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Flexible exchange rates as shock absorbers

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Abstract

In this paper we analyze empirically the effect of terms of trade shocks on economic performance *under alternative exchange rate regimes*. We are particularly interested in investigating whether terms of trade disturbances have a smaller effect on growth in countries with a flexible exchange rate arrangement. We also analyze whether negative and positive terms of trade shocks have asymmetric effects on growth, and whether the magnitude of these asymmetries depends on the exchange rate regime. We find evidence suggesting that terms of trade shocks get amplified in countries that have more rigid exchange rate regimes. We also find evidence of an asymmetric response to terms of trade shocks: the output response is larger for negative than for positive shocks. Finally, we find evidence supporting the view that, after controlling for other factors, countries with more flexible exchange rate regimes grow faster than countries with fixed exchange rates.

JEL classification: F30; F32

Keywords: Exchange rate regimes; Growth; Terms of trade shocks

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1. Introduction

During the last few years economists' views on exchange rate regimes have evolved significantly. Fixed-but-adjustable regimes have lost adepts, while hard pegs and floating rates have gained in popularity. The discussion on the relative merits of these two contrasting exchange rate systems has come to be known as the "two corners" debate (Fischer, 2001). Supporters of hard pegs have argued that this type of regime provides credibility and results in lower inflation, a more stable economic environment and faster economic growth.[1] Supporters of flexibility, on the other hand, have argued that under floating exchange rates the economy has a greater ability to adjust to external shocks.[2] According to this view, which goes back at least to Meade (1951), countries with a flexible exchange rate system will be able to buffer real shocks stemming from abroad. This, in turn, will allow countries with floating rates to avoid costly and protracted adjustment processes.[3]

In most models of open economies, real external shocks—including terms of trade and real interest rate shocks—will result in changes in the equilibrium real exchange rate (Obstfeld and Rogoff, 1995). If the nominal exchange rate is fixed, the adjustment in the equilibrium real exchange rate will have to take place through changes in domestic nominal prices and domestic wages. As Meade (1951, pp. 201–202) argued early on, this adjustment will be difficult in countries with a fixed exchange rate and inflexible money wages. According to Meade (1951), in the presence of these rigidities the economy is likely to benefit from what he called a "*variable exchange rate*", or from what we know today as a floating exchange rate regime. He was careful to note, however, that flexible exchange rates are not a panacea, and that there are indeed circumstances when they may not help to accommodate external disturbances. This would be the case, for instance, if due to indexation or other mechanisms *real* wages were inflexible.[4] This key point has also been recognized by modern scholars who have analyzed the merits of alternative exchange rate regimes (Dornbusch, 2001; Kenen, 2002).

Recently, a number of authors have argued that flexible exchange rate systems will not be effective in countries where the private and public sectors have large foreign

[1]Hard pegged regimes include currency boards, currency unions and de jure dollarization. The growth effect is supposed to take place through two channels. First, hard pegs (and, in particular, dollarization) would lead to lower interest rates, higher investment and, thus, faster growth. Dornbusch, for instance, (2001, p. 240) has emphasized this channel, arguing that dollarization-induced lower interest rates are "conducive to investment and risk-taking, which translates into growth, and... a virtuous circle". Second, by eliminating exchange rate volatility, hard pegs would encourage international trade and this, in turn, would result in faster growth. Rose (2000), and Rose and Van Wincoop (2001), among others, have emphasized this trade channel within the context of currency unions. On analytical arguments in favor of hard pegs see Calvo (1999, 2000) and Eichengreen and Haussman (1999).

[2]In this paper we will use the terms "floating" and "flexible" interchangeably.

[3]Friedman (1953) was an early proponent of this view. The idea that hard pegs magnify external shocks acquired greater prominence in the aftermath of the Argentine currency and debt crisis of 2001–2002.

[4]In fact, Meade (1951, p. 203) explicitly said that "for the variable-exchange-rate mechanism to work effectively there must be sufficient divorce in movements in the cost of living and movements in money wage rates".

currency-denominated liabilities (Eichengreen and Haussman, 1999). In this case, it has been argued, it is even possible that a flexible exchange rate regime will *amplify* the negative effects of terms of trade shocks. The reason for this is that, in the presence of ''balance sheet'' effects, the currency depreciation generated by the external shock will generate (large) increases in the value of the debt expressed in domestic currency. This, in turn, may trigger bankruptcies, lead the public sector to insolvency, and result in a reduction in the rate of growth (Calvo, 2000).

As the preceding discussion suggests, determining whether flexible exchange rate regimes are indeed able to insulate the economy from external shocks is ultimately an empirical issue that can only be elucidated by analyzing the historical evidence. Surprisingly, there has been very little empirical work on the relationship between exchange rate regimes and the way in which terms of trade shocks affect growth and other measures of economic performance. In fact, papers that have investigated empirically the way in which terms of trade disturbances affect economic growth and growth volatility, have tended to ignore the role of the exchange rate regime in the transmission process. A literature search using *EconLit* indicates that 165 papers with the words ''exchange rate regimes'' and ''growth'' in the title or abstract were published between 1969 and 2002 (August). During the same period, 98 papers with the words ''terms of trade'' and ''growth'' were published. However, only three articles that had all three terms were published during this 33-year span.[5]

The purpose of this paper is to bridge this gap in the literature, and to analyze empirically the effect of terms of trade shocks on economic performance *under alternative exchange rate regimes*. We are particularly interested in investigating whether, as supporters of exchange rate flexibility have claimed, terms of trade disturbances have a smaller effect on growth in countries with a flexible exchange rate regime, than in countries with a more rigid exchange rate arrangement. We also analyze whether negative and positive terms of trade shocks have asymmetric effects on growth, and whether the magnitude of these asymmetries depends on the exchange rate regime. In order to investigate these issues we use a new data set that provides an improved classification of the exchange rate regime in each country at any particular moment in time. The advantage of this data set—which was constructed by Levy Yeyati and Sturzenegger (2002)—is that it does not rely on official country statements for classifying countries as having a pegged, intermediate or floating regime.[6] Instead, it looks at actual data on the behavior of nominal exchange rates and international reserves to classify countries under different regimes.

Our findings may be summarized as follows. First, we find evidence suggesting that terms of trade shocks get amplified in countries that have more rigid exchange rate regimes. In other words, with other things given, countries with flexible exchange rates are able to accommodate better real external shocks. Second, we find evidence of an asymmetric response to terms of trade shocks. More precisely, the

[5]Broda (2001) is a recent contribution that analyzes whether the exchange rate regime makes a difference in the way in which terms of trade shocks impact on economic performance.

[6]It is well known that in many countries the authorities systematically state that they have a particular regime, whereas in reality they follow a different one. See Edwards (1993) for a discussion on this issue.

output response is larger for negative than for positive shocks, a fact consistent with the presence of asymmetries in the price response (with downward nominal inflexibility leading to larger quantity adjustments). Interestingly, while the output response in both directions is, again, larger the more rigid the exchange rate, this asymmetry is also significant in more flexible regimes.[7] In addition, we find evidence supporting the view that, after controlling for other factors, countries with more flexible exchange rate regimes grow faster than countries with fixed exchange rates, confirming previous findings in Levy Yeyati and Sturzenegger (2003).

The rest of the paper is organized as follows. In Section 2 we present our empirical framework, describe our data, and present our basic results. In Section 3 we examine the robustness of the results to the use of the IMF de jure classification, and we extend the analysis to explore potential asymmetries in the output response to terms of trade shocks. In Section 4 we address the issue of the exogeneity of terms of trade shocks, and we report results from the estimation of our model for several sub-samples that exclude large countries, as well as countries with a dominant position in the production of particular goods. Finally, in Section 5 we present some concluding remarks.

2. Terms of trade shocks, exchange rate regimes and growth: An empirical analysis

Economists' concerns with the effects of terms of trade changes on economic growth dates, at least, to the writings of Prebisch (1950) and Singer (1950). These influential authors claimed that developing countries' terms of trade had exhibited a secular deterioration through time, and that this decline in relative exports' prices contributed to the developing countries' lack of industrialization, and resulted in stagnation and further impoverishment. As a result of Prebisch and Singer's empirical propositions, a number of authors developed theoretical models on the relation between terms of trade and economic growth. The majority of these models considered rather simple links, and argued that, by negatively affecting real income, negative terms of trade shocks depressed aggregate demand and, thus, resulted in lower growth (Bloomfield, 1984; Singer and Lutz, 1994). More recent studies, however, have focused on a variety of transmission channels, including the effect of terms of trade on relative prices. Barro and Sala-I-Martin (1995), for example, have pointed out that whether or not growth in fact accelerates as a result of terms of trade improvements depends on the effects of relative price changes on productivity growth.

In a comprehensive study, Hadass and Williamson (2001) reviewed most of the empirical literature on terms of trade and economic performance produced during the last five decades, including the works by Easterly et al. (1993), Collier and Gunning (1999), Warner (1992), Barro and Sala-I-Martin (1995) and Barro (1997). They convincingly argued that, while there has been massive amount of work trying to explain the actual behavior of terms of trade, relatively few studies have focused

[7]This would be in principle consistent with the presence of fear of floating, as reflected in a partial response of nominal exchange rates to positive shocks that result in larger real contractions. This hypothesis or, more generally, the hypothesis that exchange rates elasticity tends to be smaller in the event of negative shocks, is a fruitful topic for future research.

on the effects of terms of trade shocks on growth. And none of the studies reviewed by them makes a distinction between countries with different exchange rate regimes. In a recent contribution, Broda (2001, 2003) provides some of the few empirical analyses on how terms of trade shocks affect growth under alternative exchange rate regimes. He uses a VARs analysis to compute the way in which terms of trade shocks affect growth. He finds that the (negative) effect of a 10% deterioration in the terms of trade is 1.7% higher in the average peg country than in the average flexible exchange rate country.

2.1. Terms of trade shocks and growth: Theoretical underpinnings

From a theoretical point of view, terms of trade shocks may affect growth through a number of possible channels. Easterly et al. (1993), for example, have argued that the two most important channels are related to factor movements and savings. According to them, as a result of positive terms of trade shocks "labor or capital might flow within the country to the sector receiving the favorable shock, capital might flow in from abroad to the export sector, or domestic savings might respond to export opportunities (Easterly et al., 1993, p. 471)". In addition, these authors have argued that positive terms of trade shocks will help relax the foreign exchange constraint that affects many poorer countries, enhancing their growth potential. The savings channel has also been emphasized by Mendoza (1997), Ostry and Reinhart (1992), and van Wincoop (1992). Mendoza (1997), for example, developed a stochastic model of growth in which terms of trade uncertainty affects savings. In this model terms of trade improvements have a positive effect on savings, capital accumulation and, thus, on the average rate of growth. The model also predicts that increased terms of trade variability could result in either faster or slower growth, depending on the degree of risk aversion.

Models that emphasize the role of technological progress on growth provide an alternative mechanism for the transmission of terms of trade shocks into real growth (Romer, 1990; Aghion and Howitt, 1992; Edwards, 1992, 1998; Easterly et al., 1993). It is possible to assume that the rate at which countries absorb technological innovations (i.e. the rate of "imitation") will depend both on national policies as well as on external conditions. If, for budgetary or related reasons, countries that suffer negative external shocks have to slow down the rate of "imitation"—that is, the rate at which they absorb innovations coming from leading countries—short-term aggregate growth will decline.

Some authors have developed theoretical models that emphasize the effects of terms of trade shocks on capital accumulation and factor intensities. Basu and McLeod (1992), for example, constructed a stochastic model of growth where imported intermediate inputs are complementary to capital. In this setting, deterioration in the terms of trade makes imported inputs more expensive and has the potential of reducing capital's productivity.

Theoretically, changes in terms of trade may also affect output growth through their incidence on relative prices and on external (and, in turn, total) demand for domestically produced goods and services. This channel has been discussed by Barro and Sala-I-Martin (1995) and Easterly et al. (1993). What is particularly interesting about this channel is that changes in competitiveness stemming from terms of trade shocks are likely to be felt almost immediately in the case of a negative shock, and only gradually in the case of positive shocks. This would be the case if there is a slow adjustment of relative prices owing to a combination of a rigid exchange rate and downward price inflexibility, which may compound the real impact of the shock in the short term.[8] Whether this asymmetric response does indeed take place is, ultimately, an empirical issue, and one that we tackle in this paper.

2.2. The empirical model

Our main interest is to investigate empirically whether, as supporters of floating exchange rates have claimed, countries with floating exchange rate regimes are (partially) insulated from the effects of terms of trade shocks. More precisely, we are interested in finding out if terms of trade disturbances affect differently countries with different exchange rate regimes. The point of departure of our empirical analysis is a two-equation formulation for the dynamics of real GDP per capita growth of country j in period t. Eq. (1) is the long-run GDP growth equation, while Eq. (2) captures the growth dynamics process.

$$g_j^* = \alpha + \mathbf{x_j}\beta + \mathbf{r_j}\theta + \omega_j, \tag{1}$$

$$\Delta g_{tj} = \lambda[g_j^* - g_{t-1j}] + \varphi v_{tj} + \gamma u_{tj} + \xi_{tj}. \tag{2}$$

The following notation has been used: g_j^* is the long-run rate of real per capita GDP growth in country j; $\mathbf{x_j}$ is a vector of structural, institutional and policy variables that determine long-run growth; $\mathbf{r_j}$ is a vector of regional dummies; α, β and θ are parameters, and ω_j is an error term assumed to be heteroskedastic. In Eq. (2), g_{tj} is the rate of growth of per capita GDP in country j in period t. The terms v_{tj} and u_{tj} are shocks, assumed to have zero mean, finite variance and to be uncorrelated among themselves. More specifically, v_{tj} is assumed to be an external *terms of trade shock*, while u_{tj} captures other shocks, including political shocks. ξ_{tj} is an error term, which is assumed to be heteroskedastic (see Eq. (3) below for details), and λ, φ, and γ are parameters that determine the particular characteristics of the growth process.

From the perspective of the exchange rate regime discussion, an important question is whether the exchange rate system has a direct effect over the long-term rate of growth. We deal with this issue by investigating whether in Eq. (1) the intercept α is different for countries with different exchange rate regimes.[9] Eq. (2), which has the form of an equilibrium correction model (ECM), states that the actual rate of growth in period t will deviate from the long run-rate of growth due to the existence of three types of shocks: v_{tj}, u_{tj} and ξ_{tj}. Over time, however, the actual rate of growth will tend to converge towards it long-run value, with the rate of

[8] Dornbusch (1980) emphasized the case of asymmetric responses due to price rigidities.

[9] On debates on the effect of alternative exchange rate regimes on performance see, for example, Ghosh et al. (1995), Levy Yeyati and Sturzenegger (2001, 2003), Frankel (1999) and Kenen (2002).

convergence given by λ. Parameter φ, in Eq. (2), is expected to be positive, indicating that an improvement in the terms of trade will result in a (temporary) acceleration in the rate of growth, and that negative terms of trade shock are expected to have a negative effect on g_{tj}.

Our main interest is to determine whether parameter φ in Eq. (2) depends on the exchange rate regime of the country in question. If, as their supporters have argued, floating exchange rates allow countries to absorb foreign shocks better, we would expect φ to be smaller in countries with floating rates than in those countries with some version of a pegged rates exchange rate regime. We are also interested in determining whether positive and negative terms of trade shocks have asymmetric effects on growth, that we do in Section 3. Our task, then, is to estimate the system given by Eqs. (1) and (2), and to analyze if the coefficients α and φ are different across exchange rate regimes. The estimation of this system is not trivial, and is subject to the complexities of estimating panels with lagged dependent variables and heteroskedastic errors.

We estimate system (1)–(2) using a two-step procedure. In the first step we estimate the long-run growth Eq. (2) using a cross-country data set. These data are averages for 1974–2000, and the estimation makes a correction for heteroskedasticity. These first stage estimates are then used to generate long-run predicted growth rates to replace g_j^* in the equilibrium error correction model (2). In the second step we estimate Eq. (2) using a feasible generalized least squares procedure (FGLS) suggested by Beck and Katz (1995) for unbalanced panels. In the estimation of Eq. (2) the error ξ_{tj} is assumed to be heteroskedastic, with a different variance for each of the k panels (where k denotes the number of countries).

$$E[\xi\xi'] = \begin{bmatrix} \sigma_1^2\mathbf{I} & 0 & \cdots & 0 \\ 0 & \sigma_2^2\mathbf{I} & \ldots & 0 \\ \cdot & \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot & \cdot \\ 0 & 0 & \cdots & \sigma_k^2\mathbf{I} \end{bmatrix}. \tag{3}$$

The FGLS estimator has the same properties as the GLS estimator, and is asymptotically efficient. Notice that an alternative estimation strategy would be to re-parameterize Eqs. (1) and (2), and to apply the generalized-method-of-moments (GMM) for dynamic panel data models suggested by Arellano and Bond (1991). When we did this, the results obtained were similar to those obtained using our two-steps-FLS methodology.[10]

We use two alternative methods to investigate whether the terms of trade coefficient φ in Eq. (2) is different for different exchange rate regimes: The first one

[10]A potential limitation of the GMM strategy, however, is it does not lend itself to a transparent interpretation of the equilibrium correction term. The results we obtained when using this method are available on request.

consists of including a variable that interacts the terms of trade shock with three alternative indicators for exchange rate regimes. Our second method consists of splitting the sample according to the exchange rate regime, and comparing the estimated coefficients for the terms of trade variable. If flexible regimes buffer the country better form external disturbances, we would expect the coefficient for the terms of trade variable to be significantly lower in countries with flexible regimes.

2.3. Data and equation specification

Our sample covers annual observations for 183 countries over the period 1974–2000. With the exception of the civil unrest, exchange rate regimes, and secondary school enrollment variables, the data were obtained from the IMF and the World Bank databases. Since data availability varies across countries and periods, all tests were run on a consistent sub-sample of observations corresponding to 96 countries. A list of countries, as well as the definitions and sources for the variables used, are reported in Appendix A.

As pointed out above, our main interest is to analyze the transmission of terms of trade shocks under alternative exchange rate regimes. There is generalized agreement, however, that the IMF's "official" exchange rate regime classification tends to be misleading. For this reason, we use a methodology proposed by Levy Yeyati and Sturzenegger (2001) to construct four indexes of exchange rate regimes. These indexes are constructed as time series, and are based on actual, as opposed to official, exchange rate behavior (see Appendix B for details). The three indexes are defined as follows:

- A binary index that takes the value of one if in that particular year the country has a pegged exchange rate regime, and zero otherwise. We call this index *pegged*.
- A dummy variable that takes the value of one if, in that particular year, the country in question has a hard (as opposed to a conventional) peg, that is, if it has a currency board, belongs to a currency union or is dollarized. The index takes a value of zero otherwise. This variable is called *hard*.
- A dummy variable that takes the value of one if the exchange rate regime is an intermediate regime—crawling pegs, managed floats, and the like (see Levy Yeyati and Sturzenegger (2001) for details). We call this index *intermediate*. Notice that from these definitions we are able to construct an index that takes the value of one if the regime is neither *pegged* nor *intermediate*. This index is called *flexible*.
- Finally, a three-way classification that combines some of the indexes described above, and distinguishes between pegged, intermediate and flexible exchange rate regimes. This index is called *regime* and takes a value of zero, one or two if, in that particular year, the country in question has a flexible intermediate or pegged exchange rate, respectively.

These indexes where constructed for each year in the sample (1974–2000). Table 1 presents a summary of the distribution of countries in our sample across the different exchange rate regimes that we have defined.

Table 1
Distribution of exchange rate regimes

Pegged			Non-pegged			Total
Conventional	Hard	Total	Intermediate	Flexible	Total	
1356	717	2073	600	662	1262	3335

Source: Levy Yeyati and Sturzenegger (2001).

In estimating Eq. (1) for long-run per capita growth, we follow the by now standard literature on growth, as summarized by Barro and Sala-I-Martin (1995), and use average data for 1974–2000. In terms of the equation specification, we also follow Barro and Sala-I-Martin (1995), Sachs and Warner (1995), and Dollar (1992) among others, and assume that the rate of growth of GDP (g_j^*) depends on a number of structural, policy and social variables. More specifically, we include the following covariates: The log of initial GDP per capita (*gdpin*); the investment ratio (*invgdp*); the coverage of secondary education (*sec*, a proxy for human capital); an index of the degree of openness of the economy (*openness*); the ratio of government consumption relative to GDP (*gov*); and regional dummies for Latin American, Sub Saharan African and Transition economies (*latam*, *safrica*, and *trans*). Finally, and in order to investigate whether the exchange rate regime affects long-run growth, in some of the regressions we also incorporated two alternative indexes for the exchange rate regime. The first one, which we call *pegged_cross*, is a cross-section version of the time series index *pegged*, defined above. It takes the value of one if the country in question has been classified as a fixed exchange rate regime for at least 50% of the time, and zero otherwise. The second index—called *regime_cross*—is a cross-section version of the index *regime* described above, and is constructed as an average of that index. A lower value of this *regime_cross* index, then, represents a more flexible exchange rate regime.

In the estimation of the dynamics of growth Eq. (2), v_{tj} is the terms of trade shock (Δtt), and is defined as the percentage change of the relative price of exports to imports. Thus, a positive (negative) number represents an improvement (deterioration) in the terms of trade. In addition to the terms of trade shocks, we also included the terms of trade shock interacted with our different exchange rate regime indexes. An index of civil unrest was included as a proxy for other shocks (this can be interpreted as being an element in vector u_{tj} in Eq. (1). In all equations we included time fixed effects, which capture systemic shocks to all countries, such as the world business cycle or changes in global liquidity (world interest rates). We also included regional dummies and, in some specifications, lagged values of the terms of trade shocks. In Table 2 we present summary statistics for all variables used in our empirical analysis.[11]

[11] As usual, data availability differs across countries and variables. For consistency, the statistics reported in the table are based on the actual sample used in the empirical tests below.

Table 2
Summary statistics

Variable	Sample	Obs.	Mean	Std. dev.	Min	Max
Δgdp	Full	100	1.157	1.933	−5.689	5.850
gdpin	Full	100	1.340	1.690	0.066	9.828
invgdp	Full	100	0.217	0.054	0.097	0.440
sec	Full	100	0.416	0.275	0.020	0.910
openness	Full	100	0.355	0.204	0.083	1.168
gov	Full	100	0.203	0.192	0.024	1.148
Civil unrest	Full	1733	3.494	1.745	1	7
$[g_j^* - g_{t-1,j}]$	Full	1733	0.046	5.153	−49.802	57.233
	Pegged	850	0.020	5.289	−17.564	40.278
	Non-pegged	883	0.092	4.990	−50.219	57.021
Δtt	Full	1733	4.226	16.185	−88.846	114.195
	Pegged	850	2.854	17.925	−83.451	85.222
	Non-pegged	883	5.546	14.197	−88.846	114.195

Note: A mean test rejects the mean equality hypothesis for the pegged and non-pegged samples is rejected for Δtt at the 1% level, but fails to reject mean equality for $[g_j^* - g_{t-1,j}]$.

2.4. Main results

The results from the first step estimation for the long-run growth equation are reported in Table 3, where the *t*-statistics have been estimated using robust standard errors computed using the Huber–White methodology. As may be seen, the results are quite satisfactory; all the coefficients have the expected sign and a number of them are statistically significant. These results confirm previous findings with respect to the roles played by initial GDP, education, openness, and government consumption in explaining differentials in long-run GDP per capita across countries. In term of questions raised in this paper, a particularly interesting finding in Table 3 is that the estimated coefficients for our two exchange rate regime indicators are significantly negative. This suggests that in the long run, and after controlling for the traditional covariates, countries with (de facto) more rigid exchange rate regimes have tended to grow at a slower rate than countries with more flexible exchange rate systems. Moreover, the absolute values of the point estimates are quite large, suggesting that, with other things given, countries with a fixed exchange rate regime have had a lower rate of growth of GDP per capita ranging between 0.66 and 0.85, than countries with a flexible regime. These findings contrast with studies such as Ghosh et al. (1995) and IMF (1997) that have used the official IMF classification of regimes. According to these studies, while fixed exchange rate countries tend to have a lower rate of inflation than flexible rate ones, there is no statistical difference in terms of GDP per capita growth across both groups of countries. Our results, on the other hand, are consistent with recent findings by Levy Yeyati and Sturzenegger (2003).

We use the fitted values from the specification reported in Table 3, col. (ii) to construct a proxy for g_j^* in the second step estimation of Eq. (2). When alternative

Table 3
Cross-section first-stage growth regressions

	(i)	(ii)	(iii)
gdpin	−0.550***	−0.467**	−0.494**
	(0.135)	(0.204)	(0.197)
invgdp	6.276	5.171	5.052
	(4.288)	(4.259)	(4.427)
sec	2.969***	2.591**	2.594**
	(0.908)	(1.138)	(1.105)
openness	0.479	1.351	1.531
	(0.970)	(1.048)	(1.098)
gov	−2.030	−2.520	−2.234
	(1.460)	(1.550)	(1.514)
latam	−0.971**	−0.828*	−0.858*
	(0.467)	(0.461)	(0.471)
safrica	−1.480***	−1.191**	−1.280**
	(0.547)	(0.566)	(0.554)
trans	−0.865**	−0.557	−0.621
	(0.412)	(0.615)	(0.593)
pegged_cross		−0.854***	
		(0.318)	
regime_cross			−0.656**
			(0.278)
Constant	0.157	0.588	0.923
	(0.950)	(0.912)	(1.001)
Obs.	100	96	96
R^2	0.45	0.45	0.44

Note: ***, **, and * represent 99%, 95% and 90% significance. Heteroskedasticity-consistent standard errors in parentheses.

specifications for the long-run growth equation were used, the results were very similar to those reported in the paper.[12]

Table 4 contains the results from the estimation, using the FGLS procedure described above, of several versions of Eq. (2) on the dynamics of growth. All equations were estimated for the 1974–2000 period and, as noted, included year fixed effects. As may be seen, the results are quite satisfactory. The estimated coefficient of $[g_j^* - g_{t-1j}]$ is, as expected, positive, significant, and smaller than one. The point estimates are on the high side, between 0.75 and 0.8, suggesting that, on average, deviations between long run and actual growth get eliminated rather quickly. For instance, according to Table 4(a), col. (i), after 4 years approximately 90% of a unitary shock to real GDP growth will be eliminated. Also, as expected, the estimated coefficients of the terms of trade shock are always positive, and statistically significant, indicating that an improvement (deterioration) in the terms of trade

[12]They are available from the authors on request.

Table 4

(a) *Growth dynamics regressions (FGLS) full sample*

	(i)	(ii)	(iii)	(iv)	(v)	(vi)
$[g_j^* - g_{t-1j}]$	0.784***	0.748***	0.782***	0.800***	0.781***	0.744***
	(0.021)	(0.023)	(0.021)	(0.023)	(0.021)	(0.023)
Δtt	0.038***	0.046***	0.057***	0.060***	0.030***	0.037***
	(0.008)	(0.009)	(0.007)	(0.007)	(0.011)	(0.014)
Δtt_1		0.022**		0.036***		0.014
		(0.008)		(0.007)		(0.011)
$\Delta tt * pegged$	0.045***	0.046***				
	(0.011)	(0.011)				
$\Delta tt * pegged\_1$		0.027**				
		(0.108)				
$\Delta tt * hard$			0.038**	0.052***		
			(0.019)	(0.019)		
$\Delta tt * hard\_1$				0.019		
				(0.018)		
$\Delta tt * regime$					0.025***	0.026***
					(0.007)	(0.007)
$\Delta tt * regime\_1$						0.017***
						(0.007)
Civil unrest	−0.051	−0.034	−0.053	−0.045	−0.058	−0.046
	(0.040)	(0.039)	(0.040)	(0.040)	(0.040)	(0.039)
Constant	−0.216	−0.388	−0.893	−0.386**	−0.886*	−1.135**
	(0.488)	(0.476)	(0.473)	(0.493)	(0.469)	(0.456)
Obs.	1733	1650	1733	1723	1733	1650
$\Delta tt + \Delta tt\_1$		0.068***		0.096***		0.051***
		[33.74]		[104.30]		[12.72]
Pegged [a]		0.073***				
		[25.21]				
Hard [b]				0.072**		
				[6.58]		
Regime [c]						0.043***
						[23.31]

(b) *Growth dynamics regressions (FGLS) split sample by regime*

	(i) Flexible	(ii) Intermediate	(iii) Peg	(iv) Hard Peg
$[g_j^* - g_{t-1j}]$	0.887***	0.939***	0.774***	0.873***
	(0.033)	(0.038)	(0.029)	(0.067)
Δtt	0.032***	0.042***	0.081***	0.130***
	(0.010)	(0.011)	(0.008)	(0.020)
Δtt_1	0.020**	0.021**	0.045***	0.051***
	(0.010)	(0.010)	(0.008)	(0.020)
Civil unrest	0.113**	−0.105	−0.087*	−0.128
	(0.054)	(0.080)	(0.052)	(0.251)
Constant	−1.830***	2.193**	0.179	1.480
	(0.572)	(1.032)	(0.377)	(2.114)

Table 4 (*continued*)

(b) *Growth dynamics regressions (FGLS) split sample by regime*

	(i) Flexible	(ii) Intermediate	(iii) Peg	(iv) Hard Peg
Obs.	462	416	845	217
$\Delta tt + \Delta tt\_1$	0.052***	0.063***	0.126***	0.181***
	[12.38]	[16.22]	[121.56]	[32.26]

(c) *Differential response by regime*

	Flexible	Intermediate	Hard
Pegged	0.068***[d]	0.064***[e]	−0.065*[f]
	[9.20]	[7.95]	[3.58]
Obs.	1307	1261	845

Note: ***, **, and * represent 99%, 95% and 90% significance. Heteroskedasticity-consistent standard errors in parentheses. χ^2 in brackets. All regressions include year dummies.

[a]Refers to: $\Delta tt * pegged + \Delta tt * pegged\_1$.

[b]Refers to: $\Delta tt * hard + \Delta tt * hard\_1$.

[c]Refers to: $\Delta tt * regime + \Delta tt * regime\_1$.

[d]Refers to: $\Delta tt * pegged + \Delta tt\_1 * pegged - (\Delta tt * flexible + \Delta tt\_1 * flexible)$.

[e]Refers to: $\Delta tt * pegged + \Delta tt\_1 * pegged - (\Delta tt * intermediate + \Delta tt\_1 * intermediate)$.

[f]Refers to: $\Delta tt * (pegged\text{-}hard) + \Delta tt\_1 * (pegged\text{-}hard) - (\Delta tt * hard + \Delta tt\_1 * hard)$.

results in an acceleration (de-acceleration) in the rate of growth of real per capita GDP. The results in Table 4 also show that the coefficients of our political shocks variable, civil unrest, are negative in every specification. However, they are not significant at conventional levels.

Our main interest in this Table is the estimated coefficient of the interactive terms between our exchange rate regime indexes and the terms of trade shock. As shown in Table 4(a), the estimated coefficients of these interactive terms are always positive and significant at conventional levels. This indicates that the effects of terms of trade shocks on growth are larger under fixed exchange rate regimes that under floating regimes. Consider, as an example, the case of column (i) in Table 4(a): the terms of trade coefficient have a point estimate of 0.038 while the estimated interactive term yields a point estimate of 0.045. These results suggest, then, that in pegged exchange rates countries a 10% deterioration in the international terms of trade has been associated, on average, with a (contemporaneous) decline in GDP per capita growth of 0.83 of one percentage point. In flexible exchange rates countries, on the other hand, the same 10% decline in the international terms of trade has been associated, on average, with a (contemporaneous) reduction in GDP per capita growth of 0.38 of one percentage point. That is, according to this equation, under flexible exchange rates the effects of terms of trade shocks on growth are less than one half than under fixed regimes.

Table 4(b) reports separate FGLS regression results for four groups, each corresponding to a different exchange rate regime. The first one is comprised of countries that according to our indicator have a flexible exchange rate; the second sub-sample contains countries with an intermediate regime. The third sub-sample contains countries with a pegged exchange rate regime. And finally, the fourth sub-sample corresponds to countries that according to our classification have had a hard peg regime. As may be seen, the results are quite satisfactory and indicate that the estimated coefficient of the terms of trade variable is always positive and significant. What is particularly interesting from the point of view of this paper's topic is that point estimates of these coefficients are different across the four sub-samples, and increasing with the rigidity of the exchange rate regimes. Indeed, the sum of the contemporaneous and lagged terms of trade coefficients is highest for the hard pegged regimes (0.181); the second highest value corresponds to the pegged regimes (0.126). The sum of these coefficients is 0.063 for the intermediate systems, and it is the lowest (0.052) for the group of countries that has had a flexible exchange rate system. Moreover, as shown in Table 4(c), the coefficients for pegs are significantly larger than those for each of the more flexible regimes.[13]

To analyze whether the results reported above are driven by the level of development, rather than by their exchange rate regime we divided our sample into industrial and emerging countries. The results obtained, which are reported in Table 5, show that flexible exchange rate regimes have helped buffer terms of trade shocks for both industrial and emerging nations.

In order to investigate further the effect of terms of trade on growth, we also computed "normalized beta coefficients" for the different growth dynamics regressions in Table 4. These coefficients allow us to assess the way in which growth is affected by a one standard deviation shock in the terms of trade. The results obtained indicate that the normalized betas are significantly higher for hard pegs and pegged regimes than for intermediate and flexible regimes. The beta for hard pegs is 0.446, and it is 0.393 for pegged regimes; for intermediate and flexible regimes the normalized beta coefficients are, respectively, 0.139 and 0.134.

As a way of investigating whether our results depended on the specification used, we performed a number of robustness checks.[14] For instance, we examined whether more open economies are more sensitive to terms of trade shocks by re-estimating our base model with an additional regressor that interacts terms of trade shocks with the degree of openness. The results obtained, available on request, suggest that while open countries appear to respond more strongly to terms of trade shocks, the impact through the exchange rate regime remains unaltered, in the sense that the coefficients of the terms of trade shocks variable are larger for countries with more rigid exchange rate regimes. Similarly, we found that the results are virtually unchanged

[13]The χ^2 statistics in this table were computed interacting each of the regressors with the corresponding regime dummy. Thus, for example, to compute the statistics for the pegged—flexible comparison we restricted the sample to include pegs and flexible regimes, interacted all controls with the *pegged* and *flexible* dummies, and tested the null $\Delta tt * pegged + \Delta tt\_1 * neg * pegged - (\Delta tt * flexible + \Delta tt\_1 * flexible) = 0$. The last column (pegged vs. hard) compares conventional and hard pegged regimes.

[14]We are grateful to the referees for suggesting these robustness checks.

Table 5
Growth dynamics regressions (FGLS) emerging and industrial countries

	(i) Emerging	(ii) Industrial	(v) Emerging	(vi) Industrial
$[g_j^* - g_{t-1j}]$	0.787***	0.627***	0.785***	0.621***
	(0.027)	(0.044)	(0.026)	(0.043)
Δtt	0.047***	0.051***	0.034***	0.064***
	(0.010)	(0.019)	(0.012)	(0.020)
Δtt_1	0.022**	0.012	0.021	−0.011
	(0.010)	(0.019)	(0.013)	(0.020)
$\Delta tt * pegged$	0.049***	0.015		
	(0.012)	(0.027)		
$\Delta tt * pegged\_1$	0.020*	0.099***		
	(0.012)	(0.027)		
$\Delta tt * regime$			0.029***	−0.003
			(0.008)	(0.013)
$\Delta tt * regime\_1$			0.010	0.066***
			(0.008)	(0.014)
Civil unrest	−0.118*	−0.222	−0.122*	−0.265**
	(0.064)	(0.145)	(0.064)	(0.142)
Constant	−0.281	−2.356***	0.357	0.179
	(0.513)	(0.454)	(0.557)	(0.407)
Obs.	1281	369	1281	369
$\Delta tt + \Delta tt\_1$	0.069***	0.063**	0.055***	0.053***
	[25.92]	[6.85]	[9.37]	[4.87]
Pegged[a]	0.069***	0.114***		
	[16.30]	[21.29]		
Regime[b]			0.039***	0.031***
			[12.64]	[24.56]

Note: ***, **, and * represent 99%, 95% and 90% significance. Heteroskedasticity-consistent standard errors in parentheses. χ^2 in brackets. All regressions include year dummies.

[a]Refers to: $\Delta tt * pegged + \Delta tt * pegged\_1$.

[b]Refers to: $\Delta tt * regime + \Delta tt * regime\_1$.

when we add the square of terms of trade shocks to control for potential nonlinearities.

Overall, the results reported in Tables 4 and 5, then, provide support for the hypothesis that countries with flexible regimes have been able to accommodate terms of trade shocks better than countries with rigid exchange rates. In the next section, we expand our analysis by exploring whether terms of trade shocks affect growth asymmetrically. More precisely, we examine whether the impact of negative shocks is stronger than that of positive shocks, as one should expect if price rigidities are stronger when it comes to downward adjustments. Moreover, we test whether the differential impact of terms of trade shocks across regimes is mostly explained by a larger real response to negative shocks in pegged arrangements.

3. Asymmetric effects and alternative definitions of regimes

In this section, we extend the analysis in two directions: First, we investigate whether there is evidence of asymmetric effects of positive and negative terms of trade shocks on growth, and whether these asymmetric effects are different under alternative exchange rate regimes. Second, we analyze the robustness of our results to alternative classifications of exchange rate regimes.

3.1. *Asymmetric effects of terms of trade shocks under alternative regimes*

According to standard models, the most important advantage of flexible exchange rates is that they allow the economy to adjust quickly in response to negative terms of trade shocks. The reason for this is that, under flexible regimes, required adjustments in the real exchange rate take place mostly through changes in the nominal exchange rate. In particular, when as a result of an external real shock—a terms of trade deterioration, say—the real exchange rate has to depreciate, the nominal exchange rate will change accordingly. This contrasts with the case of pegged exchange rate regimes, where required real exchange rate depreciations have to take place through declines in domestic nominal prices. If nominal prices are rigid, the terms of trade shock will result in unemployment, a decline in output and in the rate of growth, see Dornbusch (1980) and Kenen (2002) for details.

Therefore, it is possible to argue that, from a policy perspective, what really matters is the way in which alternative exchange rate regimes can deal with *negative* terms of trade shocks.

In order to investigate this issue, we estimated a number of regressions that distinguished between positive and negative terms of trade shocks. As before, we used a FGLS procedure for heteroskedastic panels. In this case, our system becomes:

$$g_j^* = \alpha + \mathbf{x_j}\beta + \mathbf{r_j}\theta + \omega_j, \tag{4}$$

$$\Delta g_{tj} = \lambda[g_j^* - g_{t-1j}] + \varphi vp_{tj} + \psi vn_{tj} + \gamma u_{tj} + \xi_{tj}, \tag{5}$$

where vp_{tj} refers to positive terms of trade shocks, vn_{tj} refers to negative shocks; φ and ψ are coefficients to be estimated. If the effects of negative terms of trade disturbances on growth were indeed larger than those of positive shocks, we would expect φ to be significantly smaller than ψ. In the estimation of Eqs. (4) and (5) we made a distinction between four exchange rate regimes: Hard pegged; pegged; intermediate and flexible. If, as its supporters have argued, flexible regimes are able to accommodate better negative real shocks from abroad, the estimated ψs–the coefficient of the *negative* terms of trade shocks—would be larger in countries with more rigid exchange rate regimes than in countries with more flexible ones. As before, in the estimation of the equation on growth dynamics (Eq. (5)) we included year fixed effects.

The results from the estimation of system (4)–(5) are presented in Table 6 for two alternative samples: One that includes all countries and a sub-sample of emerging countries only. As may be seen, the results indicate that there are indeed asymmetric

Table 6
Asymmetry (FGLS) full sample and emerging countries[a]

	(i) All	(ii)	(iii)	(iv)	(v) Emerging	(vi)	(vii)
	Flexible	Intermediate	Peg	Hard	Flexible	Intermediate	Peg
$[g_j^* - g_{t-1j}]$	0.895***	0.931***	0.774***	0.881***	0.917***	0.993***	0.806***
	(0.032)	(0.038)	(0.029)	(0.067)	(0.039)	(0.041)	(0.033)
$\Delta tt * pos$	0.021	0.030**	0.066***	0.076**	0.038**	0.037**	0.065***
	(0.014)	(0.015)	(0.013)	(0.036)	(0.016)	(0.018)	(0.015)
$\Delta tt * pos\_1$	0.040***	0.001	0.041***	0.042	0.030*	−0.007	0.032**
	(0.014)	(0.015)	(0.012)	(0.032)	(0.017)	(0.018)	(0.013)
Δtt_neg	0.052**	0.059**	0.102***	0.178***	0.063**	0.069***	0.115***
	(0.025)	(0.023)	(0.015)	(0.031)	(0.028)	(0.024)	(0.016)
$\Delta tt * neg\_1$	−0.009	0.046**	0.051***	0.053	0.011	0.055***	0.051***
	(0.017)	(0.020)	(0.016)	(0.034)	(0.019)	(0.021)	(0.016)
Civil unrest	0.138**	−0.013	−0.049	−0.066	0.086	−0.088	−0.138*
	(0.054)	(0.087)	(0.060)	(0.249)	(0.121)	(0.129)	(0.083)
Constant	−1.728	2.208	1.827***	1.168	−2.344	1.178	0.289
	(0.611)	(1.026)	(0.639)	(3.517)	(1.214)	(2.040)	(0.724)
Obs.	462	416	845	217	301	326	714
pos[b]	0.061***	0.031	0.107***	0.116**	0.068***	0.030	0.097***
	[11.46]	[2.06]	[41.28]	[5.80]	[10.07]	[1.32]	[28.58]
neg[c]	0.043	0.105***	0.153***	0.204***	0.074**	0.124***	0.166***
	[2.19]	[13.78]	[54.79]	[19.91]	[5.21]	[17.28]	[60.78]
neg−pos[d]	−0.018	0.074*	0.046*	0.088	0.006	0.094***	0.069**
	[0.24]	[3.79]	[2.47]	[1.73]	[0.03]	[4.98]	[5.04]

Note: ***, **, and * represent 99%, 95% and 90% significance. Heteroskedasticity-consistent standard errors in parentheses. χ^2 in brackets. All regressions include year dummies.

[a]All hard pegs belong to the emerging country sample.

[b]Refers to: $\Delta tt * pos + \Delta tt * pos\_1$.

[c]Refers to: $\Delta tt * neg + \Delta tt * neg\_1$.

[d]Refers to: $\Delta tt * pos + \Delta tt * pos\_1 - \Delta tt * neg - \Delta tt * neg\_1$.

effects of terms of trade shocks when exchange rates are not fully flexible: The coefficient for negative terms of trade shocks is significantly higher than the coefficient for positive shocks for intermediate and fixed regimes (but not for flexible ones).

On the other hand, in line with our priors, this asymmetry is largely driven by a stronger response to negative shocks. Consider, for example, the comparison between pegged vs. flexible regimes for the whole sample. According to the FGLS estimates in Table 6, the sum of the coefficients of the negative terms of trade shocks is 0.153 for the pegged regime countries, but only 0.043 for those countries with a flexible exchange rate. From a statistical point of view, the sum of the (negative) terms of trade coefficients is significantly higher for the pegged regime countries, the

Table 7
Asymmetry (FGLS) differential response by regime and type of shock

	Pegged – flex	Pegged – non-pegged	Flex – non-flex
Positive shock	0.035	0.068**	−0.040
	[1.33]	[5.99]	[1.73]
Negative shock	0.104**	0.084***	−0.087*
	[5.79]	[5.34]	[3.52]
Obs.	1307	1723	1723

Note: ***, **, and * represent 99%, 95% and 90% significance. χ^2 in brackets. All regressions include year dummies.

χ^2 has a *p*-value of 0.017 (Table 7).[15] In fact, similar tests indicate that the sum of the negative terms of trade coefficients for countries with flexible (fixed) exchange rate arrangements are significantly lower (higher) than the sum of the negative terms of trade coefficients for countries with non-flexible (non-pegged) rates.

To summarize, these results provide further support for the hypothesis that flexible exchange rates play a role as shock absorbers, helping countries accommodate real terms of trade shocks, and that this ability to accommodate these shocks appears to be particularly important in the presence of negative external shocks.

3.2. Alternative classification of exchange rate regimes

In this subsection we investigate whether the results reported above depend on the de facto classification of exchange rate regimes used in the previous tests. In order to do this, we re-estimated our model using the standard official exchange rate classification provided by the IMF. The results obtained in this case, not reported here due to space considerations, are somewhat weaker. Although the coefficients have the expected signs, and in most cases have similar point estimates to those reported in Tables 4–6, they are estimated with a lower degree of precision.

To explore further this issue we conduct the following simple exercise. We revise the IMF-based classification, and try to detect obvious misclassifications of regimes. More precisely, we re-estimate our equations using a restricted sample that exclude controversial IMF-based regimes, namely, pegs that exhibit an e*xchange rate volatility* above the sample median.[16] This entails the (relatively minor) loss of 89

[15]The χ^2 statistics in this table were computed interacting each of the regressors with the corresponding regime dummy. Thus, to compute the statistics for negative shocks for the pegged—flex comparison we included pegs and flexible regimes, interacted all the controls with the *pegged* and *flexible* dummies, and tested the null $\Delta tt * neg * pegged + \Delta tt * neg\_1 * pegged - (\Delta tt * neg * flexible + \Delta tt * neg\_1 * flexible) = 0$.

[16]Thus, we are simply excluding de jure pegs that de facto display substantial exchange rate volatility. The measurement of exchange rate volatility is described in Appendix B. While a similar correction can be done for floats and intermediates, it is certainly in the peg group where misclassifications are less debatable, as changes in the exchange rate are readily observable.

observations, which, on the other hand, only contribute to reduce the estimation precision. The estimates, which are available from the authors on request, have a higher degree of precision than those obtained when the unadjusted IMF classification is used. Moreover, these results indicate, as before, that terms of trade shocks—and in particular negative terms of trade shocks—have a larger effect on growth under rigid exchange rate regimes.

4. Large countries, dominant producers, terms of trade shocks and exchange rate regimes

The results discussed above assumed that terms of trade shocks are exogenous. While this is a non-controversial assumption for small countries, it may not hold for large countries and/or for countries that have a large market share for particular goods or commodities. In this section, we explore this issue by re-estimating our baseline regressions for four sub-samples that exclude large countries, as well as countries that have a dominant presence in international markets for commodities.[17]

Specifically, we tackle the problem in three ways. First, we use a new, smaller sample that excludes ‘‘large’’ countries, defined as those with aggregate GDP (measured in current dollars) in the top quintile of the global GDP distribution. Second, we define a second sub-sample that leaves out ‘‘major exporters’’, a group comprised of countries for which exports of a particular good represents more than 15% of total world exports and more than 5% of the country’s total exports. Third, we use a third sub-sample that excludes major oil exporters. Finally, we use a fourth sub-sample that excludes both ‘‘major exporters’’, as well as ‘‘oil exporters’’. Table 8 lists the countries excluded in each case.

Results from these estimations are reported in Table 9. In Table 9(a), the terms of trade variable is interacted with the ‘‘pegged’’ variable for the exchange rate system, and in Table 9(b) it is interacted with the ‘‘regime’’ indicator for exchange rate system. The results confirm our previous findings. In fact, a comparison with Table 4(a) shows that the point estimates are very similar to those obtained when the full sample is used, indicating that the findings are unlikely to be driven by terms of trade endogeneity.[18]

[17]Unfortunately, possible instruments for the terms of trade shock are likely to be questionable on grounds that they have been found to be correlated with growth rates in some of the various specification tested in the growth literature; hence, the second best strategy adopted here. Broda (2003) follows a similar approach to deal with the potential endogeneity of the terms of trade in his VAR analysis.

[18]In order explore whether our results are driven by the link between *long-term* growth and regimes, we rerun the baseline specification in columns (1), (2), (5) and (6) in Table 4, for two separate samples: One for ‘‘*long-term fast growing*’’ countries, and one for ‘‘*long-term slow growing countries*.’’ (A country was defined as ‘‘fast growing’’ if its average rate of growth during the period under study is above the sample’s median). The results obtained indicate that the coefficients of the interactive terms ($\Delta tt * regime$) are almost identical for (long-term) slow and fast growing countries. This indicates that our findings hold irrespective of long-term growth rates.

Table 8

(a) *List of major exporters* (15% or more of the good's world exports and 5% or more of the country's exports)[a]

SITC	Countries	Good	Percent of country's total	Percent of developing countries total	Percent of world's total
423	Argentina	Fixed vegetable oils, soft	5.86	53.18	19.48
281	Brazil	Iron ore and concentrates	5.27	65.35	33.07
682	Chile	Cooper	26.73	39.62	16.33
072	Cote d'Ivore	Cocoa	28.06	42.26	25.97
667	Israel	Pearl, Prec., semi-prec. stones	30.43	28.09	18.04
271	Jordan	Fertilizers, crude	14.97	21.15	16.33
074	Kenya	Tea and mate	29.51	20.38	17.35
793	Korea, Rep.of	Ships, boats, etc.	5.56	66.93	21.65
271	Morocco	Fertilizers, crude	5.23	37.60	29.04
286	Niger	Uranium, thorium ores, conc.	45.59	58.43	23.04
289	Papua New G.	Prec. metal ores, waste nes.	42.35	56.02	26.07
341	Russia	Gas, natural and manufactured	17.25	97.98	21.17
333	Saudi Arabia	Crude petroleum	84.58	25.03	18.65
074	Sri Lanka	Tea and mate	14.21	28.06	23.89
263	Uzbekistan	Cotton	40.93	29.15	15.26
042	Vietnam	Rice	8.88	25.29	17.80

(b) *Oil exporters* (major exporters of crude petroleum and petroleum products)[b]
Countries

Algeria	Iraq	Libya	Oman	Untd. Arab Emirates
Bahrain	Korea	Mexico	Saudi Arabia	Venezuela
Iran	Kuwait	Nigeria	Singapore	

(c) *Large countries* (average GDP in current dollars not included in percentile 80)[c]
Countries

China	Germany	Japan	Spain	United Kingdom
Canada	Italy	Netherlands	Sweden	United States
France				

[a]Total of 14 goods and 16 countries. Source: UNCTAD Handbook of Statistics 2003.
[b]*Source*: UNCTAD Handbook of Statistics 2003.
[c]*Source*: WEO.

5. Concluding remarks

In this paper we examined two aspects of the economic implications of exchange rate regimes that, despite being recurrently used to argue in favor of exchange rate flexibility, had been the subject of little, if any, empirical work: (i) the relevance of

Table 9
Growth dynamics regressions (FGLS) controlling for country size and market share

	(i) Exc. large	(ii)	(iii) Exc. major exporters (a)	(iv)	(v) Exc. oil exporters (b)	(vi)	(vii) Exc. (a) + (b)	(viii)
(a)								
$[g_j^* - g_{t-1j}]$	0.782***	0.765***	0.770***	0.725***	0.795***	0.748***	0.783***	0.724***
	(0.023)	(0.025)	(0.022)	(0.024)	(0.021)	(0.024)	(0.022)	(0.025)
Δtt	0.039***	0.048***	0.040***	0.044***	0.041***	0.050***	0.043***	0.049***
	(0.009)	(0.009)	(0.009)	(0.009)	(0.008)	(0.009)	(0.009)	(0.009)
Δtt_1		0.024***		0.022**		0.020**		0.020**
		(0.009)		(0.009)		(0.009)		(0.009)
$\Delta tt * pegged$	0.048***	0.048***	0.042***	0.046***	0.042***	0.039***	0.038***	0.039***
	(0.012)	(0.011)	(0.012)	(0.011)	(0.011)	(0.011)	(0.012)	(0.012)
$\Delta tt * pegged\_1$		0.022*		0.026**		0.029***		0.029**
		(0.011)		(0.011)		(0.011)		(0.012)
Civil unrest	−0.086*	−0.062	−0.067	−0.058	−0.032	−0.020	−0.045	−0.043**
	(0.048)	(0.047)	(0.042)	(0.041)	(0.041)	(0.040)	(0.043)	(0.041)
Constant	−0.086	−0.572	−0.098	−1.055**	−1.068**	−0.305	0.021	0.046
	(0.497)	(0.427)	(0.565)	(0.516)	(0.483)	(0.492)	(0.591)	(0.580)
Obs.	1517	1440	1532	1460	1643	1570	1442	1380
$\Delta tt + \Delta tt\_1$		0.072***		0.066***		0.070**		0.069***
		[33.10]		[29.11]		[33.87]		[29.50]
Pegged[a]		0.070***		0.072***		0.068***		0.068***
		[19.63]		[23.46]		[21.37]		[19.55]

Table 9 (*continued*)

	(i) Exc. large	(ii)	(iii) Exc. major exporters (a)	(iv)	(v) Exc. oil exporters (b)	(vi)	(vii) Exc. (a) + (b)	(viii)
(b)								
$[g_j^* - g_{t-1j}]$	0.780***	0.763***	0.768***	0.722***	0.793***	0.746***	0.781***	0.722***
	(0.023)	(0.025)	(0.022)	(0.024)	(0.021)	(0.024)	(0.022)	(0.025)
Δtt	0.029**	0.037***	0.029**	0.033***	0.032***	0.041***	0.032***	0.037***
	(0.012)	(0.012)	(0.011)	(0.011)	(0.011)	(0.012)	(0.012)	0.016
Δtt_1		0.018		0.018		0.012		0.016
		(0.012)		(0.011)		(0.011)		(0.012)
$\Delta tt * regime$	0.026***	0.028***	0.026***	0.027***	0.023***	0.023***	0.024***	0.024***
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
$\Delta tt * regime\_1$		0.013*		0.014**		0.018***		0.015**
		(0.007)		(0.007)		(0.007)		(0.007)
Civil unrest	−0.093*	−0.072	−0.073*	−0.068*	−0.038	−0.031	−0.050	−0.052
	(0.048)	(0.046)	(0.042)	(0.041)	(0.041)	(0.040)	(0.043)	(0.041)
Constant	−0.040	−0.532	−0.053	−0.092	−1.067**	−1.308***	−1.060*	0.043
	(0.500)	(0.428)	(0.564)	(0.554)	(0.485)	(0.469)	(0.549)	(0.579)
Obs.	1517	1440	1532	1460	1643	1570	1442	1380
$\Delta tt + \Delta tt\_1$		0.055***		0.051***		0.053***		0.053***
		[11.79]		[11.57]		[13.18]		[12.17]
Regime[b]		0.041***		0.041***		0.041***		0.039***
		[17.15]		[21.14]		[21.12]		[18.83]

Note: ***, **, and * represent 99%, 95% and 90% significance. Heteroskedasticity-consistent standard errors in parentheses. χ^2 in brackets. All regressions include year dummies.

[a]Refers to: $\Delta tt * pegged + \Delta tt * pegged\_1$.

[b]Refers to: $\Delta tt * regime + \Delta tt * regime\_1$.

flexible exchange rates as absorbers of real shocks, and (ii) the link between this role and the presence of downward price rigidities. More precisely, we tested whether the sensitivity of real output to terms of trade shocks decreased with the flexibility of the regime, and whether this sensitivity was higher in the event of negative shocks, as it should be the case in the presence of asymmetric price rigidities.

Our results strongly confirm the conventional view on this issue. Using a de facto classification of exchange rate regimes, we found that flexible exchange rate arrangements indeed help reduce the real impact of terms of trade shocks, both in emerging and industrial economies.[19] Moreover, we found real output to be more sensitive to negative than to positive shocks. In fact, most of the differential shock responses across regimes can be traced to the stronger real impact of negative shocks under a peg, be it of the conventional or the hard kind. The effects unveiled in this paper are, on the other hand, not only statistically significant but economically important: While a 10% deterioration of the terms of trade translates into a real contraction of around 0.4% for the average country, this effect nearly doubles under a peg. Thus, the choice of exchange rate regime indeed has important implications in terms of output volatility.

Moreover, the fact that the asymmetry of output responses to real shocks increases with the rigidity of the regime suggests that pegs are associated with deeper and longer contractions that, if not fully reversible, may lead to a slower long-run growth. The extent to which this channel contributes to explain the positive correlation between regime flexibility and growth reported in recent empirical work will certainly be the subject of future research.

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Appendix A. Description of the data

A.1. Variables and sources

Variable	Definitions and sources
g	Rate of growth of real per capita GDP (*Source*: World Economic Outlook [WEO])
Δtt	Change in terms of trade - exports as a capacity to import (constant LCU) (*Source*: World Development Indicators [WDI]; variable NY.EXP.CAPM.KN)

[19]Similar, albeit slightly weaker, results are obtained if a de jure regime classification is used.

civil unrest	Index of civil liberties (measured on a 1 to 7 scale, with one corresponding to highest degree of freedom) (*Source*: Freedom in the World - Annual survey of freedom country ratings)
gdpin	Initial per capita GDP (average over 1970–1973) (*Source*: WEO)
gov	Growth of government consumption (*Source*: IMF's International Financial Statistics [IMF])
invgdp	Investment to GDP ratio (*Source*: IMF)
openness	Openness, (ratio of [export + import]/2 to GDP) (*Source*: IMF).
sec	Total gross enrollment ratio for secondary education (*Source*: Barro, 1997)
latam	Dummy variable for Latin American countries
safrica	Dummy variable for Sub-Saharan African countries
trans	Dummy variable for Transition economies

A.2. List of countries (183-country sample; industrial countries in bold)

Australia
Austria
Belgium
Canada
Denmark
Finland
France
Germany
Greece
Iceland
Ireland
Italy
Japan
Netherlands
New Zealand
Norway
Portugal
San Marino
Spain
Sweden
Switzerland
United Kingdom
United States
Afghanistan, I.S. of
Albania
Algeria
Angola
Antigua and Barbuda
Argentina
Armenia
Aruba
Azerbaijan
Bahamas, The
Bahrain
Bangladesh
Barbados
Belarus
Belize
Benin
Bhutan
Bolivia
Bosnia and Herzegovina
Botswana
Brazil
Brunei Darussalam
Bulgaria
Burkina Faso
Burundi
Cambodia
Cameroon
Cape Verde
Central African Rep.
Colombia
Comoros
Congo, Dem. Rep. of
Congo, Republic of
Costa Rica
Cote d'Ivoire
Croatia
Cyprus
Czech Republic
Chad
Chile
China, P.R.: Mainland
China, P.R.: Hong Kong
Djibouti
Dominica
Dominican Republic
Ecuador
Egypt
El Salvador
Equatorial Guinea
Estonia
Ethiopia
Fiji
Gabon
Gambia, The
Georgia
Ghana
Grenada
Guatemala
Guinea
Guinea-Bissau
Guyana
Haiti
Honduras
Hungary
India
Indonesia
Iran, I.R. of
Iraq
Israel
Jamaica
Jordan
Kazakhstan
Kenya
Kiribati
Korea
Kuwait

Kyrgyz Republic
Lao People's Dem.Rep
Latvia
Lebanon
Lesotho
Liberia
Libya
Lithuania
Luxembourg
Macedonia, Fyr
Madagascar
Malawi
Malaysia
Maldives
Mali
Malta
Marshall Islands
Mauritania
Mauritius
Mexico
Micronesia, Fed Sts.
Moldova
Mongolia
Morocco
Mozambique
Myanmar
Namibia
Nepal
Netherlands Antilles
Nicaragua
Niger
Nigeria
Oman
Pakistan
Palau
Panama
Papua New Guinea
Paraguay
Peru
Philippines
Poland
Qatar
Romania
Russia
Rwanda
Samoa
SaoTome & Principe
Saudi Arabia
Senegal
Seychelles
Sierra Leone
Singapore
Slovak Republic
Slovenia
Solomon Islands
Somalia
South Africa
Sri Lanka
St. Kitts and Nevis
St. Lucia
St. Vincent & Grens.
Sudan
Suriname
Swaziland
Syrian Arab Republic
Tajikistan
Tanzania
Thailand
Togo
Tonga
Trinidad and Tobago
Tunisia
Turkey
Turkmenistan
Uganda
Ukraine
United Arab Emirates
Uruguay
Vanuatu
Venezuela, Rep. Bol.
Vietnam
Yemen, Republic of
Zambia
Zimbabwe

Appendix B. De facto exchange rate regime classification[20]

The de facto classification of exchange rate regimes used in this paper employ cluster analysis techniques to group countries according to the behavior of three variables related to exchange rate policy: (i) *Exchange rate volatility* (σe), measured as the average of the absolute monthly percentage changes in the nominal exchange rate relative to the relevant anchor currency (or basket of currencies, whenever the currency weights are disclosed) over the year; (ii) *Volatility of exchange rate changes* ($\sigma_{\Delta e}$), measured as the standard deviation of the monthly percentage changes in the exchange rate; and (iii) *Volatility of reserves* (σr), measured as the average of the absolute monthly change in dollar-denominated international reserves relative to the dollar value of the monetary base in the previous month.

These variables are computed on an annual basis, so that each country–year observation represents a point in the (σe, $\sigma_{\Delta e}$, σr) space. In this space, floats are associated with little intervention in the exchange rate market (low volatility of reserves) together with high volatility of exchange rates. Observations with little or no exchange rate volatility and substantial reserves volatility correspond to the group of fixes. Finally, intermediate regimes are associated with moderate to high volatility across all variables, reflecting exchange rate movements in spite of active

[20]Based on Levy Yeyati and Sturzenegger (2002)

intervention. Observations are grouped by proximity using cluster analysis according to the characteristics previously identified.[21]

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[21]Those that do not display significant variability in either dimension are judged "inconclusive" and left unclassified.

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