.

In sum, our identification approach recovers two monetary disturbances, one supply disturbance
and one demand disturbance whose historical path is reasonable and which produce dynamics which
are structurally interpretable. Our task would be to examine whether and how these US structural
shocks are transmitted to Latin America economies. We address four questions. First, we would
like to know whether these shocks have any significant influence on Latin American macro variables.
In other words, we are interested in knowing if the volatility of domestic macroeconomic variables is
primarily due to external or internal disturbances. Second, we would like to know whether structural
US shocks are transmitted to domestic macroeconomic variables primarily through relative price
changes (terms of trade effects) or through changes in interest rates (financial effects). Third,
we would like to know whether there is a continental business cycle in the sense that US and
Latin American variables comove in response to shocks. Fourth, we are interested in knowing
if the pattern of transmission depends on the exchange rate regime adopted by the country. In
particular, we are curious as to whether the responses to shocks of countries which are partially or
totally dollarized differ from those in countries where national currencies are used.

2.2 The Latin America response to US shocks

The reduced form model we use here is a VARX model where the interdependencies among do-

cumentary variables are unrestricted, while estimated US structural shocks enter exogenously in the
specification. Formally, the model we use has the form:

\[ X_t = \Theta(X_{t-1}) + \Phi(X_{t-1})e_t + \epsilon_t \]

where \( \Theta(X) = \Theta_1 + \cdots + \Theta_p \Phi^p \) and \( \Phi(X_{t-1}) = 1 + \cdots + \cdots + \Phi_q \Phi_q \).
\( \epsilon_t \) are the structural US shocks which are assumed to be uncorrelated with the error \( \epsilon_t \), i.e.
\( \epsilon_t \) is independent from \( \epsilon_t \). Our interest centers in the polynomial \( \Phi(X) \) which measures the response of domestic variables to foreign shocks. In what follows we present 68% bands for the effects of each of the four shocks at steps from 0 to 12
computed using a Monte Carlo exercise.²

The sample we use covers quarterly data for the 1990's since it is only for this period that a
consistent quarterly data set can be obtained. All variables are from the IFS database except when
noted. All series are preliminarily linearly detrended and deseasonalized with a set of deterministic

²If we let \( \gamma = \text{vec} \{ \alpha(\ell), \beta(\ell) \} \) and \( W = \text{vec} \{ X_{t-1} e_t \} \) then for a flat prior for \( \gamma \),
the posterior for \( \gamma \) is inverted Wishart with precision \( \sigma^2 \text{OLS} \) and degrees of freedom equal to the number of observations and the posterior of \( \gamma \)
is normal with mean \( \gamma_{\text{ols}} \) and variance \( (W^\dagger W)^{-1} \). Hence it is straightforward to draw from the posterior for \( \gamma \) to
construct bands around the estimates of \( \beta(\ell) \).
2 THE SPECIFICATION OF THE EMPIRICAL MODEL

dummies. We consider measures of log detrended manufacturing production in all countries except Ecuador where we use a quarterly GDP series \(^3\), detrended CPI inflation, log detrended M1, detrended ratio of exports to imports, detrended terms of trade (not available for Uruguay and Panama) and a measure of domestic interest rates. When available short term market rates are used. Otherwise, we use deposit rates for 3-6 months.

The countries we consider in this study are Mexico, Uruguay, Peru\(^\prime\), Argentina, Ecuador and Panama. These countries have different trade links with the US (see table 1) and therefore may not uniformly respond to shocks that affect good markets in the US. However, all these countries have reasonably large financial links with the US and this justifies our interest in treating them as a group. Note also that these countries have experienced different exchange rate regimes over the sample under consideration (see appendix B for a brief summary of the regimes in the 1990's) and that they span a wide spectrum regarding the level of dollarization of their economies: Mexico is not dollarized, Uruguay and Peru\(^\prime\) are partially dollarized (about 30-40%), Argentina is heavily dollarized (60-70%), Ecuador has been heavily dollarized throughout the 90's, and since the beginning of the year 2000, is totally dollarized; Panama was dollarized for the entire period under consideration.

In a study like ours which tries to examine the "normal" transmission of shocks across currency, balance of payments and other type of crises pose a problem since they may severely distort the results obtained in normal times. Furthermore, since some countries switched exchange rate regime over the sample the results may be statistically insignificant simply because we are combining periods which are structurally different. Unfortunately, given the shortness of the sample, there is no way of controlling for these factors, but one has to keep all these considerations in mind when interpreting the results.

Theoretically, one should expect transmission of shocks across countries to occur for three reasons: because shocks are common and/or because they affect either goods or financial markets. While the first source of transmission is excluded here a-priori by the assumptions underlying the identification scheme, both goods and asset markets may play some role in our context. The intuitive argument behind transmission goes as follows. Suppose that there is a shock in the US which positively affects the price level. Then the terms of trade for Latin American countries should fall as the price of imports increases relative to the price of export. This should increase exports and output (decrease imports) in Latin American countries and make their trade balance positive. The domestic price level may either increase or stay constant, depending on whether the increase in US price level is demand or supply driven and, unless monetary policy is accommodative, no effect should be observed on money and interest rates. To the extent that US price changes are not translated in price changes in Latin America either nominal or real exchange rates will adjust

\(^3\)For Argentina the series is provided by FIEL, for Ecuador it is provided by the Bank of Ecuador
to maintain equilibrium. The importance of this channel obviously depends on how important trade with the US is. Given the shares reported in table 1, one a-priori expect this channel to be important for Mexico and less crucial for the other Latin American countries.

Suppose, on the other hand, that there is a shock which affects negatively US interest rates (for example, an expansionary monetary shock or an expansionary supply disturbance). In that case the nominal exchange rate should appreciate and when this is not possible, because of a currency boards agreements, the price level of Latin American securities should increase making local interest rate decline. If the former is the case, no major changes should be observed in Latin American economies, while if the latter is the case, Latin American output and prices should increase. The money supply may increase, if central banks reacts positively to output expansion, or contract, if either a currency board agreement is in place (money supply is related to returns on US T-bills) or if price levels concerns drive monetary policy. Once again the importance of this channel depends on at least two factors: the degree of financial integration of each economy with the US and the exchange rate regime in place, with countries more integrated or with a fixed exchange rate regime responding more strongly through this channel.

We have seen that the four US shocks affect both US inflation and US interest rates contemporaneously. Hence, we should expect both channels of transmission to play a role in our study. However, their relative importance may have changed over time since in many countries the process of financial liberalization took place only in the last decade. In the end it should be possible to link the relative importance of the two channels to the evolution over time of trade shares, exchange rate regimes and integration of financial markets (measured by the correlation of interest rates in the US with US denominated interest rates in Latin America).

3 The Results

First, we examine the contribution of foreign shocks to the variability of domestic variables in each of the six countries. In particular, we are interested in measuring the relative contribution of domestic and foreign factors to the fluctuations in output, inflation, money and the trade balance. We do so by computing the $R^2$ of a regression of these variables on current values and two lags of the US shocks. Table 2 reports this statistic for the four variables in each of the six countries. Contrary to Ho\textregistered maister and Roldos (1997) and in agreement with Ahmed and Loungani (1999) the table suggests that foreign factors are important to explain the behavior of Latin American macroeconomic variables. This remains true even when lags of $X$ are included in the regression. The contribution varies with the variables considered but some similarities across countries emerge. For example, US shocks explain between 40-50% of the variability of inflation, between 22 and 42% of the variability of nominal balances and between 14 and 33% of the variability of the trade
balance. For output fluctuations, differences across countries are larger. The $R^2$ varies from a low 0.04 for Panama and 0.12 for Uruguay up to 0.41 for Mexico and 0.46 for Peru. Overall, it seems that the US shocks we have identified have substantial explanatory power for the majority of macroeconomic variables. Hence, the imported component of business cycles fluctuations in all six countries we examine is not negligible.

We organize the discussion of the other results around the remaining three questions of interest in this paper. The following discussion is based on the impulse responses bands which are reported in figures 4 to 11.

### 3.1 Channels of Transmission

Which channel is more important in transmitting US shocks to Latin America? It turns out that the answer depends on the type of shocks we are considering. In response to supply shocks terms of trade move significantly in all countries with one-two quarter lags, although the sign of the responses depends on the country, while interest rates do not often move in a significant way. In the three cases when they do, they decline strongly and persistently in Panama, while in Mexico and Ecuador the effect is short lived. Since positive realizations of this type of shock reduce US interest rates, one should expect countries which are sufficiently integrated with the US and for which this does not happen to face exchange rate pressures.

When a (contractionary) demand shock hits the US economy, terms of trade move for a short time but the direction across countries is not robust across countries (in Panama, contrary to the logic, terms of trade signifcanty increase). Domestic interest rates, on the other hand, increase in response to the shocks in all countries except for Uruguay, where they persistently decline. The response is persistent and lasts up to 8 quarters, except in Argentina, where the effect is very short lived. Since US interest rates also declined in response to shocks, interest rate parity conditions indicate that Uruguay will face stronger exchange rate pressures when shocks of this type hit the US economy.

One of the two monetary disturbances appears to be transmitted through both channels. Expansionary realizations of this shock make terms of trade signifcantly decline, as one would expect, in three countries but the effect is short lived. Interest rates also change. In general, following a disturbance which generates domestic liquidity effects, Latin American interest rates persistently decline. The exception is Uruguay, where the interest rate does not significantly move. Note that in Argentina and Panama, two of the most dollarized economies, the effect is approximately of the same magnitude as the one experienced in the US. The other monetary shocks, appears to primarily affect the US economy, with small and short lived international effects. An expansionary shock of this type makes terms of trade in decline Mexico and Argentina, but the magnitude is small and the decline is significant only for one period, while in the other two countries the effect
3 THE RESULTS

is insignificant. The responses of interest rates are, by and large, small and insignificant: only in Argentina, where interest rates temporarily and decrease, and in Ecuador, where they perversely increase for about a year, significant responses are evident.

To summarize, both channels play a role in transmitting at least three of the four US shocks we have identified. The terms of trade channel appears to be more important in the transmission of US supply disturbances while the interest rate channel is stronger when we consider the demand disturbance and of one of the monetary disturbances. In general, the sign of the responses of both the terms of trade and interest rates for almost all countries support our prior expectations suggesting that they adjust to maintain equilibrium in international goods and asset markets.

3.2 Stylized Facts about transmission

The second question of interest concerns the adjustments induced in Latin American economies by US shocks. Once again, both the direction and the magnitude of the changes depend on the type of shocks we examine.

Recall that a positive US supply shocks induces positive responses in US output and US real balances and negative responses in US inflation and interest rates. Internationally, such a shock has little effect on output: in Argentina, Mexico, Peru and Panama there is no significant response; in Ecuador there is a significantly positive but short-lived effect (just one period) and in Uruguay the effect is significantly and perversely negative but it dies out quickly. This result is somewhat surprising, given that it is shared by countries which have both large and small trade shares with the US and are either very small or relatively large in the continent. The effect on nominal balances is positive in four countries (Argentina, Mexico, Ecuador and Uruguay) but it is temporary, while in the other two countries no significant effect is visible. Inflation decline in all countries but Ecuador: the decline is significant for one (or two) quarters only and the magnitude varies with the country. Finally, the trade balance responds significantly in four of the six countries. The sign of the effect however is negative, indicating that imports increase more than export, and this fact is consistent with the negligible effect on domestic output we have noted above. The change is limited to one quarter, except in Uruguay, and it is, in general, relatively small.

The response of Latin American macrovariables to a US demand shock are, in general, small and not very significant. Recall that a contractionary shock of this type makes output, inflation, short rates and real balances contemporaneously decline in the US, even though inflation and real balances become positive after the initial impact. Latin American output responses are negligible except in Argentina, where a significant decline for two periods is observed, and Peru, where output significantly increase with one quarter delay. Inflation responses are significantly positive in Argentina and Peru, but only for a short while, and in Ecuador, where the increase is strong, persistent and it has not subsided 3 years after the shock. The behavior of inflation in these
three countries is hard to explain, especially considering the response of nominal balances, which decline significantly in all 6 countries. Apparently, countries which have experienced episodes of uncontrolled inflation, negative foreign demand shocks tend to destabilize the economy. Finally, the trade balance increases significantly only in Argentina, Uruguay and Panama. Surprisingly, the effect lasts at least a year, suggesting a large decline of US imports in these countries.

A US monetary shock, when positive, instantaneously increases US output, inflation and real balances and makes short term rates decline. The first of such shocks has a strong effect on nominal balances all over Latin America: the response is positive, strong and independent of the exchange rate regime the country is in. The magnitude and the persistence of the effect depends on the country: the shorter response is in Peru, where money significantly increases for two quarters; the longest is in Uruguay, where nominal balances are above the trend for more than three years. The responses of the other three macroeconomic variables have less cross-country similarities. Output responds positively in two cases, negatively in two cases and in the remaining two no significant movements can be observed. Also, in terms of persistence, the results are mixed: for example, in Peru and Argentina the effects die out quickly, while in Uruguay and Ecuador the effects are much more persistent. In Argentina, Ecuador and Peru inflation is, once again, moving in the wrong way and declines with one period delay even though the magnitude is small; in Mexico inflation increases for up to six quarters and in the other two countries no significant effect is found. Finally, the trade balance declines in four countries after the shock. The persistence of the response varies with the country but, everywhere, the shock appears to be completely absorbed after about 6 quarters.

The other monetary shock has small repercussion in Latin America and in the majority of cases the responses are insignificant. However, in a few cases responses are significant and persistent (see e.g. the responses of output in Mexico, Peru, and Uruguay, the trade balance in Panama and Peru, nominal balances in Ecuador and Uruguay). However, it turns out that there is no coherent pattern in the responses across countries and the joint responses of output, inflation and nominal money hard to interpret.

To summarize, the responses of macroeconomic variables are, in general, coherent with the theoretical expectations. The magnitude and the significance of the changes depends, to some extent, on the type of shocks and on the country. Latin America output does not react strongly to US shocks. This is not due to the fact that we employ measures of industrial production, which may be covering only a small percentage of national output. In fact, if we substitute GDP for industrial production in those countries where quarterly data exist, no changes emerge. Hence, there is very little evidence of a continental output cycle, generated in the US and transmitted to Latin America. This confirms the indirect evidence of Loayza, Lopez and Ubide (1999), who show that in Latin America country specific factors dominate the variability of sectorial output. The
trade balance responds to US shocks but it is because Latin American import are more procyclical than Latin American export. This is true also for a country like Mexico where a large share of the import-export activity is with the US. A pattern of this type is consistent, for example, with US firms decentralizing production in good times and bring it back to US in bad times. Nominal balances are highly positively correlated with US nominal balances in response to all US shocks. Hence, in Latin American the supply of nominal balance behaves as if each country was implicitly following a currency board agreement, with the domestic supply of money increased every time the US money supply exogenously or endogenously increase. Inflation rates are also highly correlated with US inflation in response to all US shocks. However, there are three countries (Argentina, Peru and Ecuador) where inflation responses are perverse and demand and monetary shocks which increase (decrease) US inflation cause inflation in these countries to decline (increase). Whether this is due to incorrect expectations, poor data or hyperinflation dynamics is difficult to say.

In conclusion, while Latin American nancial and money markets react signi cantly to US shocks and most of their ouctuations appear to be driven by such factors, this is not necessarily the case of goods markets. In particular, Latin American output ouctuations appear to be uncorrelated with US shocks and driven, to a large extent by local, idiosyncratic shocks.

3.3 Does the exchange regime matter?

We nally turn to the last question of interest in this paper: whether the exchange rate regime and/or the level of dollarization of the economy makes a di erence in the transmission properties of US shocks. Theoretically, one should expect transmission to be stronger in countries which use xed exchange rate or currency board regimes but this prediction needs to be quali ed to take into account the level of integration of the various economies with the US. Our results do not provide a very informative answer to this question. We have seen that output in Latin American countries does not react to signi cantly to US shocks and this is true regardless of whether the economy is under one regime or another. Also, money and prices comove substantially with US money and prices in response to shocks, regardless of the exchange rate arrangement used. In the cases of monetary shocks, nominal interest rates react quickly and more signi cantly in Argentina and Panama the two most heavily dollarized economies in the period - than in the other countries but, apart from this e ect, there is no other evidence supporting the idea that the exchange rate regime matters.

One reason for these results is clearly the fact that in many countries several exchange rate regimes were experienced in the sample. Although the e ects of shocks di er across regimes, di erences may be blurred when the sample mixes episodes with di erent regimes. One other reason for why the results are not very informative about di erences across exchange rate regimes is that some of the countries experienced currency crisis within the sample. These events were accompanied
4 CONCLUSIONS AND SOME POLICY IMPLICATIONS

by domestic measures which may have severely altered the normal transmission process. Given that
 crises times dominate in terms of variability non-crisis times, failure to separate the responses across
 regimes may be due to the presence of these outliers. Finally, it may well be that the magnitude of
 the differences is small and the short sample period makes them look as if they were statistically
 insignificant.

4 Conclusions and some policy implications

This paper studies the extent and the features of the transmission of structural US shocks to Mexico,
 Panama, Ecuador, Argentina, Uruguay and Peru. We identify structural shocks in the US using the
 two-step procedure of Canova and De Nicolo' (1999) which first extract orthogonal innovations from
 a reduced form model and then studies their informational content using aggregate macroeconomic
 theory. The basic intuition used to identify structural disturbances is that (temporary positive)
 supply shocks should generate positive transitory output responses, negative transitory responses
 in inflation and a positive transitory responses in real balances; (temporary positive) real demand
 disturbances should generate positive transitory responses in output and inflation and negative
 transitory responses in real balances; finally, (temporary positive) nominal demand disturbances
 should generate positive temporary responses of output, inflation and real balances. For the sample
 1983:1-1999:4 our approach extracts one supply disturbance, two monetary disturbances and one
 shock which is clearly of demand type, but depending on the assumptions made, can be of nominal
 or of real type. We show that these shocks generate reasonable responses in the variables of the
 system and that they have easily interpretable time paths.

We feed these shocks as exogenous into VAR models for each of the Latin American economy
 and measure the contribution of these disturbances to the variability of domestic variables. Then
 we examine the importance of different channels of transmission, collect a set of stylized fact on how
 various types of shocks impact in the economies and sort out their magnitude and their persistence
 by exchange rate regimes and/or the level of dollarization of the economies.

Four major conclusions can be drawn from our analysis. First, US shocks are important in
 accounting for the variability of inflation, money and the trade balance. The effect on output de-
 pends on the countries and foreign shocks explain between 4 and 46% of output variability. Second,
 both the terms of trade channel and the interest rate channel play a role in transmitting US shocks
to Latin American economies. Their relative importance however depends on the type of shocks:
supply shocks are primarily transmitted through terms of trade movements, while demand and
 monetary disturbances appear to feed into Latin American economies primarily through their ef-
 fect on domestic interest rates. Third, the sign, the magnitude and the persistence of the responses
 of macroeconomic variables to US shocks depends on the type of disturbances we are considering.
In general, while output responses to US shocks are small and have low correlation with output movements in the US, inflation and nominal balances positively comove with US inflation and nominal balances in response to US shocks. We interpret this finding as suggestive that increased financial integration experienced over the 1990's has not produced more synchronicity in continental output cycles. Fourth, there is no evidence that the exchange rate regime and the level of dollarization of the economy matters for transmission. The response of domestic nominal balances to US monetary shocks is more persistent for economies which are either partially or totally dollarized, but apart from this it is hard to find regularities which would set the two groups of countries apart. Given the dataset we have available we can not say whether this is due to data problems, short samples, the use of a mixture of different exchange regimes or to the presence of a Latin American factor dominating the importance of the monetary arrangement used.

Based on the evidence we have collected, is it a good idea to dollarize Latin America? The question is of the full dollarization is currently at the forefront of the policy debates since some of the countries in our sample have contemplated in adopting or already adopted the dollar as their currency. The existing literature has highlighted two aspects which are relevant here: the costs that such a measure would impose on a country when it gives up the ability to use monetary instruments to respond to internal and external shocks and the sustainability of the arrangement.

In terms of the costs of giving up monetary policy, we have noticed that the response of money to US shocks in the six Latin American countries is very highly correlated with the response of US money. This is true to such an extent that it looks as if Latin American Central Banks implicitly target domestic nominal balances to US nominal balances. If this is the case, domestic stabilization does not appear to be a crucial concern of central banks in Latin America and the costs of going to full dollarization may be small.

In discussing the sustainability of the arrangement the literature has stressed that the feasibility of currency areas crucially depends on the presence of comovements in the macroeconomic indicators have across countries. In particular, a fixed exchange rate regime to be more easily substanable if shocks are internationally contemporaneously correlated or if there is a quick transmission of shocks from one country to another. Dollarization imposes a further constraint on this picture as local currency varies only to the extent that 'dollars' enter the country. An example may clarify the matter. In a two-country cash-in-advance model where each country is endowed with a different good, money supplies are exogenous, markets are competitive and asset markets are complete, the equilibrium level of the nominal exchange rate is given by:

$$e_t = \frac{Y_1tM_2t}{Y_2tM_1t} t^{ot}$$

where $Y_{it}$ is the endowment in country i, $M_{it}$ is the money supply in country i and $t^{ot}$ are the terms of trades. Suppose that in this framework there is a shocks to the supply of $Y_{1t}$. Then if $Y_{2t}$ moves...
in the same direction, procyclical movements in \( t_0 t \) are smaller and, in general, the adjustments in \( M_2 t \) needed to keep \( e_\bar{t} \) fixed are smaller. If \( Y_2 t \) moves with a lag \( e_\bar{t} \) may be temporarily affected but in the medium-long run it will return to its original level. If there is a single currency in circulation and it is held fixed proportion in the two countries, then \( M_1 t = (1 - T) \times M_t, M_2 t = T \times M_t \) and unless shocks in \( Y_1 t \) also affect \( Y_2 t \) in the same direction, contemporaneously or with a short lag, \( e_\bar{t} \) must adjust to maintain equilibrium.

The evidence we have presented suggests that shocks that affect US output (\( Y_1 t \)) do not necessarily produce changes in Latin American outputs (\( Y_2 t \)), while \( t_0 t \) adjusts in the right direction for some shocks but not others. Hence, the sustainability of a currency board or a full dollarization may well depend on the types of shocks that hit the US economy. Since \( t_0 t \) significantly moves in response to supply shocks but not in response to demand or monetary shocks, discovering which of these sources is dominant in the US economy may provide useful information on whether the dollarization of these economies will be sustainable or not.
Appendix A: Identification of Shocks

This appendix describes the technical details involved with the identification of US shocks. Let the MA representation of the VAR system for the US be:

\[ Y_t = \hat{A} + B(\cdot)u_t \quad u_t \sim (0; \Sigma) \]  

(3)

where \( Y_t \) is a 4 x 1 vector and \( B(\cdot) \) a matrix polynomial in the lag operator. An orthogonal decomposition of the MA representation with contemporaneously uncorrelated shocks featuring unit variance-covariance matrix is of the form

\[ Y_t = \hat{A} + C(\cdot)e_t \quad e_t \sim (0; I) \]  

(4)

where \( C(\cdot) = B(\cdot)V \), \( e_t = V^{-1}u_t \) and \( \Sigma = VV' \). This orthogonal decomposition is not unique since for any orthonormal matrix \( Q; QQ' = I \), \( \Sigma = VV' = VQ'Q' \) is an admissible decomposition of \( \Sigma \). This multiplicity is well known to arise when the Choleski decomposition of \( \Sigma \) (\( V \) is lower triangular) is employed. It also arises in other statistical decompositions, for example, one of the form \( \Sigma = PDPP' = VV' \) where \( P \) is a matrix of eigenvectors, \( D \) is a diagonal matrix with eigenvalues on the main diagonal and \( V = PD^{1/2} \), which is the one employed here. Under the assumption of orthogonal shocks, the impulse response of each variable to any shock is given by the coefficients of the vector of lag polynomials \( C(\cdot) \) where \( \hat{\circ} \) satisfies \( \hat{\circ}^0 \hat{\circ} = 1 \).

As mentioned theory imposes sign restrictions on the cross-correlation function of certain variables in response to shocks. The cross correlations function of \( Y_{it} \) and \( Y_{jt+t+r} \); \( r = 0; 1; 2; \ldots \) is

\[ \frac{1}{2} \beta \left( r \right) \left( \text{Corr} \left( Y_{it}; Y_{jt+t+r} \right) \right) = q \frac{E[C_i(\cdot)e_t C_j(\cdot)e_{t+r}]}{E[C_i(\cdot)e_t]^2 E[C_j(\cdot)e_{t+r}]^2} \]  

(5)

where \( E \) indicates unconditional expectations and \( C^h \) the \( h \)-row of \( C(\cdot) \). Hence, the pairwise cross correlation conditional on the particular shock denoted by \( \hat{\circ} \) is

\[ \frac{1}{2} \beta \left( r \right) \left( \text{Corr} \left( Y_{it}; Y_{jt+t+r} \right) \right) = q \frac{(C_i(\cdot))\hat{\circ}(C_j(\cdot)^{\prime} + r)\hat{\circ}}{((C_i(\cdot))\hat{\circ})^2((C_j(\cdot)^{\prime} + r)\hat{\circ})^2} \]  

(6)

whose sign only depends on the sign of \((C(\cdot)^{\prime})\hat{\circ}(C(\cdot)^{\prime} + r)\hat{\circ})\), the cross product of the impulse responses of variables \( i; j \) at lag \( r \) to the shock. Hence, given one particular orthogonal representation, one can easily calculate the cross product of impulse responses for the variables of interest in response to the shocks and check if they conform to the sign required by theory at any lag \( r \).

The algorithm we use to search the space of orthogonal decompositions to extract structural shocks which have a reasonable economic interpretation, consists of three steps. First, we
parametrize the space of decompositions and for each possible one we check if the shocks we have constructed have an economic interpretation. To parametrize the space we use a result of Press et al (1997) which shows that a matrix of eigenvectors can be decomposed into the product of orthonormal rotation matrices of the form

\[
Q_{m,n}(\mu) = \begin{pmatrix}
0 & 1 & 0 & \cdots & 0 & 0 & 1 \\
0 & 0 & 1 & \cdots & 0 & 0 & 0 \\
\vdots & \vdots & \vdots & \ddots & \vdots & \vdots & \vdots \\
0 & 0 & \cos(\mu) & \cdots & i \sin(\mu) & 0 & \cdots \\
\vdots & \vdots & \vdots & \ddots & \vdots & \vdots & \vdots \\
0 & 0 & \sin(\mu) & \cdots & \cos(\mu) & 0 & \cdots \\
0 & 0 & 0 & \cdots & \cdots & \cdots & \cdots \\
0 & 0 & 0 & \cdots & \cdots & \cdots & \cdots \\
0 & 0 & 0 & \cdots & \cdots & \cdots & 1 \\
\end{pmatrix}
\]

where \(0 < \mu < \frac{\pi}{2}\) and the subscript \((m; n)\) indicates that rows \(m\) and \(n\) are rotated by the angle \(\mu\). Since \(Q_{m,n}(\mu)\) are orthonormal, \(\Sigma = \sqrt{\Sigma} = \sqrt{V} Q_{m,n}(\mu) Q_{m,n}(\mu)' V' = PD^{0.5} Q_{m,n}(\mu) Q_{m,n}(\mu)' D^{0.5} P'\) is an admissible decomposition and \(\mu\) index the multiplicity of decompositions. In a system of \(N\) variables there are \(N(N-1)/2\) bivariate rotations and \(N(N-1)/4\) combinations of bivariate rotations of different elements of the VAR, for a fixed \(\mu\). Hence, for \(N = 4\) there are 9 possible rotation matrices and if we grid the interval \([0; \frac{\pi}{2}]\) into 500 points we can construct 4500 orthogonal decompositions of \(\Sigma\).

Second, if some decompositions produce at least one shock which is not interpretable economically, we discard them. Third, among the decompositions which produce four interpretable shocks, we sequentially eliminate candidates by making sign restrictions more stringent. Thus, for example, suppose that when one considers only sign restrictions at \(r = 0\) one obtains three candidate decompositions which identify all four shocks. Then, among these three candidates, we choose the one that satisfies the sign restrictions also at \(r = \Sigma 1; \Sigma 2\), etc. The results we present are obtained using sign restrictions at \(r = 0\) only.
Appendix B: Exchange Rate Regimes

Argentina: Floating rate up to 1990:4; currency board afterward

Brasil: Floating rate up to 1994:4; Crawling bands up to 1997:4; Crawling bands with 2 market rates up to 1999:1; Floating afterwards

Chile: Crawling peg, central parity fixed to US dollar or to basket of currencies up to 1999:3; Floating afterwards

Ecuador: Crawling bands with 2 or 3 market rates up to 1999:1; Floating up to 1999:4; Dollarized afterwards

Mexico: Managed Floating

Panama: Dollarized

Peru: Floating

Uruguay: Managed Float up to 1994:4; Fixed band up to 1996:4; Crawling band afterwards
References


[8] Borensztein, E. and Zettelmeyer, J. 2000, "Monetary Independence in Emerging Markets: Does the exchange rate regime make a difference?", manuscript, IMF.


[34] Schmitt-Grohe, S. and Uribe, M., 2000, Stabilization Policy and the Costs of Dollarization, University of Pennsylvania, manuscript.

### Table 1: Trade shares with U.S.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
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<tr>
<td>Argentina</td>
<td>0.09750</td>
<td>0.22992</td>
<td>0.11206</td>
<td>0.19571</td>
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<tr>
<td>Brazil</td>
<td>0.20817</td>
<td>0.26208</td>
<td>0.22636</td>
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<td>Chile</td>
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<td>Uruguay</td>
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### Table 2: Relative contribution of Foreign Shocks

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<tr>
<th>Country</th>
<th>Output</th>
<th>Inflation</th>
<th>Money</th>
<th>Trade Balance</th>
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</thead>
<tbody>
<tr>
<td>Argentina</td>
<td>0.3719</td>
<td>0.4929</td>
<td>0.3544</td>
<td>0.3181</td>
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<tr>
<td>Brazil</td>
<td>0.8323</td>
<td>0.4027</td>
<td>0.3443</td>
<td>0.4255</td>
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<td>0.2471</td>
<td>0.4936</td>
<td>0.2726</td>
<td>0.2107</td>
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<tr>
<td>Ecuador</td>
<td>0.3277</td>
<td>0.4977</td>
<td>0.2201</td>
<td>0.2898</td>
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<tr>
<td>Mexico</td>
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<tr>
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<td>0.2382</td>
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<tr>
<td>Peru'</td>
<td>0.4634</td>
<td>0.4959</td>
<td>0.4226</td>
<td>0.1420</td>
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<tr>
<td>Uruguay</td>
<td>0.1274</td>
<td>0.4929</td>
<td>0.3958</td>
<td>0.3334</td>
</tr>
</tbody>
</table>

Notes: The table reports the R² of a regression of the domestic macrovariables on two lags of the four identified US shocks.
### Table 3: Correlations Output with US Output in response to shocks

<table>
<thead>
<tr>
<th></th>
<th>Monetary 1</th>
<th>Monetary 2</th>
<th>Supply</th>
<th>Demand</th>
</tr>
</thead>
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</table>

### Table 4: Correlations of Inflation with US Inflation in response to shocks

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<th>Monetary 2</th>
<th>Supply</th>
<th>Demand</th>
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</thead>
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<td>0.0249</td>
<td>0.0952</td>
<td>0.1255</td>
<td>-0.2480</td>
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Figure 1
Cross Correlations
Figure 2

Impulse Responses

Shock 1
Output

Inflation

Slope

Real Balances

Shock 2

Shock 3

Shock 4

Figure 2:
Figure 3

Structural shocks

Shock 1

Shock 2

Shock 3

Shock 4

Figure 3:
Figure 4

Impulse response bands, Terms of Trade

Figure 4:
Figure 5

Impulse response bands, Interest Rates
Figure 6

Impulse response bands, Argentina

![Impulse response bands, Argentina](image-url)
Figure 7

Impulse response bands, Mexico
Figure 8

Impulse response bands, Ecuador

Figure 8:
Figure 9
Impulse response bands, Peru
Figure 10

Impulse response bands, Uruguay

Figure 10:
Figure 11

Impulse response bands, Panama

Figure 11: