Capital Account Liberalization and Inflation in the 1990s

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Capital Account Liberalization and Inflation in the 1990s

This paper addresses two economic puzzles of the 1990s. One is why inflation fell so quickly, even in countries with long histories of printing too much money. Latin America's average inflation rate, for example, fell from over 400% in 1990 to under 10% in 1999. The other puzzle is why so many countries opened their capital accounts—despite the misgivings of many economists and the evident risk of currency crises and capital flight for some LDCs. This paper explores the extent to which these two phenomena may be related. Does capital account liberalization foster disinflation by raising the penalties for excess money creation? David Romer (1993) explored a similar hypothesis for openness as measured by trade as a share of GDP. But trade to GDP ratios change slowly. Capital account liberalization, on the other hand, is potentially an "overnight" reform. Did countries that threw open their capital accounts in the 1990s find it easier to disinflate? That question is the topic of this paper.

Capital account liberalization became fashionable in the 1990s. Of the 112 countries in our sample, the IMF Survey of Exchange Rate arrangements indicates 69 eased restrictions on foreign currency transactions, 17 tightened and 26 did nothing. As shown in Figure 1, the overall trend was on of capital account opening. During the 1980s only 13 countries had no convertibility restrictions of any kind during the entire decade—a perfect score of 4 in our index. During the first six years of the 1990s this "no restrictions" group expanded to 21 countries.

That governments can use capital account liberalization to signal policy shifts in or commitments to domestic policies is well understood.[1] When currency crises threatened in 1995 and 1998 Argentina and Chile announced new measures to reduce capital controls and to ease foreign exchange convertibility. The Southern cone programs of the late 1970s also used capital account opening in part to signal a change in regime. Though these initiatives facilitate short-term capital movements, this was clearly not their main purpose. Rather governments were attempting to reassure investors by signaling their willingness to tolerate capital outflows—to take their punishment for straying from a course of policy reform or for political instability.

When it comes to monetary policy, however, capital account liberalization is more than a signal of good intentions. It directly raises the penalty for loose monetary policy. Easier access to foreign exchange raises the elasticity of demand for money and making the central bank vulnerable

[1] Bartolini and Drazen (1997) and Laban and Larraine (1997) also emphasize The policy signaling potential of capital account opening. However, these papers focus primarily on private investment rather than inflation. They argue capital account liberalization can induce higher capital inflows as governments signal future policy changes that imply higher profits and/or more easily reversible investment decisions.

to rapid reserve losses—that is to currency substitution. Reserve losses are less of issue for flexible rate regimes, but rapid currency depreciations can be inflationary as well. By raising the penalties for excess money creation, central banks can alter private sector expectations regarding future monetary policy. With temptation to print money reduced, the time consistent inflation rate falls in the spirit of Kydland and Prescott (1977) and Barro and Gordon (1983).

However, a number of economists argue this vulnerability to money demand shifts is inflationary. Rodrik(1998) for example argues capital inflows undermine central bank efforts to control inflation. McKinnon and Mathieson (1981) see the same money volatility we term disciplinary as inflationary and recommend capital controls to reduce inflation in financially "repressed" economies. By reducing currency substitution opportunities the repressed regime lowers the inflation rate necessary to generate a given amount of seigniorage.

Hence, the extent to which capital account liberalization reduces inflation remains an empirical question. Rodrik (1998) in fact asserts there no evidence that economies with greater capital account convertibility have lower inflation. But he overlooks the evidence presented by Grilli and Miles-Ferretti (1995) who find a negative relationship between capital account openness and inflation. This paper presents considerable evidence on the "first difference" of this question: does capital account liberalization reduce inflation? Specifically, do countries that lower barriers to convertibility experience faster reductions in inflation. Because our focus is a change in policy, this argument is cleaner than those that compare the level of controls with the rate of inflation. The comprehensive survey of Grilli and Miles-Ferretti (1995) does not examine the effect of changes in capital controls or liberalization—on the rate of inflation. In fact, their study ends in 1989—before the capital account liberalization wave of the 1990s began.

In some respects, this paper simply extends Romer's (1983) argument regarding inflation and trade openness to the capital account. In the model of the next section, capital account liberalization reduces the inflation rate that maximizes seigniorage and increases the penalties for excess money creation. Inflation falls because the private sector anticipates the tighter monetary policy needed to stabilize reserves the newly open capital account. Romer (1983) makes an analogous argument regarding the potential pain caused by currency depreciation, which in turn depends on openess to trade. However there are obviously important differences between trade and capital account openness. Whereas trade shares changes slowly and depend on location, per capita income and other structural variables, capital account openness has a large discretionary

component. Countries rich or poor, landlocked in Africa or in the middle of Europe can open or close their capital account, overnight, if they so desire.[2]

That capital account liberalization reduces inflation has important implications for economic policy. Often blamed for domestic banking and currency crises, to the extent that capital account openness reduces inflation it also raises economic growth and reduces poverty.[3]

I. Capital Account Openness and Disinflation

The question of why inflation differs across countries has generated a large literature, focusing on a number of key political, institutional and structural characteristics. The question addressed here is similar, but slightly more specific. That is, how can a central bank with a poor record of monetary discipline signal the private sector that is has changed its ways? A variety of institutional changes are recommended: increase central bank independence, hire a conservative central banker, set up a currency board, join a monetary union, fix the exchange rate temporarily, etc. All of these methods aim to overcome the inherent inflationary bias of discretionary monetary policy. Short of institutional change, some countries have inherent advantages. Romer (1993) for example, argues Central Banks in more open economies have less incentive to initiate a surprise monetary expansion because the resulting real depreciation of the exchange rate is more painful. He provides an illustrative model of large economy where increased openness worsens the output inflation tradeoff and thus reduces the Central Bank's temptation to inflate.

This section sets forth a simple model of Central Bank discretion that recasts these tradeoffs and institutional constraints for the case of a small open economy with a managed exchange rate, as opposed to the large open flexible rate case examined by Romer(1993) and Lane(1997). Here discretionary monetary policy still has an inherent inflationary bias but rather than seeking to exploit output inflation tradeoffs[4] the Central Bank responds to Treasury pressure to generate

[2] The fact that a country can throw open its border to capital flows does not always mean that it should. Economists who have no qualms about trade liberalization nevertheless hesitant to recommend capital account opening—especially to countries with weak banking systems or have not previously liberalized their trade account, see for example Rodrik (1998) or Cooper (1999) for a recent survey and Edwards (1991) on sequencing. But despite these misgivings there was a global movement toward capital account liberalization in the 1990s.

[3] The link between higher growth and lower inflation and between inflation and poverty is fairly well established. On the link between growth and inflation, see De Gregorio (1993), Barro (1997) and Easterly and Robelo (1992). That inflation increases poverty see Cardoso(1992), Lustig and McLeod (1997) and Romer and Romer (1998).

[4] In small open economies real exchange rate depreciations may or may not be expansionary and inflation-output tradeoffs may not be exploitable in any case. Since the majority of countries in our sample (and Romer's) fit this description our approach to modeling the impact of capital account liberalization is somewhat different.

seigniorage revenue. With tax revenue from other sources is limited the inflation tax becomes the path of least resistance for the fiscal authorities. These countries often experiences rates of inflation too high to be explained by efforts to exploit an expectations-adjusted Phillips curve. Of course, the private sector of course seeks to evade this tax, and an open capital account gives it more opportunities to do so which is the basic story we explore.

Seigniorage revenues are limited by the size of the inflation tax base, in this case the stock of local currency in circulation. Capital account openness raises the elasticity of demand of for money thereby lowering the revenue-maximizing rate of inflation. An unexpected increase in domestic prices also affects the trade account and speculative demand for dollars—both of which can erode Central Bank foreign exchange reserves and eventually lead to a currency crisis or force a nominal devaluation of the currency. Thus central bank heads face a tradeoff between tax revenues and potential loss of reserves. McLeod and Welch (1993) use a similar setup to examine the choice of exchange rate regime. Here we assume the exchange rate is "managed" and temporarily fixed, so that higher inflation at home the abroad leads to an exchange rate appreciation. The Central Bank maximizes

(1) $U_{CB} = \theta_1 S(\pi^e) + \theta_2 \Delta R(\pi^e, \pi^*, \pi)$.

Where π^e is expected home and π^* foreign inflation, S is tax revenue generated by seigniorage and R is the stock of foreign currency reserves. The relative weights in the Central Bank utility function depend on the degree of Central Bank Independence θ_1—that is the pressure it feels from the Treasury to raise seigniorage revenue-- and its obligation to defend its semi-fixed exchange rate regime (θ_2). To the extent that reserves are less essential, floating rate regimes may have an inflationary bias—though even developing countries that "float" seem to feel Agénor and Montiel (1999) use a similar set up, except that the Central Bank trades seigniorage revenue against tax revenue lost to the Olivera-Tanzi effect plus dead-weight inflation loses. To bring capital controls directly into view, we start with a Cagan-type semi-log money demand function where nominal interest rates are dominated by. For a given steady-state level of output, demand for real money balances is thus depends mainly on expected inflation, π^e,

(2) $m^d = m_0 \exp(-\alpha(\omega_1) (\pi^e - \pi^*))$

where the elasticity of demand for money, $\alpha(\omega_1)$ depends on the degree of capital account openness, ω_1 which varies from zero to one as the restrictions on foreign currency transactions are lifted. In this currency substitution story residents evade the inflation tax rises by switching to foreign currency unless exchange controls prevent them from doing so. As capital account restrictions are lifted the inflation elasticity of demand for domestic currency rises. Ignoring any costs associated with inflation—such as those elaborated below—the steady state (fixed output) inflation tax is, $S = \mu m^d$ where is the money supply growth rate set by authorities. In equilibrium $\mu = \pi$ and the revenue maximizing inflation and money growth rate is $1/\alpha(\omega_1)$. In a world of perfect floating where foreign exchange reserves were irrelevant and inflation costless, capital controls would still raise the optimal inflation rate as they lower the interest rate elasticity of money demand, α.

However, inflation is not costless and reserves levels do matter even for "managed floating" regimes. The other side of this currency substitution story—and another constraint on seigniorage revenue-- is potential loss of reserves when the currency appreciates or when home prices rise faster than foreign prices, $\pi > \pi^*$. Here too various type capital controls can reduce the sensitivity of reserves to domestic inflation. The Central Banks stock reserves depends on the trade balance Tb and net capital inflows as reflected in the change in foreign assets, F,

$$(3) \qquad \Delta R_t = Tb(\pi - \pi^*, \omega_2, g^*, g) + \Delta F(\pi^e - \pi^*, \omega_1, r^*).$$

The trade balance Tb in turn depends on the appreciation of the real exchange rate, expected or not and trading partner GDP growth. Net capital inflows depend on expected exchange rate changes, as an expected appreciation raises expectations of a future currency depreciation (a speculative attack) so investors hedge by exchanging local currency assets for dollars. In addition to direct controls on capital account transactions, denoted here as ω_1, the IMF Survey of Exchange Rate Arrangements tracks three other types of convertibility restrictions, captured here as ω_2: multiple exchange rates for imports, exports or capital vs. current account transactions (dual exchange rates); restrictions on current account transactions and surrender of export proceeds. These later convertibility restrictions can also affect efforts to convert local currency into dollars, thus the distinction between current and capital controls is not as sharp as equation (3) suggests. Note that the impact of type 2 restrictions and of an exchange rate appreciation on the current traded goods transactions also depends on the share of imports in GDP, m/y. This is the openness measure Romer (1993) emphasizes.

To simplify the analysis and solve for the inflation under rules vs. discretion regimes we assume for now that $\pi^* = g = g^* = r^* = 0$ and set $m_0 = 1$. Our attention now focuses only on expected and actual inflation and the classic rules vs. discretion problem. Several solutions are available at this point, including the fixed (rules) vs. flexible exchange rate scenarios explored by McLeod and Welch (1993). But capital controls are an attempt to achieve discretion despite commitment to a particular exchange rate regime. Discretion without precommitment implies the monetary authorities takes expected inflation rate set by the private sector Agénor and Montiel(1999) suggest a particularly simple form of the loss function (1) disutility of reserve loss function,

(4) $U_R = \theta_2 \exp(\gamma_1 \omega_1 \pi^e + \gamma_2 \omega_2 \pi)$

where $\gamma_1 \omega_1$ captures the response of reserves to expected inflation π^e in the presence of type 1 exchange controls on speculative holdings of dollar balances and $\gamma_2 \omega_2$ captures the impact of actual inflation π on the trade balance again attenuated by type 2 exchange controls on current account transactions. Substituting (2) and (4) into (1) the monetary authorities maximize happiness subject to money demand and potential reserve losses taking private sector inflation expectations as given. Recalling that in the steady state $\mu = \pi$ and output is taken a given, taking the log of both sides of (1) and solving for inflation under discretionary monetary policy yields

(5) $\pi_d = \ln(\theta/\gamma_1 \omega_1) [(\omega_1 \{\alpha(\omega_1) + \gamma_2\} + \gamma_2 \omega_2]^{-1}$

where $\theta = \theta_1/\theta_2$ or the relative weight of seigniorage to reserves in the Central bankers utility function. Note that increasing openness, that is raising ω_1 or ω_2 lowers the equilibrium inflation rate both by lowering the optimal inflation rate from a pure seigniorage point of view and by making the balance of payments more sensitive to deviations of domestic from foreign inflation. The solution for rules based monetary policy where the monetary authorities can effectively pre-commit to the optimal inflation rate is similar (see Appendix 2). Though inflation is lower to begin with it still falls with capital account liberalization—a result we test in the next section.

II. Capital Controls and Disinflation: Empirical Results

The 1990s provide a natural experiment for assessing the impact of capital account liberalization on a range of macroeconomic variables as the decade saw a pronounced shift toward capital account liberalization. Using an index of capital account openness constructed from various issues the annual IMF survey of exchange rate arrangements[5] 69 of 112 countries moved toward more open capital account in the 1990s. Of the remaining 43 countries, 27 had no change and 17 countries tightened controls on convertibility. As shown in Figure 1, our index of average global openness rose from 1.6 in the 1980s to 2.1 in the 1990s after falling to 1.69 in the 1970s. The overall index shown in Figure 1 is an average for 112 countries, where each of the receive a score from 0 to 4 which is the sum of four different components shown in Figure 1. For example, if a country employed capital account restrictions in five of ten years, it receives a .4 for that decade. A country that did not employ a given restriction for at all receives a "1" for that decade, and so on.

The empirical link between trade openness and inflation is explored by Romer (1993), Lane (1997) and Campillo and Miron (1996). Though they differ on causal mechanisms and ancillary variables, each of these papers find a strong link between inflation and openness to trade, as measured by the share of imports in total GDP. Similar results for capital account openness and inflation are found Grilli and Miles-Ferretti (1995). Using a panel data set over the period 1973-89 they find greater restrictions on capital account transactions and convertibility is associated with higher inflation. Grill and Miles-Ferretti, do not however, explore the potential link between capital account liberalization and inflation. The period 1973 to 1989 was one of constant to increasing capital controls. It was not until the 1990s that capital account liberalization gained favor.

The section provides empirical evidence regarding the impact of capital account liberalization on inflation during the 1990s. Did this capital account liberalization contribute to the global disinflation of the 1990s? This is an important question not just because of the central bank discipline outlined in the previous section, but because the wisdom of capital account liberalization has been widely questioned especially for LDCs. To address this question we construct a composite index of currency convertibility aggregating four the categories of exchange rate restrictions monitored by the IMF in its Annual Survey of Exchange rate arrangements. For our purposes the

[5] A Quinn and Toyoda(1996) point, this approach its problems. Focusing on the change in this index is, however, a little better than assessing the "level of controls" which is what Quinn and Toyoda attempt to do.

1980s are defined as 1981-90 and the 1990s are 1991-96—in 1997 the IMF change the format of its survey and the data are not comparable with the previous survey.

We aggregate all four exchange rate restrictions into a single index—varying from one to four with four indicate full openness. The four components of this index are shown in Figure 1. The index takes a value of 0 to 4 depending upon the proportion of years a given restriction was employed in each decade. Note that in this section we focus entirely the change in this between the 1980s and 1990s (see Appendix A for regressions using the level of this index and alternative capital control indices). Figure 1 shows a slight move toward more capital account restrictions from the 1970s to 1980s. However, the 1990s saw a pronounced shift toward liberalization—as the popular view of globalization and capital market integration would suggest. The aggregate index rose from 1.6 to 2.1 in the 1990s as show in Figure 1. Liberalization in all four categories with capital account and multiple rate rates accounting for about 35% of the change and current account and export proceeds accounting for about 65% of the liberalization.

Table 1 summarizes our main results for the full 112-country sample. Table 2 provides an almost identical set of regressions for the 80 developing countries in the larger sample. In virtually every regression, reported and unreported, the change in capital account openness was significantly increased disinflation—the fall in average inflation between decades. Countries that opened their capital account experienced greater disinflation in the 1990s than those that did not. Capital account liberalization was more important for developing countries and for countries with a history of Central Bank creditability problems—results that are consistent with the rules vs. discretion or credibility model developed in the previous section. After presenting the results for the main index, the next section presents regressions for a disaggregated index to confirm that it is indeed capital account liberalization, as opposed to other convertibility restrictions, that is really at work here.

Following Romer(1993) we take the log of inflation to reduce the extreme variability of inflation across countries. Other methods of reducing the variability of inflation and even using the change in inflation rates as the dependent variable yields similar results, at least for the liberalization index. As in Romer(1993) all equations include per capita income and openness—imports over GDP—key structural determinants of inflation. We tried using the change in openness or the growth in per capita income, with less success. Apparently these slow changing variables act as "state variables" or proxies for instutional conditions associated with level of development and openness to trade. We also found location (latitude) and being a Latin nation affected the rate of disinflation. Being in Latin America, for example, reduced the rate of disinflation all else equal.

To reduce the impact of outliers and heteroskedasticity the basic regression equation 1.1 was also run excluding the five countries where inflation averaged over 100% annually in the 1980s. These results are report as equations 1.2 and 2.2. To minimize heteroskedasticity problems only White's heteroskedasticity-consistent standard errors are reported. The third line from the bottom in Tables 1 and 2 reports the confidence level at which heteroskedasticity can be rejected based on the standard White test. Heteroskedasticity is not a problem in equation 1.3 when the same political stability variable used by Romer(1993) is added to the basic model. However, when we move to the smaller 52 country sample for which the Central Bank Independence indices is available, the White test does suggest heteroskedasticity problems. To reduce this problem equation 1.4 is restimated using the Central Bank turnover rate as the weighting variable. This reduces heteroskedasticity and increases the impact of capital account liberalization. That is, in countries with a history of problems with central bank turnover, capital account opening has a bigger impact on the rate of disinflation. This is consistent with the disciplining or signaling interpretation of capital account opening underlying the model of the previous section.

In additional to the institutional and structural variables discussed above, it is also important to control for other "fundamentals." Campillo and Martin(1996) find debt to GDP ratios raises the level of inflation across countries (they do not look at changes in inflation). We tried various debt burden measures, levels and changes, but found no consistent effects on disinflation. Another obvious fundamental is the budget deficit. Equation 1.4 and 2.4 include the change in the average budget surplus, 1980s to 1990s as reported by World Bank. This variable is sometimes significant—especially in the weighted least squares estimates.

Another potential econometric problem involves the potential endogeneity of capital controls. It is possible that countries which experience disinflation are then in a better position to open their capital accounts—or than a surge in capital inflows provides both the opportunity to disinflate and to open the capital account. There a number of approaches to testing for endogeneity—here we take the traditional route of using two stage least squares. The last three columns of Tables 1 and 2 report two stage least squares estimates of equations 1.1, 1.3 and 1.4. The instruments used to predict changes in capital controls and changes in the budget surplus are country size variables: total GDP in 1980 dollars and square miles. Large countries tended to liberalize less, perhaps because they were already more open or were more self-sufficient than other countries. Oil exporting countries were also less likely to liberalize.

The two-stage estimates tend to show a stronger impact of capital account liberalization on inflation—and in every case capital account opening remains a significant predictor of disinflation. Two specification tests were used to determine how well these instrumental variable estimates perform. The uses a Hausman-type specification test to compare the OLS and TSLS estimates, assuming the later are consistent. Assuming that the endogeneity of capital controls for example is what makes the OLS estimates inconsistent, this test can be interpreted as test of the extent to which these variables are endogenous and simultaneous equation bias is a problem. Davidson and MacKinnon (1993) term this Durbin-Hausman-Wu (DWH) and provide the simple artificial regression approach to conducting the test we used. The penultimate row of Tables 1 and 2 provide mild evidence that capital controls and/or the fiscal deficit have an endogenous component and warrant TSLS estimation.

The second TSLS specification test is the Sargan instrument test. The last row of Tables 1 and 2 provides the confidence level for rejecting the null hypothesis that the instruments are correlated with the error term. The results of this test strongly confirm what is should be obvious from type of instruments selected—the instruments chosen here are not correlated with the dependent variable-- the rate of disinflation.

Taken together these specification tests suggest the TSLS estimates presented in the last three columns of Table 1 and 2 provide a less biased picture of how capital account liberalization affects inflation. In almost every case the coefficient on capital controls is higher in the TSLS—hence we conclude if anything the OLS understate the importance of capital account opening

III. Tests of Exchange Controls by type of Restriction

The capital controls tracked by the IMF survey fall into two categories, one group affects capital account transactions directly and a second group affects current account transactions. But this distinction should not be over emphasized. For example, in regulated economies a popular method of accumulating dollar assets is to over invoice imports or under invoice exports. In this situation current account restrictions or even "surrendering export proceeds" restrictions may in fact inhibit a capital account transactions. Also governments that invoke one or more restrictions on foreign exchange convertibility are also more likely to restrict capital account transactions—perhaps in a fashion not picked up by the IMF survey. In this situation the aggregate index communicates more information than each component taken separately.

The above considerations tend to support use of an aggregate capital control index, such as one tested in the previous section. But it also legitimate to ask, are the four components of this index equally important? To address we deconstruct our index into its four components and rerun the regressions reported in Tables 1 and 2. These results are presented in Table 3, where to conserve space only the coefficients on the four convertibility restrictions are reported. Again the index is computed by summing years in which restrictions were in place, dividing by the total years in the "decade" and the subtracting that average from one. A country that used that restriction every year would score 0, while a country that had no restriction in any year during the decade would receive a "1"—full openness for that restriction.

The results reported in Table 3 suggest capital and currency account restrictions and "surrender export proceeds" are robust and significant explanatory variables for disinflation—with coefficient on the order of magnitude for the results reported for the aggregate index in Table 1 and 2. There is a minor colinearity problem between the capital account and "surrender" variable—hence we also report equation 2.1 without the later variable. Note that the multiple exchange rate variable is less significant and not reliably negative. We therefore test two restrictions—one that all four variables have the same value and one that all variables except the multiple rate variable are equal. Again it is much harder to reject the null of equal coefficients for the three components other than multiple exchange rates. In a companion paper we construct and estimate as similar set of equations using a three-component index—see Gruben and McLeod (2000). The evidence on the multiple exchange rates suggests these restrictions are not as damaging as other forms of capital account restrictions—a result consistent with 1980s literature on dual exchange rates for capital and

current account transactions. Overall these disaggregated estimates confirm and justify the arguments presented in the previous section regarding capital account liberalization and disinflation.

IV. Conclusions

The last decade has produced a variety of cautionary tales regarding capital account liberalization and the potential risk of costly currency and banking crises. What is missing from most of these stories is the "why risk it" prequel to capital account opening. This evidence presented in this paper suggests one potential important benefit of sustained capital account liberalization is lower inflation. Our results suggest that sustained removal of one of the four restrictions inventoried by the IMF can reduce average annual inflation by as much as 3%. Since the connection between higher growth and lower inflation and between high inflation and poverty is by now fairly well established, disinflation may be an important by-product of globalization. Interpreting these results more broadly than is perhaps justified by the results reported here—that the 1990s were both a period of freer capital flows and falling inflation may not be a coincidence. More research is needed to determine the various channels through which capital account liberalization reduces inflation. Alternative capital account indices also need to be developed and tested, as in Quinn and Toyoda (1997).

Perhaps it is not surprising that the strong link between openness and inflation found by David Romer(1993) for trade extends to capital account openness. But again especially for developing countries economists have tended to draw a sharp distinction between the potential benefits of trade vs. capital account liberalization. For example the lessons of the failed Southern Cone stabilization experiments of the 1970s often include sequencing—trade then capital account liberalization— and the stern warning that the law one price will not bring down inflation fast enough. The results presented by Romer and this paper do not contradict these policy maxims, but they do suggest that a sustained move toward trade and capital account openness can help rein in errant Treasuries and Central Banks thereby stimulating growth and raising real wages.

Appendix A: Exchange Rate Restrictions and Inflation

Since about 1969 the IMF Survey of Exchange Rate Arrangements has tracked, in a very broad way, the use of a four different restrictions on currency convertibility. In their comprehensive survey Grilli and Miles-Ferretti(1995) use these indices to study the effect of capital controls on GDP growth and inflation. Their results show level of capital controls do contribute to inflation. Similarly, Klein and Olivei (1998) use an index of capital controls to study the effect of capital account deepening on financial market development. Unfortunately, there are a number of limitations of indices constructed from the IMF survey. The improved Quinn and Toyoda (1996) index is not available yet for the 1990s, but we discussion—for estimates of the link between inflation index see Table A.1.

To help overcome some limitations of the IMF Survey indices we focus mainly on changes across decades in a composite index constructed from four measures related measures of capital account openness. Each index is constructed by designating a country that employs a restriction in a given year with a 1 or 0 when no restriction is present. This index is then averaged across a decade and then subtracted from one. This if country did not employ that restriction at all during the decade it receives a "1" designating full openness,

$$v^{1}_{80s} = 1 - (1/n)\sum_{i=1}^{n} w_i$$

If restrictions were employed for 5 of 10 years, the index would take a value of .5. If a country employ a given restriction for the entire decade the index would be zero indicating no openness.

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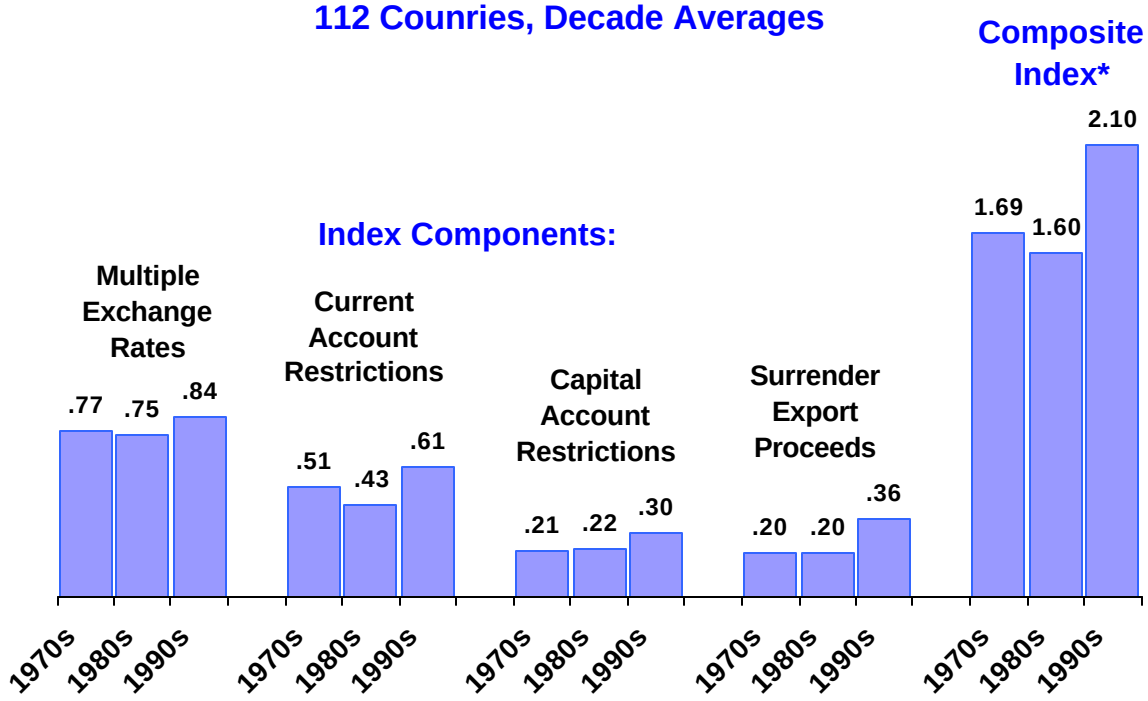
Figure 1: Capital Account Openness Indices for 112 Counries, Decade Averages



*Full open for the whole decade is 1 for each component and 4 for the composite index.
Source: IMF Survey of Exchange Rate Arrangements, Various Issues

Table 1 – Disinflation and Capital Account Liberalization: 1980s to 1990s

Dependent Variable: Change in Log Average CPI Inflation ***(White Heteroskedasticity-Consistent t-statistic)***

Subsample:	OLS—Full sample				WLS	TSLS 3/		
	All ctys	π < 100%	**Pstab**	**CBI 1/**	**CBI 2/**	All	Pstab	CBI 1/
	(1.1)	(1.2)	(1.3)	(1.4)	(1.4w)	(1.1a)	(1.3a)	(1.4a)
Constant	2.63 ***(4.73)***	2.57 ***(4.42)***	3.79 ***(4.52)***	3.72 ***(4.2)***	3.84 ***(4.8)***	2.56 ***(4.04)***	3.95 ***(4.54)***	4.01 ***(3.23)***
Per Capita GDP 1980 $ppp	-0.38 ***(-5.22)***	-0.36 ***(-5.3)***	-0.49 ***(5.26)***	-.50 ***(-4.9)***	-.51 ***(-4.6)***	-.35 ***(-4.12)***	-0.49 ***(-5.14)***	-0.50 ***(-3.28)***
Trade Openness 4/	.002 ***(1.01)***	.001 ***(0.53)***	-0.00 ***(-.12)***	0.01 ***(2.49)***	0.01 ***(3.9)***	.002 ***(.57)***	-.001 ***(-.41)***	.011 ***(2.17)***
Capital Account Openess Change 1980s to 1990s	-0.60 ***(-5.97)***	-0.49 ***(-4.95)***	-0.62 ***(-6.0)***	-.50 ***(-4.37)***	-.70 ***(-6.1)***	-1.08 ***(-3.01)***	-1.00 ***(-3.02)***	-1.21 ***(-4.41)***
Latin America Dummy	0.40 ***(1.37)***	0.65 ***(3.01)***	0.60 ***(2.57)***	0.48 ***(1.33)***	1.13 ***(3.72)***	.68 ***(2.45)***	.82 ***(2.55)***	1.51 ***(5.9)***
Latitude	.009 ***(2.43)***	.005 ***(1.63)***	.009 ***(2.99)***	.004 ***(1.33)***	.02 ***(3.64)***	.013 ***(2.46)***	.013 ***(2.82)***	011 ***(2.15)***
Political Stability 4/			-1.35 ***(-1.63)***				-1.56 ***(-1.93)***	
Central Bank Independence 1/				-.97 ***(-.89)***	-1.75 ***(-3.37)***			-1.12 ***(-1.11)***
Change in Gov. Surplus				-.05 ***(-2.02)***	-.08 ***(-3.79)***			-.16 ***(-2.19)***
Number of Observations	103	98	102	52	52	97	96	52
Adjusted R^2	.34	.43	.37	.51	.90	.13	.28	-.25
White Heteroskedasticity Test – Prob Value.	.21	.40	.00	.87	.08	.33	.00	.00
Hausmann Test for OLS Consistency—Prob Value[5/]						.08	.12	.09
Sargan Instrument test—Prob Value[6/]						.69	.23	.73

1/ Central Bank Turnover is used as an index of Central Bank Independence as prepared for 61 countries by Cukierman, Webb.and Neyapti (1992) as reported in Table 11 page 380.

2/ The weighting variable for the WLS estimates reported as equation 1.5 is also the Central Bank turnover ratio discussed in footnote 1 above. The R^2 reported is that for the unweighted regression. .

3/ Instruments are all variables listed except the capital controls index and the budget surplus plus total GDP in PPP$1980, log area in square miles and a country dummy for fuel exporters. The last three instruments were obtained from the GDN data based "Fixed Factors" spreadsheet—also the source for the Latitude variable (World Bank Growth Research Web Page: http://www.worldbank.org/research/growth/GDNdata.htm#4).

4/ Openess to trade is the average share of imports in GDP 1973-89. This openess measure, the political stability index and 1980 per capital GDP are from Romer(1993) Appendix 2.

5/ See Table 2 notes.

6/ See Table 2.

Table 2 – Disinflation and Capital Account Liberalization 1980s to 1990s—LDCs only

Dependent Variable: Change in Log Average CPI Inflation ***(White Heteroskedasticity-Consistent t-statistic)***

Subsample:	OLS—Developing Countries				WLS[2]	TSLS-LDCs [3/]		
	All ldcs	π < 100%	**Pol. Stab**	**CBI 1/**	**All ldcs**	All	Pol stab	CBI 1/
	(1.1)	**(1.2)**	**(1.3)**	**(1.4)**	**(1.4w)**	**(1.1a)**	**(1.3a)**	**(1.4a)**
Constant	1.97 *(2.74)*	2.05 *(3.13)*	3.06 *(4.01)*	1.81 *(1.92)*	2.54 *(4.27)*	1.90 *(2.18)*	3.14 *(3.52)*	.69 *(3.88)*
Per Capita GDP 1980 $ppp	-0.27 *(-2.72)*	-0.28 *(-3.0)*	-0.36 *(3.92)*	-.20 *(-1.53)*	-.34 *(-4.2)*	-.24 *(-1.78)*	-0.34 *(-2.96)*	-0.40 *(-4.41)*
Trade Share 1980 GDP	.0001 *(.43)*	.001 *(0.14)*	-.003 *(-.77)*	0.004 *(1.2)*	-.003 *(-.73)*	-.001 *(.24)*	-.005 *(-1.17)*	-.001 *(-.09)*
Capital Account Openess Change 1980s to 1990s	-0.64 *(-5.47)*	-0.50 *(-4.36)*	-0.68 *(-5.67)*	-.68 *(-6.8)*	-.60 *(-3.58)*	-1.12 *(-2.15)*	-1.10 *(-2.33)*	-1.35 *(-3.12)*
Latin America Dummy	0.28 *(.84)*	0.54 *(2.21)*	0.48 *(1.79)*	0.37 *(1.15)*	.11 *(.37)*	.52 *(1.29)*	0.68 *(1.77)*	.82 *(2.10)*
Latitude	.013 *(2.81)*	.008 *(2.12)*	.015 *(3.55)*	.013 *(2.54)*	.014 *(3.16)*	.016 *(2.38)*	.018 *(2.94)*	.02 *(3.46)*
Political Stability			-1.56 *(-1.91)*				-1.78 *(-2.19)*	
Central Bank Independence				-1.32 *(-1.63)*				-1.05 *(-1.21)*
Change in Gov. Surplus				-.06 *(-2.43)*				-.10 *(-1.64)*
Number of Observations	80	75	79	31	80	75	74	31
Adjusted R^2	.25	.24	.37	.71	.21	.08	.26	.28
White Heteroskedasticity Test – Prob Value.	.61	.05	.00	.86	.08	.50	.00	.002
DWH Endogeniety Test[5]						.27	.23	.03
Sargan Instrument Test[6/]						.78	.65	.99

For notes 1-4, see Table 1.

5/ The Durbin-Wu-Hausman test compares the TSLS and OLS estimates assuming the former are consistent. We report the confidence level at which consistency of OLS estimates can be rejected. This test can be interpreted as an exogeneity, provided any lack consistency is attributed to simultanous equation bias—that is, endogeneity of capital controls and the fiscal surplus variables.

6/ The Sargan test null is that the chosen instruments are uncorrelated with error term, a condition appropriate instruments should fufill.

Table 3 – Capital Account Liberalization by type of Restriction: 1980s to 1990s

Dependent Variable: Change in Log Average CPI Inflation ***(White Heteroskedasticity-Consistent t-statistic)***

	OLS—Full sample 1/				OLS—LDCs Only 1/			
Plus all Variables Reported in this Equation see Tables 1&2:	All ctys **(1.1)**	**Pstab (1.3)**	**CBI 2/ (1.4)**	WLS **(1.4) 3/**	all ldcs **(2.1)**	all ldcs **(2.1)**	Pstab **(2.3)**	CBI 2/ **(2.4)**
Capital Account Restrictions	-.88 ***(-2.21)***	-.80 ***(-2.44)***	-.67 ***(-1.96)***	-1.64 ***(7.67)***	-1.23 ***(-1.86)***	-1.46 ***(-2.55)***	-.93 ***(-2.07)***	-1.36 ***(-3.94)***
Current Account Restrictions	-.66 ***(-2.13)***	-.60 ***(-1.96)***	-.83 ***(-1.8)***	-.51 ***(-4.6)***	-.46 ***(-1.45)***	-.46 ***(-1.43)***	-.47 ***(-1.49)***	-.57 ***(-1.28)***
Multiple Exchange Rates	-.21 ***(-.73)***	-.30 ***(-1.27)***	.11 ***-(.40)***	0.01 ***(3.9)***	-.37 ***(-1.07)***	-.40 ***(-1.11)***	-.49 ***(-1.79)***	-.32 ***(-.83)***
Surrender Export Proceeds	-.72 ***(-2.36)***	-.83 ***(-3.12)***	-.73 ***(-2.7)***	-.70 ***(-6.1)***	-.77 ***(-1.61)***		-1.02 ***(-2.75)***	-.72 ***(-3.76)***
Number of Observations	103	102	52	52	80	80	79	31
Adjusted R^2	.31	.37	.53	.22	.25	.22	.36	.74
Wald Test for Equal Coeffs on all Restrictions[4/]	.43	.33	.10	.00	.31	.23	.22	.20
Wald Test for Equal Coeffs excluding multiple fx rates[5/]	.89	.81	.97	.02	.31		.34	.26

1/ These equations are estimated with all the variables reported in Tables 1 and 2 under the same equation number. However, only the disaggregated capital restriction coefficients are reported here to conserve space. All regression are OLS except 1.4 which uses weighted least squares—see footnote 3 below.

2/ The central bank independence index is available for 61 countries as prepared by and reported in Cukierman, Webb.and Neyapti (1992). Here the variable is Central Bank Turnover, 1951-89 as reported in Table 11.

3 / The weighting variable is Central Bank Turnover, as discussed in footnote 1 above. This same weighted least squares equation reported in Table 1 as eq. 1.4, however only the coefficients for capital controls variables are reported here.

4/ This is the prob. value for the Wald test of the null hypothesis that all of the capital control coefficients are equal. For example for equation 1.1 the hypothesis of equal capital restriction coefficients with can be rejected 43% confidence, well below the conventional 5% standard. The regressions reported in Tables 1 and 2 implicitly impose this restriction by using the aggregate capital control index. This restriction is rarely rejected by the unrestricted regressions run in this table, with the exception of equation 1.4 when estimated by WLS.

5/ Note that the coefficient for multiple exchange rate arrangements is often quite different, but generally low statistical significance. This row tests the hypothesis that all the coefficients other than multiple exchange rates are equal.