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Terms of trade and exchange rate regimes in developing countries

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Terms of Trade and Exchange Rate Regimes in Developing Countries*

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Abstract

Since Friedman (1953), an advantage often attributed to flexible exchange rate regimes over fixed regimes is their ability to insulate the economy more effectively against real shocks. I use a post-Bretton Woods sample (1973-96) of seventy-five developing countries to assess whether the responses of real GDP, real exchange rates, and prices to terms-of-trade shocks differ systematically across exchange rate regimes. I find that responses are significantly different across regimes in a way that supports Friedman's hypothesis. In response to a negative terms-of-trade shock, countries with fixed regimes experience large and significant declines in real GDP, and the real exchange rate depreciates slowly and by means of a fall in prices. Countries with more flexible regimes, by contrast, tend to have small real GDP losses and immediate large real depreciations. The contributions of terms-of-trade disturbances to the actual fluctuation of real GDP, real exchange rates, and prices are also examined.

Keywords: exchange rate regimes, exchange rate flexibility, terms-of-trade shocks

JEL classification: E30, F31, F33, F41

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1 Introduction

In the early 1950s, Milton Friedman made his case in favor of flexible exchange rate regimes, based on the fact that, in a world with sticky prices, the nominal exchange rate could be used to insulate the economy against real shocks. Since then, a number of theories have confirmed his original intuition and it has become one of the least disputed arguments in favor of flexible exchange rate regimes.[1] An empirical implication of this set of theories is that the short run response to real shocks should differ across exchange rate regimes. In particular, regimes that allow for a larger movement in relative prices should have smoother adjustment of output to real shocks. The aim of this paper is to test and quantify Friedman's hypothesis.

The reason why the nominal exchange rate may matter is the presence of some kind of price stickiness. In countries with fixed exchange rate regimes, after a negative real shock, output falls until wages and prices are (slowly) bid down at a rate permitted by the nominal stickiness. In countries with a flexible regime, by contrast, the monetary authority can respond to the shock by a depreciation of the currency. The depreciation increases the domestic price of exported goods exactly when the international price of these goods has fallen and thereby partially offsets the negative effect of the shock. Furthermore, the currency depreciation reduces real wages at precisely the time when labor demand has fallen, which also contributes to a smoother adjustment.

Given the prominent role played by exchange rate regimes in developing countries, it is perhaps surprising that there is scant empirical work addressing the validity of Friedman's hypothesis. Most of the empirical literature on exchange rate regimes presents no direct test of the hypothesis addressed in this paper because it makes no distinction between nominal and real shocks. For instance, Baxter and Stockman (1989), Flood and Rose (1995), and Ghosh et al. (1997) examine output and real exchange rate volatility across exchange rate regimes but do not distinguish between the contribution of real and nominal shocks in the volatility of those variables. Aside from the greater variability of real exchange rates in countries with flexible regimes, they find little evidence of systematic differences in the behavior of other macroeconomic variables across regimes. By contrast, Bayoumi and

[1] Subsequent to Friedman [1953], a large number of authors examined the choice of regime under the assumption of price or wage stickiness (see Turnovsky (1983), and Flood and Marion (1989); see Dornbusch (1980) for direct descendants of the open economy Mundell Fleming models with sticky prices; see Obstfeld and Rogoff (1996) and Corsetti and Pesenti (2001) for dynamic general equilibrium models with nominal stickiness.)

Eichengreen (1994) find that output and inflation in G-7 countries have responded differently to aggregate demand shocks under the Bretton Woods system and the regime of flexible rates that has prevailed subsequently. The focus of their paper, however, is different from the mechanism underlying Friedman's theory.

In this paper, in order to focus on Friedman's hypothesis, the analysis is restricted to a single real shock given by the terms of trade of a country (the ratio between export prices and import prices in the same currency). Evidence is presented suggesting that the terms-of-trade series can be treated as exogenous for the sample of developing countries examined. The exogeneity of the terms of trade helps identifying the response of the real GDP, the real exchange rate, and consumer price to terms-of-trade changes across different regimes, eliminating the need for complex identification strategies and interpretations of estimated residuals. The sample used includes data for seventy-five developing countries from 1973 to 1996.

The findings of this paper provide ample empirical support for Friedman's hypothesis. The following results are obtained: (a) the real GDP response to terms-of-trade changes is significantly smoother in countries with flexible exchange rate regimes (floats) than in those with fixed regimes (pegs). Differences are mostly driven by the response to negative shocks. After two years, a 10% fall in the terms of trade reduced real GDP by 1.9% in pegs and 0.2% in floats; (b) after a negative shock, the real exchange rate is slow to depreciate in pegs, while it depreciates immediately and significantly in floats. Two years after a 10% negative shock, the real exchange rate has only depreciated by 1.3% in pegs and by 5.1% in floats. The response of the real exchange rate to positive shocks is not significantly different across regimes. In particular, there is no sharp appreciation in floats after positive shocks; (c) in floats, the nominal exchange rate depreciates more than the real rate, while in pegs, the (small) real depreciation comes from a fall in domestic prices. Overall, the evidence is consistent with the view that countries with flexible regimes are able to buffer real shocks better than those with fix regimes.

The empirical methodology is also used to estimate the importance of terms-of-trade shocks in driving the actual fluctuations of real GDP, the real exchange rate and the price level. This paper finds that approximately 33% of the real GDP fluctuations in developing countries with a fixed regime can be explained by terms-of-trade disturbances. In floats, by contrast, the contribution of terms of trade is smaller than 15%. In the case of the real exchange rate volatility, terms of trade explain 13% in pegs and 43% in floats. The findings are significantly smaller than the results in Kose (2001) and Mendoza (1995) which are based in calibrations of real-business-cycle models.

The empirical framework used also provides a natural way to test a hypothesis presented in Calvo and Reinhart (2000), and Reinhart (2000) that developing countries may be reluctant to float their exchange rates and thus prevent flexible regimes from obtaining the benefits that accrue from that flexibility. As mentioned above, floats let their nominal exchange rate fluctuate considerably when hit by terms of trade changes. Since the magnitudes are similar to those for developed countries in DeGregorio and Wolf (1994), the findings of the paper suggest that countries do not avoid floating in response to terms of trade changes.

The paper proceeds as follows. Section 2 provides a formal description of Friedman's hypothesis. Section 3 describes the classification of exchange rate regimes and the data used, and examines the exogeneity assumption of terms of trade. Section 4 introduces the empirical specification used and the dynamic response functions generated. Section 5 reports a series of robustness checks that include whether the response to shocks vary with the magnitude of the shocks, the different samples, and the various periods. Section 6 presents conclusions.

2 A Simple Model

This section provides a framework to study the effects of terms-of-trade shocks in a small open economy under different exchange rate regimes. The model includes a nominal rigidity, tradable and non-tradable goods, uncertainty in exogenous terms of trade and different degrees of accomodating exchange rate policies. It draws from the new stochastic open economy literature and takes a positive approach toward the issue of how regimes respond to terms of trade shocks.

2.1 Households

Consider a small open economy with one-period preset wages, two traded goods, home (h) and foreign (f), and one non-tradable good (nt). Both tradable goods sell in world markets at P^{h*} and P^{f*}, the export and import price, respectively.[2] By definition, $p^* = \frac{P^{h*}}{P^{f*}}$ represents the (exogenous) terms of trade of this economy. For simplicity, normalize $P^{f*} = 1$. The model assumes a continuum of households, indexed by $j \epsilon [0, 1]$, each of

[2] Asterisks indicate foreign-currency denominated prices.

which is a monopoly supplier of a differentiated labor type, $N(j)$. The utility function of agent j is:

$$U(j) = E_t \sum_{t=0}^{\infty} \beta^t \left[\log C_t(j) - \frac{1}{\psi} N_t(j)^{\psi} \right], \tag{1}$$

where $\beta \in (0,1)$, $\psi > 1$, and $C = \left(C^{nt}\right)^{1-v_f-v_h} \left(C^f\right)^{v_f} \left(C^h\right)^{v_h}$. Each household faces uncertainty about the magnitude of the terms-of-trade shock. Households decide on their current consumption, $C_t(j)$, and their future wages, $W_{t+1}(j)$, once the shock in period t is observed. Note that current wages, $W_t(j)$, are set in period $t-1$ without observing the shock in period t. Assume that the terms-of-trade shocks can take two values, p_H^* (high) or p_L^* (low), and follow a process driven by a Markov chain where $\Pr(p_t^* = p_i^* | p_{t-1}^* = p_i^*) = \pi$ for $i = H, L$ where $\pi > \frac{1}{2}$.[3]

Each household has no access to the international capital market[4] and earns $W_t(j)N_t(j)$ in period t from labor income. The budget constraint faced by agent j in terms of local currency is simply the zero trade balance condition:

$$W_t(j)N_t(j) = P_t^{nt}C_t^{nt}(j) + P_t^f C_t^f(j) + P_t^h C_t^h(j), \tag{2}$$

where the law of one price holds for both goods $P_t^h = P_t^{h*} * S_t$ and $P_t^f = S_t$, and S_t is the nominal exchange rate. Finally a type j agent faces a demand function for his labor (which is derived below), and sets his wage when maximizing his utility. For future reference, the consumer price index and the real exchange rate is defined as (ts are dropped):

$$\begin{aligned} CPI &= \tau \left(P^{nt}\right)^{1-2v} \left(P^h P^f\right)^v \\ rer &= \frac{S * CPI_F}{CPI_H} = \left(\frac{SP^{nt*}}{P^{nt}}\right)^{1-2v}, \end{aligned}$$

assuming $v = v_h = v_f$ and equal across countries so that the terms of trade have no direct effect on the real exchange rate. In addition, $\tau^{-1} = (2v)^{2v}(1-2v)^{1-2v}$.

[3] This distribution tries to capture a higher persistence in terms of trade relative to the nominal rigidity. It is useful to determine how wages change, once allowed, after the shock. The rest of the results do not depend on this special distribution.

[4] Since this restriction has no effect on the comparative statics in the more general two-country model, it is assumed here (see Corsetti and Pesenti (1998)).

2.2 Home Firm

The model assumes that the home good and the non-tradable good are supplied competitevely by a single firm. The production functions in the home sector and non-traded sectors respectively are,

$$\begin{aligned} Y_H &= N_H^\alpha = \left[\int_0^1 N_H^{(\theta-1)\theta^{-1}}(j)dj\right]^{\alpha\theta(\theta-1)^{-1}} \\ Y_{NT} &= N_{NT} = \left[\int_0^1 N_{NT}^{(\theta-1)\theta^{-1}}(j)dj\right]^{\theta(\theta-1)^{-1}}, \end{aligned} \tag{3}$$

where $\theta > 1$ is the elasticity of substitution between different types of labor and $\alpha < 1$ is the degree of decreasing returns in the home goods sector. The firm's production decision is made after observing the shock, so N is state dependant.

2.3 Monetary Authority

After observing the shock (p_t^*), a country's monetary authority has the chance to intervene in the exchange rate market and to change S_t (note that nominal wages are determined prior to the shock). The monetary authority can credibly commit to it's exchange rate policy. Under a fixed regime, the exchange rate is kept constant, $S_L = S_H = S$, while under a flexible regime the monetary authority accomodates the shock by behaving countercyclically, i.e., $S_L > S_H$. A fully accomodating policy is defined as (S_L^F, S_H^F) such that $S_L^F p_L^* = S_H^F p_H^*$.[5] I compare below the response to shocks when the monetary authority does not intervene (fixed regime) and with the fully accomodating policy (flexible regime).

2.4 Equilibrium

The firm maximizes profits subject to (3), taking prices and wages as given. The labor demands derived from the problem of the firm are:

$$N_{NT}^d(j) = \left[\frac{W(j)}{P_{NT}}\right]^{-\theta} N_{NT} \tag{4}$$

$$N_H^d(j) = \left[\frac{W(j)}{\alpha S p^*}\right]^{-\theta} N_H^{1-\theta(1-\alpha)} \tag{5}$$

[5] It is easy to show that this is the optimal policy of the monetary authority since it mimics the fully flexible wage case. The optimal policy is not unique.

where the aggregate wage is $W = \left[\int_0^1 W(j)^{1-\theta} dj\right]^{(1-\theta)^{-1}}$. The households' problem can be solved by backward induction for each previous shock at a time. To obtain the optimal preset wages, $W_i(j)$ where i denotes whether $p_{-1}^* = p_H^*$ or p_L^*, households first choose $C_i^f(j)$ for a given $W_i(j)$; households then decide on $W_i(j)$ by maximizing (1) subject to (4) and (5) and $C_i = C(W_i(j))$. I obtain the following expressions for the aggregate preset wages:

$$\overline{W}_H = \mu\left[\pi\left(S_H p_H^*\right)^\gamma + (1-\pi)\left(S_L p_L^*\right)^\gamma\right]^{\frac{1}{\gamma}} \quad (6)$$

$$\overline{W}_L = \mu\left[(1-\pi)\left(S_H p_H^*\right)^\gamma + \pi\left(S_L p_L^*\right)^\gamma\right]^{\frac{1}{\gamma}}, \quad (7)$$

where $\gamma = \frac{\psi}{1-\alpha} > 1$ and $\mu = \alpha\left(\frac{\theta}{\theta-1}\right)^\gamma$.[6]

It can be further shown that employment in the nontraded sector is a constant share of total employment and therefore the equilibrium (log) real GDP (in terms of home goods) when $p_{-1}^* = i$ and $p^* = j$ is given by,

$$y_{ji} = \log\kappa + \alpha\log N_{H,ji} = \log\kappa + \frac{\alpha}{1-\alpha}\left[\log\alpha + \log S_j p_j^* - \log\overline{W}_i\right],$$

where $\kappa = 1 + \alpha(\frac{1}{2v\alpha} - 1) > 1$. Given the nature of the terms of trade process, the "long-term" variance of (log) real GDP can be defined as $\sigma_y^2 = \frac{1}{2}\sigma_{y_H}^2 + \frac{1}{2}\sigma_{y_L}^2$, where $\sigma_{y_i}^2 = E\left(y_{ji} - Ey_i\right)^2$. Using (6)and (7) it follows that

$$\sigma_y^2 = \pi(1-\pi)\left[\frac{\alpha}{1-\alpha}\left(\log S_H p_H^* - \log S_L p_L^*\right)\right]^2. \quad (8)$$

Equations (6), (7), and (8) yield the following results (see appendix for proofs):

Result 1: Under full wage flexibility, the variance of real GDP and the response of dollar wages to terms of trade shocks are the same across regimes.

Friedman (1953) argued that the choice of exchange rate regime would be irrelevant if all nominal prices adjusted instantanously, an assertion that is supported in this model. Nonetheless, even with price and wage flexibility, other theories may explain why the exchange rate regime might affect the relative insulating properties of regimes.[7]

[6] See Broda (2001b) for a study of price levels across exchange rate regimes.

[7] They include reasons related to the strategic behavior of fiscal authority under different regimes (Tornell and Velasco (1996)), the visibility or transparency of the regime (Canavan

Result 2: Under full wage rigidity, increasing the degree of accomodation from fixed to fully accomodating implies a monotonic fall in the variance of real GDP, σ_y^2.

Floats have smoother real GDP responses to terms-of-trade shocks than do pegs. The intuition behind this finding reflects the forces in the labor market: a country faced by a terms-of-trade shock with nominal wage rigidity and a fixed exchange rate regime, cannot escape an adjustment in employment. Employment changes one to one with the change in labor demand in the home sector caused by the shock. In floats, by contrast, a depreciation (appreciation) of the exchange rate can reduce (increase) the dollar wage exactly when the demand for labor is low (high), therefore diminishing the effect of the shocks on employment. That is, $\left(\frac{d\ln y}{d\ln p^*}\right)_{Peg} > \left(\frac{d\ln y}{d\ln p^*}\right)_{Float}$.

Result 3: In the same period of the shock, in flexible regimes real exchange rates are counter-cyclical, while in fixed regimes they are constant. In flexible regimes, consumer prices increase (decrease) immediately after a low (high) shock, while in fixed regimes, consumer prices decrease (increase) after one year.

Note that in equilibrium,

$$\begin{aligned} rer &= \left(P^{nt*}\left(\frac{\overline{W}}{S}\right)^{-1}\right)^{1-2v} \\ CPI &= \tau\left(\overline{W}\right)^{1-2v}(SP^{h*})^v S^v. \end{aligned}$$

The real imbalance generated by a shock requires an equilibrium change in the rer, which can be achieved by a nominal depreciation or a fall in wages. Since floats are able to use the exchange rate immediately, whereas in pegs, prices change only after a period, the immediate response of the real exchange rate is larger in floats, that is, $\left|\frac{d\ln rer}{d\ln p^*}\right|_{Float} > \left|\frac{d\ln rer}{d\ln p^*}\right|_{Peg}$. Furthermore, as soon as wages are allowed to change, $\left(\frac{d\ln cpi}{d\ln p^*}\right)_{Peg} > 0$. In floats, a high (low) terms-of-trade shock is followed by a immediate fall (rise) in the CPI, i.e., $\left(\frac{d\ln cpi}{d\ln p^*}\right)_{Float} < 0$.

and Tommasi (1997)), the effects of uncertainty and imperfect capital markets (Helpman and Razin (1982), and Aguiar (1999) among others). I should also note an old strand of the literature that emphasizes the use of reserves to buffer temporary supply shocks, including those associated to the terms of trade, in fixed exchange rate regimes (Lipschitz (1978)).

The results above support the basic intuition that flexible regimes have better insulating properties than do fixed regimes. In the empirical excercise that follows I test this intuition by examining how the real GDP, real exchange rate, and prices respond to terms of trade changes in developing countries.

3 Data Description

3.1 Classifying Exchange Rate Regimes

The basic reference for classification of exchange rate regimes is the International Monetary Fund's Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER).[8] This classification is a *de jure* classification that is based on the publicly stated commitment of the authorities in the country in question. The report captures the notion of a formal commitment to a regime, but fails to capture whether the actual policies were consistent with the stated commitment. For example, *de jure* pegs can pursue policies inconsistent with their stated regime and require frequent changes in the nominal exchange rate, making the degree of commitment embedded in the peg in fact similar to a float.[9] Similarly, fear of floating can cause central banks to subordinate their monetary policy to eliminate fluctuations in the exchange rate, rendering a *de jure* float equivalent to a *de facto* peg.[10]

The problems of the *de jure* classification can potentially be solved if the classification is based on the observed behavior of the exchange rate. Such *de facto* classifications, however, fail in principle to distinguish between stability that results from policy commitments and that which results from the absence of shocks. A suggested solution is to look at data on interventions in an attempt to have a better understanding of the actual behavior of the monetary authority. In this spirit, Levy Yeyati and Sturzennegger [1999] analyze data on volatility of reserves and exchange rates. I use this database

[8] The AREAER classification consists of nine categories, broadly grouped into pegs, arrangements with limited flexibility, and "more flexible arrangements", which include managed and pure floats. This description is based on the AREAER (1996).

[9] Take Central America in the mid-80s as an example. El Salvador (1983-1984), Guatemala (1986-1988) and Nicaragua (1985-1987) are classified as pegs (with respect to the dollar) in AREAER, while they had average nominal depreciations (with respect to the dollar) of 10%, 41% and 106% respectively.

[10] For different causes of this "fear" see Calvo and Reinhart (2000) and Reinhart (2000). They have also examined numerous examples of this behavior, which include Bolivia (1985-1996), Mexico (1995-1999), Peru (1990-1999), and Uganda (1992-1999).

only as a robustness check in section 4.

This paper uses Ghosh et al. [1997] to classify exchange rate regimes, which combines the *de jure* and *de facto* approaches. Ghosh et al. start with the AREAER classification and further divide pegged regimes into "frequent" and "infrequent" adjusters, the former being defined as all regimes with more than one change per year in either parity or, in the case of basket pegs, in their weights.[11] All other pegs are classified as infrequent adjusters. They also distinguish between heavily managed floats and other type of floats. Also following Ghosh et al., I adopt a three-way classification of pegged, intermediate and floating regimes. Pegged regimes include countries with single currency pegs, SDR pegs, other official basket pegs and secret basket pegs excluding those classified as frequent adjusters in these categories. The pegged frequent adjusters are included in the intermediate category along with all cooperative arrangements, floats within a pre-determined range and heavily managed floats. The floating category includes other types of managed floats and the independent floats. Figure 1 shows the evolution of exchange rate regimes for the 75 developing countries in the sample during the period 1973-1996.

3.2 Descriptive Statistics

The sample used consists of annual observations for developing, non-oil countries with populations larger than 1 million over the period 1973-1996.[12] Data sources, variable definitions and a list of the 75 countries with available data appear in the appendix (Table A1 and Table A2). A table summarizing the main variables by exchange rate regime is also presented in the appendix (Table A3).[13] In the main text, I focus on the behavior of the terms of trade during the sample period, its relation to exchange rate regimes, and the time series properties of the variables involved in the regression analysis that follows.

Figure 2 presents the standard deviation of terms of trade and the average exchange rate regime flexibility for each country between 1973 and 1996.

[11] I completed their classification using information from the World Currency Book (1996) about the magnitude and period a country had devalued using the guidelines of Ghosh et al. (1997).

[12] Broda (2001a) uses data upto 1994. This paper uses revised data for terms of trade in 1994 and new terms of trade data for 1995 and 1996.

[13] For instance, this table shows that in developing countries the real exchange rate volatility is significantly higher in floats than in pegs. This has been widely documented in the case of OECD countries (see Mussa (1986) and Baxter and Stockman (1989)). This table is obviously subject to endogeneity problems.

The average regime flexibility for a country is captured by the share of the time a country is classified as having a flexible regime during the period. For instance, a share of one implies that a country had a flexible exchange rate regime during the entire sample period. As the figure illustrates, terms of trade have fluctuated substantially over the last 25 years. In some countries, namely Burundi and Ecuador, the standard deviation of the period surpasses 20%. On average, one standard deviations implies a change in the terms of trade of around 12%. Furthermore, the scatter plot suggests that there is no stong pattern between the volatility of the terms of trade and the regime. This will prove useful for the interpretation of the results of next section, though it is not a necessary condition for that analysis.

Table 1 reports the results of unit root tests for the endogenous variables in the VAR (real GDP, real exchange rate, price levels and terms of trade). In approximately 75 percent of the countries, the individual Augmented Dickey Fuller tests could not reject the existence of a unit root in the four series examined.[14] In order to improve on the power of the individual tests, a panel unit root test was performed. The test is based on the method proposed by Levin and Lin (1993). The table shows that the conclusions from the individual tests are not altered. For the full sample, the panel tests cannot reject the existence of a unit root in the series examined. For certain sub-samples, however, the existence of a unit root can be rejected. This is the case for real GDP in Asia and Latin America as well as for terms of trade in Africa.

Finally, panel cointegration tests were performed (not reported). According to Pedroni (1995) and Kao (1999)'s test statistics, the null hypothesis for zero cointegration vectors is not rejected in the data.[15] As a result, the empirical properties of the variables examined imply that estimating the VAR in first differences without imposing any cointegration relationships is a good approximation. Standard time-series tests further suggest that 4 lags should be used in the VAR.

[14] In the case of the real exchange rate series, the overall evidence on the existence of a unit root has been mixed (see Floot and Rogoff (1996) for a survey, and Papell (1997)).

[15] A statistical appendix is available from the author upon request. It includes: a) Kao (1999) and Pedroni (1995)'s panel test for cointegration. Kao's method was applied for pairwise comparison of these variables, while Pedroni's statistic tests the existence of two or three cointegration vectors in the system; b) unit root tests for each countries; c) Portmanteau (Q) test for white noise for each country; d) Im, Pesaran and Shin (1997)'s panel unit-root tests.

3.3 Exogeneity of Terms of Trade

The assumption of exogeneity of the terms of trade for the countries under study is key for the identifying strategy used in the next section. In theory, the small country assumption is used as a rationale for these countries being price takers in world markets. In practice, however, despite the seventy-five developing countries in the sample accounting for less than 17 percent of world trade (in 1996), these countries can potentially influence the price of the goods they buy or sell. This sub-section shows that only a small number of countries exert such an influence and only on a small share of the goods they export. This finding, in turn, suggests that the bias introduced by assuming exogenous terms of trade is small.

Table 2A shows a list of all the goods for which the export share of any developing country exceeds 15 percent of the world export of that good. Only 22 goods from 9 countries (out of a sample of 1000 goods and 75 countries) satisfy this criteria.[16] Furthermore, these exported goods account for a small share of the countries' total exports (on average, 6.2%). This suggests that, inasmuch as the monopoly power depends on the market share of the exported goods, the price taking assumption is a good approximation for most of the countries involved.

Some specific exceptions remain, notably, Brazil's iron ore exports and Cote d'Ivoire's cocoa exports. For these cases, it then becomes important to assess the effect of the endogeneity bias in the regression analysis. First, since the paper focuses on the different responses across exchange rate regimes, the bias has to be different across regimes for it to influence the results. The countries in Table 2A cover a broad range of regimes, from fully flexible regimes (Sri Lanka) to fixed regimes (Cote d'Ivoire). Second, if the endogeneity comes from real GDP affecting the terms of trade, finding significant terms of trade coefficients may become more difficult. Take the case of Brazil's iron exports. A negative supply shock to the production of iron would increase Brazil's terms of trade at the same time that real GDP is falling, inducing a negative correlation between terms of trade and real GDP. As will be shown in section 4, the data suggests the opposite and, therefore, if anything, the bias makes finding significant coefficients more difficult. Third, if the real exchange rate affects the terms of trade, the direction of the bias would be unclear and would depend on whether a country's monopoly power is on the goods they buy or sell.

The above exceptions notwithstanding, Table 2B shows that exports,

[16] Note that Chile's copper exports and Colombia's coffee exports are not included in the table since they account for 12.88 and 14.24 percent of world exports, respectively.

imports, and the real exchange rate fail to granger cause the terms of trade in the developing countries included in the sample. The table also shows that, as expected, the exogeneity assumption of terms of trade is rejected for developed and oil-exporting countries. Reassuringly, all the results prove to be robust to the exclusion of the countries listed in Table 2A. Several other papers (see Mendoza (1995) and Kose (2001)) have used this exogeneity assumption in calibrations of real-business-cycle models.

4 Empirical Model and Results

4.1 Panel VAR

This sub-section models the empirical behavior of real GDP (y_{it}), the real exchange rate (rer), the price level (p), and terms of trade (tt) in countries with different exchange rate regimes. The structural model estimated can be expressed as,

$$\mathbf{A}_0\mathbf{Y}_{it} = \mathbf{A}(L)\mathbf{Y}_{it} + \mathbf{B}(L)\,\mathbf{X}_{it} + \mathbf{u}_{it} \tag{9}$$

where $\mathbf{Y}'_{it} = (\triangle \ln tt_{it}, \triangle \ln y_{it}, \triangle \ln rer_{it}, \triangle \ln p_{it})$ is a vector of stationary endogenous variables $(\triangle = (1-L))$, $\mathbf{u}'_{it} = \left(u^{tt}_{it}, u^{y}_{it}, u^{rer}_{it}, u^{p}_{it}\right)$ are the structural errors, $\mathbf{X}_{it}$ is a matrix of exogenous variables, $\mathbf{A}(L)$ and $\mathbf{B}(L)$ are matrix polynomials in the lag operator of order $q = 4$, and $var(\mathbf{u}_{it}) = \Omega$.

In general, the dynamic responses of $\mathbf{Y}_{it}$ to u^{tt}_{it} can be identified if A_0 and Ω can be recovered from the reduced form estimates. The main identifying assumption of this paper is the exogeneity of the terms of trade. This assumption implies that $a^q_{12} = a^q_{13} = a^q_{14} = 0\ \forall q$. Three additional assumptions $(a_{23} = a_{24} = a_{34} = 0)$ are required for $\mathbf{A}_0$ to be block diagonal and, in turn, to recover the structural coefficients. Changing the ordering of the variables has no implication on the dynamic response functions. The reduced form of (9) is estimated using SUR.[17]

To examine whether the response to real shocks are different across exchange rate regimes $\mathbf{A}(L)$ and $\mathbf{B}(L)$ are allowed to differ across regimes. For that purpose, $\mathbf{Y}_{it}$ and $\mathbf{X}_{it}$ are interacted with a dummy for the regime

[17] Since each equation has lagged dependant variables the consistency of the SUR estimates heavily relies on the errors being serially uncorrelated. Three potential sources of autocorrelation were checked for: 1) the presence of fixed effects in the model in first differences using a procedure similar to that in Holtz-Eakin (1988); 2) the potential moving average structure of the errors in (1); and 3) omission of lags (using the tests provided in Arelllano and Bond (1999)). These tests are available upon request.

(R_{it}, where $R = Peg$ or $Float$ and $Intermediate$). Furthermore, to avoid the influence of those years where countries change regime, I constrain the observations to satisfy the following condition:

$$R_{it} = R_{it-1} = R_{it-2}. \tag{10}$$

That is, if a peg (float) today decides to float (peg), that observation is not included in the regression in the current period nor in the two periods that follow. Thus, I compare countries with fix regimes that did not abandon the peg versus floats that did not abandon the float. Results without this restriction are presented in the next section.

The exchange rate regime of a country can be correlated with other characteristics of the country that may influence the response to shocks. To prevent these correlations from being captured by the exchange rate regime variable, a number of control variables are included in $\mathbf{X}_{it}$. In the general specification I try to control for the degree of openness, financial development, access to international capital markets, and fiscal policy. Openness is key to assess the income effect of a given terms-of-trade change and hence its effect on GDP. It is proxied as the share of trade in GDP ($open_{it}$). Financial development is proxied by the difference of quasi money to money as a share of GDP ($findev_{it}$). Finally, the change in the current account position ($\triangle ca\_y_{it}$) proxied for access to foreign markets, and the change in real government expenditure as a share of GDP ($\triangle \ln g$) served as a control for fiscal policy. The only systematically significant controls are $open_{it}$ and $\triangle \ln g$. In both cases, including these controls makes the difference across regimes less significant.

4.2 Main Results

4.2.1 Dynamic responses

Figures 3, 4, and 5 show the dynamic responses of y_{it}, rer_{it} and p_{it} to a permanent change in terms of trade with present value equal to -10% (roughly, one standard deviation) in countries with a fixed exchange rate regime. The coefficients on the terms-of-trade variables are restricted to be the same no matter the sign of the terms-of-trade shock. This constraint is relaxed in the next section. Figures 6, 7, and 8 show the dynamic responses to the same shock in countries with a flexible regime. Solid lines are the point estimates of the dynamic response functions, and dashed lines represent two standard deviations (5th and 95th percentile) of the empirical distribution of the responses.[18]

As Figure 3 shows, the effect of the terms-of-trade change on real GDP in countries with fixed exchange rate regime is significantly negative for the first three periods after the shock. The short run drop in real GDP following a 10% present value decrease in the terms of trade of 10% is around 1.9%. Figure 4 shows that the real exchange rate is almost unchanged during the first period after the shock and then it slowly depreciates. The long run real depreciation is 2.1%. Furthermore, Figure 5 shows that this real depreciation is achieved through a fall in the price level of the pegs. These figures confirm that real shocks have large effects on peg regimes and are consistent with the predicted sluggish adjustment in the real exchange rate (dollar wage) since pegs rely on the sticky price (wage) level to produce such adjustment.

Figures 6 and 7 show that the effect on real GDP is negligible in countries with flexible regimes and that the response of the real exchange rate is also markedly different from that in pegs. In floats, the real exchange rate depreciates immediately and significantly by 4.1%. Furthermore, the response of prices in floats is opposite to that in pegs. The consumer price level in floats increases by approximately 2% within two years of the shock.[19] This response implies that in floats the nominal exchange rate rises by more than the real rate. The joint response of real GDP, the real exchange rate, and prices is consistent with Friedman's conclusion that floats can smooth the effects of negative real shocks and achieve a rapid depreciation of the real exchange rate since they can use the nominal exchange rate as an immediate adjustment variable. Table A4 in the appendix presents the five estimated coefficients for the terms of trade variable on each of the equations in system (9).

The combined response of prices and the real exchange rate can be used

[18] The 90th percent confidence intervals were computed using the following Monte Carlo procedure. Let $\underset{4k\times 1}{\boldsymbol{\pi}} = \mathbf{vec}(\Pi)$ denote the reduced from estimated coefficients from the system in (1) where $k = 4p + 1$, and $\boldsymbol{\psi}_s = \boldsymbol{\psi}_s(\boldsymbol{\pi}) = \frac{\delta \mathbf{Y}_{t+s}}{\delta e_t^{tt}}$ be a (4×1) vector where ψ_{js} identifies the consequence of the innovation e_t^{tt} on variable j at date $t+s$ (see Appendix 3 for details). I then randomly generated a $4k \times 1$ vector drawn from the (estimated) distribution of $\boldsymbol{\pi}$, $N(\boldsymbol{\pi}, \Omega \otimes E(X'X)^{-1})$,where X includes all regressands. Denote this vector by $\widehat{\boldsymbol{\pi}}^{(1)}$. Using $\widehat{\boldsymbol{\pi}}^{(1)}$ I re-simulated the VAR and obtained $\widehat{\boldsymbol{\psi}}_s^{(1)} = \boldsymbol{\psi}_s(\widehat{\boldsymbol{\pi}}^{(1)})$ and repeated the above procedure for 10000 different simulations and for each fixed lag, calculated the 500th lowest and 9500th highest value of the corresponding impulse response coefficient across all 10000 estimated impulse response functions.

[19] Interestingly, the response of prices in opposite directions across regimes is consistent with evidence from Australia's experience under different exchange rate regimes. See Gruen and Shuetrim (1994).

to test the fear of floating hypothesis suggested by Calvo and Reinhart (2000) and Reinhart (2000). These papers argue that the fear of inflation and the existence of large sectors of the economy indebted in foreign currency can prevent developing countries from using exchange rate policy. The findings of this paper suggests otherwise. Two years after a 10% permanent fall in terms of trade, the nominal exchange rate depreciated by 6.9 % in the average developing country with a flexible regime. This is higher than the 4.8% nominal depreciation observed in OECD countries, as reported by DeGregorio and Wolf (1994). As will be shown in the next section, in highly dollarized countries where the fear of floating should be strongest, the nominal exchange rate also reacts significantly to terms-of-trade changes in the short run. These findings suggest that countries do not avoid floating in response to terms-of-trade changes.

4.2.2 How important are terms-of-trade shocks?

The main objective of this sub-section is to determine the contribution of terms-of-trade shocks to the actual volatility of real GDP, real exchange rates, and prices in developing countries. The contribution of terms of trade shocks is computed by using the estimated VAR model in the previous subsection. As in Kose (2001) and Mendoza (1995), terms of trade shocks are assumed uncorrelated with all other shocks in the economy.

Table 3 shows the percentage in the variation of each variable that is explained by terms-of-trade shocks using two different approaches. The first approach (superscript A) calculates standard deviations for each country for the period 1973-1998. Each of the 75 countries is then grouped under Fixed or Flexible depending on their average exchange rate regime during the period (as in Figure 2). The VAR is then estimated separately for each group of countries. The second approach (superscript B) uses 5-year moving averages to compute standard deviations of each variable for each country-year data point. To avoid problems that arise from countries changing regime, each observation is included only if a country's regime remained constant over the 5-year period.

The results for real GDP show that between 30% and 33% of the actual variance of pegs can be explained by terms-of-trade disturbances. For countries with flexible regimes, the contribution of terms-of-trade shocks accounts for less than 13% of actual real GDP volatility. This contrasts with the results found in Kose (2001) and Mendoza (1995). They parametrize and simulate a real-business-cycle model with multiple shocks for a subsample of the countries involved in this study. Mendoza (1995) finds that terms of trade disturbances explain 56% of output fluctuations in developing countries. Kose (2001) considers main import and export prices that are more volatile than the aggregate terms-of-trade index. Based on average moments of 28 developing countries, he finds intermediate input prices to explain 45% of the output fluctuations, and capital goods prices to explain an additional 42%. Overall, the estimates of the contribution of terms of trade disturbances in output volatility based on real-business-cycle model estimates are significantly higher than those found in this paper.

The estimated model suggests that terms-of-trade shocks explain approximately 13% of the real exchange rate volatility in pegs and between 31% and 43% of real exchange rate fluctuations in floats. In the case of floats, the results are closer to the 49% found by Mendoza (1995). For consumer prices, in turn, terms-of-trade shocks can explain approximately 20% of variation in pegs and between 11% and 20% in floats. As will be shown below, the pattern of large contributions to real GDP in pegs and large contributions to real exchange rate in floats can be found in all the regions examined.

4.2.3 Asymmetry

In the main specification of the empirical model, the coefficients on the terms-of-trade variables are restricted to be the same no matter what sign the terms-of-trade shock takes. Therefore, the responses to negative and positive shocks are assumed to be symmetric. I will now discuss the results in the case where shocks of different signs are allowed to have different coefficients and hence the response to positive and negative shocks can differ. This sub-section highlights the differences in responses to shocks of different signs within exchange rate regimes. The additional restrictions imposed in the model result in coefficients that are less robust to specification changes relative to the main empirical model. For an examination of differences across regimes see Table 4.

In light of the discussion of section 2, the response to positive and negative shocks may be asymmetric within regimes. Under pegs, for example, the stickiness of prices might be larger when prices are required to fall compared with when they have to rise. This would imply that the adjustment to positive shocks should be smoother in terms of output since the change in relative prices are easier to bring about. Figure 9 and 10 depict the responses of real GDP and the real exchange rate to a negative (solid line) and positive (dotted line) 10% terms-of-trade change in countries with a fixed exchange rate regime. In pegs, the short-run real GDP response is symmetric across shocks and the real exchange rate response is not significantly different from zero following a positive or negative shock. A Wald test for the null hypothesis that coefficients of the terms-of-trade variable in the real GDP (*rer*) regression are larger (smaller) after negative shocks than after positive shocks is rejected at the 1% level (not reported)). These responses suggest that nominal rigidities may not be larger for downward relative to upward movements of the terms of trade.

In countries with flexible regimes, the response to shocks of opposite sign is less symmetric. Figure 12 shows that the real exchange rate sharply depreciates immediately following a negative shock but barely appreciates one year after a positive shock. This difference is only significant for the period of the shock. Two years after a positive shock, the real exchange rate has appreciated by 3.9%, which is not significantly different from the 5.7% real depreciation two years after a negative shock. The real GDP responses suggest that, after a positive shock, the impact effect on real GDP is significantly larger than after a negative shock (see Figure 11). The different short-run responses of real GDP and real exchange rate suggests that countries follow a counter-cyclical exchange rate policy when shocks are negative but less so when shocks are positive. The long run responses, by contrast, are not significantly different.

5 Sensitivity Analysis

This section examines the robustness of the results to different time periods, sub-samples, and shocks. It highlights several important findings. The qualitative findings of the previous section are not altered by using a different exchange rate regime classification or different selection criteria. The observed pattern is present in all time periods and regions, though it is most pronounced in the 80s and in Africa. The response to large and small terms of trade shocks follow the same pattern, though the response to large shocks are statistically more significant. Highly dollarized countries with flexible regimes have similar short-run responses to those of the average float. Finally, the different level of financial development that exists across regimes (see Table A3) is not the driving force of the results. Table 4 summarizes all the results.

5.1 Exchange Rate Regime Classification

Since the classification of exchange rate regimes is subject to numerous problems, I replicate the analysis of the previous section using different criteria for selecting regimes. I first examine the behavior of selected groups of countries with clearer regime classifications. The groups were selected using information on Central Banks' interventions, specific events gathered in the World Currency Book (1996), the *de facto* classification by Levy Yeyati and Sturzennegger (1999) and that in Stein et al. (1999) for Central America. Sixteen pegs were selected (232 observations in total): Argentina (since 1991), Bangladesh (until 1990), Belize, CFA zone countries, Estonia (since 1992), Hong Kong (since 1983), and Panama. Under floats the following countries and periods were selected (127 observations in total): Cambodia (since 1991), Ecuador and Ghana (since 1983), Dominican Republic, Guatemala (since 1989), New Zealand (since 1985), Pakistan (since 1982), Romania (since 1992), South Africa (since 1979) and Sri Lanka (since 1982).[20]

Table 4 (section (1)) shows the results for the selected sample. Once again the same patterns as in the full sample can be observed, but responses are larger and more significant in the selected sample (except for prices). The real GDP response of pegs and the real exchange rate response of floats are significantly different from zero at the 1% level, and the difference between real GDP and real exchange rate responses across regimes are also significant at the 1% level.

In order to further test the validity of the exchange rate classification I estimated the main specification of the model using Levy Yeyati and Sturzenegger's (2000) de facto classification for the period between 1973 to 1996. The results are also presented in Section 1 of Table 4. The VAR was computed under the same restrictions as in the main specification. Using the *de facto* classification, the magnitude of the differences are smaller but statistically more significant than those using Ghosh et al.'s classification (despite the number of observations falling from 1286 to 729). The same is true when the VAR is estimated without restriction (10).[21]

The last attempt to check the robustness of the exchange rate classification appears under Method (A) in Section 1. Under this method, separate VARs are estimated for two groups of countries, countries with limited exchange rate flexibility in the period as a whole, and countries with more flexibility. The exchange rate flexibility index used in Figure 2 is used to divide the groups. In particular, a cut-off point of 0.35 was used. Real

[20] Even in these selected countries, the exchange rate regime is far from a text-book float. Take Ghana for example, during the 90s it is classified as a float by the IMF, Ghosh et al., and according to the Central Bankb4s behavior. Ghana's Cedi, however, was placed on a "controlled floating basis" in some years during the 80s and in a multiple exchange rate system during other years.

[21] In this case, the number of observations increases to 1578.

GDP responses are larger for both regimes relative to the main specification, and real exchange rate responses are smaller, but a similar overall pattern emerges. Since separate VARs were estimated the significance of the difference across regimes cannot be tested.

5.2 Different Time Periods, Regions, and Shocks

The three decades included in the full sample differ considerably in terms of the distribution of the shocks. In particular, the major oil shocks occurred during the 70s and since then the volatility of terms of trade has fallen throughout the period. Table 4 (Section 2) presents the impact, short-run and long-run responses of real GDP, real exchange rates and prices to a 10% decrease in terms of trade for three different time periods (1973-1981, 1982-1989 and 1990-1996).

Results in each period show the same pattern as those in the full sample. For instance, in all the periods large short-run real GDP changes in fixed regimes and large immediate depreciation in flexible regimes are observed. An exception is the behavior of prices in the 90s. In countries with flexible regimes, prices fall after a negative shock, while they rise in countries with fixed regimes. Despite the rise in consumer prices in pegs, the real exchange rate depreciates in the short run. This is mostly driven by the one-time devaluation of all CFA zone countries in 1994, which makes the separation between responses of different regimes more difficult. In general, results are most significant during the 80s and least significant during the 90s.

The third set of results in Table 4 show the responses by region. Africa and Latin America show patterns that are similar to those in the full sample. Despite the considerable fall in the number of observations, short-run differences between regimes are highly significant. By contrast, the differences between regimes in Asia are not significant. The effect of terms of trade on the real GDP of pegs is larger and more persistant through time than in other regions. This is mostly the result of large positive real GDP autoregressive coefficients. The immediate depreciation of the real exchange rate is smaller and less robust than in the other regions. In the case of Asia, estimating the VAR without restriction (10) renders larger real GDP responses in pegs and larger real exchange rate responses in floats.

Table 5 illustrates the importance of terms-of-trade disturbances in explaining the fluctuations of real GDP, real exchange rates and prices in the different regions. The two methods (A and B) used to calculate standard deviations are explained in Table 3. Under both procedures, Latin America is the region where terms of trade shocks explain the most of the observed real

GDP fluctuations. Almost 40% of the real GDP volatility in Latin American pegs can be accounted by terms-of-trade shocks. For those countries that had flexible regimes in Latin America, less than 20% of the volatility is explained by terms-of-trade disturbances. The contribution of terms-of-trade shocks to the volatility of real GDP is also larger in pegs than in floats in the other regions. In terms of the real exchange rate volatility, the contribution of terms-of-trade disturbances is larger in Latin America and Asia than in Africa. In Asia, for instance, the share of real exchange rate volatility explained by terms-of-trade shocks reaches 44%. Despite the larger real exchange rate volatility in floats relative to pegs,[22] terms-of-trade disturbances can explain a larger share of this volatility in floats than in pegs. This result is common in all three regions.

The last robustness check of this sub-section examines the possibility of non-linearities in the response to shocks. The model reviewed in section 2 suggests that pegs may find it less costly to change prices when faced by large shocks than when faced by smaller shocks. There is a vast literature of state dependent pricing models suggesting such a behavior. By contrast, floats may find smaller shocks easier to buffer because they require smaller price changes and, therefore, less resistance from exchange-rate sensitive groups.[23] I replicate the VAR analysis allowing for different terms of trade coefficients depending on the magnitude of the shock. In particular, I treat all terms-of-trade changes smaller than 4% in absolute value as "small".[24] Real GDP responses from the small shock VAR are less responsive in pegs than in the full sample. Real GDP drops only 1.2% compared to 1.9% in the full sample. Price changes, however, are still equally slow to occur in countries with fixed regimes under the small-shock restriction. For floats, the real depreciation obtained is equally large to that in the full sample. Overall, responses for small shocks are less significant than for large shocks.[25] This point notwithstanding, the same pattern emerges from smaller shocks as well. Section (3) also confirms the results on the assymetry to shocks discussed above.

[22] This fact has been widely documented for the case of developed countries (see Mussa (1986) and Baxter and Stockman (1989)).

[23] For a classical description of this problem see Olson (1971).

[24] For comparison reasons, the table 4 (section (4)) shows the responses to a 10% negative shock computed from the estimated VAR for small shocks.

[25] It is unclear if this is the result of a weaker relationship or the smaller number of observations when restricting the sample for "small" shocks. Total observations halve.

5.3 Dollarization and Financial Development

In this sub-section I present the results obtained from using two special sample of countries. First, I analyze the response of countries in the CFA zone in Africa versus all African floaters.[26] Second, I examine the group of highly dollarized countries. The first comparison is informative because in this special sample, as opposed to the full sample, pegs are more financially developed than floats. Table A3 shows that in the full sample the level of financial development, proxied by the ratio between quasi-money to money, is significantly larger in floats than in pegs.[27] Caballero (2001) have emphasized the role of financial development to smooth external shocks. To safely interpret the differences across regimes as caused by the exchange rate regime and not by the different level of financial development I repeat the exercise of the previous section for this special sample. The findings are presented in section (5) of Table 4. The responses to all three endogenous variables are significantly different across regimes and consistent with the pattern observed in the full sample. This is interpreted as evidence that the level of financial development is not the underlying cause driving the results.[28]

The second sample includes the group of countries classified as highly and moderately dollarized by Balino et al. (1999). Reinhert (2000) argues that one of the reasons for developing countries' unwillingness to float comes from the negative balance sheet effects that a nominal depreciation imply to sectors indebted in dollars. Thus, one would expect that for this group of countries the fear of floating might apply. Table 4 (section (5)) examines how highly dollarized floats cope with terms of trade changes. The short-run depreciation of the nominal exchange rate is as large and significant in highly dollarized floats as it is in the average float in the full sample. This suggests that even highly dollarized countries do not avoid using the flexibility of the exchange rate regime. However, the long-run response of the nominal exchange rate differs from that of the average float. Prices in highly dollarized countries fall by approximately the same amount as the real depreciation, suggesting that the short run nominal depreciation is completely undone in later periods.

[26] The CFA franc zone comprises 10 member countries: Burkina Faso, Cameroon, Central African Republic, Chad, Congo, Cote d'Ivoire, Gabon, Mali, Niger, Senegal and Togo.

[27] This is also the case using other indicators. For example, bank assets over GDP and bank liabilities over GDP.

[28] The response of real GDP is similar to that in Hoffmaister and Roldos (1997). However, the authors find that the real exchange rate response is gradual in non-CFA countries and immediate in CFA countries, opposite to what I find here.

6 Concluding Remarks

The fixed versus flexible debate remains highly contentious. In the search for clearer answers, the theoretical arguments involved ought to be tested and quantified. This paper presents substantial evidence in favor of Friedman's hypothesis that real GDP responses to real shocks are significantly smoother in floats than in pegs. Furthermore, the real exchange rate response is consistent with the assertion that the exchange rate regime plays a key role to explain the significance of the different growth responses. In response to a fall in the terms of trade, the small and slow real depreciation observed in pegs is due to the fall in domestic prices while the large and immediate real depreciation in floats reflects a large nominal depreciation. This pattern is present in all the time periods and regions examined, though it is most pronounced in the 80s and in Africa.

The paper also finds that responses are symmetric to shocks of different signs in pegs and assymetric in floats. After a negative shock, countries with flexible exchange rate regimes have larger real exchange rate changes and smaller real GDP changes than after positive shocks. Terms-of-trade disturbances are also found to explain approximately 30 percent of real GDP fluctuations in fixed regimes and approximately 40 percent of real exchange rate fluctuations in countries with flexible regimes.

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7 Appendix

Proof of Result 1): This can be seen from the two FOCs when all wages are flexible,

$$\frac{\theta-1}{\theta} = W_{H,i}^{\theta\psi} W_H^{-\theta\psi} N_H^{\psi}$$
$$\frac{\theta-1}{\theta} = W_{L,i}^{\theta\psi} W_L^{-\theta\psi} N_L^{\psi}$$

and the fact that $W_i = W$, therefore $N_L = N_H$ and $\sigma_y^2 = 0$.

Proof of Result 2): I restrict attention to policies such that $S_L p_L^* \leq S_H p_H^*$ and where $(S_L, S_H) = (S + \frac{\pi}{1-\pi}\varepsilon, S - \varepsilon)$. The higher is ε the more accomodating is the policy. It follows that

$$\frac{d\sigma_y}{d\varepsilon} = \frac{\alpha}{1-\alpha}\pi(1-\pi)\left[-\frac{1}{S_H} - \frac{\pi}{(1-\pi)S_L}\right] < 0.$$

Proof of Result 3) The first statement follows from the fact that the fully accomodating policy is optimal. With fixed wages, this implies a fall (rise) in dollar wage under a low (high) terms-of-trade shock, i.e., $\left(\frac{d\ln rer}{d\ln p^*}\right)_{float} < 0$. The first part of the second statement follows from $\left(\frac{d\ln cpi}{d\ln p^*}\right)_{float} = v\frac{d\ln S}{d\ln p^*} < 0$; the second part follows from $W_H > W_L$ in pegs.

Figure 1
Evolution of Exchange Rate Regimes for Developing Countries (1973-1998)

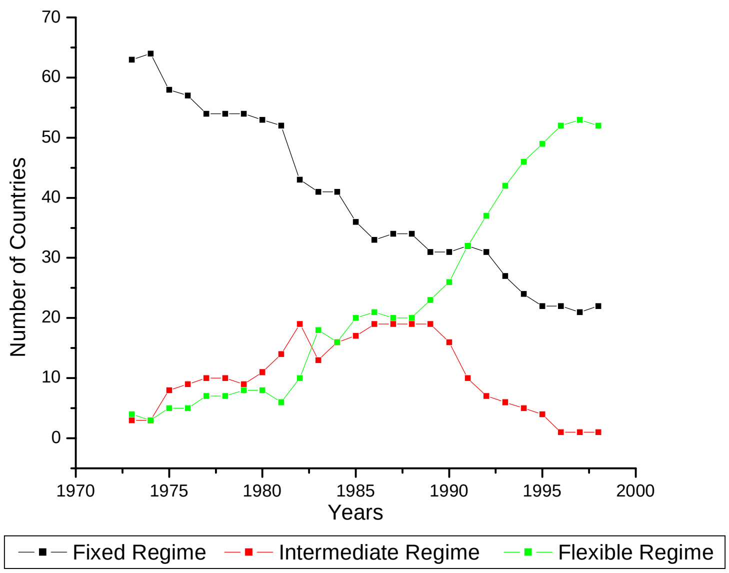
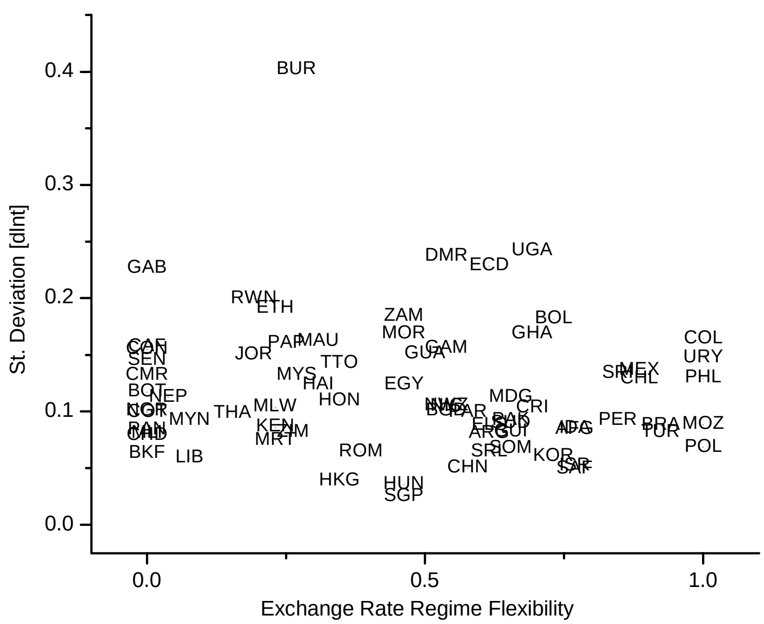


Figure 2
Terms of Trade Volatility and Exchange Rate Regime (1973-1998)



Notes: The Exchange Rate Regime Flexibility variable is defined as: the ratio between the number of years a country is classified as having a flexible or intermediate regime to the total number of years for which regime data is available during the period 1973-1998. Acronyms and variable definitions can be found in Table A1 and A2 in the appendix.

Table 1: Levin and Lin (1993) panel unit roots

Series	lny			lnr			lnp			lnt		
	a	t-star	# ADF(j) Reject	a	t-star	# ADF(j) Reject	a	t-star	# ADF(j) Reject	a	t-star	# ADF(j) Reject
All 75 countries	-0.043	-0.206	17	-0.088	1.085	18	-0.010	-0.060	15	-0.157	-0.022	22
Only Africa	-0.040	-1.132	5	-0.103	0.488	5	0.007	2.026	6	-0.259	-2.522*	8
Only Asia	-0.062	-1.553***	5	-0.009	1.345	6	-0.032	1.179	5	-0.123	-0.870	8
Only Latin	-0.048	-1.73**	4	-0.124	-1.240	5	-0.004	0.859	3	-0.228	-0.988	4

Notes: $\Delta \ln x_{it} = m + a \ln x_{it-1} + \sum_{i=1}^{k} b_{ji} \Delta \ln x_{it-i} + e_{it}$; t-star is Levin and Lin's adjusted test statistic for the unit root null hypothesis. t-star is distributed N(0,1). *,** and *** denote statistical significance at the 1%, 5% and 10% levels, respectively. Lag lengths (k) are based on the average across countries of the optimal lag length of each country. Optimal lag lengths are based on Q-tests (Portmanteau's) . "#ADF Reject" stands for the number of country's for which Augmented Dickey Fuller test (null hypothesis of a unit root) is rejected. "Only Europe" is excluded since terms of trade data span for a short time period for european countries.

Table 3: Variance Decompositions

	ToT		Real GDP				Real Exchange Rate				Consumer Prices			
	s_i^A	s_i^B	s_i^A	s_i^B	$s_{i,tt}/s_i^A$	$s_{i,tt}/s_i^B$	s_i^A	s_i^B	$s_{i,tt}/s_i^A$	$s_{i,tt}/s_i^B$	s_i^A	s_i^B	$s_{i,tt}/s_i^A$	$s_{i,tt}/s_i^B$
Fixed	13.8	12.1	5.7	4.6	30.0	32.6	9.8	8.3	12.9	13.2	5.6	4.0	18.7	23.0
					[24.5 , 36.4]	[26.6 , 42.2]			[8.3 , 19.2]	[9.2 , 21.4]			[14.7 , 29.8]	[18.4 , 40.7]
Flexible	11.8	11.1	4.4	3.4	9.6	12.9	15.2	12.0	31.2	42.7	11.8	6.1	11.2	19.8
					[8.5 , 13.4]	[10.6 , 16.2]			[23.3 , 46.2]	[29.8 , 45.8]			[8.3 , 19.2]	[15.2 , 32.4]

Notes: Superscript A and B stand for the method used to calculate the standard deviation. Method A calculates standard deviations for each country during 1973-1998. Each of the 75 countries' standard deviation is then grouped under Fixed (Flexible) if the country is classified as pegged (float) during most of the time period (in terms of Figure 2, the exact cutoff point was set to be 0.35). Method B calculates 5-year moving average standard deviations. Country-year data points are included only if $R(egime)_{it-2}=R_{it-1}=R_{it}=R_{it+1}=R_{it+2}$.

$s_{i,tt}/s_i$ is the percentage of the variance of series i (dlnt, dlny, dlnr or dlnp) that can be explained by terms of trade shocks. The 5th and 95th percentile value included in brackets.

Table 2A
Goods with 15% or more World Export Share

SITC	Good	Country	Good's X-share in Country's total X	Good's X-share in World's total X
71	Coffee and Substitutes	Brazil	5.6	17.71
281	Iron ore concentrates	Brazil	5.38	29.28
652	Cotton fabrics, woven	China	2.29	16.41
658	Textile articles nes	China	1.76	20.51
831	Travel goods, handbags	China	1.94	27.13
842	Mens outerwear not knit	China	3.94	20.3
843	Womens outerwear nonknit	China	4.79	17.65
844	Undergarments not knit	China	1.66	18.34
848	Headgear, nontxtl clothing	China	1.96	23.52
851	Footwear	China	4.44	18.41
894	Toys, sporting goods, etc	China	4.06	19.15
899	Other manufactured goods	China	1.91	16.38
72	Cocoa	Cote d'Ivoire	39.92	24.27
653	Wovn man-made fib fabric	Korea	5.58	20.12
233	Natural rubber, gums	Malaysia	2.06	21.73
424	Fixed veg oil nonsoft	Malaysia	5.23	47.54
762	Radio broadcast receivers	Malaysia	4.77	18.74
271	Fertilizers, crude	Morocco	6.47	22.01
752	Automtic data proc equip	Singapore	15.9	15.12
74	Tea and Mate	Sri Lanka	13.06	18.67
36	Rice	Thailand	3.46	26.54
37	Fish etc prepd, prsvd nes	Thailand	3.03	18.43
232	Natural rubber, gums	Thailand	4.06	32.77
TOTAL	22 Goods	9 Countries	6.23	22.21

Notes: By changing the cutoff line to 5% and 10%, 50 and 39 goods were selected. Source: Handbook of International Trade and Development Statistics (1996-1997), United Nations.

Table 2B
P-values for Granger Causality Tests

	Exports Granger Cause ToT	Imports Granger Cause ToT	RER Granger Cause ToT
OECD Countries	0.057***	0.009*	0.000*
Oil Countries	0.025**	0.018**	0.006*
Developing Countries	0.98	0.93	0.39

Notes: The p-values reported are for the test that terms of trade are not granger caused by the corresponding variable (i.e., coefficients on all leads of the terms of trade coefficient equal to zero). *, **, and *** stand for rejection of no granger causality at the 1, 5 and 10 percent level.

Responses to a 10% (PV) Permanent Fall in TT

Under Fixed Regimes

Under Flexible Regimes

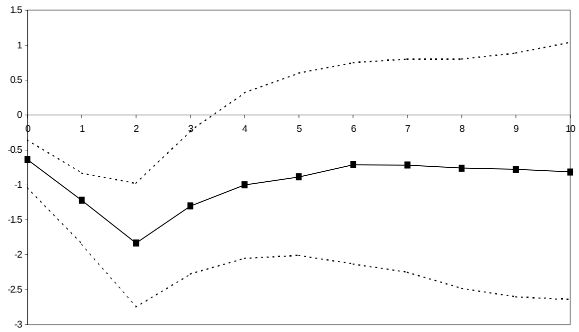


Figure 3: Real GDP Response

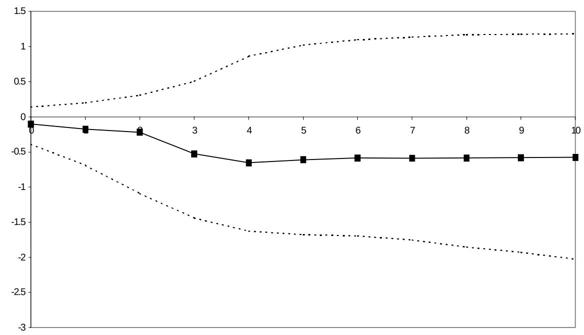


Figure 6: Real GDP Response

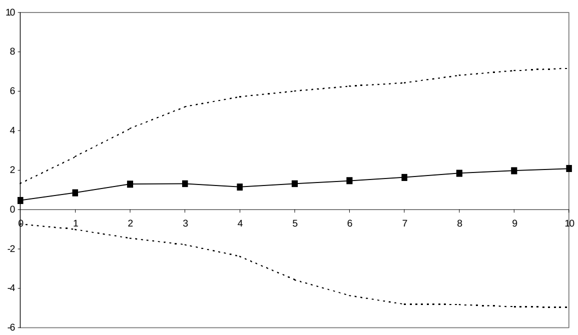


Figure 4: RER Response

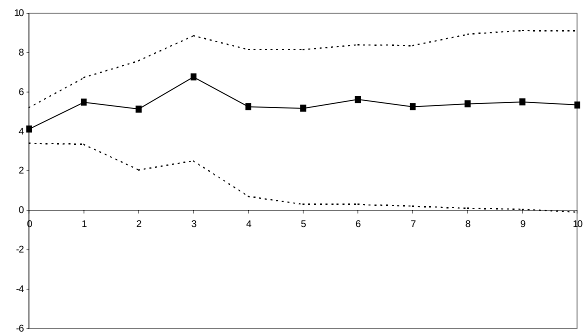


Figure 7: RER Response

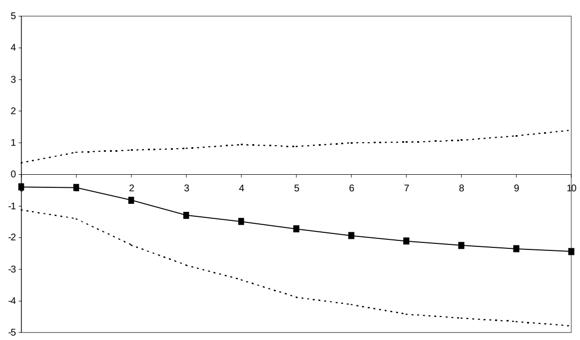


Figure 5: CPI Response

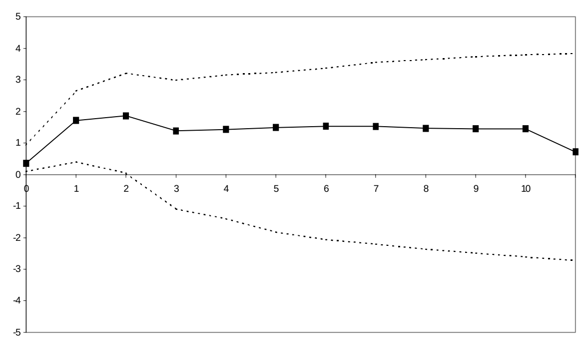


Figure 8: CPI Response

Responses to a 10% (PV) Permanent Positive (dotted line) and Negative (solid line) change in TT under Fixed Regimes

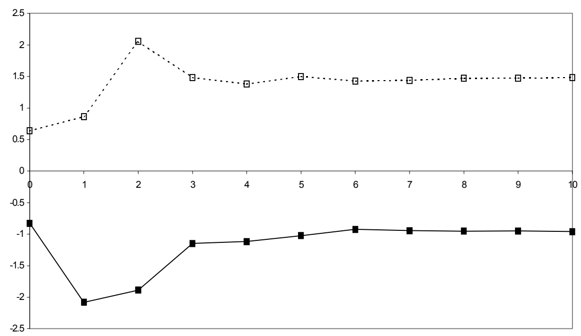


Figure 9: Real GDP Response

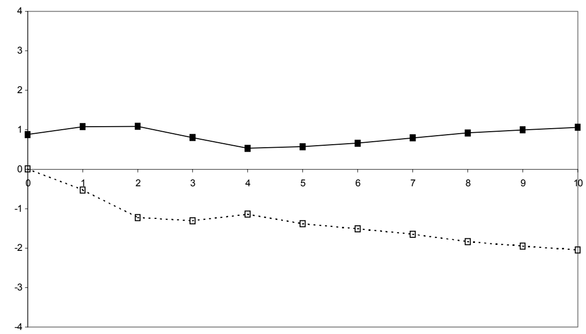


Figure 10: RER Response

Responses to a 10% (PV) Permanent Positive (dotted line) and Negative (solid line) change in TT under Flexible Regimes

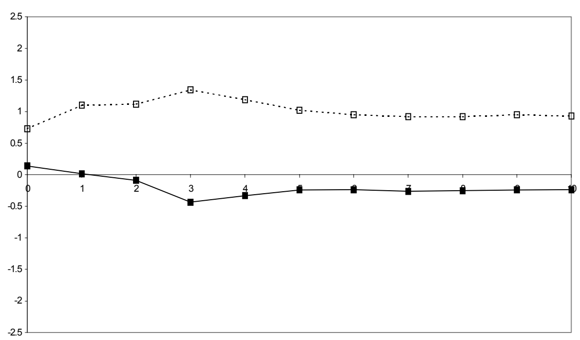


Figure 11: Real GDP Response

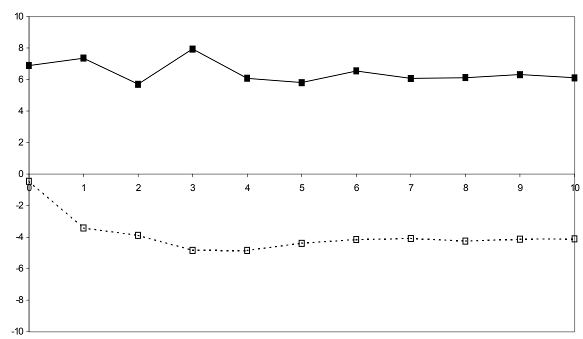


Figure 12: RER Response

Table 4. Sensitivity Analysis

	Real GDP				Real Exchange Rate				Consumer Prices			
	Impact	Short Run	Long Run	Wald	Impact	Short Run	Long Run	Wald	Impact	Short Run	Long Run	Wald
Full Sample												
Fixed	-0.64	-1.85	-0.81		0.47	1.29	2.07		-0.39	-0.81	-2.41	
Flexible	-0.10	-0.21***	-0.57	18.41*	4.11*	5.13*	5.35	19.86*	0.36	1.86***	1.45	8.07***
(1) Classification												
Selected Regimes												
Fixed	-0.55	-2.34	-1.25		-0.05	0.81	1.99		-0.30	-0.99	-2.45	
Flexible	-0.10*	-0.28*	-0.38	12.61*	3.13*	5.19*	5.88	20.97*	0.61	2.33***	2.84	2.25
De facto												
Fixed	-0.63	-1.65	-1.03		0.07	1.38	3.86		-0.47	-1.34	-4.39	
Flexible	0.03***	-0.17**	-0.41	16.91*	4.14*	4.33*	3.96	19.43*	0.22***	1.74**	1.70	8.22***
Without Restriction (10)												
Fixed	-0.60	-1.56	-0.82		0.44	2.03	3.59		-0.28	-0.77	-2.70	
Flexible	-0.04***	-0.32	-0.43	16.4*	4.43*	4.43*	3.97	18.98*	0.60**	2.04***	0.93	9.78**
Method A (1)												
Fixed	-0.47	-2.18	-1.86		0.48	1.27	0.70		-0.33	-0.88	-1.49	
Flexible	-0.29	-0.75	-0.87		2.61	3.52	4.98		-0.16	0.42	-1.10	
(2) Time Periods												
70s												
Fixed	-0.60	-1.73	-0.90		0.28	1.23	1.92		-0.40	-0.95	-2.04	
Flexible	-0.35	-0.19***	0.47	8.04***	2.62***	0.21	0.52	10.13**	0.18	0.90	0.46	2.89
80s												
Fixed	-0.96	-1.89	-2.02		0.52	0.92	1.01		-1.12	-2.01	-3.21	
Flexible	0.17**	-0.12	0.40	6.35	4.85*	5.38**	5.76	9.1***	0.33	3.41***	1.58	10.38**
90s												
Fixed	-0.75	-1.59	-1.27		3.13	2.45	-2.18		0.92	3.66	4.44	
Flexible	-0.05	-0.12	-0.68	5.11	2.70	7.20	5.82	4.64	-0.18	-1.22	-2.57	13.02**
(3) Regions												
Latin America												
Fixed	-0.53	-1.72	-1.70		0.37	0.92	0.70		-0.88	-0.61	-1.96	
Flexible	0.07***	-0.50	-0.38	3.87	4.29**	4.03***	4.67	5.88	0.80	-1.75	-2.66	2.62
Africa												
Fixed	-0.73	-1.79	-0.72		0.68	2.44	4.41		-0.17	-0.93	-2.67	
Flexible	0.22***	0.34	-0.62	10.51**	4.99*	8.55**	6.79	10.56**	2.24	4.88*	3.79	28.17*
Asia												
Fixed	-0.85	-2.19	-2.54		0.70	0.52	0.99		-0.67	-1.72	-2.97	
Flexible	0.27	-0.27	-0.28	3.06	2.60	3.57	5.04	6.12	-2.56	0.64**	-1.35	7.68
(4) TOT Distribution												
Small Shocks												
Fixed	-0.44	-1.22	-0.65		-0.56	1.55	1.95		-1.57	-1.45	-1.25	
Flexible	-0.18	-0.55	-0.29	12.01***	2.62	4.67	3.99	12.89**	-1.11	-0.54	-1.32	2.22
Positive												
Fixed	0.63	2.05	1.48		0.00	-1.22	-2.04		0.55	1.27	3.09	
Flexible	0.73	1.12	1.09	7.55	-0.43	-3.88	-4.11	7.27	-1.46**	-2.60	-2.43	7.11
Negative												
Fixed	-0.82	-1.88	-0.96		0.88	1.08	1.06		-0.24	-0.11	-1.12	
Flexible	0.14**	-0.08*	-0.24	11.45***	6.89*	5.7*	6.11	23.21*	-0.38	1.48	1.24	6.65
(5) Selected Samples												
CFA Fixed	-0.79	-2.14	-0.58		0.74	2.23	2.46		-0.25	-1.68	-2.86	
African Flexible	-0.27***	-0.88***	-1.53	10.08***	5.92**	11.79**	7.81	20.06*	2.51	6.50*	4.97	17.45*
Highly Dollarized												
Fixed	-0.87	-2.46	-1.30		-0.80	-2.71	2.60		-0.75	-1.34	-5.67	
Flexible	-0.40	-1.08	-1.46	3.48	4.63	5.63	8.67	13.82**	1.43**	0.65**	-7.30	16.05*

Notes: This table reports the impact, short run (after 2 years) and long run (after 10 years) response of real GDP, RER and CPI to a -10% Terms of Trade change (except in Section under "Positive" where the change is of +10%). Wald tests the null hypothesis of terms of trade coefficients (4 lags) being equal across exchange rate regimes. * ** and *** stars mean significant at the 1%, 5% and 10% level respectively. Stars next to Impact (Short run) effects for Flexible regimes stand for the significance of the null hypothesis of the first lag (first to third lag) of the terms of trade coefficient being equal across exchange rate regimes. "Highly dollarized" includes CRI ECD EGY GUI HON JOR LAO MLW MEX NIC PAK SRL TTO TUR UGA URY VNM ZAM HUN POL ROM. Restriction (10) refers to $R(egime)_{it}=R_{it-1}=R_{it-2}$. (1) Method A runs separate VAR for two groups of countries, countries with less exchange rate flexibility during the entire period (BOT BKF BUR CMR CAF CHD CON COT ETH GAB HAI HON JOR KEN LIB MYS MLW MLI MRT MAU MYN NEP NGR PAN PAP RWN SEN THA TTO HKG), and countries with more exchange rate flexibilty (all the rest). In terms of Figure 2, the cut-off point is set to be 0.35. Under Method A, significance across regimes cannot be tested.

Table 5. Variance Decompositions by Region

		ToT		Real GDP				Real Exchange Rate				Consumer Prices			
	nobs	s_i^A	s_i^B	s_i^A	s_i^B	$s_{i,tt}^A / s_i^A$	$s_{i,tt}^B / s_i^B$	s_i^A	s_i^B	$s_{i,tt}^A / s_i^A$	$s_{i,tt}^B / s_i^B$	s_i^A	s_i^B	$s_{i,tt}^A / s_i^A$	$s_{i,tt}^B / s_i^B$
Africa															
Fixed	(458)	14.2	12.8	6.2	4.8	24.4	28.7	10.2	9.1	7.5	7.7	6.2	4.4	16.6	21.2
Flexible	(110)	12.0	9.4	4.8	3.9	8.4	10.1	18.7	16.5	25.8	25.5	11.2	6.2	12.9	16.5
Latin America															
Fixed	(164)	14.1	14.0	4.4	3.8	32.4	39.9	7.8	7.2	12.5	15.6	4.9	4.4	12.4	21.8
Flexible	(127)	15.0	12.2	4.3	3.1	11.1	16.3	17.2	13.6	34.6	37.9	13.7	6.4	14.1	26.6
Asia															
Fixed	(167)	12.7	10.1	4.5	3.3	33.2	36.3	8.2	6.3	13.2	9.7	4.6	3.4	20.1	15.0
Flexible	(187)	8.1	6.8	3.8	2.5	9.9	13.4	11.4	6.3	29.0	43.5	9.0	5.8	12.6	18.0

Notes: Same notes as Table 3.Under Method A, the following countries are classified as Fixed: Africa (BOT, BKF, BUR, CMR, CAF, CHD, CON, COT, ETH, GAB, KEN, LIB, MLW, MLI, MRT, MAU, NGR, RWN); Latin America (HAI, HON, PAN, TTO); Asia (HKG, MYS, MYN, NEP, PAP, THA). The following countries are classified as Flexible: Africa (EGY, GHA, GUI, MDG, MOR, MOZ, SRL, SOM, SAF, SUD, UGA, ZAM); Latin America (ARG, BOL, BRA, CHL, COL, CRI, DMR, ECD, ELS, GUA, MEX, NIC, PAR, PER, URY); Asia (AFG, BGD, CHN, IDA, PAK, PHL, SRI, KOR, SGP). Under Method B, the country-year pairs used under each regime can be obtained from Table A1.

Table A1. Countries used and Years Pegged

Country Name	Code	Peg Years	Country Name	Code	Peg Years	Country Name	Code	Peg Years
Afghanistan	AFG	(1973-74, 1987-90)	Guatemala	GUA	(1973-85)	Peru	PER	(1973-75, 1986)
Argentina	ARG	(1973-74, 1991-98)	Guinea	GUI	(1973-81)	Philippines	PHL	
Bangladesh	BGD	(1973-74, 1979-80, 1991-	Haiti	HAI	(1973-90)	Rwanda	RWN	(1973-93)
Bolivia	BOL	(1973-79)	Honduras	HON	(1973-90)	Senegal	SEN	(1973-98)
Botswana	BOT	(1973-98)	India	IDA	(1973-78)	Sierra Leone	SRL	(1973-83)
Brazil	BRA	(1973-74)	Jordan	JOR	(1973-98)	Somalia	SOM	(1973-83)
Burkina Faso	BKF	(1973-98)	Kenya	KEN	(1973-92)	South Africa	SAF	(1973-78)
Burundi	BUR	(1973-98)	Liberia	LIB	(1973-96)	Sri Lanka	SRI	(1973-76)
Cameroon	CMR	(1973-98)	Madagascar	MDG	(1973-81)	Sudan	SUD	(1973-81)
Central African Republic	CAF	(1973-98)	Malaysia	MYS	(1975-92, 1998)	Thailand	THA	(1973-93)
Chad	CHD	(1973-98)	Malawi	MLW	(1973-92)	Trinidad and Tobago	TTO	(1973-91)
Chile	CHL	(1979-80)	Mali	MLI	(1973-98)	Turkey	TUR	(1973-74)
China	CHN	(1973-78, 1981-85)	Mauritania	MRT	(1973-92)	Uganda	UGA	(1973-80)
Colombia	COL		Mauritius	MAU	(1973-94)	Uraguay	URY	
Congo	CON	(1973-96)	Mexico	MEX	(1973-75)	Zambia	ZAM	(1973-84, 1987-88)
Cote d'Ivoire	COT	(1973-98)	Morocco	MOR	(1973-79, 1991-98)	Zimbabwe	ZIM	(1980-93)
Costa Rica	CRI	(1973-80)	Mozambique	MOZ		Hong Kong, China	HKG	(1973-74, 1984-98)
Dominican Republic	DMR	(1973-84)	Myanmar	MYN	(1973-98)	Korea, Rep.	KOR	(1973-79)
Ecuador	ECD	(1973-82)	Nepal	NEP	(1974-93)	Singapore	SGP	(1980-86)
Egypt, Arab Rep.	EGY	(1973-86)	Nicaragua	NIC	(1973-84)	Israel	ISR	(1973-74, 1985-88)
El Salvador	ELS	(1973-82)	Niger	NGR	(1973-98)	Bulgaria	BUL	
Ethiopia	ETH	(1973-92)	Pakistan	PAK	(1973-81)	Hungary	HUN	(1981-91)
Gabon	GAB	(1973-98)	Panama	PAN	(1973-98)	Poland	POL	
Gambia	GAM	(1973-84)	Papua New Guinea	PAP	(1975-76, 1978-93)	Romania	ROM	(1973-89)
Ghana	GHA	(1973-77, 1980-82)	Paraguay	PAR	(1973-83)	New Zealand	NWZ	(1973-84)

Notes: All non-oil exporting countries with population larger than 1 million for which terms of trade data is available are included in this table. Years were included when Country is classified as having a fixed ex

Table A2. Variables and Sources

Name	Description and Source
Peg, Float	Dummy variable that takes the value of 1 if country/year pais is classified as pegged. Ghosh et al. (1997) Exchange Rate Classification used. (Based on IMF's Annual Report on Exchange Rate Rate Arrangements and Exchange Restrictions and World Currency Book (1996)). Data available from 1973 to 1998.
dlne	Year to year differerence in the natural log of the nominal exchange rate. Source: International Financial Statistics, IMF.
dlnr	Year to year differerence in the natural log of the real exchange rate. When available, data on the real effective exchange rates used. If peg, real exchange rate with base country used. If float, real exchange rate with U.S. dollar used.Source: International Financial Statistics, IMF and Information Notice System.
dlny	Year to year differerence in the natural log of real GDP. Source: International Finacial Statistics, IMF.
dlnp	Year to year differerence in the natural log of consumer price index (correction for outliers as in Ghosh et al. (1997) applied; dlnp/(1+dlnp)). Source: International Financial Statistics, IMF.
dlnt	Year to year differerence in the natural log of terms of trade. Source: World Development Indicators (World Bank) and Handbook of International Trade and Development (United Nations Conference on Trade and Development). Data available from 1970 to 1996.
open	Openness: ratio of Exports plus Imports (in dollars) to nominal GDP (in dollars). Source: International Financial Statistics, IMF. As a robustness "freeop" (a Measure of "Free trade openness") and "freetar" (Measure of tariff restriction) from Lee (1993) were used.
ca_y	Current account as a share of GDP. Source: International Financial Statistics, IMF.
findev	Measure of financial development: Quasi-Money/Money Source: International Financial Statistics, IMF. Alternatively, the black market premium (source World Development Report (1991) and Wood (1988)) and the ratio of bank assets to GDP and liquid liabilities to GDP were used (King and Levine database and Bruno and Easterly available at www.worldbank.org/growth/paauthor.htm.)
gc_y	Government consumption as a share of GDP. Source: International Financial Statistics, IMF.
dollar	Dummy variable that the value of 1 when country is highly and moderately dollarized (share of foreign-currency deposits to overall deposits). Source: Balino et al (1999)

Table A3. Descriptive Statistics by Exchange Rate Regime

	dlne	std(dlne) (A)	std(dlne) (B)	dlnr	std(dlnr) (A)	std(dlnr) (B)	dlny	std(dlny) (A)	std(dlny) (B)	dlnp	std(dlnp) (A)	std(dlnp) (B)	open	ca_y	findev	gc_y
Full Sample																
Fixed	3.1	9.6	11.5	1.0	9.8	8.4	3.5	5.7	4.6	8.7	5.6	4.2	33.6	-4.3	1.0	14.6
Flexible	21.1	16.1	27.6	0.7	15.2	12.0	3.5	4.4	3.4	17.1	11.8	6.1	29.4	-4.4	1.9	13.5
Hotelling(1)	0.000*	0.024**	0.006*	0.119	0.016*	0.082***	0.453	.012**	0.002*	0.006*	0.010*	0.297	0.191	0.696	0.038**	0.202
Latin America																
Fixed	0.71	4.14	8.00	-2.48	7.80	7.20	3.54	4.40	3.83	9.27	4.90	4.40	30.64	-5.59	1.45	13.01
Flexible	21.10	14.62	41.40	-0.50	17.20	13.60	3.35	4.30	3.13	23.25	13.65	6.40	22.23	-4.16	2.10	10.99
Africa																
Fixed	3.71	11.70	13.60	-0.78	10.20	9.10	3.00	6.20	4.86	8.78	6.15	4.40	32.04	-3.97	0.71	15.98
Flexible	19.63	15.57	26.60	3.73	18.70	16.50	3.00	4.80	4.25	15.71	11.20	6.20	27.22	-5.87	0.61	13.92
Asia																
Fixed	1.65	5.07	7.70	-1.93	8.20	6.30	5.43	4.50	3.38	7.76	4.64	3.40	41.10	-4.40	1.73	14.12
Flexible	5.99	6.23	8.80	2.89	11.40	6.30	5.14	3.80	2.87	9.11	9.02	5.80	32.73	-3.21	2.04	10.90
70s																
Fixed	0.60	7.63		-4.30		9.40	4.39		4.54	10.82		4.21	31.86	0.78	0.64	14.45
Flexible	16.00	9.27		-1.71		9.12	4.20		3.80	11.66		4.10	25.19	-3.58	1.06	13.19
80s																
Fixed	4.33	10.09		1.26		10.01	2.91		4.38	10.03		3.79	35.56	-9.06	1.15	15.83
Flexible	27.70	17.91		6.20		19.92	2.75		3.42	24.70		13.60	23.45	-4.24	1.82	12.12
90s																
Fixed	5.47	14.31		0.68		11.54	3.13		3.90	6.91		4.52	33.16	-4.68	1.43	14.21
Flexible	14.50	15.02		0.40		12.15	3.64		3.10	14.60		5.10	29.60	-5.07	2.08	12.22

Notes: Hotelling stands for the p-value of a Hotelling's T-squared test for equality of means between the Fixed and Flexible regimes. The test was performed for the years 1975, 1980, 1985, 1990, and 1995. std(x) stands for the standard deviation of x. Letters A and B stand for the method used to calculate the standard deviation. Method A calculates standard deviations for each country during 1973-1998. Each of the 75 countries' standard deviationis then grouped under Fixed (Flexible) if the country is classified as pegged (float) during more than 70% of the time period. (Under Method (A), Hotelling tests were adjusted to 75 observations). . Under method B, standard deviations are calculated as 5-year moving averages. Country-year data points included only if R(egime)it-2=Rit-1=Rit=Rit+1=Rit+2. dlne and std(dlne) excludes ARG, BOL, and PER. See Table A2 for variable definitions.

Table A4. Coefficients on Terms of Trade Variable

	Real GDP (dlny)			Real Exchange Rate (dlnr)			Consumer Prices (dlnp)		
	Fix	Float	Difference Float - Fix	Fix	Float	Difference Float - Fix	Fix	Float	Difference Float - Fix
dlnt(t)	0.046	0.008	-0.038	-0.033	-0.293	-0.260	0.028	-0.026	-0.054
	(3.38)	(0.36)	-(1.57)	-(0.86)	-(5.03)	-(3.72)	(1.47)	-(0.90)	-(1.57)
dlnt(t-1)	0.029	0.001	-0.028	-0.011	-0.171	-0.160	-0.090	-0.072	-0.062
	(2.43)	(0.00)	-(1.23)	-(0.32)	-(2.98)	-(2.42)	-(0.57)	-(2.49)	-(1.88)
dlnt(t-2)	0.035	-0.004	-0.039	-0.031	-0.045	-0.014	0.031	0.046	0.015
	(2.90)	-(0.26)	-(1.70)	-(0.89)	-(0.76)	-(0.21)	(1.81)	(1.56)	(0.44)
dlnt(t-3)	-0.055	0.020	0.075	0.045	-0.045	-0.090	0.021	0.063	0.042
	-(4.60)	(1.01)	(3.28)	(0.44)	-(1.30)	-(1.36)	(1.22)	(2.12)	(1.29)
dlnt(t-4)	0.001	0.009	0.008	0.016	0.076	0.060	-0.004	0.005	0.009
	(0.08)	(0.43)	(0.33)	(0.48)	(1.43)	(1.00)	-(0.27)	(0.16)	(0.28)
Wald	49.93*	1.36	18.41*	1.64	37.45*	19.86*	6.39	15.02*	8.07***

Notes: This table reports the estimated coefficients for the terms of trade variable in the system (9) presented in the main text. 1) t-statistics in between brackets; 2) Wald tests the joint significance of the 5 coefficients ; 4)*, **, and *** means significant at the 1%, 5% and 10% level respectively; 4) nobs= 1286.