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ABSTRACT

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By combining expansionary open market operations with sales of foreign exchange, the central bank can expand the monetary base without depreciating the exchange rate. Thus, if there is a monetary political business cycle, sales of foreign exchange are especially likely before elections. Our panel data analysis for up to 158 countries in 1975-2001 supports this hypothesis. Foreign exchange reserves relative to trend GDP depend negatively on the pre-election index regardless of the exchange rate system. The relationship is significant and robust irrespective of the type of electoral variable, the choice of control variables and the estimation technique.

Keywords: Foreign exchange interventions, political business cycles

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1. The Hypothesis

There is abundant evidence that many central banks tend to pursue significantly more expansionary monetary policies before elections than in normal times.[1] This is true even for independent central banks[2] – especially if most members of the central bank council have been appointed by the incumbent government or the ruling parties.[3] However, there are also cases in which we would not expect a monetary political business cycle – for example, if the election is not democratic, if there is no doubt about the reelection of the government, if the election has to be called at short notice or if the central bank is independent and the government lacks a partisan majority in the central bank council. Thus, the evidence is likely to vary across countries and over time.

What has not been analyzed so far is the way in which monetary acceleration before elections is brought about. This is surprising because the economic and electoral effects of an accelerating monetary base growth may crucially depend on whether and to what extent the central bank expands the domestic or the foreign component of the monetary base. The main difference of effect relates to the exchange rate. If the exchange rate is fixed, the central bank is likely to prefer a monetary expansion without devaluation. However, even under a flexible exchange rate regime, the authorities will probably wish to minimize the exchange rate effects of the monetary acceleration because a depreciation of the currency would be a very visible sign of pre-electoral pump-priming and because it would instantaneously raise import prices and feed into the general price level. Foreign exchange intervention can be used to reduce the unwelcome exchange rate effect of an expansionary pre-electoral monetary policy (Vaubel 1991, 2005).

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[1] For international panel data analyses see notably Alesina, Cohen, Roubini (1992, Table 7) and Dreher, Vaubel (2004, Table 2). Time series analyses for the industrial countries have been presented by Soh (1986, Table 5).

[2] See Soh's results for Germany, Switzerland and the United States. For the U.S. see also Grier (1987), Havrilesky (1995, Ch. 4) and Carlsen (1997) and for Germany Berger, Woitek (1997) and Lohmann (1998).

[3] See Vaubel (1993, 1997a, b) for Germany and McGregor (1996) for the U.S.

Ideally, the central bank might also wish to increase the monetary base of the foreign reserve currency to which its own currency is pegged. This would create room for raising domestic monetary base growth while maintaining the exchange rate parity. The domestic central bank can achieve this objective by first selling foreign exchange reserves in exchange for its own central bank money, then sterilizing the reduction of its central bank money supply through open-market operations and finally raising its own rate of monetary expansion in line with the foreign monetary acceleration which its foreign exchange interventions have brought about. In the monetary approach to exchange rate determination and with equal money multipliers at home and abroad, the initial decrease of the domestic monetary base due to the intervention is overcompensated by an increase that is twice as large.[4]

Of course, the sequence of events may be the reverse. The central bank may start by increasing its monetary base through open market operations, then prevent depreciation by selling foreign currency and finally sterilize the foreign exchange intervention at home. The central bank is likely to prefer this sequence because the incipient depreciation can serve as a justification for the foreign exchange intervention.

If the exchange rate is rigidly fixed, all three operations have to be executed simultaneously.

In any case, we should expect that some part of the foreign component of the monetary base is substituted by the domestic component prior to elections and that this phenomenon is not confined to fixed exchange rate regimes.

So far the analysis has assumed that the foreign central bank does not sterilize the increase of its monetary base due to the intervention. Since the foreign central bank issues a reserve currency and represents a large country, this assumption is not likely to be warranted. In fact, the International Monetary Fund obliges the central banks of its member states to inform each other about their foreign exchange interventions, and the U.S. Federal Reserve

[4] See appendix A for a brief demonstration of this elementary result.

System is known to sterilize foreign dollar interventions as a rule. Thus, the more relevant case is a foreign exchange intervention that is sterilized in both countries.

In this case, the ultimate change in the reserve currency country is not an increase in the monetary base but an increase in the supply of bonds. Its exchange rate effect cannot be analyzed in the framework of the monetary approach because the latter views bonds denominated in different currencies as perfect substitutes. The portfolio balance approach has to be used.

If the sale of reserve currency is sterilized by both central banks, the net effect is an increase in reserve currency bonds and a decrease in domestic currency bonds. In the portfolio balance approach, this asset substitution in supply causes an appreciation of the domestic currency, thus raising the domestic rate of monetary expansion consistent with exchange rate stability. Once more, the intervention enables the domestic central bank to step up monetary expansion before the election without risking a depreciation of the currency.

Figure 1 contains the standard graphical exposition of the short run effects which are relevant for the electoral cycle.[5] It shows all combinations of the nominal exchange rate (E) and the domestic interest rate (i) consistent with equilibrium in the domestic money market (MM), the market for domestic currency bonds (BB) and the market for foreign currency bonds (FF).[6] In Figure 1, a sale of reserves that is sterilized in both countries shifts the BB curve to the left from BB_o to BB_1 (the purchase of domestic currency bonds lowers their rate

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[5] For a textbook exposition see, e.g., Claassen (1996: 76ff.). The graph is related to Branson (1977) but Branson does not cover the case of foreign exchange interventions.

[6] The equilibrium condition for the money market (MM) slopes upwards because an increase in the interest rate reduces the demand for money whereas an increase in E (a depreciation of the domestic currency) raises the value of foreign-currency bonds and total portfolio size in terms of the domestic currency and thereby increases the demand for domestic money. The equilibrium condition for domestic currency bonds (BB) slopes downwards because the demand for these bonds depends positively on both i and E, i.e., portfolio size. The equilibrium condition for foreign currency bonds (FF) is also downward sloping because an increase in the domestic interest rate reduces the demand for foreign currency bonds while the depreciation of the domestic currency increases the supply of foreign currency bonds in terms of the domestic currency. However, FF is flatter than BB because changes in i have a stronger effect on the demand for domestic currency bonds (i is their own rate of return) than on the demand for foreign currency bonds.

of return i) and the FF curve down from FF_o to FF_1 (the sale of foreign currency bonds lowers E). The net effect is an appreciation of the domestic currency (from E* to E_{FEI}) and a drop in the domestic interest rate from i_A to i_{FEI}. The equilibrium moves from point A to point FEI. The domestic central bank may now return to E* by implementing an expansionary open market operation shifting MM to MM_2 and BB further to BB_2 so that equilibrium point B is reached. Thus, it may increase monetary expansion and lower the interest rate without depreciating the exchange rate.

If the central bank raised the domestic component of the monetary base without reducing the foreign component at the same time, both the BB and the MM curves would shift to the left, intersecting at OMO, and the lower domestic interest rate i_B could only be attained at the (electoral) cost of depreciating the currency to E_{OMO}.

The combination of a fully sterilized sale of foreign exchange and an expansionary domestic open market operation does not stimulate the economy unless it is unexpected – at least in part. Thus, it is a Keynesian strategy. Indeed, in the negotiations at Bretton Woods in 1944, it was Lord Keynes who insisted that the newly founded fixed exchange rate system should be bolstered up by a generous supply of subsidized foreign exchange credits to be provided by the newly founded International Monetary Fund. The foreign exchange credits would give the member countries some leeway to pursue their own macroeconomic policies irrespective of their international exchange rate commitments. It was also clear that the credits would enable the governments to generate monetary political business cycles.[7]

2. Empirical specification and results

Our hypothesis predicts that foreign exchange reserves drop before elections and are replenished sometime thereafter. It also predicts that the fall of the foreign component of the

[7] The GMM estimates of Dreher, Vaubel (2004) show that new net non-concessional credits from the International Monetary Fund relative to GDP are significantly larger prior to elections.

monetary base is overcompensated by an increase in the domestic component. In the following, we test only for the first part of the hypothesis because there exists already ample evidence that the rate of expansion of the money supply and hence of the monetary base tends to rise prior to elections.[8]

Our dependent variable is the log of international reserves to trend GDP. As in other studies (e.g., Lane and Burke 2001), GDP is used as a scale variable. We employ trend GDP rather than current GDP because the latter may also be affected by the political business cycle. However, our results do not depend on this modification. Trend GDP is calculated with the Hodrick-Prescott filter. Following the bulk of recent literature, international reserves are measured net of gold holdings because central banks do not cyclically vary their holdings of gold reserves. But inclusion of gold reserves, valued at SDR 35 per ounce, would not change the main results of the paper.

We measure the pre-election period by the share of the year which is within twelve months prior to a national election.[9] Similarly, the post-election period is measured by the share of the year which is within twelve months after an election. To test the robustness of our results, we alternatively include an election year dummy in the following section.

As for the other explanatory variables, we follow Lane and Burke (2001) as closely as possible.[10] GDP per capita is included to control for development. More developed countries may wish to hold smaller amounts of reserves as they are more rarely affected by speculative crises. However, since they can afford to hold more reserves, the expected impact of per capita GDP is not obvious a priori. The sum of exports and imports (in percent of GDP) measures a country's openness to trade. More open countries are expected to hold more

[8] Moreover, a simple regression of M2 (in percent of GDP) on our pre-election index introduced below yields a positive and highly significant coefficient.

[9] For example, if the election took place in February, the index would take the value of 2/12 in that year and 10/12 in the year before. A similar variable is employed in Dreher and Vaubel (2004).

[10] The authors derive them from the model of Frenkel and Jovanovic (1981). Central banks face a trade-off between macroeconomic adjustment costs in the absence of international reserves and the opportunity costs of holding them.

reserves as they are more vulnerable to external shocks. Another explanatory variable is the level of external debt (in percent of GDP) because reserves might serve as collateral for debt or be used to offset sudden capital outflows. Since empirical studies find external debt to be among the most important causes of currency crises (Dreher, Herz and Karb 2004), more reserves might be accumulated to account for this risk.

The standard deviation of the growth rate of exports (over the last five years) is employed to measure external volatility. If volatility is high, reserve levels are more likely to hit their lower bound. Thus, higher volatility should lead countries to hold more reserves.[11] A variable measuring the degree of exchange rate flexibility is also included. It is usually assumed that peggers hold more reserves than floaters. However, as we have explained in section 1, politicians may have a keen interest in accumulating foreign reserves even under a flexible exchange rate regime.[12]

Lane and Burke also include population, M2 relative to GDP and the share of short-term debt in total external debt as explanatory variables. As we are not convinced by their arguments for doing so[13], we omit these variables in our preferred estimates (Tables 1 and 2) but our tests for robustness (Tables 3-6) include them.

Moreover, we do not follow Lane and Burke in estimating a cross-section. They chose a cross-section analysis because they wanted to abstract from cyclical fluctuations in reserves.

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[11] This measure for external volatility has also been employed, among others, by Edwards (1985), Flood and Marion (2002, 2004) and Choi and Baek (2004).

[12] Williamson (1976) suggests that more reserves might be held under flexible regimes to compensate for destabilizing capital flows. Grimes (1993) even argues that the level of reserves might not be influenced by the exchange rate regime at all when the opportunity costs of holding reserves is sufficiently small or if central banks are highly risk averse regarding reserve shortages.

[13] According to Lane and Burke (2001), population is used as a proxy for country size because „if the absolute level of international reserves matters in deterring speculators, a larger country may be able to survive with a lower reserves/ GDP ratio". Why should the absolute level of reserves matter, and is population a good proxy for the size of the country or economy? Their rationale for including the M2/ GDP ratio is that international reserves are higher "to the extent that the liabilities of the domestic financial sector are partly denominated in foreign currency." Is the M2/ GDP ratio in any way related to the share of foreign currency liabilities? The share of short term debt in total external debt is hardly exogenous. The level of reserves may affect the maturity of foreign debt and both are likely to be affected by international debt and currency crises.

However, cyclical fluctuations induced by elections are precisely what we are interested in. Thus, we need pooled time-series cross-section analyses (panel data).

The annual data cover the years 1975-2001 and extend to a maximum of 158 countries.[14] Since some of the data are not available for all countries or years, the panel data are unbalanced and our number of observations depends on the choice of explanatory variables. Since there was significant first-order autocorrelation in all models, the disturbance term is modeled as an AR(1) process. We found significant fixed country and period effects in all specifications. However, the coefficients of the country and time effects are not reported in the tables. All variables, their precise definitions and data sources are listed in the appendix.[15]

Table 1 ignores interactions. As can be seen in column 1, reserve holdings are significantly lower when the standard deviation of export growth rises, with a coefficient significant at the one percent level. This result is not in line with the hypothesis. As will be seen, however, it is not robust with respect to outliers and the inclusion or omission of control variables. Moreover, throughout the analysis, omission of this variable would not qualitatively affect our results. At the one percent level of significance, and in line with our a priori hypothesis, openness to trade leads to higher reserve holdings. Reserves rise with per capita GDP at the ten percent level of significance. The fixed exchange rate dummy, based on the (de facto) classification of Reinhart and Rogoff (2004) has no significant impact on reserves. This is in line with previous research (e.g., Lane and Burke 2001). The results also show that external debt does not significantly influence reserve holdings. As for the electoral cycle, the pre-election index takes a negative coefficient which is significant at the five percent level. The post-election index, however, is completely insignificant.

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[14] Our selection of countries is determined by data availability. The countries included in our sample are listed in Appendix D.

[15] Due to the difference in estimation procedure, we have to deviate slightly from column 8 of Lane and Burke's Table 7. Lane and Burke include the fraction of years a country had restrictions on the capital account over the sample period and a dummy for countries heavily dependent on oil revenues. Since these variables do not vary over time, we cannot use them in our fixed effects specifications.

Regarding the quantitative impact of the explanatory variables, a ten percentage points increase in trade openness increases the level of international reserves (relative to trend GDP) by six percent. An 0.1 percentage point increase in the standard deviation of export growth reduces them by 6.7 percent. Twelve months prior to an election, reserve holdings are almost 9 percent lower than otherwise.

Column 2 includes the lagged dependent variable. As can be seen, most previous results remain. The only exception is the coefficient of per capita GDP which is now insignificant. The pre-election index is still significant at the five percent level – the post election index remains insignificant. The lagged dependent variable is highly significant: 42 percent of the desired adjustment takes place contemporaneously. The regression explains 52 percent of the variation of the dependent variable.

However, there is a problem with panel data regressions including the lagged dependent variable. Since the lagged endogenous variable is correlated with the error term in the presence of fixed country effects, the OLS estimator is biased and inconsistent in a short panel (Nickel 1981). For this reason, we proceed to the Generalized Methods of Moments (GMM) estimator suggested by Arellano and Bond (1991). This estimator removes the fixed country effects by first-differencing the equation. Lagged levels of the dependent variable and differences of the exogenous right hand side variables are then used as instruments. The period effects and the other indices/dummies are strictly exogenous variables and are simply instrumented by themselves.

Since there are more instruments than right-hand side variables, the equations are over-identified and the instruments must be weighted. The Arellano-Bond one-step estimator uses the identity matrix as a weighting matrix. The two-step estimator weighs the instruments asymptotically efficiently using the covariance of the one-step estimates. However, standard errors tend to be under-estimated by the two-step estimator (Arellano and Bond 1991: 291). For this reason, we report the one-step estimates only.

We employ a Sargan test to ensure that the instruments are not correlated with the error term, and we use the Arellano-Bond test for second-order autocorrelation in the first difference residuals because the estimator would not be consistent in the presence of second-order correlation. In line with the bulk of literature, these tests are based on the two-step estimator.

Column 3 of Table 1 reports the results. While trade openness remains significant at the five percent level, the negative coefficient of the standard deviation of export growth which ran counter to the hypothesis is no longer significant. Again, the coefficient of the pre-election index is negative and significant at the five percent level. Both the Sargan test and the Arellano-Bond test clearly accept the specification, indicating that the estimator is consistent.

In Table 2 we further test for the impact of fixed exchange rate regimes on international reserve holdings. We interact all independent variables with this dummy. In doing so, we test for the hypothesis that the exchange rate regime affects the way in which the other explanatory variables determine reserve holdings. Column 1 omits the lagged endogenous variable, column 3 reports results estimated with the Arellano-Bond GMM estimator.

As can be seen, the coefficients of the election variables are insignificant when estimated with OLS. Only in the consistent GMM estimate of column 3 would the negative coefficient of the pre-election index be significant at the ten percent level. Also in column 3, the post-election index has a positive impact on reserve holdings. The impact remains positive under fixed exchange rates but declines. The election indices and their interaction terms are jointly significant at the five percent level at least. Overall, however, the interaction terms are jointly insignificant in all regressions. As can be seen in the Table, most of them are individually insignificant as well. To summarize Table 2, international reserves do not significantly depend on the exchange rate regime – neither directly nor through interactions. However, the collinearity introduced by the interactions undermines the significance of most direct effects.

3. Testing for Robustness

How robust are these results to changes in the selection of explanatory variables, the measurement of the electoral effect and the observations included in the regressions? To increase the number of observations, we omit the variables GDP per capita and government debt which have been insignificant in most previous regressions.

First, regarding additional variables, we follow the previous literature to identify candidate variables. Choi and Baek (2004) suggest including GDP as a measure of size, squared per capita GDP in addition to GDP per capita, financial openness (measured as gross private capital flows as a share of GDP) and lending interest rates (as a proxy for opportunity costs of holding reserves). Lane and Burke (2001) propose the M2/GDP ratio as a measure of financial depth and population as a proxy for country size. They also use short term debt as a share of total debt. As an additional test, we employ the IMF's de jure exchange regime classification instead of the de facto classification by Reinhart and Rogoff (2004) included above.

Second, and equally important, we focus on the role of outliers. Some authors suggest using so-called robust estimation techniques to deal with them. Robust estimators can be thought of as trying to identify that part of the data best approximated by the model being estimated (see de Haan and Sturm 2003 for an illustrative discussion). We therefore employ the Least Median Squares (LMS) estimator introduced by Rousseeuw (1984) to test the robustness of our results, minimizing the median of the squared residuals. This estimator will not be influenced by observations lying outside the typical relationship between the dependent and explanatory variables revealed by the remaining data. In using this estimator, we have to omit the fixed country and period effects.

Finally, we try a simple election year dummy in place of our pre- and post-election indices because the rundown of reserves before the election may trigger a speculative crisis which continues beyond the election day.

Table 3 contains the results of the OLS/LMS regressions, Table 4 the consistent GMM regressions.[16] In column 1 of both Tables, the IMF's de jure classification of the exchange rate regime replaces the de facto regime. The coefficient remains insignificant. Among the additional variables (columns 2-9), only money/GDP, short-term debt and, in the OLS regressions, financial openness pass the 10 per cent significance test. In all regressions which are consistently estimated by GMM, the coefficient of the pre-election index is negative and significant at least at the 10 per cent level. The same holds for most OLS regressions. There are two exceptions. When money relative to GDP or the lending interest rate is included, the coefficient loses its significance. Since both variables are also influenced by the political business cycle, this is not surprising. The results also confirm that the significance of the post-election index depends on whether the regression is estimated by OLS or consistently by GMM.

Column 9 of Table 3 reports the regression estimated with Least Median Squares. Again, the pre-election index is significant at the ten percent level, indicating that the previous results are not driven by outliers. The post-election index has no significant impact on reserve holdings.

In Tables 5 and 6, we use an election year dummy instead of the pre- and post-election indices. The results are very similar to the previous ones. In Table 5, the election dummy is significant at the one percent level in the three regressions without interactions, with a negative coefficient. When interactions are included (Table 6), the dummy is individually significant at the five percent level in the OLS regressions. The election dummy and its

[16] Again, all variables have also been interacted with the regime dummy. As the results are qualitatively identical to those reported previously, we do not reproduce these regressions here. We also replicated all (OLS-) regressions with GMM, obtaining qualitatively similar results. These results are available upon request.

interaction with the exchange rate dummy are jointly significant in all regressions. We also replicated the regressions of Tables 3 and 4 with the election year dummy. Its coefficient is negative and significant in all regressions estimated with OLS/LMS and GMM .

In summary, our result is robust regarding outliers and the inclusion of other control variables suggested in the literature. As for the quantitative impact of elections, the smallest significant coefficient (Table 3, column 2, among others) implies that reserve holdings are 4.8 percent lower in pre-election years; the highest coefficients (Table 2, column 3) indicate a reduction of 20 percent in pre-election years when the exchange rate is freely floating and a reduction of 15 percent under fixed exchange rate regimes.

4. Conclusion

Democratic elections tend to have a significantly negative effect on the level of foreign exchange reserves relative to trend GDP. This result is robust to the measurement of the election effect, the choice of control variables and the influence of outliers. It is fully consistent with the hypothesis that central banks use foreign exchange interventions to gain leeway for expansionary open market operations without depreciating the currency at election time.

The evidence is compatible with the alternative hypothesis that elections raise political risk and induce capital flight. Even though the expected change of government may just as well cause a net inflow of capital, there may be a pre-electoral risk premium which reduces net capital flows. We have tested for this possibility but we do not find a significant correlation between our pre-election index and net private capital flows.

Our results are also in line with the hypothesis suggested by Aizenman and Marion (2004) that a 'tough' administration has little incentive to accumulate reserves if there is some probability that a future administration will be 'soft' (and will thus allocate the reserves to favoured groups).[17] As elections might lead to a change in regime, 'tough' governments might reduce their holdings of reserves. However, including the interaction of the pre-election index with a dummy for right-wing governments as classified by Beck et al. (2001) does not yield a significant coefficient in any specification, while the significance of the pre-election index is not affected.

As there is ample evidence of monetary political business cycles, we conclude that central banks tend to run down their foreign exchange reserves at election time in order to mitigate the exchange rate effect of their expansionary monetary policies and replenish them thereafter.

[17] See also Aizenman and Marion (2002).

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Figure 1

Foreign exchange intervention in the portfolio balance model

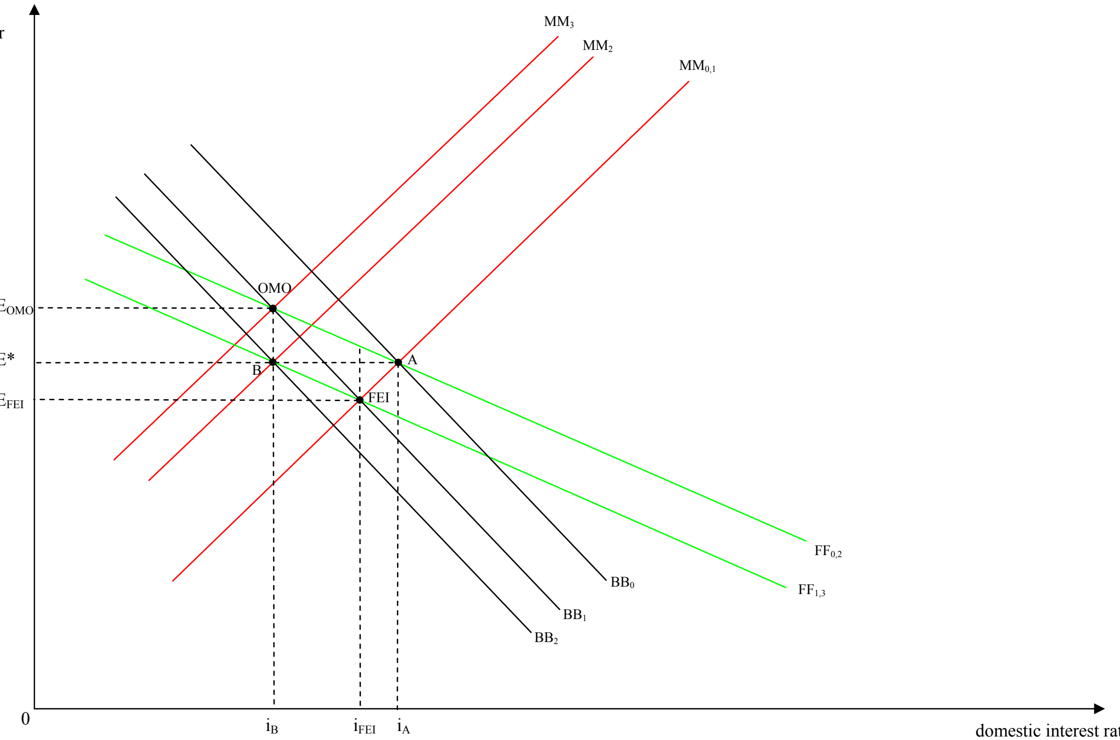

Table 1: International Reserves relative to trend GDP (logarithm, 1975-2001)

Explanatory Variables	(1)	(2)	(3)
Part of the year which is within 12 months prior to an election	-0.088 (2.22**)	-0.090 (1.99**)	-0.160 (2.53**)
Part of the year which is within 12 months after an election	-0.006 (0.15)	0.034 (0.75)	0.095 (1.58)
Fixed Exchange Rates, Dummy	0.095 (1.48)	0.055 (0.92)	0.006 (0.31)
GDP per capita	0.449 (1.65°)	0.014 (0.11)	-0.439 (1.35)
Openness	0.006 (3.19*)	0.005 (3.30*)	0.006 (2.34**)
Debt (percent of GDP)	-0.001 (1.40)	-0.001 (1.57)	-0.0001 (0.22)
Export Growth, Standard Deviation	-0.665 (2.76*)	-0.421 (2.23**)	-0.190 (0.63)
Lagged Endogenous Variable		0.581 (25.46*)	0.614 (9.34*)
Number of countries	76	76	76
Number of observations	1368	1359	1356
Method of Estimation	OLS AR(1)	OLS AR(1)	GMM
R^2 (overall)	0.14	0.52	
Sargan Test (p-level)			1.00
Arellano-Bond-Test (p-level)			0.89

Notes:
Fixed country and period effects included in OLS regressions; fixed period effects included in GMM regression.
(robust) t-statistics in parentheses:
*, **, ° significant at the 1, 5 and 10 percent levels respectively

Table 2: International Reserves relative to trend GDP with interactions (logarithm, 1975-2001)

Explanatory Variables	(1)	(2)	(3)
Part of the year which is within 12 months prior to an election	-0.100 (1.15)	-0.077 (0.75)	-0.200 (1.66°)
Pre-election index*fixed rate#	0.016 (0.16)	0.016 (0.13)	0.050 (0.31)
Part of the year which is within 12 months after an election	0.014 (0.15)	0.061 (0.56)	0.326 (2.50**)
Post-election index*fixed rate#	-0.029 (0.29)	-0.034 (0.29)	-0.287 (1.89°)
Fixed Exchange Rates, Dummy	0.045 (0.09)	-0.267 (0.61)	0.059 (1.55)
GDP per capita	0.386 (1.39)	0.013 (0.09)	-0.584 (1.86°)
GDP p.c.*fixed rate#	-0.013 (0.22)	0.019 (0.35)	-0.022 (0.80)
Openness	0.004 (1.76°)	0.002 (0.87)	0.005 (1.58)
Openness*fixed rate#	0.003 (1.65°)	0.003 (1.67°)	0.002 (0.59)
Debt (percent of GDP)	-0.001 (1.03)	-0.0004 (0.78)	0.0001 (0.23)
Debt*fixed rate#	-0.001 (1.61)	-0.001 (1.13)	-0.001 (2.02**)
Export Growth, Standard Deviation	-1.070 (2.00**)	-0.915 (1.85°)	-1.338 (2.55*)
Export Growth*fixed rate#	0.456 (0.83)	0.540 (1.06)	1.361 (3.07*)
Lagged Endogenous Variable		0.574 (24.95*)	0.595 (8.50*)
Number of countries	76	76	76
Number of observations	1368	1359	1355
Method of Estimation	OLS AR(1)	OLS AR(1)	GMM
R^2 (overall)	0.14	0.52	
Sargan Test (p-level)			1.00
Arellano-Bond-Test (p-level)			0.96

Notes:
Coefficient and t-statistic of interaction of the dummy for fixed exchange regimes with corresponding variable.
Fixed country and period effects included in OLS regressions; fixed period effects included in GMM regression.
(robust) t-statistics in parentheses: *, **, ° significant at the 1, 5 and 10 percent levels respectively.

Table 3: International Reserves relative to trend GDP (logarithm, 1975-2001): tests for robustness

Explanatory Variables	(1)	(2)	(3)	(4)
Part of the year which is within 12 months prior to an election	-0.055 (1.82°)	-0.048 (1.71°)	-0.048 (1.70°)	-0.034 (1.11)
Part of the year which is within 12 months after an election	0.012 (0.39)	0.007 (0.24)	0.006 (0.19)	0.020 (0.66)
Fixed Exchange Rates, de jure, Dummy	-0.040 (1.20)			
Openness	0.004 (4.15*)	0.003 (4.59*)	0.004 (4.78*)	0.004 (4.24*)
Export Growth, Standard Deviation	-0.249 (2.21**)	-0.133 (1.33)	-0.085 (0.84)	-0.236 (1.59)
GDP		0.032 (0.77)		
GDP per capita			-0.00002 (1.19)	
GDP per capita squared			9.23e-11 (0.26)	
Lending interest rate				-0.0001 (0.81)
Lagged Endogenous Variable	0.647 (39.48*)	0.644 (42.37*)	0.661 (45.34*)	0.532 (28.66*)
Number of countries	118	158	157	149
Number of observations	2240	2723	2699	2136
Method of Estimation	OLS AR(1)	OLS AR(1)	OLS AR(1)	OLS AR(1)
R^2 (overall)	0.53	0.54	0.56	0.42

Notes:
Fixed country and period effects included in OLS regressions.
(robust) t-statistics in parentheses:
*, **, ° significant at the 1, 5 and 10 percent levels respectively

Table 3 (continued): International Reserves relative to trend GDP (logarithm, 1975-2001): tests for robustness

Explanatory Variables	(5)	(6)	(7)	(8)	(9)
Part of the year which is within 12 months prior to an election	-0.048 (1.68°)	-0.046 (1.50)	-0.048 (1.71°)	-0.062 (1.73°)	-0.046 (1.86°)
Part of the year which is within 12 months after an election	0.009 (0.30)	0.010 (0.32)	0.006 (0.20)	0.027 (0.75)	-0.001 (0.04)
Openness	0.003 (4.48*)	0.004 (5.07*)	0.003 (4.63*)	0.004 (3.91*)	0.001 (3.30*)
Export Growth, Standard Deviation	-0.119 (1.23)	-0.128 (1.23)	-0.104 (1.03)	-0.147 (1.03)	0.050 (0.72)
Fixed Exchange Rates, Dummy					-0.003 (0.13)
GDP per capita					0.002 (0.20)
Debt (percent of GDP)					-0.0002 (1.78°)
Financial Openness	-0.001 (1.90°)				
Money (percent of GDP)		-0.004 (3.29*)			
Population			0.228 (1.59)		
Short-term debt (percent of total external debt)				-0.004 (2.39**)	
Lagged Endogenous Variable	0.670 (44.86*)	0.639 (40.61*)	0.651 (44.26*)	0.619 (34.87*)	0.926 (123.90*)
Number of countries	154	144	158	124	76
Number of observations	2560	2404	2723	1998	1435
Method of Estimation	OLS AR(1)	OLS AR(1)	OLS AR(1)	OLS AR(1)	LMS
R^2 (overall)	0.57	0.55	0.55	0.54	0.63

Notes:
Fixed country and period effects included in OLS regressions.
(robust) t-statistics in parentheses:
*, **, ° significant at the 1, 5 and 10 percent levels respectively

Table 4: International Reserves relative to trend GDP (logarithm, 1975-2001): tests for robustness

Explanatory Variables	(1)	(2)	(3)	(4)
Part of the year which is within 12 months prior to an election	-0.090 (2.27**)	-0.082 (2.25**)	-0.068 (1.92^{o})	-0.068 (1.63^{o})
Part of the year which is within 12 months after an election	0.082 (1.79^{o})	0.086 (2.25**)	0.092 (2.26**)	0.071 (1.67^{o})
Fixed Exchange Rates, de jure, Dummy	-0.020 (1.47)			
Openness	0.005 (2.75*)	0.004 (2.52**)	0.005 (3.14*)	0.005 (3.43*)
Export Growth, Standard Deviation	-0.333 (1.66^{o})	-0.156 (0.97)	-0.195 (1.15)	-0.302 (1.33)
GDP		0.018 (0.15)		
GDP per capita			0.00003 (0.51)	
GDP per capita squared			1.60e-09 (1.17)	
Lending interest rate				-0.00004 (0.70)
Lagged Endogenous Variable	0.682 (11.19*)	0.691 (12.08*)	0.696 (12.33*)	0.548 (7.35*)
Number of countries	118	158	157	149
Number of observations	2236	2716	2692	2120
Method of Estimation	GMM	GMM	GMM	GMM
Sargan Test (p-level)	1.00	1.00	1.00	1.00
Arellano-Bond-Test (p-level)	0.99	0.30	0.44	0.53

Notes:
Fixed period effects included.
(robust) t-statistics in parentheses:
*, **, ^{o} significant at the 1, 5 and 10 percent levels respectively

Table 4 (continued): International Reserves relative to trend GDP (logarithm, 1975-2001): tests for robustness

Explanatory Variables	(5)	(6)	(7)	(8)
Part of the year which is within 12 months prior to an election	-0.071 (1.96**)	-0.069 (1.81°)	-0.081 (2.24**)	-0.107 (2.33**)
Part of the year which is within 12 months after an election	0.088 (2.25**)	0.085 (2.05**)	0.085 (2.23**)	0.117 (2.52**)
Openness	0.005 (2.73*)	0.005 (2.76*)	0.004 (2.72*)	0.005 (2.81*)
Export Growth, Standard Deviation	-0.209 (1.26)	-0.212 (1.31)	-0.155 (0.99)	-0.118 (0.57)
Fixed Exchange Rates, Dummy				
GDP per capita				
Debt (percent of GDP)				
Financial Openness	0.0001 (0.39)			
Money (percent of GDP)		-0.006 (2.67*)		
Population			0.156 (0.33)	
Short-term debt (percent of total external debt)				-0.004 (1.78°)
Lagged Endogenous Variable	0.704 (14.56*)	0.681 (13.15*)	0.698 (14.42*)	0.655 (11.69*)
Number of countries	154	144	158	124
Number of observations	2552	2396	2716	1991
Method of Estimation	GMM	GMM	GMM	GMM
Sargan Test (p-level)	1.00	1.00	1.00	1.00
Arellano-Bond-Test (p-level)	0.21	0.34	0.30	0.55

Notes:
Fixed period effects included.
(robust) t-statistics in parentheses:
*, **, ° significant at the 1, 5 and 10 percent levels respectively

Table 5: International Reserves relative to trend GDP (logarithm, 1975-2001) : tests for robustness

Explanatory Variables	(1)	(2)	(3)
Election, Dummy	-0.098 (3.77*)	-0.117 (3.47*)	-0.121 (2.78*)
Fixed Exchange Rates, Dummy	0.098 (1.55)	0.044 (0.78)	0.0004 (0.02)
GDP per capita	-0.039 (0.25)	0.053 (0.46)	-0.368 (1.14)
Openness	0.005 (2.61*)	0.004 (3.19*)	0.005 (2.09**)
Debt (percent of GDP)	-0.001 (1.78°)	-0.001 (1.45)	-0.00003 (0.06)
Export Growth, Standard Deviation	-0.610 (2.61*)	-0.423 (2.38**)	-0.193 (0.69)
Lagged Endogenous Variable		0.625 (29.09*)	0.630 (8.88*)
Number of countries	76	76	76
Number of observations	1441	1432	1429
Method of Estimation	OLS AR(1)	OLS AR(1)	GMM
R^2 (overall)	0.21	0.79	
Sargan Test (p-level)			1.00
Arellano-Bond-Test (p-level)			0.17

Notes:
Fixed country and period effects included in OLS regressions; fixed period effects included in GMM regression.
(robust) t-statistics in parentheses:
*, **, ° significant at the 1, 5 and 10 percent levels respectively

Table 6: International Reserves relative to trend GDP with interactions (logarithm, 1975-2001): tests for robustness

Explanatory Variables	(1)	(2)	(3)
Election, Dummy	-0.141 (2.35**)	-0.169 (2.15**)	-0.145 (1.39)
Election*fixed rate#	0.051 (0.77)	0.063 (0.72)	0.035 (0.29)
Fixed Exchange Rates, Dummy	-0.158 (0.33)	-0.231 (0.55)	-0.006 (0.18)
GDP per capita	-0.066 (0.42)	0.035 (0.29)	-0.416 (1.34)
GDP p.c.*fixed rate#	0.014 (0.23)	0.014 (0.26)	-0.021 (0.76)
Openness	0.003 (1.33)	0.001 (0.69)	0.004 (1.45)
Openness*fixed rate#	0.003 (1.57)	0.003 (1.67°)	0.001 (0.39)
Debt (percent of GDP)	-0.001 (1.34)	-0.0003 (0.52)	0.0001 (0.24)
Debt*fixed rate#	-0.001 (1.75°)	-0.001 (1.21)	-0.001 (1.43)
Export Growth, Standard Deviation	-1.098 (2.09**)	-0.767 (1.66°)	-1.130 (2.50**)
Export Growth*fixed rate#	0.538 (1.00)	0.375 (0.78)	1.113 (2.50**)
Lagged Endogenous Variable		0.619 (28.58*)	0.623 (8.42*)
Number of countries	76	76	76
Number of observations	1441	1432	1428
Method of Estimation	OLS AR(1)	OLS AR(1)	GMM
R^2 (overall)	0.14	0.79	
Sargan Test (p-level)			1.00
Arellano-Bond-Test (p-level)			0.20

Notes:
Coefficient and t-statistic of interaction of the dummy for fixed exchange regimes with corresponding variable.
Fixed country and period effects included in OLS regressions; fixed period effects included in GMM regression.
(robust) t-statistics in parentheses:
*, **, ° significant at the 1, 5 and 10 percent levels respectively.

Appendix A: Monetary Approach

The money supply at home (M_d) and abroad (M_f) is the product of the monetary base (B) and the money multiplier (m):

(1) $M_d \equiv m_d \cdot B_d$

(2) $M_f \equiv m_f \cdot B_f$

The sale of foreign exchange raises the foreign monetary base by the same amount by which it reduces the domestic monetary base:

(3) $\Delta B_f \cdot E^* = -\Delta B_d$

where E* is the fixed exchange rate (units of domestic currency per one unit of the foreign currency).

According to the simplest version of the monetary approach to exchange rates,

$$(4) \quad E = \frac{P_d}{P_f} = \frac{M_d / y_d}{M_f / y_f} = \frac{m_d \cdot B_d / y_d}{m_f \cdot B_f / y_f}$$

where P_d and P_f are the domestic and foreign price levels and y_d and y_f are the exogenous domestic and foreign permanent income levels, respectively.

If $m_d = m_f$ and if $B_d / y_d = B_f / y_f$ before the intervention, the fixed exchange rate requires that $\frac{\Delta B_f \cdot E^*}{B_f \cdot E^*} = \frac{\Delta B_d}{B_d}$. Thus, the decrease of $-\Delta B_d$ in equation (3) has to be overcompensated by an increase of twice its size ($+2\Delta B_d$).

Appendix B: Variable Definitions and Sources

Variable	Source	Definition
log (International Reserves / trend GDP)	World Bank (2003)	Net international reserves comprise special drawing rights, reserves of IMF members held by the IMF, and holdings of foreign exchange under the control of monetary authorities. Gold holdings are excluded. Data used are the log (reserves divided by trend GDP). The trend GDP series has been calculated employing the Hodrick-Prescott filter.
Election, Dummy	Beck et al. (2001)	Equals one in years of national elections and zero otherwise.
Part of the year which is within 12 months prior to an election	Own calculations based on Beck et al. (2001)	Includes the election month as being part of the pre-election period. For example, if an election would be in February, the index would take the value of 2/12 in that year and 10/12 in the year before.
Part of the year which is within 12 months after an election	Own calculations based on Beck et al. (2001)	Includes the election month as being part of the post-election period. For example, if an election would be in February, the index would take the value of 11/12 in that year and 1/12 in the year after.
Fixed Exchange Rates (de facto), Dummy	Reinhart and Rogoff (2004)	Equals zero if one of the following categories applies: Freely Floating, Freely Falling, Freely Falling/Freely Floating, Freely Falling/Managed Floating, Freely Floating/Dual Market, Freely falling/Dual Market, Freely Falling/Multiple Rates, Freely Falling/Crawling Band, Freely Falling/Parallel Market.
Fixed Exchange Rates (de jure), Dummy	IMF, various years	Equals zero if classified as freely fluctuating (1971-73), not maintained within relatively narrow margins (1974-82), more flexible arrangements (1983-98), managed floating or independently floating (1999-2001).
GDP per capita (logarithm)	World Bank (2003)	GDP per capita is gross domestic product divided by midyear population. Data are in constant U.S. dollars.

Appendix B (continued)

Variable	Source	Definition
GDP (logarithm)	World Bank (2003)	GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. Data are in constant U.S. dollars.
Openness	World Bank (2003)	Trade is the sum of exports and imports of goods and services measured as a share of gross domestic product. Data are in percent of GDP.
Financial Openness	World Bank (2003)	Gross private capital flows are the sum of the absolute values of direct, portfolio, and other investment inflows and outflows recorded in the balance of payments financial account, excluding changes in the assets and liabilities of monetary authorities and general government. Calculated as a ratio to GDP in U.S. dollars.
Lending Interest Rate	World Bank (2003)	Lending interest rate is the rate charged by banks on loans to prime customers.
Debt (percent of GDP)	World Bank (2003)	Total external debt is the sum of public, publicly guaranteed, and private nonguaranteed long-term debt, use of IMF credit, and short-term debt. Data are in percent of GDP.
Short-term debt (percent of total external debt)	World Bank (2003)	Short-term debt includes all debt having an original maturity of one year or less and interest in arrears on long-term debt.
Money (percent of GDP)	World Bank (2003)	Money and quasi money comprise the sum of currency outside banks, demand deposits other than those of the central government, and the time, savings, and foreign currency deposits of resident sectors other than the central government.
Population (logarithm)	World Bank (2003)	Total population is based on the de facto definition of population, which counts all residents regardless of legal status or citizenship – except for refugees not permanently settled in the country of asylum.
Export Growth (Standard Dev.)	World Bank (2003)	Standard Deviation of previous five years of growth rate of exports of goods and services.

Appendix C: Descriptive Statistics (Estimation Sample)

Variable	Min	Max	Mean	Std. Dev. (overall)
log (International Reserves/trend GDP)	-9.37	0.23	-2.88	1.27
Election, Dummy	0	1	0.28	0.45
Part of the year which is within 12 months prior to an election	0	1	0.24	0.34
Part of the year which is within 12 months after an election	0	1	0.24	0.33
Fixed Exchange Rates (de facto), Dummy	0	1	0.82	0.38
Fixed Exchange Rates (de jure), Dummy	0	1	0.56	0.49
GDP per capita (log)	3.90	10.94	7.57	7.56
GDP (log)	16.48	29.94	22.52	2.42
Openness	6.32	361.18	68.14	42.11
Financial Openness	0.002	800.64	15.50	41.81
Lending Interest Rate	1.26	4774.53	22.93	102.90
Debt (percent of GDP)	0	1064.41	73.20	74.19
Short-term debt (percent of total external debt)	0	83.37	14.16	11.69
Money (percent of GDP)	4.11	237.37	40.61	29.58
Population (log)	9.84	20.96	15.17	2.06
Export Growth (Standard Dev.)	0.1	1.43	0.15	0.14

Appendix D: Country List

Albania	Denmark	Lebanon	Sierra Leone
Algeria	Dominica	Lesotho	Singapore
Angola	Dominican Republic	Lithuania	Slovak Republic
Antigua and Barbuds	Ecuador	Macedonia, FYR	Slovenia
Argentina	Egypt	Madagascar	Solomon Islands
Armenia	El Salvador	Malawi	Somalia
Australia	Estonia	Malaysia	South Africa
Austria	Ethiopia	Maldives	Spain
Azerbaijan	Fiji	Mali	Sri Lanka
Bahamas	Finland	Malta	St. Kitts and Nevis
Bahrain	France	Mauritania	St. Lucia
Bangladesh	Gabon	Mauritius	St. Vincent and the Grenadines
Barbados	Gambia	Mexico	Sudan
Belarus	Germany	Mongolia	Suriname
Belgium	Ghana	Morocco	Swaziland
Belize	Greece	Mozambique	Sweden
Benin	Grenada	Namibia	Switzerland
Bhutan	Guatemala	Nepal	Syrian Arab Republic
Bolivia	Guinea	Netherlands	Tajikistan
Botswana	Guinea-Bissau	New Zealand	Tanzania
Brazil	Guyana	Nicaragua	Thailand
Bulgaria	Haiti	Niger	Togo
Burkina Faso	Honduras	Nigeria	Tonga
Burundi	Hong Kong, China	Norway	Trinidad and Tobago
Cameroon	Hungary	Oman	Tunisia
Canada	Iceland	Pakistan	Turkey
Cape Verde	India	Panama	Turkmenistan
Central African Republic	Indonesia	Papua New Guinea	Uganda
Chad	Ireland	Paraguay	Ukraine
Chile	Israel	Peru	United Kingdom
China	Italy	Philippines	United States
Colombia	Jamaica	Poland	Uruguay
Comoros	Japan	Portugal	Vanuatu
Congo, Dem. Rep.	Jordan	Romania	Venezuela
Congo, Rep.	Kazakhstan	Russian Federation	Vietnam
Costa Rica	Kenya	Rwanda	Yemen, Rep.
Cote d'Ivoire	Korea, Rep.	Samoa	Zambia
Croatia	Kuwait	Saudi Arabia	Zimbabwe
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