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# Fiscal dominance and foreign debt: five decades of Latin American experience

## 1. INTRODUCTION AND CONCLUSIONS

This paper explores the different manifestations of fiscal dominance in the Latin American region throughout the last half century or so, by employing access to foreign lending as the main criteria for distinguishing between separate periods. While the interaction between debt dynamics, the budget and nominal monetary variables is clearly highlighted in the graphic presentation of these time series, an underlying pattern also emerges with respect to the level and volatility of the real exchange rate.

Although it is generally accepted that public spending can have a direct impact on economic growth, spending in excess of revenues does not necessarily imply "more of a good thing". Since it requires financing, it opens up an indirect channel of influence on stability and growth that operates via the macro policy mix. This refers primarily to the interaction between fiscal and monetary policy, and which one is "dominant" over the other.

*Paper prepared by K. Coates, Director General, and E. Rivera, Economist, of CEMLA, for the Latin American Workshop hosted by Banco de Portugal, Lisbon, October 14th-15th, 2004.*

It is not just a question of politicians versus technocrats, or the relative influence of Ministers of Finance and Central Bank Governors. Fiscal policy determines whether there is a deficit to be financed, and of what size. Monetary policy is aimed at price stability, in the understanding that it is conducive to long-term growth. In the past, monetary policy could be co-opted into financing the fiscal deficit at the expense of its primary objective of low inflation. Experience has shown this to be a poor framework for macroeconomic management, and as a result monetary authorities have tended to acquire greater autonomy over the years. In some cases their charter now precludes lending to government.

This division of labor does not guarantee, however, that fiscal and monetary policies operate in water-tight compartments. In industrialized economies, where fiscal deficits are for the most part financed in domestic capital markets in which the monetary authorities are also active, conflicts may arise in the area of interest rate levels and trends even though the parties tend to operate on opposite ends of the yield curve.

In emerging economies the situation is far more complex and the chances of conflicting policies are greater. To start with domestic capital markets are imperfect, which usually implies that they are incapable of financing the entire fiscal deficit and that the spectrum of available maturities is more limited, especially in the local currency. Secondly, in some countries the "culture" of central bank independence is still in a formative stage, despite legislation to the contrary. In other words, institutionality in some areas is still weak. Furthermore, in many cases the central bank acts as the financial agent for the government, including its external financial operations.

If there is a fiscal decision to overspend significantly (or more likely, not to adjust spending to anticipated revenues), it automatically becomes dominant over monetary policy. This dominance can adopt various forms, according to how the deficit is financed. If external borrowing is a fiscal option, it will affect the way in which dominance plays out. In Latin America's past these forms have included the subordination of monetary policy and its substitution by exchange-rate policy.

The short-run consequences of fiscal dominance, which may take the form of excessive inflation, exchange rate instability or high interest rates, are in themselves inimical to economic development. But the ability to postpone these nominal movements via the excessive accumulation of external debt can lead to a further detrimental impact on trade, investment and growth operating primarily through volatility in the real exchange rate.

In the present Latin American context of growing central bank autonomy, imperfect capital markets and volatile foreign capital flows, fiscal dominance has come to have a new and weaker interpretation. The generalized adoption of different variants of inflation targeting in monetary policy requires the subordination in principle of fiscal to monetary policy. In practice this has not occurred, since persistence in deficit spending continues to condition monetary policy. But the problem has eased to the point where in a growing number of countries it is now more a matter of coordination than of subordination.

The volatility of foreign capital flows represents a major macroeconomic management problem in the current context, since governments depend on external savings to finance part of their deficits. If these flows suddenly halt, fiscal dominance resurfaces and puts upward pressure on interest rates in the local debt markets. Capital flow reversals will tend to depreciate the local currency, also requiring higher interest rates from the central bank in order to defend the inflation targets.

Continued deficit spending requires the central bank to adopt a more restrictive stance than would otherwise be required in order to attain its inflation targets. This imposes two costs on the central bank: a "credibility premium" on rates which is necessary to show the markets that it means business, and a "financial premium" that arises when Treasury operations compete with open market operations on the shorter end of the available maturity spectrum.

As a result interest rates tend to be higher than needed, thereby dampening internal demand directly and reducing external demand via the effect of an appreciated local currency. The cost of poor coordination in setting macroeconomic policy goals is thus exacted in terms of a lower than warranted growth rate for the economy as a whole.

There is a further lesson to be gained from this analysis, no matter how intuitive it may be from the outset: the best sustained growth performances occur in those cases where fiscal deficits have declined over time. These cases also coincide with the instances where the real exchange rate displays a steadily upward trend.

## 2. FORMS OF FISCAL DOMINANCE

The best type of fiscal deficit is none at all. All others will exert some degree of fiscal dominance, depending on how they are financed.

**a) Monetary subordination**

Monetary subordination is the most complete form of fiscal dominance, and occurs when monetary policy is simply directed at financing the fiscal deficit through money creation. The cost is obviously inflation of all nominal variables (including interest and exchange rates) in a floating exchange-rate environment. Under pegged rates this will simply be a formula for financing the deficit with reserve losses, unless the economy is operating under current and capital account controls as during the pre-1974 era in Latin America. In that situation, the high frequency of peg adjustments under the dollar standard provides for the same dynamics in the long run as in a floating rate system.

**b) Fiscal dominance**

Fiscal dominance in its contemporary sense occurs when the fiscal deficit is financed in domestic capital markets in the local currency. In this scenario, Treasury and open market operations may be competing in similar segments of the yield curve, bidding interest rates up. This is more likely to occur in emerging markets where the spectrum of local currency maturities is usually more limited.

**c) No dominance**

No dominance occurs when the fiscal deficit is financed externally (in a "hard" currency), as long as this method is employed only for the foreign exchange component of public expenditure. In bypassing the local exchange and debt markets there would be no monetary consequences, and perhaps herein is the making of a "fiscal rule" for external debt. However it would imply a currency mismatch for the government plus the associated future servicing risks, essentially a debt management problem.

**d) Exchange-rate dominance**

If applied to local expenses, public external debt like any other capital inflow under floating rates tends to appreciate the local currency, lowering the domestic price of tradable goods and raising the current account deficit. Since the domestic money supply is not affected, the price of non-tradable output (mainly services) would tend to rise. The net effect on headline inflation would de-

pend on the relative weights of tradable and non-tradable goods in production and consumption. If inflation were to rise, as is common under heavy capital inflows, under inflation-targeting the central bank would have to raise interest rates to defend its inflation objective. This could have the perverse effect of attracting further capital inflows, imposing exchange-rate dominance on the central bank.

**e) Complete dominance**

Under fixed rates the story differs, as during the ill-fated "long pegs" in Latin America in the '70s' and '90s'. As foreign capital flows in, the central bank is obliged to accumulate reserves and issue local currency in exchange. The upward pressure on non-tradable prices is greater, while tradable prices remain fixed. As a result inflation is higher than in a floating rate environment. However in this scenario interest rates are not an instrument of monetary policy, but rather are determined by the external rate for the peg currency plus the announced rate of crawl (if any) plus a risk premium reflecting the compliance probability. In fact there is complete dominance, since exchange-rate policy has taken over. Theoretically the central bank could sterilize capital inflows through open market operations, but the scale and cost of these would be enormous.

Further complications for developing countries arise from the fact that in practice recourse is usually made to more than one source of fiscal financing, since domestic currency debt markets cannot handle the entire brunt of the deficit, and that access to external financing is not continuously available. The volatility of international capital markets may suddenly shift the burden of financing onto incomplete domestic capital markets, raising the degree of fiscal dominance. But access to external finance may also be a country-specific phenomenon, more so in those cases debt has been used to finance consumption rather than investment, or where negative developments in debt-servicing capacity (either fiscal or external) are perceived.

## 3. REGIONAL BACKGROUND

Fiscal dominance has been a permanent feature in the macroeconomic landscape of Latin America throughout the last five decades, although presenting itself in different guises according to

external circumstances. By fiscal dominance we mean persistent imbalances in overall public sector accounts, whose financing inhibits the degrees of freedom available to monetary policy in the pursuit of price stability.

Since fiscal dominance is first and foremost a problem of financing, access to foreign savings can clearly play a crucial role in determining how it shall manifest itself in nominal and real terms. Most Latin American countries experience a chronic shortage in domestic savings. External debt can supplement this shortfall, relieving pressure on the internal nominal variables of an economy to finance the deficit. But the remedy presents its own dangers in the form of a tendency to increase the dosage beyond what is advisable for treatment, leading to the delusion in some cases that there should be no constraints to deficit-spending if someone else is willing to finance it.

Debt addiction has its own dynamics, which sooner or later begin to feed back into the fiscal problem. Fiscal dominance is no longer a matter of choice but of imposition as external debt service swells in proportion to the budget, fueled by the snowball effect of new financing for interest and maturity payments, and often complicated by non-country-specific "sudden stops" in lending or by adverse developments in variable interest rates, export markets and prices.

External circumstances can therefore dictate the particular form in which fiscal dominance expresses itself in the monetary arena. Access to international capital markets can alleviate the monetary symptoms. Excessive access can aggravate them. Subsequent closure of access can send the nominal variables spiraling as the major burden of adjustment falls on the domestic private sector via the inflation tax.

In the presence of fiscal dominance, access to external financing appeared to lengthen the monetary cycles but to increase real exchange rate volatility. In the pre-1973 years of closed capital markets, the crises were quick in coming and quasi-instantaneous in their adjustment of nominal variables. The pass-through from exchange-rates to prices when pegs were adjusted was high, and the real exchange rate remained relatively stable around a stationary or trend value. Again during the enduring crises of the '80s' when access to private capital markets was shut down, the nominal variables appear to move in tandem.

In periods of access to international capital markets, however, the time seemed ripe to attack inflation and the entire nominal system became anchored to the exchange rate as the main in-

strument of stabilization. As inflationary inertia and fiscal dominance continued (in large part due to wage indexation), the real exchange rate declined substantially before stabilizing. Although long announced, crises were now slow in coming while nominal adjustments were few and far between. The end result was to extend the periods of relative price and exchange rate stability, at the expense of more violent corrections, giving rise to a tradeoff between nominal and real exchange rate stability.

## 4. THE FOUR PERIODS OF ANALYSIS

In order to analyze long-run regional performance, at CEMLA we have reconstructed over fifty years of time series for a representative group of eight Latin American countries conformed by Argentina, Brazil, Chile, Colombia, Mexico, Peru, Uruguay and Venezuela. The primary data is from CEMLA's archives dating back to 1952, comprising reports and bulletins provided by our central bank members. In some cases the data is complemented by time series compiled by international financial institutions. The series are: overall fiscal outcome, real GDP, consumer prices, exchange rates, broad money supply, exports of goods and services, imports, BOP current account and reserves, for the period 1950-2003. Statistics on public external debt and debt service are available for the period 1965-2003. All ratios and growth rates presented have been calculated on the basis of these eleven primary series, and in the case of real exchange rates, the U.S.A. consumer price index.

On the basis of the available time series data, the years 1950-2003 are subdivided into four separate periods of analysis, with the main criteria for differentiation being the degree of access to international capital markets. Prior to this era most Latin American countries had remained on the Gold Standard until the early '30s' and experienced severe debt servicing difficulties during the Great Depression. A combination of import substitution policies and the war-induced recovery of commodity export prices put them back on a growth path, but by the mid '50s' both these factors were showing signs of fatigue.

### a) The post-war years (1950-73)

The most rudimentary variant of fiscal dominance, monetary subordination, appears during these years of restricted access to

international markets. Lower commodity export prices led to fiscal revenue shortfalls, where financing was provided through growth in the domestic money supply. This obviously soon led to high inflation and, in the presence of current and capital account controls, to increasing distortions. Since this period coincided with the Bretton Woods system of fixed parities, external adjustment was obtained through the frequent devaluation of pegged exchange rates.

External borrowing opportunities were limited to official bilateral arrangements and lending from international financial institutions: the IMF during payments crises, and the IBRD & IBD for development projects. Capital controls were in place in most parts of the world, and trade consisted mainly in exports of primary commodities and imports of capital equipment and essential raw materials. Multiple exchange-rate systems were common in the region.

**b) Recycling petrodollars (1974-82)**

The collapse of the dollar standard and the onset of the first oil crisis altered this scenario permanently. With easier access to syndicated commercial bank loans since the mid 1970's in a context of growing trade and financial liberalization, in the first instance the fiscal deficit was financed by a build-up of external debt. This relieved the immediate pressure on the central bank and allowed for attempts to reduce the rate of inflation via exchange rate anchoring. Fiscal dominance continued to exist, but no longer in its primitive form. Pressure on the central bank switched from continuous (money creation) to discrete (reserve accumulation), with the net stock of external debt acting as a buffer. Growth in the domestic money supply no longer stemmed from an active policy of deficit-financing, but rather operated passively through the inflow of private capital seeking interest rate differentials. Inflationary pressures initially abated, but ultimately were exacerbated through the exchange rate which finally succumbed to an external payments crisis that rendered debt service unsustainable through the loss of trade competitiveness and the sharp spike in interest rates that heralded the world recession of 1981.

**c) The external debt crisis (1983-90)**

Voluntary lending dried up and external debt dynamics rapidly came to dominate not only the fiscal budgets, but the region's

entire economy. During this third period inflation, devaluation and growth in the nominal money supply reached unprecedented levels as the burden of adjustment fell almost entirely upon the local private sectors. External debt also grew rapidly in proportion to GDP, due to a combination of exchange rate depreciation, involuntary lending by creditors, and a more active presence of the international financial institutions. In this floating exchange rate environment, monetary policy once again became an active ally in the government's need for foreign exchange. As could be expected, the region's worst bouts of hyperinflation occurred during this period.

### d) The global bond market (1991-03)

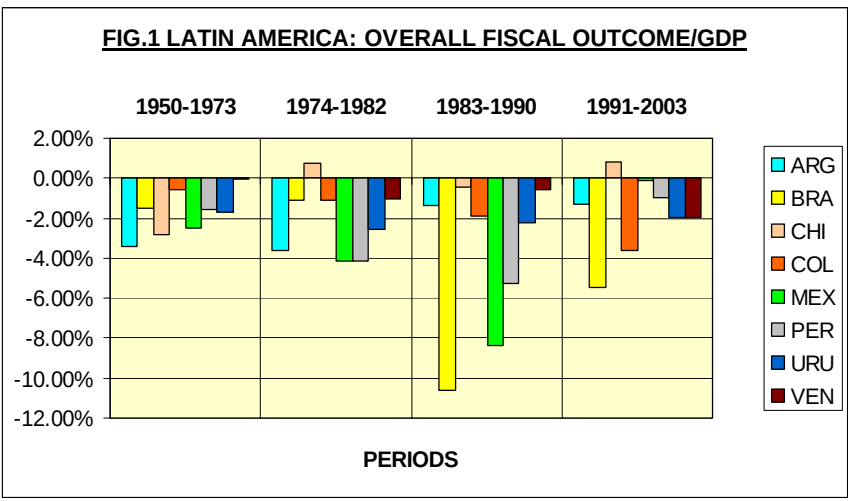
Following the debt restructuring and relief exercises that provided an exit from the crisis years, selective re-entry to international capital markets came about in a surprisingly short lapse of time. The issuance of Brady bonds had paved the way for a new asset class to compete with corporate "junk bonds" in satisfying the appetite for risk among investors awash in global liquidity. New rules applied though, as markets were prone to fits and seizures of a highly contagious nature. With the resumption of private capital inflows, initial efforts to stabilize prices again sought out the exchange rate (pegged, crawling or banded) as an anchor for the system. Some opted for Currency Boards and even outright dollarization. But after a series of high-profile (although contained) disasters within and without the region, a gradual movement began towards greater flexibility.

For the most part fiscal deficits returned to their more modest levels of pre-crisis periods. While the accumulation of external debt in order to finance these deficits slowed, debt stocks remained substantially above their pre-crisis levels in proportion to GDP. Meanwhile central banks in the region had also evolved, in many cases acquiring autonomy (both formal and practical) from governments that allowed them to embark upon inflation targeting strategies.

## 5. A PERSISTENT IMBALANCE IN THE FISCAL OUTCOME

Figure 1 presents the fiscal time series averages for each country during each period. The overall fiscal outcome refers to general government finances (excluding off-balance-sheet items and con-

tingencies). While there were isolated instances of surplus outcomes for given years during each of the periods, the average outcomes for each period fall squarely in the red except in the case of Chile. There emerges a clear picture of persistent fiscal dominance throughout the second half of the XX$^{th}$ Century in Latin America. From initially low deficit levels (around 2% of GDP) in the early period, deficit spending begins to climb during the second period once external financing becomes available. The crisis years see a sharp jump as debt dynamics take over the budget, with levels for the most part falling back to the pre-crisis range in the last period, during which country behavior becomes less uniform.

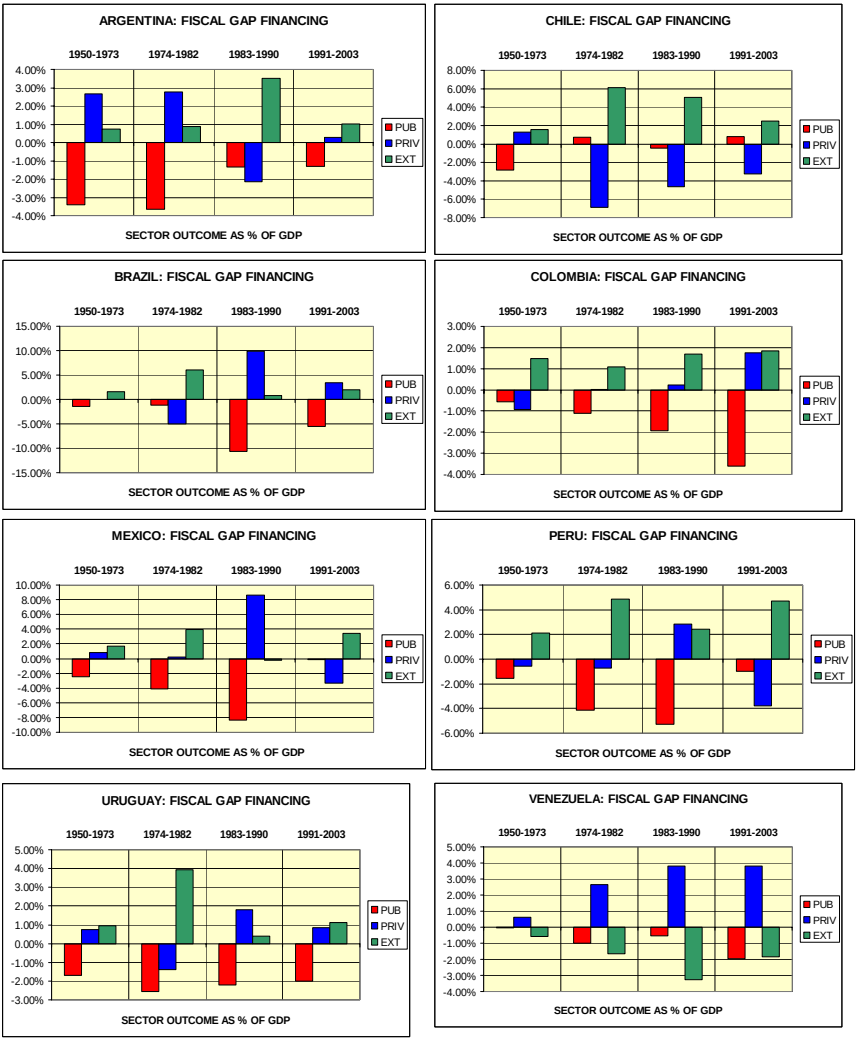



## 6. SOURCES OF FINANCING

Figure 2 presents the financing flows between the public, private and external sectors for each of the eight countries. The public sector financing requirement corresponds to the fiscal outcome represented in Figure 1. The external provision of funding corresponds to the counterpart of the current account outcome in the balance of payments, i.e. capital inflows when there is a current account deficit. The private sector flows are the residual balancing item, sometimes providing and sometimes requiring financing.

While each country presents an individual story with its specific timing, certain common patterns emerge in funding the fiscal gap

**FIGURE 2: PUBLIC, PRIVATE AND EXTERNAL FINANCING**

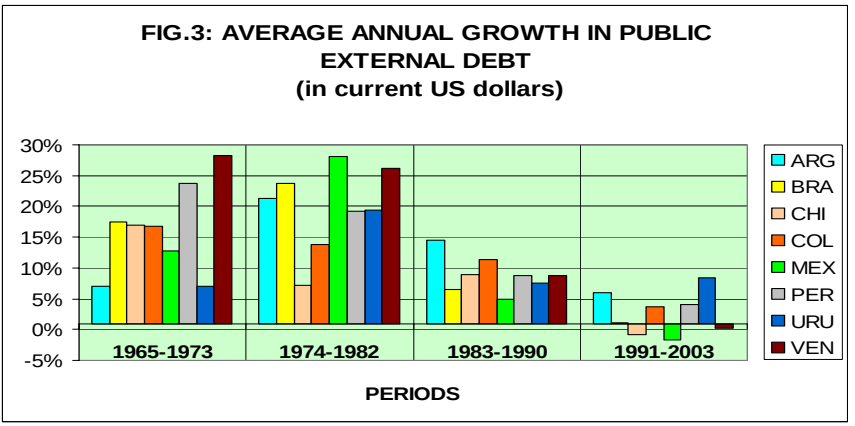



during the different periods. During the first stage where external lending is unavailable on a large scale, current account deficits are relatively small and caused by excess public spending. The private sector is in most cases an equal provider of financing to the public sector. During the second period the public sector borrowing requirement increases on average, as does the availability of external finance. The private sector also becomes a net external borrower. With the onset of the debt crisis, external

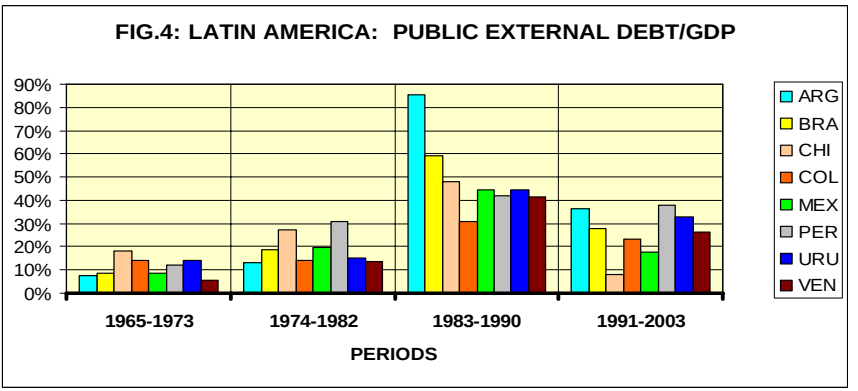
funding shrinks and the brunt of adjustment is in most cases borne by the private sector. Finally, as a condition for the resumption of access to international capital markets, most countries succeed in reducing their fiscal funding requirement and the pressure on the private sector, as dependence on external borrowing recedes.

## 7. EXTERNAL DEBT STOCKS AND SUSTAINABILITY OF DEBT SERVICE

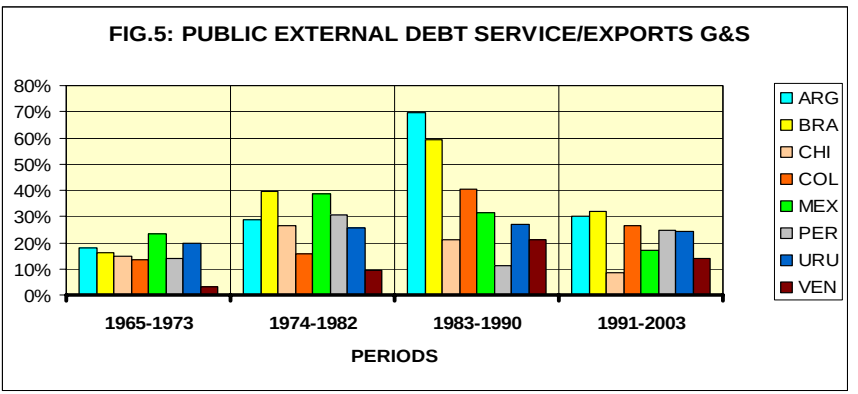
Although there is a generalized perception that following the defaults of the Great Depression international bank lending to Latin America only resumed in the aftermath of the 1973 oil crisis, the data seems to bear out the fact that substantial sovereign exposure had already begun accumulating in the late 1960's. As seen in Figure 3 the growth rates of public external debt in this early phase are no doubt exaggerated by the low base period, but then continue unabated into the next stage from a significantly higher debt platform. Although the rates of growth decline during the crisis years, they are still high enough (together with other factors) to produce an expansion in the debt-to-GDP ratio, which only begins to fall in the final stage (see Figure 4).




The debt-to-GDP ratio is not a good indicator of debt sustainability, among other reasons because it is distorted by the undervaluation and overvaluation cycles of the local currency that in turn appear to correlate with periods of monetary and debt fi-



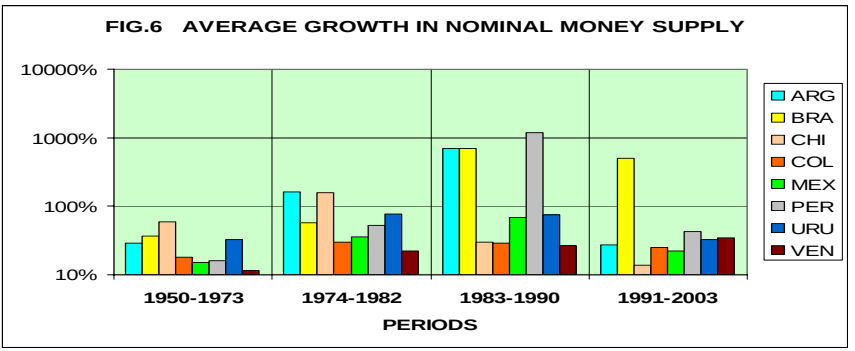

nancing, respectively. A superior measure of sustainability is the pressure exerted by debt service on the generation of foreign exchange on current account (exports of goods and services), as presented in Figure 5. This is an economy-wide indicator which does not take into account the fiscal problem faced by the public sector in acquiring its foreign exchange needs. However its utility lies in the comparison of flow magnitudes in the same currency.



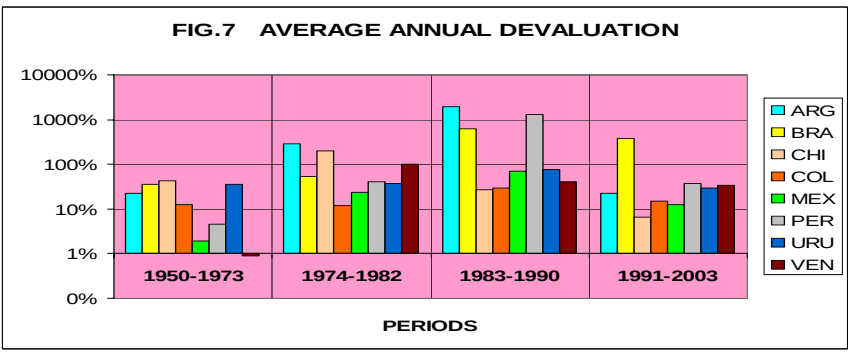

A combination of high stocks of debt and high interest rates in a scenario of world recession with depressed export markets and prices, as existed during the debt crisis, can send this indicator soaring. Subsequent debt relief and lower interest rates, together with sustained export prospects, can produce a quick return to sustainable levels of debt service as seen for some countries during the final period of analysis.

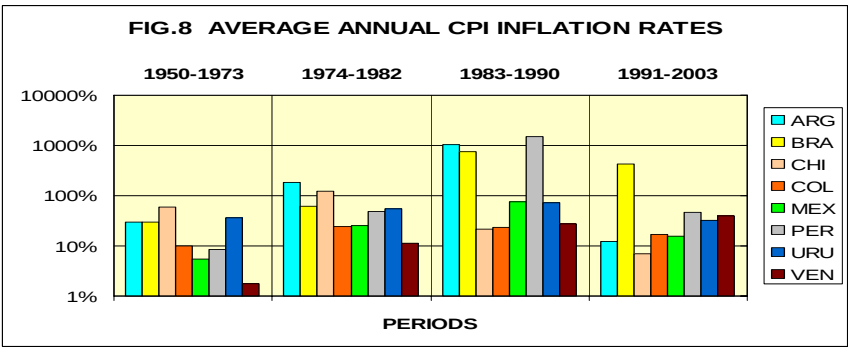
## 8. MONETARY EFFECTS OF DEFICIT FINANCING

Figures 6 to 8 compare the average performance of the nominal variables among the countries throughout the four periods, while Figure 9 presents their comparative evolution within each of the eight countries. The fact that in some cases the scale is logarithmic is in itself indicative of the magnitudes involved.




While visual inspection on the basis of uniform periods which do not necessarily coincide with the specific cycles of each country is perhaps not the most rigorous approach to analysis, nevertheless it seems that two general conclusions may be drawn from the data. First, that in situations of hyperinflation money does indeed appear to be more neutral between consumer prices and the exchange rate; in other words, it is more difficult to achieve a "real" devaluation when everything is out of control. While this must be qualified by the relative importance of the tradable sector in each economy, in true hyperinflation even the "pass-through" to wages is instantaneous.






Secondly, during the periods which we have identified as offering access to international capital markets, inflation generally exceeds devaluation. This doubtlessly reflects the identified tendency for countries to rely on external debt for fiscal deficit finance, while trying to peg the exchange rate in order to subdue inflation. These long cycles of stabilization end abruptly when creditors lose faith in the country's ability to service debt, which can happen for many reasons: simple contagion, excessively high debt stock, growing fiscal and current account deficits, problems in the generation of foreign exchange via the export sector, higher interest rates, political developments, etc. But one should

**FIGURE 9: COMPARATIVE AVERAGE ANNUAL GROWTH OF NOMINAL VARIABLES**

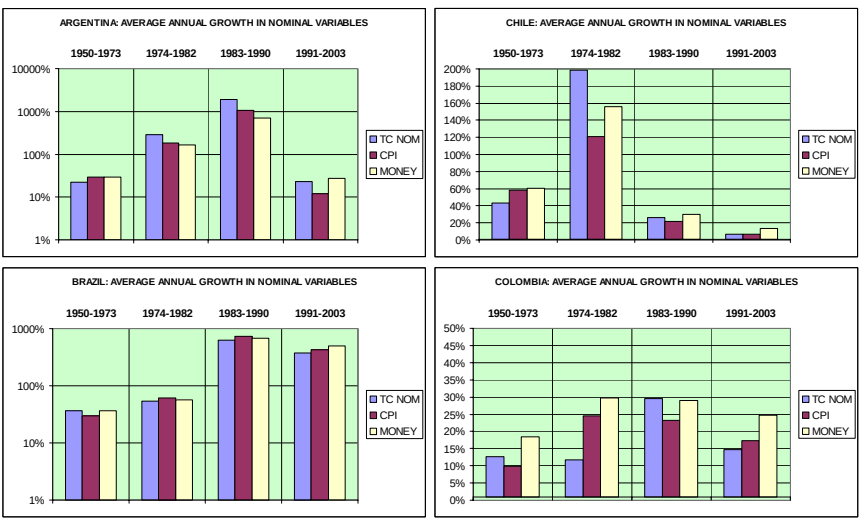
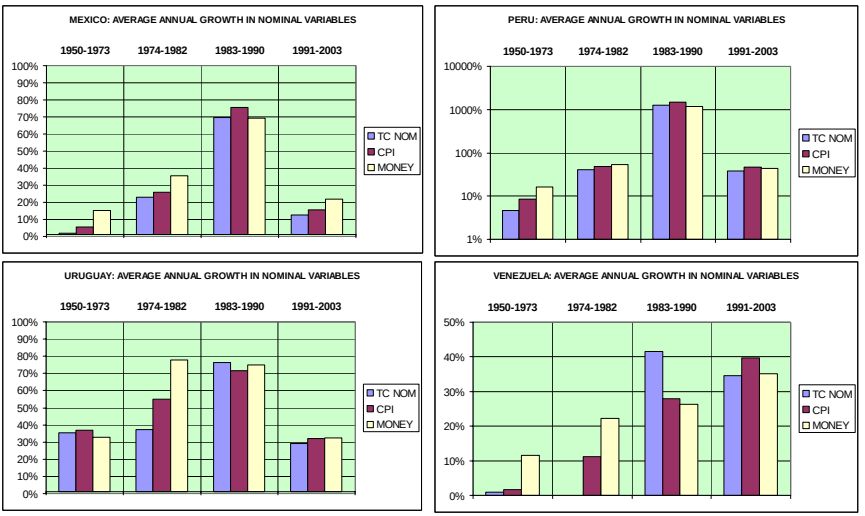


**FIGURE 9** ***(continued)***



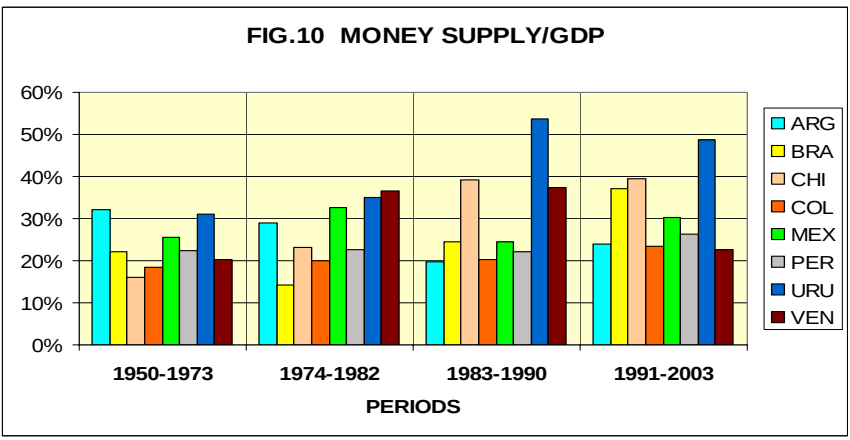

not lose sight of the fact that some of these causes are endogenous to the lack of a monetary policy. By the later stages of the domestic currency overvaluation cycle the real exchange rate has fallen to levels at which international competitiveness is severely diminished and recession sets in.

A final consideration with respect to monetary performance relates to the process of financial deepening, as shown in Figure 10. In most cases the broad money supply has not increased significantly with respect to the overall level of economic activity throughout the entire time-span of the analysis. High levels of inflation, the process of dollarization and the impact of devaluation on financial sector stability are likely contributors to this lack of progress.

## 9. THE THREE STAGES OF FISCAL DOMINANCE

Fiscal dominance has evolved in Latin America during the period under analysis. In the first stage fiscal dominance took the form of monetary subordination, and was reflected by an expansion of the monetary base to accommodate fiscal needs at the expense of price and exchange rate stability, thus debasing the local currency. We have referred to this situation as one of monetary subordination, during which what has aptly been referred to as

"original sin" was incurred in. This phrase implies the inability to borrow long-term in one's own currency, but also describes the justification for the pervasive process of dollarization within the region.




At a second stage during which international lending resumed in hard currencies, fiscal deficits could be financed with foreign savings. Fiscal dominance became complete as monetary policy completely disappeared, to be replaced by fixed exchange-rate policies in an attempt to break with the inflationary inertia of the previous period. But after so many years of financing fiscal excesses with money creation, it was almost a natural to confuse a genuinely-financed deficit with no deficit at all. External debt grew, the real exchange rate declined and economies became more exposed to a change in lender sentiment.

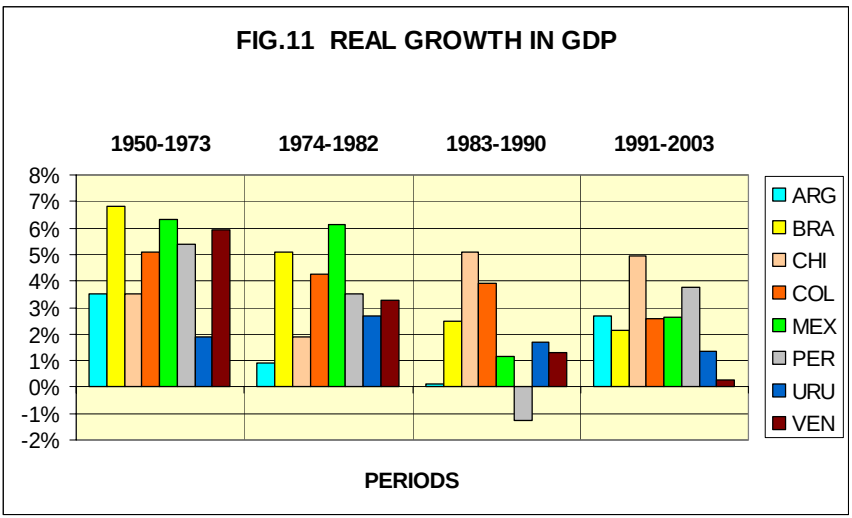
When the crisis finally broke out, exchange rates were floated and subordinate monetary policy came galloping back to the rescue. But this time the fiscal deficits had been bloated beyond recognition by external debt dynamics, and access to international capital markets had been cut off. As a result nominal variables hit the ceiling. It took a decade of turmoil and adjustment, a substantial dose of debt relief and a sharp rise in the real exchange rate for matters to eventually settle down.

Even so, when international capital markets reopened in the '90s' several of the regional players (both big and small) went down the same road again, pegging exchange rates and building up external debt. But this time around the crises were selective and the creditors harder to pin down, while the stability of the in-

ternational financial system was no longer at stake. A third stage is now in the making as from the mid 1990's, based on a move towards inflation targeting in the context of floating exchange rates. Under this new regional paradigm, a lesser variant of fiscal dominance is played out in the field of interest rates.

## 10. ECONOMIC PERFORMANCE AND THE REAL EXCHANGE RATE

Most countries in the region were able to sustain dynamic real growth momentum during the first period despite the unstable monetary environment, as shown in Figure 11. However the world recession induced by the 1973 oil shock forced the energy-dependent countries to step up foreign borrowing in order to finance imports that were essential for continued growth. The oil-producers (Mexico and Venezuela) also increased their borrowing abroad to finance a development drive backed by their new-found bonanza.




As capital flowed into the region, both public and private consumption and investment took off. The resulting growth rates for the second period tapered off only slightly, as towards the end of the currency overvaluation cycle the expansion began to lose steam. But GDP growth rates declined dramatically during the

crisis years, in many cases turning negative in per capita terms. Only Colombia was able to escape the recession years of the early '80s', while Chile compensated for them with a strong export drive in the later years of the decade based on a sharp recovery in the real exchange rate.

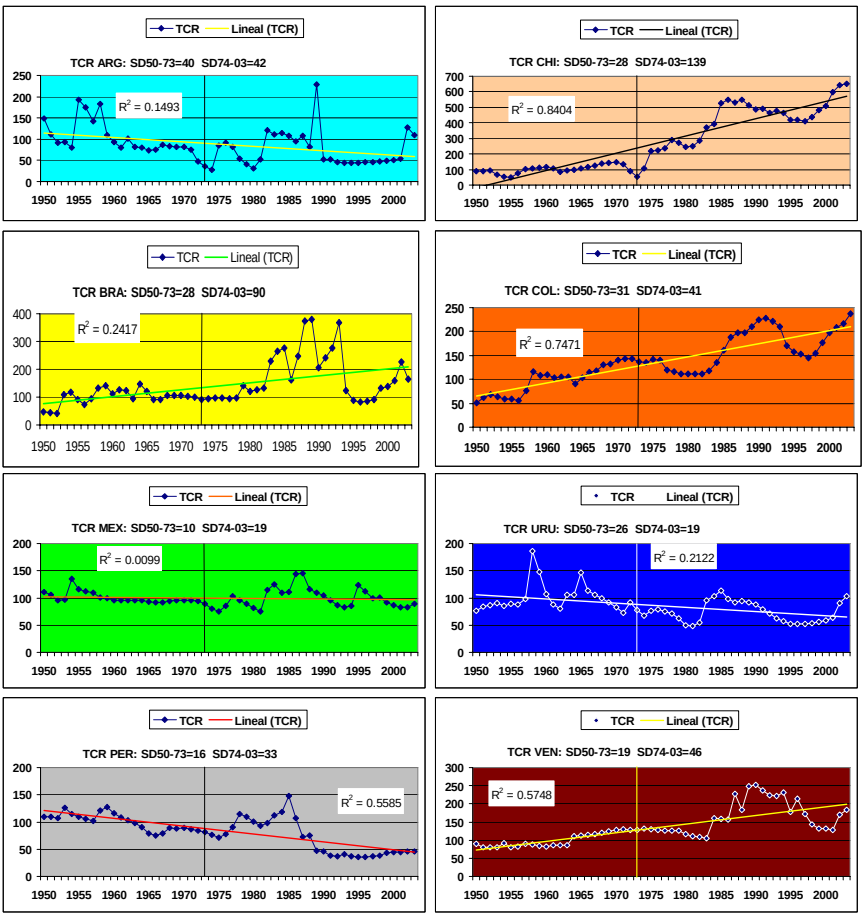
The last period shows a generalized recovery in economic growth rates, although they remain well below historical averages for the region. The frequency of external and regional shocks (Mexico 95, South East Asia 97, Russia 98, Brazil 99 and Argentina 2001) in the form of capital flow reversals no doubt contributed to this outcome, but again the overvaluation cycles under pegged rates (hard and soft) had put some economies into recession long before the crisis ensued (Brazil 98-99, Argentina 99-01 and Uruguay 99-02).

Figure 12 presents the long run performance of real exchange rates. These are basically indicators of comparative U.S. dollar consumer purchasing power in the selected economies. A high real exchange rate ("pesos per dollar") implies that the country is cheap in dollar terms, and that its exports of goods and services are competitive. These rates are presented in index form with their average level for the first period (1950-73) set as the base of 100. Both theory and observation suggest that the output of tradable sectors within each economy will react favorably (albeit in lagged form) to a "real" devaluation (an increase in the RER).

Each graph has been fitted with a linear trend (OLS) and the standard deviation is shown for two periods: 1950-1973 and 1974-2003. Four countries show an upward trend over time (Brazil, Chile, Colombia and Venezuela), while three present a downward trend (Argentina, Peru and Uruguay). Mexico shows a stationary level. In every case but one (Uruguay), the standard deviation is higher in the second period, implying that volatility has risen over time.

The concept of a real exchange rate must be handled with care in attempting to relate it to growth. To start with it is mainly applicable to open economies that apply an export-oriented economic growth strategy, although for the most part this applies to Latin American countries since the trade and financial liberalization processes began circa 1973. Secondly the choice of price indexes (wholesale or retail) and comparators (U.S.A., Europe or trade-weighted average) can influence the results. Moreover, tradable output cannot react immediately to more favorable relative prices for the sectors, so there is clearly a time lag involved. Also, a favorable RER may be outweighed by low international pri-

**FIGURE 12: COMPARATIVE LONG TERM BEHAVIOR OF REAL EXCHANGE RATES**




ces or high domestic taxes. But it is useful as an informal guide for international or regional competitiveness, and as such is usually a good predictor for growth.

At the same time volatility in the real exchange rate is an important consideration for investment, in view of the production cycles involved. If a favorable RER is not expected to last, investment will not be forthcoming. So expectations regarding the sustainability of a given policy mix also play a key role.

Under what we have called monetary subordination, RER volatility would appear to be low. This is because nominal variables (money, prices and exchange rate) are all inflating at approxi-

mately the same very high rates. This may contribute to explaining why, despite this unstable environment, real growth rates are relatively high during the first period.

During the long pegs of the second period (1974-82) and specific country experiences of the '90s' the nominal variables are out of synch. Prices grow faster than exchange rates, and as a result the RER declines. There is also higher RER volatility in this period of complete dominance, even though nominal movements are lower. Both these factors may contribute to the observed decline in growth rates.

The data suggest that, in the presence of a substantial fiscal deficit, RER volatility is higher during periods of access to external debt, although the determining factor is the decision to peg nominal exchange-rates as a stabilization strategy. It remains to be seen whether under the floating rate regimes implied by inflation targeting strategies, this volatility can be reduced. Clearly the determining factor in this case will be the volatility of capital flows.

*Juan Antonio Morales*

# Dollarization of assets and liabilities: problem or solution? The case of Bolivia

## 1. INTRODUCTION

The purpose of this paper is to present the experience of a highly dollarized economy, from the viewpoint of a policy maker. There is a growing literature (see *inter alia* the paper of De Nicoló, Ize and Honohan (2003) and the references therein, and the book by Levy Yeyati and Sturzenegger (2003a), providing a mix of highbrow theory and careful empirical work, to which I will refer on occasion. The paper is not on theory, nor is it a comparative study on the causes and effects of dollarization, but rather an inventory of the problems caused by *de facto* dollarization to actual

*Paper presented by J. A. Morales, President of the Central Bank of Bolivia, at the Seminar Program: The way to regional and global prosperity challengers and apportunities, organized by the International Monetary Fund (IMF) and the World Bank in Dubai, United Arab Emirates, September 20-22, 2003. Published in* Revista de Análisis, *vol. 6, nº 1, June 2003, pp. 7-39. The views expressed correspond to the author. They do not represent necessarily those of the Central Bank of Bolivia. The author thanks Fernando Escobar for his excellent assistance in the computation of the econometric results of the paper. (E-mail address: jam@bcb.gov.bo.)*

policy making, without ignoring its benefits, which can be substantial.

I refer mainly to my Bolivian experience. According to the data set of De Nicolo, Honohan and Ize (2003), Bolivia ranked second in year 2001 in terms of the ratio of foreign currency deposits to total deposits. Only Cambodia had a higher rate among the partially dollarized countries. I would like to place the *caveat* that I believe that dollarization is path dependent and country specific in its extent and shape. Initial conditions do matter.

Dollarization has a long history in Bolivia and has deep roots, which can be traced to the aftermath of the Chaco War (1932-1936). Although inflation was moderate most of the time, there were some short outbursts of very high and variable inflation. Since 1985, after a noxious hyperinflation was controlled, inflation has followed a declining trend. In the past five years, the Bolivian inflation was only slightly above the United States' inflation. Despite the declining trend of inflation, dollarization increased, an outcome observed elsewhere. It remains however true that dollarization was engendered by high inflation, and that de-dollarization is still waiting for clearer signals that low inflation is to stay.

There is real, payments, and financial dollarization in Bolivia. It is very widespread in the three forms but it is partial. While real dollarization is limited, the dollarization of assets and liabilities of the financial system is close to complete (over 90% of total deposits and loans).

Dollarization received a push with the increasing dependency of Bolivia on foreign savings, that started in the 1960's. Dollarization was part and parcel of globalization. Moreover, after the end of the dramatic hyperinflation of 1982-1985, it is fair to assume that the reconstitution of the financial sector would have been impossible without the recourse to dollars.

Over time a dual monetary system emerged, and the central bank had the illusion that it could conduct a monetary policy in domestic currency as well as in dollars, with the standard instruments and the standard IMF type of monetary programming. Only after a while did we realize the modesty of our results.

The cohabitation of two monies was accepted by the public and no major problem seemed to be posed by dollarization, except the loss of seigniorage, that after a hyperinflation was going to be small anyway or very slow to reconstruct.

When the crisis hit the region around 1998, and our neighbors started to devalue rapidly, the bi-monetary architecture started to

show its weakness. It is important to note that the shocks were idiosyncratic to the region. The central bank responded to the shocks by increasing the rate of crawl of the Bolivian exchange rate peg. This presumably increased the default risk of the loans granted by the banks to non-traded sectors of the economy. The question is open whether the more active crawl was the right policy and whether this policy was not contractionary, given the high indebtedness in dollars of the non-traded sector.

The policy of maintaining a stable RER in face of exogenous shocks through the crawling peg probably increased dollarization as predicted by the Ize-Levy Yeyati (1998) model of minimum variance portfolio (henceforth the ILY model). We believe however that the lingering peso problem had more importance, and the data seem to show this. This, together with the liquidation policies, that are currency-blind, and the lender-of-last-resort functions of the central bank, as shown in a more general context by Broda and Levy-Yeyati (2003a), further promoted dollarization.

Dollarization, even partial, changes the nature of the central bank in fundamental ways. The central bank is reduced to the role of liquidity insurer in dollars to the banking system and keeping its financing of the government's deficit (and the deficit itself) under control. Its stated goal of price stability will depend more on the fiscal situation and the soundness of the banks, than of its own actions. In most states, monetary policy cannot be employed as a shock absorber and to stabilize output and employment.

Credit crunches are more likely in a (partially) dollarized economy, than in an economy with more monetary autonomy. Since exchange rate devaluations lower the dollar value of non-traded collateral and increase the risks of default of dollarized loans, banks reduce their lending. Also, in times of financial stress, banks hold to their liquid assets in dollars and there is a high liquidity premium. In the current recession, dollarization is among the causes of the implosion of the financial system. In addition, maintaining high levels of international reserves is costly both to central bank and the banks.

If partial dollarization is the cause of the problem, then why not resort to a full dollarization? Many problems will not disappear with full dollarization and new problems, related mainly, but not exclusively, to long term international competitiveness, would appear. The move would be, at best, risky. Then, why not go to the other extreme, to strict inflation targeting? We argue in the

text that this solution is not realistic and probably riskier than full dollarization. Then, what is left? The tentative answer is a middle of the road solution, consisting of a gradual reduction of dollarization, through market-friendly mechanisms.

Given the dramatic experience with forced de-dollarization in the early 1980's, any increased use of domestic currency has to be fully voluntary. A difficult fine-tuning of policy measures and announcements needs to take place. Doubts on the integrity of the current bi-monetary arrangement, that heavily favors dollar holders, may scare depositors. Yet, given that the situation is of unstable equilibrium, changes of sufficient impact are required. The problem is then of both timeliness and sequencing.

The public has to perceive that there are gains in total welfare with a more independent monetary policy (and a more flexible exchange rate). Yet, a full recognition has to be given to the fact that domestic currencies cannot easily compete in terms of quality and scope of services with solid, internationally accepted currencies. The most important point is that de-dollarization requires a credible commitment to maintain inflation low, not only now but in the future, even the distant future. Actual and expected inflation have to be very low.

The paper is organized as follows. In section 2 we review the origins of dollarization, by highlighting the main economic developments of Bolivian history, and based on this case study, some conclusions are suggested. Section 3 is devoted to the examination of the alternative (or rather, complementary) hypothesis of the presence of a peso problem and of different volatilities between inflation and the RER. Section 4 examines with more detail public policies, as a major factor behind dollarization. Section 5 highlights the diminished role of central banks in dollarized economies and how they stand with regard to the objectives set for modern central banking. In section 6 the issue of the benefits and costs of going either to full dollarization or to a fully flexible exchange rate (the bipolar option) is examined. Section 7 proposes concluding remarks.

## 2. THE ORIGINS OF DOLLARIZATION

The common thread in the dollarization of the economies, real and financial, is the legacy of distrust in their domestic currencies, because of prolonged periods of high and unstable inflations. The perception remains that the same forces that continuously led to

the depreciation of exchange rates, also pushed prices up. For a vast majority of the public, inflation and depreciation of the currency are synonymous.[1]

The origin of dollarization in Bolivia can be traced back to the abandonment of the convertibility to gold for domestic transactions in the early 1930's, and to the Chaco War against our neighbor Paraguay.[2] After controlling the high inflation of the 1950's (more than 100 % per year), dollarization continued with even more impetus, not withstanding that during the whole decade of the sixties, inflation was low.[3] As early as then, virtually all long-term contracts, loans and others, were agreed in dollars. The increasing dependence of Bolivia on foreign savings, either under the form of loans from the international development banks, or foreign direct investment was another factor. The loans were contracted in dollars and had to be serviced in the same currency; the same was true for profit remittances of the multinational companies. This form of opening the economy to foreign capital became a major explanatory factor of dollarization.

In the seventies, inflation increased again. Then wealthy Bolivians did not limit themselves to hoarding dollar bills and pricing big items, like houses and cars in dollars as they did before, and begun to open accounts off-shore. To impede capital flight and to attract back the off-shore deposits of Bolivians, the government allowed banks in the mid seventies to offer time-deposits. They rapidly took off as Bolivians switched their domestic currency deposits to domestic dollar deposits. Also, some repatriation took place. Deposit dollarization increased, and this was coincidental, and not independent of, a rapid accumulation of public external debt. By the mid-1970's, payments, financial and real dollarization were already important.

In November 1982, after the international debt crisis had started, the government took the unwise and dramatic decision to

[1] Despite the fact that, in the context of both recession and depreciating currencies in our trade partners, the pass-through effects to inflation from bilateral depreciation of the domestic currency vis-à-vis the dollar have been greatly reduced.

[2] Méndez (1987) gives data on dollarized deposits since 1940. The data show a spike in dollarized deposits *after* the high inflation of the 1950's ended, and immediately *after* the Bolivian hyperinflation of 1985 was over.

[3] For a short overview of the Bolivian economy between 1952 and 1986, see Sachs and Morales (1998).

de-dollarize all financial contracts, forcing moreover the conversion of dollarized assets to domestic currency-denominated assets, at an exchange rate lower than the free-market rate. Simultaneously, it imposed foreign exchange controls. These decisions in the eve of accelerating inflation produced huge transfers of wealth and income from creditors to debtors. Private savings were wiped out and the financial system shrunk to a dismally small size.

The exchange controls led to a black market for dollars, with incredible high premia. Forced de-dollarization, in turn, sent underground the operations in dollars, that despite the prohibition continued on, frequently undertaken by the domestic banks themselves, that created off-shore branches to continue working in foreign currency.

The shrinking of financial intermediation had very negative consequences on real GDP. In addition to these visible real effects, the opposition parties blamed de-dollarization as a direct cause of the hyperinflation that afflicted Bolivia in 1984-1985. This accusation cannot be justified on economic grounds, but we must acknowledge that de-dollarization caused high real costs. In addition, since de-dollarization affected the rich and the middle classes, their press and the opinion-makers related to them, as well as the opposition parties of that time, took due care of presenting de-dollarization itself, and not only the forced conversion of dollars to domestic currency at an unfair rate, as a confiscatory measure (as indeed it was). As important, the public resented not being allowed to operate freely with a trusted money or, in other words, not having an anchor. Afterwards, the slightest hint at de-dollarization would evoke tremors in the population that translated into capital flight.

The hyperinflation was controlled by end-1985 with a drastic, orthodox, stabilization plan. Exchange rate unification was central to the success of the stabilization plan.[4] To reconstruct the financial system, deposits in dollars and onlending them in the domestic market were allowed again. The banking system and, beyond, the whole financial system, is now almost completely dollarized. It is observed in figure 1 that loan dollarization has a smoother trend than deposit dollarization, probably because banks financed part of their loans by borrowing abroad. Also in 1992, the crucial, but largely unnoticed, decision was taken to al-

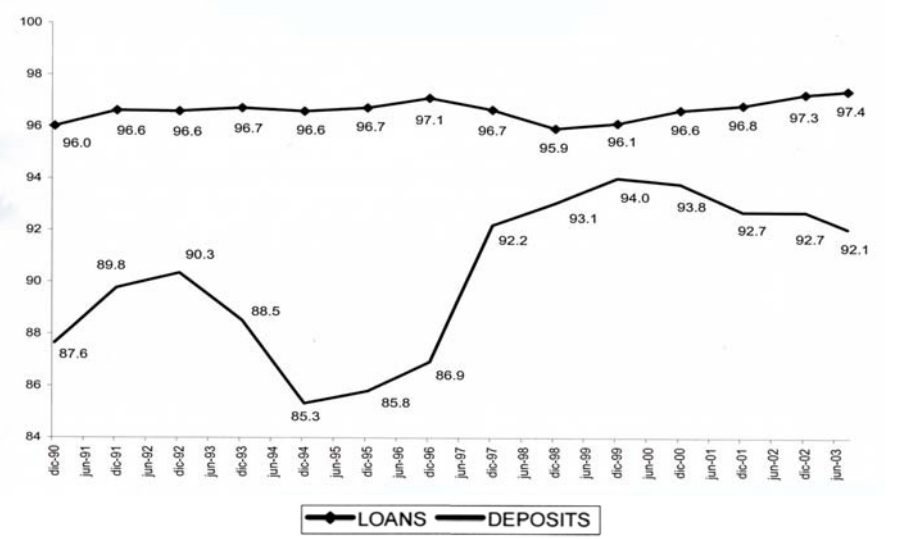
[4] The Bolivian hyperinflation has received considerable attention. See e.g., Sachs (1987), Morales (1987), Morales (1988a), Morales (1988b).

low banks to settle their dollar positions in the books of the central bank.

Re-dollarization returned after 1985 with a vengeance; no restriction, however small, to the right to possess dollarized assets and to move freely and at no cost between dollars and the domestic currency was politically admitted.[5] Operations in dollars, on both sides of the balance sheet of the banks, rapidly increased during the 1990's, as shown in figure 1.

In the aftermath of the stabilization plan, when there was a dire need of international reserves, there were no minimum reserve requirements for dollar or dollar-indexed deposits. Regulations on open foreign exchange positions were issued at the same time, but with ample tolerance granted for positions of excess assets over liabilities in dollars.[6]

**FIGURE 1.** DOMESTIC DOLLARIZED DEPOSITS AND LOANS AS PERCENT OF TOTAL DEPOSITS AND TOTAL LOANS 1990-AUGUST 2003




As a consequence of the actions taken, not only financial dollarization took off with great impulse, but a whole monetary sys-

[5] For instance, the technical measure taken by the central bank in October 2002, to widen the bid/ask spread for the exchange rate of its own operations from 2 cents of Boliviano to 6 cents (a change of about half a cent of a dollar) met such a strong opposition in the public, that the measure had to be reverted.

[6] Technically: oversold positions in dollars.

tem in dollars developed. Claims in dollars were created inside Bolivia very extensively. Banks received deposits in dollars from residents in Bolivia and borrowed abroad, always in US currency. More important for our purposes, they onlent the dollars received, more often than not, to firms in the non-tradable sector and to households.

On a closer look, the monetary system in local dollars is a "hard peg" system, with an irrevocable parity, except in the case of collapse. The local dollars are backed with dollars held abroad as international reserves by the central bank and by the banks, and under the form of notes held in their vaults. The vision of a hard peg acquires further relevance when it is realized that only a fraction of the dollar denominated deposits is covered by the (consolidated) foreign exchange reserves of the central bank and of the banking system. The uncovered dollarized deposits are "local dollars" or "inside money". Table 1 gives some estimates of the money multipliers. The narrow money multipliers (M1) do not seem large; on the other hand the broad money multipliers (M3) are indeed important.[7]

**TABLE 1.** MONETARY BASE IN U$ AND MONEY MULTIPLIERS

| | | *FE M1* | *FE M3* | *Multipliers* | |
|---|---|---|---|---|---|
| *Year* | *Base* | *U$m* | *U$m* | *M1* | *M3* |
| 1990 | 215 | 160 | 810 | 0.7417 | 3.7586 |
| 1995 | 428 | 527 | 2,308 | 1.2303 | 5.3913 |
| 1997 | 635 | 729 | 3,683 | 1.1487 | 5.8050 |
| 1999 | 650 | 675 | 3,917 | 1.0382 | 6.0278 |
| 2001 | 686 | 773 | 3,862 | 1.1270 | 5.6333 |
| 2002 | 634 | 777 | 3,432 | 1.2267 | 5.4163 |

NOTES: Monetary base = Cash reserves at the central bank and in vault + liquid assets abroad to meet central bank reserve requirements + estimate of currency in U$.

Deposits in the Bolivian banking system exhibit a high degree of concentration, reflecting the very uneven distribution of income and wealth. This concentration of wealth, income and de-

[7] M3 is largely constituted by time deposits, which are not used for transaction purposes; hence, financial dollarization may be analytically separated from the features of a monetary system in dollars. The causes and effects may be different, although the implications of this disentanglement are not very important.

posits may be another explanatory factor of dollarization and the low demand for financial instruments indexed to prices. The financial savings of the rich are in dollars to protect their consumption levels.[8]

In incipient banking systems like the Bolivian one, loans are frequently collaterized by real estate. While real estate is a non tradable asset, it has however been priced in dollars for decades. So we can make the conjecture that this form of previous real dollarization paved the way for financial dollarization.[9]

The government developed a market for its domestic debt. Practically all government paper is issued in dollars, except for very short maturities. Note that on the asset side of their balance sheet, banks have, by and large, credits lent to non-tradable sectors, collateralized with non-tradable assets, and government paper.

This rapid overview of Bolivian economic and monetary history allows us to draw some conclusions: 1) the public has always sought a monetary anchor, preferably from abroad, because of the lack of credibility of the domestic institutions; 2) Bolivia confirms very clearly the finding of De Nicoló, Honoban and Ize (2001), that dollarization is more likely to appear in countries having suffered high inflation, as a way to make progress in inflation stabilization and as a rational response to weak monetary policies; 3) that inflationary environments are very destructive of financial systems, and that their reconstruction, once inflation ends, requires a credible money like dollars; 4) that financial dollarization and the development of a monetary system in (local) dollars are intertwined; 5) that globalization and the access to foreign savings needed for the development of the country could not (and cannot) be done in local currency, and; 6) that forced de-dollarization, especially when undertaken, as is likely to be the case, in a context of high inflation, only destroys financial intermediation but does not de-dollarize the economy.

[8] Dollarization of deposits goes now well beyond the rich. The quasi-banks (saving and loans associations and credit unions) and the micro-finance institutions are the most dollarized institutions in the country, while their customers are mostly street vendors, small traders and family-owned, small-scale enterprises, heavily exposed to foreign exchange risk. Why this dollarization? A tentative answer lies in that they bet on their political power.

[9] Real estate prices, that should be affected by real depreciation, have shown significant downward rigidity, with the results varying across cities.

## 3. VOLATILITIES OR PESO PROBLEM

Before proceeding, a short presentation of the current exchange regime is needed. The exchange rate regime, after the stabilization of 1985, started as a managed float, with the auctioning of foreign exchange by the central bank in a Dutch auction with a reservation price, as the main (and sole) intervention mechanism. Since the beginning of 1986, two things happened: a) almost imperceptibly at first, inflation was anchored to the exchange rate; b) to use the exchange rate as an anchor, without formally changing the system, the supply of dollars for the auction was increased several times, which reinforced the convergence effect of the bids of the public to the reservation price of the central bank. The central bank could readjust the exchange rate by changing within short periods its reservation price.[10] Hence the system has evolved from a managed float to an incomplete crawling peg, whose objective is to maintain a stable RER. The stability of the RER is however subordinated to keeping domestic inflation low. This system, which is over 17 years old, is *sui generis* but it has worked reasonably well. More important, the system enjoys high credibility.

The current crawling peg system has reduced the volatility of the RER. Both the level and the volatility of domestic inflation have also experienced a significant reduction. Over a long-term span, the variance of inflation has been larger than the variance of the RER, but somewhat surprisingly, the variance of the RER is larger than the variance of inflation in the more recent period. In the terms of the ILY model, the difference in volatility (valid for long samples in Bolivia) is behind the high degree of dollarization. The ILY model uses interest rate parity as a starting point but focuses on the hedging decisions against inflation and foreign exchange risk of depositors and borrowers. The authors look at the second moments of the distribution of real yields in dollars and local currency. Portfolio equilibriae gravitate around interest rate parity and minimum variance allocations.

The minimum variance portfolio allocations (MPV) provide a natural benchmark for actual allocations on both sides of a bank's balance sheet. Thus, the explanation for financial dollarization must essentially be based on volatilities rather than levels. An interesting implication of the model is that deviations from MPV

[10] The issues in the aftermath of the stabilization of 1985, are examined in Morales (1991).

can be explained by a mismatch between the supply and demand of loanable funds; and public policies, like monetary policy, currency denomination of public domestic debt and of bank reserves in the central bank, and regulatory restrictions. If the variance of the RER is smaller than the variance of inflation, this would explain "core" or underlying dollarization. This result is the more affecting, the more attention is paid by the authorities to the stability of the RER.

What do the data tell us? In Appendix A, a very high underlying dollarization coefficient (0.88) can be observed for the large sample there considered. This confirms the result of Ize and Levy Yeyati (1998) of a MPV allocation. This number is slightly lower than the estimate in ILY (p.23), obtained with a sample of quarterly observations for the period 1990:I- 1996:IV.

Our sub-sample 1992.02-2003.07 yields a negative underlying dollarization coefficient, introducing doubts on the MVP theory.[11] In this smaller sample, the more active depreciation policy between 1999 and 2002 is less diluted than in the larger sample. In addition, between 1999 and 2002, inflation was low, as was its variance. There was real depreciation on average, but the variance of the RER was larger than the variance of inflation.

The failure of MVP allocations to explain the increasing dollarization of the past few years send us back to our explanations based on the difficult predictability of the path of the RER. It can be conjectured, that around 1999, a regime change occurred with the eruption of the regional crisis. The MVP theory remains valid for more "normal" times.

In addition, the results of the ILY model fit well when expectations on the exchange rate (and inflation) are both continuous and bounded. Yet without dismissing the model, I think that we have to focus more on the inherent difficulty to find the equivalence of returns (on an ex-ante basis) in, say, pesos and dollars.

Dollarization may arise from the market rational forecasts of discrete events, which drives to very high levels the spread be-

[11] While $\lambda^*$, the underlying dollarization coefficient is bounded from above by 1, it may not be bounded by 0 from below, if the correlation coefficient between inflation and the RER is negative, and the standard deviation of the RER is sufficiently larger than the standard deviation of inflation. A negative correlation coefficient is not abnormal, if there is the policy of keeping the bilateral RER constant, even is some real appreciation is temporarily allowed when inflation is high. What is more annoying is the variance of real depreciation being significantly larger than the one of inflation.

tween dollar and domestic currency interest rates, perceived conventionally as risk premia. The uncovered interest rate parity may not hold in the long run because the public assigns a positive probability (even if small) to its future collapse, although the exact timing is not known.[12] Especially in countries like Bolivia, that have gone though dramatic periods of high inflation, doubts on the stability of the exchange rate and of inflation are likely to remain, no matter how much time has elapsed since the last inflation. The public continues anticipating a discrete change in the distribution of the economic determinants of the current exchange-rate regime that will lead to depreciation.[13]

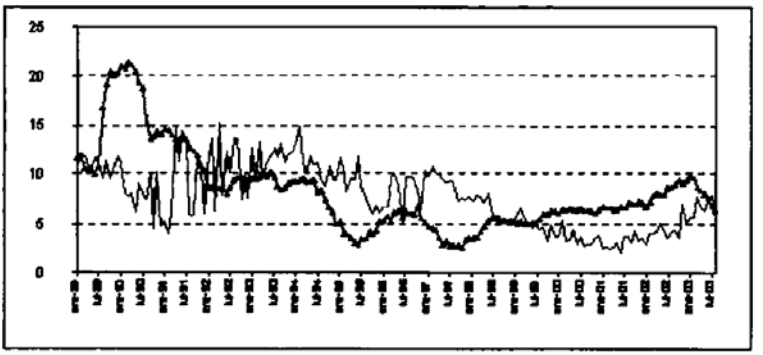
Figure 2 shows the evolution of the difference between the borrowing rates in dollars and domestic currency (lagged 12 months) and compares it with the actual currency depreciation. The monthly data show that in the period from January 1992 through July 1999, except occasionally, the interest rate spread was above the depreciation rate. From July 1999 on, when the depreciation rate speeded up, the relation was inverted. Moreover, because of a more rapid depreciation and of changes in the regulations on foreign exchange positions, the banks discouraged the constitution of remunerated deposits in domestic currency. The perceived funding costs by the banks were so high, that they refused local currency deposits. The easiest way to refuse them, without incurring in the displeasure of the authorities, was to offer ridiculous low interest rates to depositors, lower than the exchange rate depreciations. Banks did not want to operate with lo-

[12] Actually, not even a positive probability of collapse is needed. Dollarization is independent of the probability of a regime switch. It suffices that in real dollarization, the public expects a depreciation of sufficient size (Ize and Parrado 2002). This expectation is translated to financial dollarization.

[13] One major reason why the central bank stepped up the rate of crawl between 1999 and 2002, in addition to keep the competitiveness of Bolivian production, was to pre-empt the expectation that a major (and catastrophic) devaluation may occur, given the turmoil in the region. In doing so, it was expected that the peso problem would be limited. The Bolivian system was shown to the public as a system of smooth transition to a more depreciated, equilibrium exchange rate. Of course there was the cost that the public anticipated correctly that a continuous depreciation would go on, and this may have increased dollarization temporarily. On the other hand, it was important to forestall the expectation of a major devaluation, because this would have led to a run of dollarized bank deposits. A hint of this happened in June 1999 (the so-called Corpus Christi episode), when fears of a major devaluation (and the abandonment of the crawling peg) caused a deposit run.

cal currency, except with costless sight deposits and very low cost savings passbooks.[14] Because of this non-linearity, the econometric analysis cannot take fully into account the extent of the peso problem.

**FIGURE 2.** EXCHANGE RATES AND INTEREST RATES SPREAD




Even with the caveat given above, the econometric analysis of the data in Figure 1 reveals a peso problem. The *absence* of a peso problem is rejected in the different tests on the regression coefficients in Appendix A. Furthermore, the residuals of the regression models are correlated and heterocedastic. Note also that, before the crisis of 1999, lending rates and borrowing rates were closely correlated because, among other things, of the tightness of the loan market. When banks started to accumulate excess reserves, once the crisis started, this correlation was lost. We can conjecture that the peso problem that is usually associated with depositors, also appeared in the loan market. There are other, more qualitative, elements, that support our belief in a peso problem. While inflation has been very low in the past few years, the perception in the public remains (e.g. in press reports), that this has been the case because of the recession and the slack in aggregate demand, and that once the crisis is over, the rate of inflation will increase. To many, the steady state inflation rate is significantly higher than the observed one.

[14] After becoming more aware of the default risk that exchange rate devaluations may cause, banks returned timidly to offering time deposits in local currency, and increased their interest rates for domestic currency deposits.

Furthermore, the persistence of macroeconomic dis-equilibriae, like high fiscal and current account deficits in the Balance-of-Payments makes the public more inclined to anticipate a catastrophic devaluation (followed by inflation). In particular, the persistent and large current account deficit may be behind the public's concerns on the exchange rate. For instance, if its financing is perceived as endangered because of reductions in foreign aid, or foreign direct investment, or sudden stops in capital inflows. If there is no financing, the elimination of the current account deficit will require a large-scale redeployment of resources from non-traded to traded good sectors, something that can occur smoothly, without a recession, only if it is gradual.[15] The redeployment requires, in turn, improvements in the RER that lead to the persistence of doubts on the maintenance of the exchange rate regime. Unless the twin deficits, fiscal and external, are solved and their solution is expected to be permanent, the public would prefer dollars to domestic financial instruments. The twin deficits are the fruit of weak institutions. Thus, the ultimate cause of dollarization lies on institutions that pale with those of countries issuing hard currency, especially in terms of their taxing powers.[16]

The perceived uncertainty on the returns of assets in domestic currency (whatever the form it takes) deters depositors and pushes creditors (banks) to set very high premia on the interest rates they charge in their credits in domestic currency. On an ex-post basis, borrowers feel that they are better off with loans in dollars and prefer to bear the exchange rate risk than to pay very large uncertainty premia.

It has been often suggested in the past four years that a more parsimonious approach to the crawl would reduce dollarization. Parsimony in the rate of devaluation may obtain this result for a while, but if, for lack of credibility, there are pressures on the stretched foreign exchange reserves of the central bank, more dollarization rather than less may eventually occur. Moreover, the slower rate of crawl would have enhanced the government guarantee on the fixed exchange rate, contributing to more dollarization.[17]

[15] A point made by Eichengreen (2003) when discussing the Asian crisis.

[16] At a deeper level, the peso problem reflects the persistence of weak currencies. In turn, the weakness of the currency results of several factors: incomplete markets, weak institutions and moral hazard, this time on the part of the government. See De la Torre, Levy Yeyati and Schmukler (2002).

[17] A point made, in a general setting, by De Nicoló, Honohan and Ize (2003).

The exchange rate uncertainty of course affects all types of returns, whether on capital or labor.[18] Holders of financial wealth seem however to be more sensitive. In fact it is exactly the fact that real dollarization is limited in face of financial dollarization that is at the root of many of the difficulties of partial (or de facto) dollarization. In Bolivia, two big items of Gross National Income, namely wages and taxes, with few exceptions, are settled and paid in domestic currency.[19]

Domestic currency still has a role because of its properties as a real shock absorber, according to the model of Ize and Parrado (2002). More important, with the regime of virtually irrestrict access to foreign exchange, the domestic money is a stepping stone to the coveted dollars. We have noticed that any excessive supply of domestic money is rapidly converted into dollars, with excessive meaning any amount beyond the cash needed for obtaining wage goods.[20] While domestic currency carries some costs and inconvenience, they are relatively minor vis-à-vis alternative measures, for instance delays in payment by the public sector, as could happen if salaries and other expenses were paid in dollars.[21]

## 4. PUBLIC POLICY AS SUBSTITUTE FATHER OF DOLLARIZATION

It is useful to see dollarization as an extreme case of a fixed exchange regime; i.e., a "hard peg", and with the government that grants an irrevocable exchange rate guarantee that remains valid, except when the financial system collapses, or what amounts very closely to the same thing, when the central bank runs out of foreign reserves. "Fear of floating" and shyness in managing the

[18] See the analysis of Ize and Parrado (2002 ) and Chang and Velasco (2003 ) for very important insights.

[19] Arrears in tax payments are however formally readjusted to the exchange rate, to avoid Olivera-Tanzi effects. Also, the tax base of some taxes is informally readjusted with the exchange rate which amounts to a dollarization of some tax collections, for example, the local taxes on properties and vehicles.

[20] It is interesting to note that a few weeks after the Christmas bonus is paid (in domestic currency) there is a big demand for dollars at the central bank. The amount of domestic currency decreases very significantly in January, while the central bank experiences a big loss in its reserves of foreign exchange.

[21] Alternatively, public sector cash shortfalls of foreign exchange in a dollarized economy can lead to the issuance of quasi-monies like the notorious "patacones" in Argentina, which were not convertible to dollars (or pesos).

crawling peg reinforce the perception in the public of this exchange rate guarantee.

The government can assure the rate of conversion of the local dollars to "true" dollars, yet the risk remains that some deposits in local dollars would not be able to be converted to true dollars, through mechanisms like deposit freezes. Indeed, after the Argentinean experience of year 2001, the risk of a deposit freeze has become more present to the public than before. Even so, given that in the event of bank's failure, the liquidation policy gives a symmetric treatment to deposits in dollars and domestic currency; this favors dollarization in most cases, and independently of moral hazard considerations.[22]

A strong central bank (because it carries large inventories of foreign exchange) reduces the subjective probability assigned to a collapse of the financial system caused by exchange rate movements. The higher the level of central bank reserves, the more dollarized the system becomes. Moreover, holders of dollar deposits feel that they have a senior claim on the resources of the central bank (its reserves) vis-à-vis other stakeholders because there are precedents. In any event, dollar depositors as well as dollar borrowers expect to be bailed out if a catastrophic devaluation happens, so there is a moral hazard problem. The central bank finds itself facing a dilemma: a) to keep a high level of reserves in order to safeguard deposits and avoid a catastrophic run on banks; b) the high level of reserves and efficient assistance with liquidity to banks, increases dollarization, which augments liquidity (and solvency) risks.[23]

The systemic risks of currency mismatches of the economy can be compounded by procrastination, when weak banks are allowed to continue operating. Frequently, those weak banks already exhibit a high percentage of (short-term) dollarized deposits, while the value of their deteriorated dollarized loans is smaller (because of provisions) than the value of their dollarized deposits. This creates an incentive for the banks to increase risky loans, provided that they are dollarized. Their exposure to both exchange rate risk and credit risk increases, and leaving them to continue operating creates hazards for the whole system.

[22] See the arguments of Broda and Levy Yeyati (2003).

[23] This dilemma leads to the discussion on the optimal level of reserves, a difficult problem insofar that the volatility of liquidity shocks is itself endogenous to the amount of reserves, as pointed out by Broda and Levy Yeyati (2003b) and by Levy Yeyati and Sturzenegger (2003b).

The conversion risk of domestic dollarized deposits to cash or foreign deposits explains the spread (that sometimes has been very high) of domestic rates over US rates on deposits of similar nature. This spread is sometimes called, by extension, "country risk". In the past four years, that were years of recession and weakening of the banks, the spread however continuously fell. We can conjecture that depositors are not pricing adequately the conversion risk, probably under the assumption that it will be fully shifted to the government and the central bank in the event of a collapse.

Also, given their liquidity and their inability to place loans to credit-worthy customers because of the recession, banks have been discouraging deposits (in any currency) by offering very low borrowing rates in dollars, only slightly above the international ones. Also, the regulations on money laundering in the industrial countries have significantly increased the transaction costs for cross-border deposits. Increased transaction costs plus low international rates have mitigated capital flight.

As liquidity insurer, the central bank can attenuate the risk, shifting from dollarized deposits to local currency deposits; and the moral hazard problems, by charging punitive interest rates on its lender-of-last-resort loans in dollars, or equivalently making access to these loans contingent on stringent conditions. High interest rates have the shortcoming that they may penalize the profits of the banks more in need. Also, it must be added that high central bank interest rates increase the premia on the bank's own liquidity. It becomes then difficult for the central bank to redirect the liquidity of banks with excess reserves to banks lacking them, because of, say, a deposit run. The central bank finds then more difficulties in acting as a middleman in brokering liquidity arrangements among banks. On the whole, the benefits of central bank's high interest rate as a lender-of-last resort outweighs the costs.

The stringent conditions for lender-of-last-resort loans may lack credibility in the case of systemic risk, as banks may believe that the central bank will yield on them. Still, some dose of ex-ante stringency may be helpful in the sense that, if banks believe that central bank liquidity is either expensive or of difficult availability, they will increase the share of their dollarized liquid assets in their total assets. The first line of defense, in case of a confidence crisis, is then provided by the banks themselves. Maintaining high levels of international reserves is costly to the central bank, and, contrary to commonly held belief, dollarization is also

costly to the banks, insofar that they have to assume higher liquid positions than otherwise.[24] When banks privilege liquidity, their lending activity is sharply reduced and even performing loans are not renewed or are called in, with negative effects on financial intermediation. So, dollarization, that favored financial deepening after the hyperinflation, in times of stress of the financial system, impedes the recovery of intermediation. This has happened in Bolivia in the past four years.

## 5. DOLLARIZATION AND THE WEAKENING OF CENTRAL BANKS

The problems posed by dollarization to the conduct of economic policy in highly dollarized economies are more severe than generally admitted. When high inflation was the problem to tackle, relatively minor changes to the standard IMF approach were needed. This changes substantially when the dollarized economies suffer the effects of strong shocks, as has been the case for many Latin American countries in the past five past years. It is not only a problem of a more careful choice of intermediate targets for monetary policy, but of a whole new environment for the central bank.[25]

Full dollarization changes the nature of the central banks in some fundamental ways. Actually, it makes them redundant or with wholly different functions as is well known. It is less well known that even partial dollarization (if high) changes the nature of central banks. They do not any longer have full control of the monetary base, as long as banks can accumulate foreign liabilities and deposits in foreign currency, and onlend them directly to

[24] It is curious to note that in the mild bank runs that Bolivia has experienced since the stabilization of 1985, most depositors converted their deposits to cash, actually to dollar bills, rather than to cross-border deposits. The central bank has thus been obliged to carry large inventories of dollar bills or to import them on short notice, assuming at the same time very high operational risks. The holding of this type of reserves has been very costly to the central bank, and ultimately to the Treasury. The stashing of large amounts of dollar bills by the public is basically unstable. So, once the confidence shocks that led to the bank runs subsided, most of the cash returned to the banks.

[25] The conventional thought, at the IMF and elsewhere, may have been too optimistic in believing that the standard monetary program design should be guided by the same criteria in non-dollarized economies, as stated, e.g., in Baliño *et al*. (1999).

their costumers, without passing through the central bank to convert them to domestic currency.

With partial dollarization, the central bank looses its grip on the monetary aggregates that are normally under its control in less dollarized economies. A setting of a multiplicity of central banks is created. In addition, in a highly dollarized economy, the transmission channels of the central bank policies to the financial sectors are largely clogged: the interest rate channel is barely available; the banking credit channel probably has some reach, but more as a result of the public sector borrowing needs (or lack of) than of central bank policy. Ironically, the exchange rate may be the only direct channel insofar as the frequent adjustments in the exchange rate, given by the crawling peg arrangement, Granger-cause interest rates in foreign currency, presumably because they change the dollar excess reserves of the banks as well as their perceptions of exchange risk.

The econometric exercises in Appendix B show that the rate of depreciation Granger-causes the lending rate in dollars of the banks and the interbank rate. This was not however the case before mid-2001. The situation changed afterwards, coincidental with the rate of devaluation stepping up. From mid-2001 on, it appears that the depreciation rate incides on the lending activity of the banks and on the interest rates that they charge, except when the banks were under distress, as was the case in the bank runs of June-July 2002. It is noteworthy that similar procedures applied to dollar borrowing rates, and domestic currency lending and borrowing rates do not show the same type of causality.

For many years, we have tried in the Central Bank of Bolivia to conduct a monetary policy in dollars, including the central banks' usual fare of open market operations, and of lending and borrowing facilities. There was the illusion that we could have operational targets in dollars like: a) with a controlled monetary base; b) short-term interest rates.

Although we cannot dismiss entirely the results, the bulk of the quantity of money and of interest rates was almost completely endogenous, as predicted by standard economic theory with fixed exchange rates, and with perfect capital mobility, substituted this time by movements of dollars off-shore and on-shore. Attempts to guide the interest rates of the banking system were specially futile: expansionary policies only resulted in more capital flight and contractionary policies had a very high off-set coefficient.

The central bank in a highly dollarized economy doesn't have a monetary policy *strictu senso*. It limits itself to try not to succumb

to the borrowing pressures of the government to finance its deficits and to act as a liquidity insurer for the banking system. The constitution of liquidity buffers (that is, high levels of international reserves) becomes the dominating concern. Price stability, the main mandate of the modern central bank, depends by and large of the soundness of the fiscal accounts, and (most) nominal income stabilization is beyond the reach of the central bank.[26]

As a side effect of partial dollarization, the demand for domestic money becomes rather unpredictable and the signs in the usual explanatory variables may not be the ones expected from economic theory and conventional assumptions. For instance, if credit was mainly granted in dollars and becomes less available, there will be an increase in the demand of money for transaction purposes, which is largely satisfied with domestic currency. If the demand for domestic currency is largely unstable, the demand for bank reserves held at the central bank (that given the high deposits dollarization is also in dollars in Bolivia) is even more unstable and largely beyond the control of the central bank.

## 6. THE BIPOLAR OPTION

As is well known by now, partial dollarization and the currency mismatch between debtors and creditors (mainly banks) gives rise to great fragility in the financial sector. It increases liquidity and solvency risks.[27] The fragility has become more apparent in view of the somehow more rapid exchange rate adjustments in response to the major changes in the exchange rates of our trade partners. The problem goes beyond borrowers with income in domestic currency. In fact, the problem remains with all borrowers in the non-tradable sectors (mainly construction and services), for even if they price in dollars, the purchasers of their goods and services have their incomes in domestic currency and hence, with real depreciation, the prices of most non-tradable sectors fall in dollars, regardless of the currency in which they are denominated.

The multilateral exchange rate volatility has shaken the confi-

[26] To be sure, the central bank still provides crucial payment services to the banking system, that could however be offered also by the private sector. In addition, it provides crucial information to the market, but again, other public and private institutions could do the same.

[27] However, with more integration to international capital markets, the risks may be diminished. Bolivia is not yet there.

dence in the bi-monetary arrangement, that seemed to have worked so smoothly over 14 years after the inflation-stabilization of 1985. Bolivian policy-makers (as in other countries facing similar problems) find themselves in the uneasy situation where, if they use the exchange rate as a shock absorber to protect national income and employment, they may, by the same measure, be imperiling the banks and other financial institutions.

Given the direction of trade of Bolivia, that goes in a significant fraction to its neighbors and the weak exposure of Bolivia to international capital movements, it is reasonable to assume that real shocks, especially those arising from exchange rate fluctuations, are more important than monetary shocks. The real shocks to the Bolivian economy have been, moreover, region idiosyncratic and presumably uncorrelated with the real shocks of the country issuing dollars (the US). The optimal currency area argument remains fully in force. So there should be a case for an independent counter-cyclical monetary policy.[28]

**TABLE 2.** BOLIVIAN NET EXPORTS AND REERs[a] (in U$ millions and percent)

| | 1998 | | 1999 | | 2000 | | 2001 | | 2002 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Net exports | REER | Net exports | REER | Net exports | REER | Net exports | REER | Net exports | REER |
| Argentina | -148.0 | 98.9 | -192.3 | 100.0 | -256.8 | 102.4 | -223.2 | 101.4 | -283.4 | 47.5 |
| Brazil | -223.6 | 90.3 | -248.1 | 67.6 | -238.4 | 67.9 | -214.2 | 66.3 | -319.4 | 53.3 |
| Chile | -108.2 | 96.9 | -103.7 | 91.2 | -139.7 | 91.0 | -110.5 | 85.5 | -90.5 | 86.5 |
| The world | -1181.6 | 97.5 | -731.2 | 96.2 | -666.8 | 98.1 | -593.8 | 100.1 | -663.9 | 99.1 |

[a] Excluding natural gas exports. REER: bilateral real effective exchanges rates with the countries in the table with base 1996 = 100. A fall in REER is appreciation.

Table 2 illustrates what happened to Bolivia's net exports after the big currency depreciations of our regional trade partners. Notice the big falls in net exports with respect to Argentina and Brazil between 1998 and 2002, and with respect to Chile until 2000. The negative net exports mainly resulted from the huge *bilateral* RER appreciations of the Bolivian currency.[29]

[28] Unless the Bolivian currency aligns itself with the Brazilian real, the Argentinean or the Chilean peso, or a basket of these currencies. Bolivia would not be willing to take this step, except when a regional MERCOSUR currency is agreed.

[29] It must also be said that Table 2 underestimates the extent of the worsening of the Bolivian trade, as it does not include informal (contraband) trade that is deemed to be substantial.

In this case, welfare can be enhanced with more flexibility of the exchange rate, rather than with more rigidity. In that setting monetary policy can be used to stabilize income and as a shock absorber. While real dollarization may be prevented, it would be at the cost of increasing financial dollarization. The high degree of financial dollarization puts a brake on, otherwise, sensible adjustments in the exchange rate, and increases the vulnerability of the banking system to confidence crisis.

Partial dollarization increases the likelihood of persistently high real interest rates. Indeed, in a dollarized banking system where most borrowers either have their incomes in domestic currency or are in the non-tradable sectors of the economy, the relevant real interest rate for them is (approximately) the interest rate in dollars plus the rate of real depreciation. If a policy of adjustments of the (pegged but adjustable) exchange rate takes place to obtain real depreciations, reductions of the nominal dollar interest rate may offset the bilateral (domestic currency/dollar) depreciation.

The argument that real depreciations increase the burden of the debt, because of its effects both on the stock and the flows, is quite straight-forward. Yet, if outrageous overvaluation of the domestic currency were allowed to persist, the balance sheet of the banks may also suffer, because of the deterioration in their assets brought about by the recession, in turn explained by the overvaluation.

A point often overlooked is that, since most broad money is constituted by dollar deposits, a real depreciation increases its domestic currency real value. Thus, real depreciation may prevent deflation and sow the seeds for recovery, as in some models of the Great Depression. Partial dollarization, despite all its shortcomings, may have some benefits.

However, all in all, partial dollarization adds vulnerability to the financial system, and increases the risks of a collapse of the banks and of a fiscal crisis, if the government comes to the rescue of the former. A full, *de jure*, dollarization may overcome this problem by eliminating currency mismatches. In addition, given the already very high degree of *de facto* dollarization, the transition costs to full dollarization may be small.[30] Moreover, given the feeble fiscal position and the weakened financial system, put-

[30] For instance, in terms of the capacity of the central bank to act as lender-of-resort, and of the loss-of-seigneurage.

ting monetary policies in automatic pilot may have many benefits.[31]

The problem is what would happen afterwards, to a dollarized economy, which depends for its foreign exchange on the exportation of a few commodities and on foreign aid, with low productivity growth, weak fiscal position, banks saddled with a large amount of dollarized non-performing loans, an inflexible labor legislation and no foreseeable scheme of fiscal compensation from the issuer of dollars.[32] Also, without resorting to full dollarization, the inflation rate is already low and very close to the international one. Thus there will be no gain with dollarization in terms of the fight against inflation, except to pre-empt expectations of it, which is very important. Last, with full dollarization in situations that can be handled with other means, the option to give up monetary policy and the exchange rate *in extremis* is killed.[33] The convergence of domestic dollar interest rates to international rates may not be forthcoming either.

The other corner solution is to aim to inflation targeting and a truly floating exchange rate. This road is even bumpier than the one to full dollarization. It implies back-tracking the route followed over 17 years (or even more). Beyond this legacy, there is the point made by Fischer (2001), recalling the observation of Mussa et al. (2000) that for low income, small countries, with "limited involvement with modern global financial markets, some form of exchange rate peg is generally more viable and more appropriate for them than for most of the emerging market countries".

The political obstacles to reduce dollarization are also formidable, as the constituencies in its favor are very large.[34] In fact, not even all exporters, particularly if they are commodity exporters, are against dollarization, since they are price-takers in the international market, their production is capital intensive, most of their inputs are imported, and their debts are in dollars. The ex-

[31] Would dollarization significantly accelerate the process of policy reform? This is one important question that Eichengreen (2000) addresses in a general context.

[32] Dollarization by itself, if not accompanied by policy reform, will not solve the problems and may even be counterproductive. See the arguments of De la Torre, Levy Yeyati and Schmukler (2002).

[33] Going beyond the argument of Fisher (2001) along similar lines.

[34] See the discussion of Frieden (2003) on the political economy of dollarization.

change rate is of marginal importance to them, unless it is absurdly overvalued. Only the producers of import substitutes or in border towns have been supporters of a more active exchange rate policy. To cope with the destruction of productive activity, caused by the exogenous shocks, entrepreneurial groups have been lobbying for financial assistance from the government rather than for a more aggressive exchange rate policy.

The current intermediate exchange rate arrangement has its merits, without ignoring its risks. The Bolivian authorities feel that, to overcome the crisis, dollarization has to decrease. However, given the dramatic experience with forced de-dollarization, any increased use of domestic currency has to be fully voluntary. Relatively small changes in prudential regulations may be supportive of the efforts to reduce dollarization, but the thrust has to be on institution strengthening. Reducing dollarization requires, first and foremost, a credible commitment to maintain inflation low, not only now but in the future, even the distant future. Full credibility in the domestic currency may take time to achieve and a long track record of stability is required. The changes in prudential regulations intend to make banks internalize the costs of dollarization; a first step is to make them aware of these costs.

## 7. CONCLUDING REMARKS

The paper has examined the causes and consequences of dollarization using the Bolivian experience as a case study. The emphasis throughout the paper has been on the importance of inflation and, especially, expectations of it, to explain dollarization in countries with limited integration to the international economy. It is argued that the quality of institutions would be a major factor for reducing the extent of dollarization, should this be deemed desirable.

Dollarization is a major problem, especially when it is partial because of the currency mismatches that are produced in the economy and the reduction of the range of policies, and without contradiction, the unconventional roles that it imposes to central banks. Full dollarization is an issue to the problem, but the countries willing to follow this route, have to be ready. The question on when to dollarize is more relevant than ever. With full dollarization, there is no place for a central bank, strictly speaking, but also its unconventional burden of being a liquidity insurer of dollar deposits disappears.

There are many questions not addressed in this paper and that are in need of further research. Among them, we have to see the full implications of liability dollarization as distinct from asset dollarization. More understanding is needed too on the optimal policies for central banks in partially dollarized economies. Also, granted that a reduction in dollarization is desirable, to what extent financial operations indexed to inflation, including public debt bonds, can be encouraged and issued. Would inflation indexed instruments help to develop long-term capital markets in domestic currency? Last, what political economy problems can be expected in reducing dollarization, and who would be the winners and losers?

## *Appendix A*

### Volatilities and peso problems

**A.** SAMPLE CHARACTERISTICS, MONTHLY DATA

*(Interest rate spreads: domestic currency – dollars)*

| | *Lending* | *Borrowing* | *Interbank* | *Depreciation rate* | *Inflation* | *Real depreciation rate* |
|---|---|---|---|---|---|---|
| | | | **Sample: 1988.01 - 2003.07** | | | |
| Mean | 22.76 | 7.87 | 6.56 | 8.71 | 9.28 | -0.57 |
| Std. Dev. | 12.17 | 3.22 | 3.93 | 4.37 | 6.42 | 5.18 |
| Skewness | 0.24 | 0.13 | 0.35 | 1.09 | 0.60 | -0.17 |
| Kurtosis | 1.81 | 2.04 | 2.15 | 3.75 | 2.56 | 2.10 |
| | | | **Sample: 1992.02 - 2003.07** | | | |
| Mean | 25.09 | 7.19 | 6.56 | 6.58 | 6.41 | 0.18 |
| Std. Dev. | 13.21 | 3.04 | 3.93 | 2.06 | 4.05 | 4.58 |
| Skewness | -0.19 | 0.25 | 0.35 | -0.06 | 0.18 | -0.09 |
| Kurtosis | 1.63 | 2.06 | 2.15 | 2.01 | 1.97 | 2.20 |

**B.** COVARIANCE MATRIX

| | *Inflation* | *Real depreciation* |
|---|---|---|
| | **Sample: 1988.01- 2003.07** | |
| Inflation | 41.02 | |
| Real depreciation | -24.35 | 26.65 |

| | *Inflation* | *Real depreciation* |
|---|---|---|
| | **Sample: 1992.02 - 2003.07** | |
| Inflation | 16.3 | |
| Real depreciation | -16.46 | 20.84 |

**C.** CORRELATIONS MATRIX

| | | |
|---|---|---|
| | **Sample: 1988.01- 2003.07** | |
| Inflation | 1.00 | |
| Real depreciation | -0.74 | 1.00 |
| | **Sample: 1992.02 - 2003.07** | |
| Inflation | 1.00 | |
| Real depreciation | -0.89 | 1.00 |

**D.** $\lambda^*$ = UNDERLYING DOLLARIZATION

| | |
|---|---|
| **Sample: 1988.01 – 2003.07** | |
| $\lambda^*$ | 0. 87875593 |
| **Sample: 1992.02 – 2003.07** | |
| $\lambda^*$ | - 0.037914692 |

The sample exhibits the following main characteristics for the spreads between local currency interest rates and (domestic) dollar rates: 1) The means are high in both samples for lending and borrowing interest rates. The interbank spread is significantly smaller, given the very short maturities of the operations leading to low currency risk. 2) The standard deviations are larger for the spreads in lending rates than for the other rates. 3) The spreads have a positive skewness for all rates, except for the lending rates in the smaller sample, reflecting hence that high spreads have been more frequent than low spreads. 4) The kurtosis are lower than 3, indicating that the spreads are more concentrated around the mean than in normal distribution. The hypothesis of a normal distribution of the spreads is rejected with the Jarque-Bera test (not shown) at 5% significance level.

The mean yearly depreciation rate and inflation are below 10%, and close to each other in both samples. The real depreciation rate is small and negative in the large sample, and small and positive in the smaller sample. The smallness of these means confirms the policy of stable RERs on average. More strikingly, for our purpose, while the standard devia-

tion of the real depreciation rate is smaller than the one for inflation in the large sample, the opposite result holds for the smaller sample.

Inflation has a positive skewness in both samples. Also, its kurtosis is below 3. Depreciation has a positive skewness and a kurtosis higher than 3 in the large sample; these measures are reverted in the smaller sample. The real depreciation has a negative skewness and a kurtosis smaller than 3. Given the closeness to zero of the mean values of real depreciation, we can assert that real appreciation was more frequent than real depreciation.

**E.** THE PESO PROBLEM

The following specification can be used to assess the presence of a peso problem:

$$\ln\frac{1+i_{t-12}}{1+\pi_t} = C(1) + C(2)\ln(1+i^*_{t-12}) + C(3)\ln\frac{1+d_t}{1+\pi_t}$$

where i = interest rate in domestic currency; i* = interest rate in dollars in the domestic system; π = inflation; d = depreciation.

**Method: Least squares**
**Date: 09/05/03 Time: 19.10**
**Sample (adjusted) 1990:01 2003:07**
**Included observations: 163 after adjusting endpoints.**

| | Coefficient | Std. deviation | t-statistic | Prob. |
|---|---|---|---|---|
| C(1) | 0.06 | 0.01 | 5.79 | 0.00 |
| C(2) | 0.24 | 0.11 | 2.26 | 0.03 |
| C(3) | 0.40 | 0.07 | 5.58 | 0.00 |

| | | | |
|---|---|---|---|
| R-squared | 0.17 | Mean dependent var | 0.08 |
| Adjusted R-squared | 0.16 | S.D dependent var | 0.04 |
| Log likelihood | 322.74 | F-statistic | 16.22 |
| Durbin-Watson | 0.40 | Prob. | 0.00 |

Wald test

H0: C(1)=0 C(2)=1 C(3)=1

| Test statistic | Value | df | Prob. |
|---|---|---|---|
| F-statistic | 29.89605 | (3,1609) | 0.0000 |
| Chi-square | 89.68816 | 3 | 0.0000 |

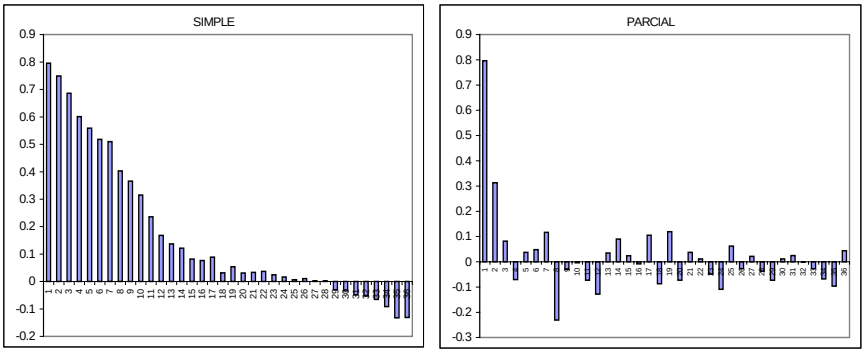
Null Hypothesis Summary:

| Normalized Restriction (= 0) | Value | Std. Err. |
|---|---|---|
| C(1) | 0.060545 | 0.010453 |
| -1 + C(2) | -0.755863 | 0.108193 |
| -1 + C(3) | -0.601675 | 0.071411 |

Restrictions are linear in coefficients.

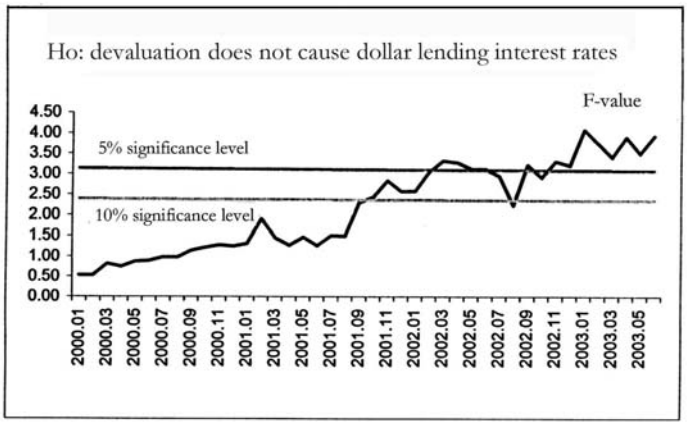
The null hypothesis is rejected at the 1% significance level.

The graphs below suggest the presence of autocorrelation and heterocedasticity. Indeed, Box-Pierce applied to the residuals and the squared residuals show problems of autocorrelation and heterocedasticity.




## *Appendix B*

**Granger Causality Test on Interest Rates**
**(period: March 1994 to June 2003)**



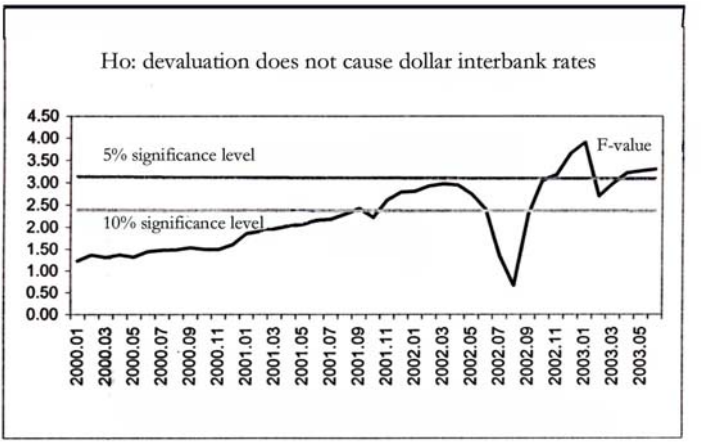



Figure B1 and B2 give rolling F-values, obtained by including every time a extra observation to the sample to the initial set March 1994-January 2000. The data was first tested and corrected for non-stationarity.

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# External price competitiveness and trade in the Caribbean

## INTRODUCTION

Caribbean countries rely heavily on international trade to generate foreign exchange, much of which is re-invested into the productive sectors of the economy to stimulate growth, employment and allows for the faster absorption of technological innovations into these economies. Undoubtedly, however, the global trading environment is evolving at a rapid pace; evidenced by the formation of trading blocks such as the Free Trade Area of the Americas and the Caricom Single Market and Economy in recent years, as well as the steady liberalisation of foreign trade under the World Trade Organisation's regime. Thus, faced with the many challenges of a changing international trading environment, and given the importance of trade to the development and growth of the Caribbean, it is imperative that these countries place great emphasis on continuously enhancing their competitive position in export markets.

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**TABLE 1:** GROWTH IN REAL TRADE FLOWS AND EXTERNAL COMPETITIVENESS

| | *Imports* | | *Exports* | | *REER* | |
|---|---|---|---|---|---|---|
| *Country* | *Mean* | *St. dev* | *Mean* | *St. dev* | *Mean* | *St. dev* |
| Antigua and Barbuda | 0.076 | 0.143 | -0.045 | 0.321 | 0.000 | 0.035 |
| Barbados | 0.037 | 0.127 | -0.030 | 0.191 | 0.063 | 0.087 |
| Belize | -0.038 | 0.443 | -0.001 | 0.123 | 0.003 | 0.051 |
| Dominica | 0.078 | 0.149 | 0.035 | 0.194 | 0.012 | 0.049 |
| Dominican Republic | 0.072 | 0.132 | -0.153 | 0.241 | -0.015 | 0.111 |
| Grenada | 0.047 | 0.075 | 0.154 | 0.975 | 0.011 | 0.075 |
| Guyana | 0.256 | 0.417 | 0.026 | 0.249 | -0.090 | 0.280 |
| Jamaica | 0.218 | 0.511 | -0.002 | 0.115 | 0.005 | 0.143 |
| St. Kitts and Nevis | 0.075 | 0.105 | -0.021 | 0.138 | 0.002 | 0.035 |
| St. Lucia | 0.047 | 0.099 | -0.028 | 0.220 | 0.009 | 0.039 |
| St. Vincent | 0.048 | 0.116 | 0.011 | 0.205 | 0.005 | 0.036 |
| Trinidad and Tobago | 0.064 | 0.300 | 0.011 | 0.113 | -0.028 | 0.112 |
| *Average* | *0.082* | *0.218* | *-0.004* | *0.257* | *-0.002* | *0.088* |

NOTE: $Growth = \ln y_{it} - \ln y_{it-1}$.

Table 1 gives the growth in real imports, real exports and the real effective exchange rate (reer) for a sample of twelve (12) Caribbean countries (Antigua and Barbuda, Barbados, Belize, Dominica, the Dominican Republic, Grenada, Guyana, Jamaica, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines and Trinidad and Tobago). From the table it can be gleaned that, while growth in real imports has been robust (8.2%), the expansion in real exports has been rather anaemic. Indeed, seven countries in the sample – Antigua and Barbuda, Barbados, Belize, the Dominican Republic, Jamaica, St. Kitts and Nevis and St. Lucia – experienced declining real export flows. The relatively low growth in real export flows can be partially linked to a reduction in external price competitiveness (or growth in the reer) since a casual analysis of the data reveals that most of the countries that recorded a contraction in real exports also experienced an increase in the reer. Only three countries in the sample, namely, the Dominican Republic, Guyana and Trinidad and Tobago, registered improvements in external price competitiveness. The gains, however, resulted mainly from currency devaluations in each of the countries listed.

There are several potential benefits of maintaining a high degree of external competitiveness. Firstly, it can reduce the de-

pendence on preferential trading agreements with industrialised countries. Secondly, it can facilitate greater accumulation of foreign reserves and decrease the economic spill-over effects from foreign-exchange shortage, including balance of payments problems, pressure on the exchange rate and inflation. As such, establishing the link between external price competitiveness and trade performance could greatly assist Caribbean countries in devising appropriate strategies to promote the success of their exports in the international market place. This paper, therefore, examines whether external price competitiveness is a significant determinant of fluctuations in Caribbean real trade levels. A non-stationary panel approach is employed because of its superiority over the single equation cointegration techniques used in much of the literature. In addition, the study focuses on real merchandise trade flows since these industries are usually the recipients of tariff and other non-tariff protective measures.

The remainder of the paper is organised as follows. Section 2 provides a review of the relevant literature addressing both the measurement of external competitiveness and its link to trade. In Section 3, the theoretical underpinnings, data issues and the econometric approach are discussed. Section 4 presents an analysis of the empirical results and Section 5 concludes.

## I. LITERATURE REVIEW

### A. Measuring external competitiveness

The most popular measure of external competitiveness is the *reer*. It calculates how nominal exchange rates, adjusted to take into account price differentials between a country and its trading partners, change over a specified period of time. Thus, if the prices of a country's exports are rising relative to its trading partners', this will be reflected in an appreciation of the *reer* or a decline in external competitiveness.

There are two general approaches to estimating the *reer*. The first, defines the *reer* as the weighted index of the domestic price level relative to that abroad:

$$reer_1 = \sum_{i=1}^{N} w_i (p / e_i . p_i^*) \tag{1}$$

where $w_i$ is the weight attached to country $i$, $e_i$ the bilateral

nominal exchange rate defined as the domestic currency price of foreign exchange, $p_i^*$ is a measure of prices in trading partner country $i$, and $p$ the domestic price index. One drawback in estimating the index is that there is no general agreement on which price index to use, with consumer prices, export prices and producer prices all being employed (see Nilsson, 1999). Furthermore, the *reer* may be calculated as either a weighted average or an unweighted average.

An alternative definition of the *reer* is to calculate it as the domestic relative price of non-tradables to that of tradables:

$$reer_2 = \sum_{i=1}^{N} w_i (p^{NTR} / e_i . p_i^{TR}) \tag{2}$$

where $p_i^{TR}$ is the price of tradables and $p^{NTR}$ the price of non-tradables. This measure of the *reer* is close to the dependent economy literature (see Chinn, 2002) and suggests that if the *reer* depreciates, the profitability of producing tradables rises, which induces a shift in resources from the non-tradable to the tradable sectors. The major shortcoming of this second approach to estimating the *reer* is that it is not easily applied empirically because most available price indices are contaminated with some element of both tradable and non-tradable prices.

Bynoe-Mayers (1997) attempts to overcome the empirical difficulty in calculating the $reer_2$ by using (GDP) deflators. The analysis uses data on Barbados, Jamaica, Trinidad, Guyana, Mexico, Honduras, Costa Rica, the Dominican Republic, Columbia and Venezuela over the period 1970 to 1995. The author decomposes the nominal and real GDP statistics of the ten countries into tradable and non-tradable activities. Total nominal GDP for the traded sector is then divided by the real GDP for that sector to generate a deflator index. The same procedure is also applied to derive a price index for the non-traded sector. However, when the calculated *reer* indices are compared to those generated by the International Monetary Fund (IMF), in the International Financial Statistics (IFS) database, a significant divergence between the two estimates is observed. As noted above, this result reflects the difficulty in decomposing prices into traded and non-traded components, especially in small open economies. Bynoe-Mayers also reports that those countries that devalued their nominal exchange rates did not show substantial gains in external competitiveness.

Boamah (1989) also attempts to estimate external competitiveness in the region using the $reer_1$ definition of the real effective

exchange rate. Data on the nominal wage rate in the domestic manufacturing sector serves as a proxy for domestic prices, while an index of world market prices for developing countries' exports captures the foreign price component. The export tax rate is also taken into account in the analysis. The *reer* is estimated for the period 1980 to 1987 for Barbados, Guyana, Jamaica and Trinidad and Tobago. Boamah's results show that Barbados is less internationally competitive than all of the other countries studied, while Jamaica is the most competitive. In contrast to Bynoe-Mayers (1997), Boamah finds that nominal exchange rate devaluations did play an important role in improving external competitiveness in the Caribbean countries considered. However, Boamah advises the reader to interpret the results with caution, in light of the data limitations of the study. In addition, the calculated *reer* seems to be more a measure of manufacturing competitiveness than external competitiveness, and this may explain Barbados' relatively poor results since it is primarily a service driven economy.

### B. External competitiveness and trade

Rose (1991) provides one of the first studies relating external competitiveness to trade using modern econometric modelling techniques. The author derives a reduced form equation relating a country's balance of trade to the reer, domestic output and foreign output. Rose estimates the reduced form equation for the United Kingdom, Canada, Germany, Japan and the US using monthly data covering the period 1975 to 1986. All the series are shown to be non-stationary in levels; however, there is no evidence of cointegration for the five countries studied. The model is therefore estimated in first differences to examine whether the reer significantly affects changes in the external trade balance. Nevertheless, changes in the reer do not prove to be a significant determinant of changes in the country's balance of trade. However, the author's results seem to be related to the low power of the Engle and Granger (1987) two-step procedure. In contrast, Chinn and Johnston (1996) use the Johansen procedure to tests for cointegration in separate import and export equations. The authors conduct the analysis using US trade flow data. Unlike Rose (1991), Chinn and Johnston find positive evidence relating trade flows to the reer in both the short and long-run. Craigwell and Samaroo (1997) also employ cointegration and error correction models to estimate current account functions for Barbados and Trinidad and Tobago. Utilising annual time series and

pooled data for the period 1967 to 1991, the study finds that the real exchange rate, the level of foreign incomes, the budget surplus to GDP ratio and the lagged current account are significant variables influencing long-run current account behaviour in Trinidad and Tobago. For Barbados, however, the government budget variable and the terms of trade proved to be the important explanatory variables in the long run.

Marsh and Tokarick (1996) empirically examine the ability of various measures of the reer to explain movements in a country's external position. The author's conclusions essentially provide an alternative explanation of Rose's (1991) findings. They argue that different measures of the reer should be exploited when examining more than one country. For example, in France only unit labour cost deflated reer indices seem to influence trade, in the US, all of the alternative measures are equally successful, while in Canada no measure of the reer appears to influence trade.

Most of the econometric studies on the impact of the reer on trade flows in developing countries have been conducted using data on East Asian economies. Cerra and Gulati (1999) utilise quarterly data for the period 1983 to 1997 to examine the factors that influence China's real trade flows. They estimate reduced form equations, which relate imports to the reer, income, a measure of the availability of foreign exchange and the capacity of the world to supply imports to China. Exports, on the other hand, are expressed as a function of the reer, world income and an index of domestic production capacity. The authors find evidence of cointegration in both the import and export equations and conclude that the reer significantly affects exports and imports. The results also suggest that the responsiveness of trade to the reer usually rises with greater trade liberalisation.

Wilson (2001) conducts an analysis of the impact of the reer on trade flows in Singapore, Malaysia and Korea. The author does not find any evidence of a relationship between trade flows and the reer. This, however, seems to be related to the rather odd price indices used. Wilson exploits the domestic wholesale price index as a measure of domestic prices, while the domestic consumer price index serves as a proxy for foreign prices.

## II. METHODOLOGY

This section of the study presents a simple theoretical framework to link real trade flows to the *reer*. The methods used to estimate

the reduced form equations are then discussed. The quantity of exports demanded ($x^d$) is assumed to depend on foreign income, $y^*$, and the relative price of domestic exports compared to foreign goods:

$$(3) \qquad \ln x^d = \alpha \ln p_x - \alpha \ln p_x^* + \phi \ln y^*; \qquad \alpha < 0, \phi > 0$$

where $p_x$ is the domestic price of exports, and $p_x^*$ is the foreign price of exports. Thus, a decrease in relative prices would lead to an increase in export demand, while an expansion in world income would also increase export demand. The export supply ($x^s$) equation is specified as a function of export prices, domestic prices ( $p_d$ ) and domestic production capacity (*CAP*):

$$(4) \qquad \ln x^s = \beta \ln p_x + \beta \ln \left[ \frac{e}{p_d} \right] + \delta \ln CAP; \qquad \beta, \delta > 0$$

where $e$ is the exchange rate. Hence, as the prices of exports rise relative to the prices available domestically, then firms would be encouraged to export more. On the other hand, the production variable captures the ability of firms to satisfy foreign demand.

Assuming the equilibrium condition that $x^d = x^s = x$ and solving Equations (3) and (4) simultaneously and simplifying, one obtains:

$$(5) \ln x = \alpha^* \ln reer + \phi^* \ln y^* + \delta^* \ln CAP; \qquad \alpha^* < 0, \textit{and } \phi^*, \delta^* > 0$$

Therefore, in equilibrium, the actual level of exports would be inversely related to the *reer*, since an appreciation in the *reer* would imply that exports had become more expensive, and domestic producers would realise a reduction in sales in their overseas markets. In contrast, exports are expected to be positively related to income, since higher incomes in export markets should lead to an expansion in demand. There should also be a positive relationship between exports and capacity given that with an increase in the latter, domestic suppliers should be better able to fill orders that were previously beyond their production capacity.

Shifting the focus to imports, it is assumed that import demand ($m^d$) would depend on domestic income, $y$, and the relative price of imports and domestic goods:

$$(6) \qquad \ln m^d = \varphi \ln p_m + \varphi \ln \left[ \frac{e}{p_d} \right] + \varpi \ln y; \qquad \varphi < 0, \varpi > 0$$

where $p_m$ is import prices. Thus, an increase in import prices should lead to a decline in the demand for imports, while a rise in domestic incomes should be positively related to import demand. The import supply ($m^s$) equation is modelled as a function of relative import prices and world production capacity (*WCAP*):

$$(7) \qquad \ln m^s = \gamma \ln p_m - \gamma \ln p_m^* + \tau \ln WCAP; \qquad \gamma, \tau > 0$$

where $p_m^*$ is the price of competing foreign imports.

Assuming the equilibrium condition that $m^d = m^s = m$ and solving Equations (6) and (7) simultaneously, one obtains:

$$(8) \qquad \ln m = \varphi^* \ln reer + \theta^* \ln y + \tau^* WCAP; \quad \varphi^*, \theta^*, \tau^* > 0$$

With respect to imports, therefore, the sign of the *reer* is expected to be positive, since foreign suppliers should be willing to increase their exports to Caribbean countries as the real rate of return rises. Growth in domestic income should cause an expansion in imports, assuming that domestic consumers would use the additional income to purchase more goods, while firms experiencing greater demand would require higher levels of foreign inputs. The positive relationship between world production capacity and imports implies that as capacity increases, producers would supply more goods at lower prices to Caribbean countries and, as such, the level of imports should rise.

**A. Data**

The data utilised are annual observations over the twenty-six year period from 1975 to 2001. They are compiled from the IMF's International Financial Statistics (IFS) CD-Rom, the Eastern Caribbean Central Bank's Economic and Financial Review (various issues), the Central Bank of Barbados' Annual Statistical Digest 2001, the Central Bank of Guyana's Statistical Bulletin and the Central Bank of Jamaica's Statistical Digest. To obtain estimates of real imports, the nominal merchandise imports values are deflated by the world export price index, while the nominal merchandise exports values are deflated by the GDP deflator for each country. Domestic income is given by real GDP in each country, while foreign income is represented by real GDP in the US given that the US is the principal trading partner of most Caribbean countries. An alternative proxy for foreign GDP is a weighted average of the GDPs of the major trading countries such as the US, UK and Canada. However, this measure does not

yield significantly different results. The *reer* is taken primarily from the IFS database but for Barbados and Jamaica it is estimated using the $reer_1$ definition. Domestic capacity is proxied by real GDP, since indices of industrial production are not readily available for most Caribbean countries, while world production capacity is represented by the index of industrial production for industrial countries obtained from the IFS CD-Rom. The natural logarithm of all variables is used.

**B. Econometric Approach**

Given the low power of single equation cointegration techniques, a non-stationary panel approach is emerging as a recommended alternative (see Baltagi, 2001). First, tests for unit roots in the variables under consideration are undertaken using the panel unit root test developed by Im, Pesaran and Shin (1997). This approach is chosen over competing panel unit root tests due to its superior finite sample properties when $N$ is small and $T$ is large (Choi, 1999). Let $s_{it}$ represent real imports, real exports, real GDP, world production capacity or *reer*. Im, Pesaran and Shin allow for heterogeneity by proposing a unit root testing procedure based on averaging the individual unit root *t-adf* statistics. The regression used is:

$$\Delta s_{it} = \alpha_i + \rho_i s_{it-1} + \sum_{j=1}^{\rho_i} \theta_{ij} \Delta s_{it-j} + \varepsilon_{it} \tag{9}$$

where $\alpha$ is the intercept, $\Delta$ is the difference operator and $\varepsilon_{it}$ is a residual term which is assumed to have normal properties. The null hypothesis is that each series in the panel contains a unit root, i.e. $H_0 : \rho_i = 1$ for all $i$, and the alternative hypothesis is that at least one of the individual series in the panel is stationary, i.e. $H_1 : \rho_i < 1$ for at least one $i$. The Im, Pesaran and Shin *t-bar* statistic is defined as the average of all the individual *t-adf* statistics. The *t-bar* statistic is then compared to the critical values tabulated by Im, Pesaran and Shin.

Second, the Larsson, Lyhagen and Lothgren (2001) panel cointegration test is utilised to test for cointegration among the variables specified in Equations (5) and (8). Consider a heterogeneous panel error correction model:

$$\Delta s_{it} = \Pi_i s_{it-1} + \sum_{k=1}^{k_i - 1} \Gamma_{ik} \Delta s_{it-k} + \varepsilon_{it} \tag{10}$$

where $\Pi_i$ is a $p \times p$ matrix. To test the null of cointegration, $H_0 : rank(\Pi_i) = r_i < r$ where $r$ is the number of cointegrating relationships among the $p$ variables. The Larsson, Lyhagen and Lothgren technique calculates the standardised $LR$ statistic, given below:

$$\bar{LR} = \sqrt{N}\left[\frac{\bar{LR}_{NT} - E(Z_k)}{\sqrt{Var(Z_k)}}\right] \tag{11}$$

where $\bar{LR}_{NT}$ is the average of the $N$ individual trace statistics, $E(Z_k)$ is the asymptotic mean and $Var(Z_k)$ is the asymptotic variance of the test statistic. This technique is chosen because of its superiority over competing panel cointegration procedures, as $T$ gets larger.

Finally, if the variables are cointegrated, the study then moves on to estimate the long-run cointegrating equation. For panel cointegrated regression models, the asymptotic properties of the estimators of the regression coefficients and the associated statistical tests are different from those of the time-series cointegration regression models and as a result, ordinary least squares (OLS) is no longer appropriate. Accordingly, this study utilises the Dynamic Ordinary Least Squares (DOLS) estimator proposed by Kao and Chiang (2000) to obtain the long-run coefficient estimates. Kao and Chiang report, using a simulation experiment, that the finite sample properties of the DOLS estimators tend to be superior to competing estimators such as the fully modified (FM) and OLS estimators. The DOLS estimator can be obtained by running the following regression:

$$y_{it} = \alpha_i + \beta x_{it} + \sum_{j=-q_1}^{q_2} c_{ij} \Delta x_{it+j} + v_{it} \tag{12}$$

where $y_{it}$ is the dependent variable, $x_{it}$ are the explanatory variables, $q$ is the number of leads or lags of the explanatory variables (two lags and one lead variable are employed in this study), and $v_{it}$ is the error term which is assumed to have normal properties. Equation (12) is, therefore, an ordinary regression with past and future values of the changes in the explanatory variables as additional regressors.

## III. EMPIRICAL RESULTS

This section presents the results of the estimated export and im-

port equations, using data for the period 1975 to 2001. Table 2 shows the Augmented Dickey-Fuller tests for non-stationarity in the import and export values and the other explanatory variables. Deterministic components, such as a trend, are not included in the unit root tests, since they decrease the power of the panel unit root test (Choi, 1999). The most common result from the individual country specific test statistics is that all the variables are stationary in first differences, or could be classified as I(1) variables. The panel unit root test statistics are also given in the second last row of Table 2. Comparing the one-tailed critical value of the normal distribution at the 1% level (2.326) to the panel test statistics suggests that all three of the variables are non-stationary in levels but stationary in first differences. One can, therefore, move on to test for cointegration in the export and import equations.

The panel cointegration test values for the import and export regressions are reported in Table 3. The critical value used to test for cointegration is again the one tailed value of 2.326 from the standard normal distribution. Therefore, the results imply that there exists at most one cointegrating relationship in the system and, hence, long-run estimates of the import and export functions can be obtained by estimating the equilibrium model.

The long-run coefficients for Equations (5) and (8) are derived from the panel model estimated using the DOLS method discussed in the previous section and the results are shown in Table 4. The coefficient estimates obtained for the export function are in general agreement with the theory presented in Section 3. The *reer* is inversely related to exports and is significant at classical levels of testing. This finding implies that as a country becomes more price competitive – a decline in the *reer* – real exports usually expand. In addition, the magnitude of the coefficient reported is broadly comparable to those obtained in other studies for developing countries. For example, the elasticity (with respect to the *reer)* for total exports reported by Cerra and Dayal-Gulati (1999) for China was –0.32.

The coefficient on the capacity variable is positively, but insignificantly related to exports and also agrees with *a priori* economic reasoning, which posits that exports from the Caribbean are supply-side constrained. Thus, if domestic firms were able to increase capacity beyond their current level, then they could possibly benefit from increased foreign sales. The results also show that the volume of exports from the Caribbean during the review period was positively related to world income; however, the latter

**TABLE 2:** UNIT ROOT TESTS STATISTICS

| | *Imports* | | *Exports* | | *REER* | | *GDP* | |
|---|---|---|---|---|---|---|---|---|
| *Country* | *Levels* | *First Differences* | *Levels* | *First Differences* | *Levels* | *First Differences* | *Levels* | *First Differences* |
| Antigua and Barbuda | -1.643 | -4.384** | -2.540 | -3.876** | -1.449 | -4.134** | -1.673 | -3.232* |
| Barbados | -0.570 | -4.011** | -1.521 | -3.909** | -2.578 | -3.190* | -1.434 | -3.352* |
| Belize | -2.312 | -2.466 | -1.777 | -5.508** | -1.227 | -3.436* | 0.349 | -2.996 |
| Dominica | -0.598 | -3.514* | -2.594 | -5.354** | -1.928 | -3.289* | -1.510 | -4.981** |
| Dominican Republic | 1.392 | -4.828** | -1.635 | -2.656 | -2.626 | -4.734** | 1.666 | -3.220* |
| Grenada | -1.468 | -2.661 | -1.102 | -2.545 | -1.056 | -1.760 | 0.510 | -2.159 |
| Guyana | -0.367 | -3.812* | -0.678 | -4.200** | -0.988 | -1.812 | 1.078 | -2.000 |
| Jamaica | -1.213 | -5.191** | -0.600 | -3.186* | -2.533 | -2.778 | -7.276** | -1.678 |
| St. Kitts and Nevis | 0.050 | -4.680** | -1.816 | -4.614** | -1.558 | -2.109 | -0.325 | -4.593** |
| St. Lucia | -0.753 | -3.703* | -0.392 | -5.016** | -0.710 | -3.753* | -2.468 | -2.960 |
| St. Vincent | -1.912 | -3.376* | -1.319 | -4.849** | -1.293 | -3.626* | -1.075 | -5.294** |
| Trinidad and Tobago | 2.693 | -2.168 | -1.087 | -3.203 | -6.467** | -3.390* | -0.901 | -1.239 |
| Panel Unit Root Test | -0.558 | -3.733** | -1.422 | -4.076** | -2.034* | -3.167** | -1.088 | -3.142** |
| World | - | - | - | - | - | - | 0.524 | -3.356* |

NOTES: *,** indicates significance at the 5% and 1% levels, respectively. The world production capacity variable was also included in the unit root test and was found to be stationary in first differences.

variable is not significant at classical levels of testing. Nevertheless, this finding suggests that most of the tangible exports from Caribbean countries, such as sugar and other agricultural commodities, have a low income elasticity. Additionally, since these goods are usually constrained by supply, even if there exists excess demand for a particular export, the firm(s) under consideration may not be able to fill the orders in the short-term or even the medium-term. Furthermore, by the time production capacity rises, the demand may have already been filled from another exporter. Non-price factors are also likely to be important determinants of the level of Caribbean exports, since most exports from the region compete with goods from developed countries, which benefit from non-price advantages such as multinational advertising campaigns that increase their income elasticity of demand.

**TABLE 3:** PANEL COINTEGRATION TEST STATISTICS

| | *Trace statistic* | | | |
|---|---|---|---|---|
| | *r = 0* | *r = 1* | *r = 2* | *r= 3* |
| Import Equation | 12.188 | 5.954 | 1.502 | -0.724 |
| Export Equation | 13.698 | 6.293 | 2.283 | -0.487 |

As with the export regression, the *reer* is inversely related to import flows, however, this variable is insignificant at normal levels of testing. Although the sign of the variable does not agree with previous expectations, this finding is not too surprising given the import-dependent nature of most countries in the region. It implies that imports are, for the most part, price inelastic because the majority of countries do not have the capacity to produce all the goods demanded by the domestic economy.

The regression results also show that imports are positively related to domestic income, which serves as a proxy for domestic demand. Thus, as Caribbean countries experience faster rates of economic expansion, real imports also increase. Similarly, the proxy for world production capacity, which is included in the regression equation, is found to be positively and significantly related to domestic imports. The significance of this variable suggests that as world capacity expands, domestic imports usually rise. This relationship does not imply that world capacity is insufficient to supply the region's needs, but rather that the decline in price caused by expanding world supply usually leads to greater demand for imported goods regionally.

**TABLE 4:** PANEL REGRESSION RESULTS

| | *Dependent variable* | |
|---|---|---|
| *Regressors* | ln *imports* # | ln exp *orts* #& |
| ln *reer* | -0.798<br>(0.474) | -0.426<br>(0.184)** |
| ln *CAP* | - | 0.562<br>(0.414) |
| ln *gdp* | 0.336<br>(0.861) | - |
| ln *gdpf* | - | 0.124<br>(0.343) |
| ln *WCAP* | 3.882<br>(1.349)** | - |
| R-squared | 0.982 | 0.995 |
| Obs | 209 | 209 |

NOTES: *, ** indicates significance at the 5 and 1% levels, respectively. Standard errors are reported in parentheses. #: Country-specific constants included. &: Time-specific dummies included.

## CONCLUSIONS

This paper has attempted to examine the impact of the real effective exchange rate on real trade flows in the Caribbean. The analysis is undertaken using a non-stationary panel approach and data covering the period 1975 to 2001. The signs of most of the coefficients agree with *a priori* economic reasoning. The results suggest that the decline in real exports from the region can be linked, for the most part, to deterioration in external price competitiveness. It is also shown that the *reer* is negatively related to import flows but the former variable is insignificant at classical level of testing. These findings imply that countries in the region need to focus on improving productivity, one of the major determinants of variations in the real effective exchange rate, to encourage greater levels of trade.

As Caribbean countries become more dependent on services for the generation of foreign exchange, the studies of trade flows will increasingly emphasis this aspect of the current account. Therefore, future research could perhaps investigate the impact

of external price competitiveness for both goods and services, and this would require the derivation of exchange rate indices that take into account the changes in domestic and foreign prices of services (see approach suggested by Worrell, Boamah and Campbell (1996)). Moreover, although non-price determinants of competitiveness, such as corporate culture and product quality, are not explicitly dealt with in this paper, the authors acknowledge the importance of these factors. Indeed, there is a need for further study of the influence of non-price factors in the Caribbean, in order to facilitate a more complete assessment of the overall external competitiveness of the region. However, given the difficulties in actually capturing and quantifying these non-price components, such research is likely to pose significant challenges.

## *Appendix*

### DERIVATION OF REDUCED FORM EQUATION

Assuming the equilibrium condition that $x^d = x^s = x$ and solving Equations (3) and (4) simultaneously yields the equilibrium price level:

$$\text{(A.1)} \quad \ln p_x = \frac{\alpha}{\alpha - \beta} \ln p_x^* + \frac{\beta}{\alpha - \beta} \ln \frac{e}{p_d} - \frac{\phi}{\alpha - \beta} \ln y^* + \frac{\tau}{\alpha - \beta} \ln CAP$$

Substituting the equilibrium price level given by Equation (A.1) into Equation (3) gives the following reduced form for exports:

$$\text{(A.2)} \quad \ln x = -\frac{\alpha\beta}{\alpha - \beta} \left[ \ln \frac{p_d}{e \times p_x^*} \right] - \frac{\beta\phi}{\alpha - \beta} \ln y^* + \frac{\alpha\tau}{\alpha - \beta} \ln CAP$$

where $\left[ \ln \frac{p_d}{e \times p_x^*} \right]$ is the *reer*. The derivation of the import equation is obtained using a similar approach.

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*Trevor Campbell*

# The impact of real domestic income on indirect taxes in Barbados with the use of an impulse response function

## INTRODUCTION

Indirect taxes have played a major role in Government's revenue collections over the years. Until 1997, they comprised consumption taxes, excise taxes, stamp duties, hotel and restaurant taxes and import duties. From 1997 until the present time, they have been made up of value-added taxes (VAT), stamp duties, excise duties and import duties. The importance of indirect taxes will be even more crucial to Government's revenue intake as Government seeks to gradually reduce its rate on personal tax, a rate considered by many as too steep.

Domestic income has been crucial to the collection of indirect tax receipts over the years. As persons receive higher incomes, any spending undertaken by Barbadians would have been anticipated to improve indirect taxes through higher collections from consumption taxes, import duties and hotel and restaurant taxes in the earlier years and from VAT, import duties and excise taxes

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within the last six years. As Government's revenue collections become boosted through rising domestic income, Government is then in a better position to engage in projects and programmes for the further development of Barbados. Such projects and programmes are likely to generate additional employment opportunities, which in themselves can result in an increased revenue intake not only from spending but also from direct tax receipts. It is with these details in mind that some attempt will be made to see how indirect taxes will be influenced by real domestic income in Barbados over the medium term with the use of an impulse response function for the period 1970 to 2003.

The first section will look at previous studies done on indirect taxes. This will be followed by a section analyzing the trends in indirect tax revenue over the above-mentioned period. Section three will focus on the impact of domestic income on indirect taxes and this will be followed by a conclusion.

## 1. A REVIEW OF SOME OF THE LITERATURE ON INDIRECT TAXES

There have been several studies conducted on this interesting subject of indirect taxes. Campbell (2003) sought to determine, by the use of an error correction model, how consumer imports impacted on indirect taxes in the long and short run, using annual data from 1970 to 2001. The results showed that in the long run, a 1% rise in consumer imports would give rise to a 0.46% increase in indirect taxes in the long run and a 0.78% expansion in the short run. Chen and al (2001), with the use of data on expenditures from a 1992 Integrated Household Survey, conducted a welfare dominance analysis of tax incidence in Uganda. The study showed that reducing export taxes on coffee (one of Uganda's main exports) and taxes on paraffin or kerosene (which is consumed by the poor) would benefit poor individuals. In addition, the substitution of VAT for sales tax would not necessarily worsen the welfare of the poor since most goods consumed by the poor were zero-rated.

Michael and Hatzipanayotou (1999) examined the welfare effects of migration in societies with indirect taxes, income transfers and public good provision. They constructed a general equilibrium trade model of a two-class small open host or source country. They argued that government consumption tax or tariff revenue finances either the provision of an imported public con-

sumption good or income transfers. Within this framework among other things, under plausible assumptions, they showed that (a) when consumption tax revenue finances the provision of a public good, marginal migration reduces social welfare in the source country and raises it in the host country. When consumption tax revenue is equally distributed among domestic households in each country, then migration has an ambiguous impact on the social welfare in either country. When tariff revenue in either country is either equally distributed among domestic households, or it is used to finance the provision of a public good, then migration has an ambiguous effect on social welfare in the host country, and is expected to reduce welfare in the source country.

Howard (1993) identified indirect taxation as the principal source of revenue in Barbados during the 1950s and 1960s. In the mid 1950s, they constituted 58 percent of total tax revenue but by the early 1970s, had fallen to 49 percent. He associated this downward trend in indirect taxation with the importance of income taxation as the Caribbean economies pursued industralisation strategies to raise income and employment levels.

Mascoll and Harding (1992) analysed the effects of changing common external tariff (CET) rates with specific reference to Barbados. The CET was regarded as the prime instrument of consensus among members of CARICOM, yet it was characterized by disagreement, that is agreement reached in principle but difficult to implement. They advanced the view that a high protection offered by the CET was against the spirit of "hemispheric trade liberalization". Goods were considered to be competing if the regional manufacturing had the potential to supply 75 percent of the regional market. The CET rate structure was based on two goods in terms of economic usage, namely input and final goods. The results of the writers indicated that a reduction in the maximum rate of the CET would reduce the level of protection particularly in the manufacturing. Furthermore, Government revenue might decline due to a fall-off in import duties and alternative sources of revenue might have to be found.

In a study on India, Ahmad and Stern (1987) examined the effect of replacing a number of direct and indirect taxes on consumption by a simple proportional VAT. With the use of data from 1979-1980, they discovered that switching to a VAT would be equivalent to reducing the real expenditures of the poorest rural households by as much as 6.8 percent and increasing those of the richest rural households by more than 3 percent. Similarly, the real expenditures of the poorest urban households were re-

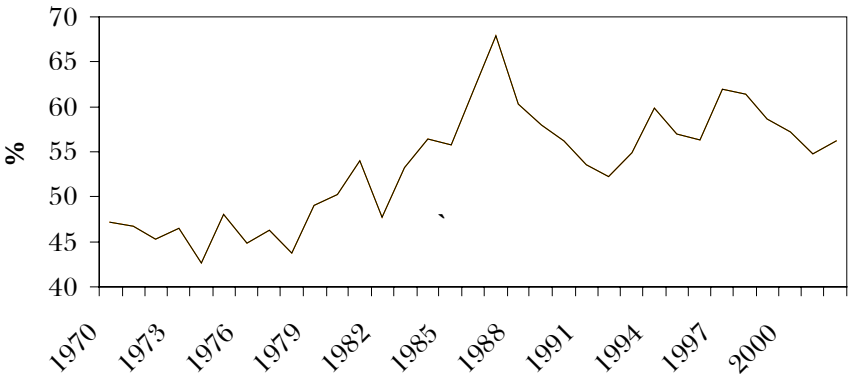
duced by about 4.8 percent while those of the richest were increased by 4.2 percent. This indicated that the welfare of the poor would be reduced if a proportional VAT replaced existing indirect consumption taxes.

Due (1985) identified a list of objectionable features of the pre-1991 highly complex indirect tax structure of Jamaica. He argued that the multiple tax system and different forms of consumption taxes in that country interfered with simplicity, compliance and administration of the system. He further observed that since the consumption duty was applied at the import and manufacturing levels, wholesale and retail margins were not included in the base. This meant that the consumption duty had to be levied at a higher rate to achieve a given level of revenue. This higher rate increased the final burden on consumers.

## 2. TRENDS IN INDIRECT TAXES IN BARBADOS

From 1970 until 1975, the overall performance of the Barbados economy was affected by the disruptive effects of the oil crisis, world-wide inflation and the deepening recession in the major industrial countries of the world. Central Bank policy during these five years was clear. In the initial stages, the Bank was concerned with problems of persistent inflation, a tenuous balance of payments situation and mounting unemployment. It therefore supported Government's measures to exercise the maximum fiscal restraint possibly by increasing taxes. In the latter part of this

**FIGURE 1.** INDIRECT TAXES AS A PERCENTAGE OF TAX REVENUE




SOURCE: Central Bank of Barbados.

period, although the Bank focused on measures to stimulate the Barbadian economy, there were fears that a resurgence of consumer spending might revive the inflationary pressures that had shown some easing towards end-1974. It therefore supported the Government's continued policy of fiscal restraint. During this period, indirect tax collections averaged around $60 million or around 46% of total tax revenue (see Figure 1). These were boosted primarily by customs duties and to a lesser extent, consumption taxes and excise taxes. There also occurred at this time, the introduction of the restaurant sales tax and retail sales tax as well as the imposition of customs duties on 376 items in an effort to conform to the CARICOM agreement relating to the CET.

After three years of economic recession, output rose in all major sectors of the economy in 1976. The Central Bank's main concern during that year was to provide the monetary and financial conditions necessary for the restoration of economic growth. Consequently, indirect taxes receipts benefited from expansions in import duties, goods and services and consumption taxes. It is interesting to note that revenue from taxes on goods and services increased by 8.9% over the previous year despite the abolition of the sales tax in October of that year. Revenue from consumption taxes rose by 11% to $11 million on the strength of a strong increase in the purchases of consumer durables late in the year. On the contrary, receipts from the tax on hotel and restaurant sales fell by around 8% to $3.6 million, suggesting that tourist expenditure in these establishments may have fallen (see Annual Central Bank Report).

The continued improvement in real economic activity from between 1977 and 1980 manifested itself in higher indirect tax collections. Indeed, during 1980, the Bank was aware of the recessionary trends in the international economy and its policy in that year was one of caution. Despite this, indirect taxes grew by some 25% and constituted around 50% of total revenues. Consumption tax collections were primarily the result of revenue from motor vehicle taxes, the airport service charge, highway revenue and other miscellaneous charges. Import duties largely reflected increases in dutiable imports needed to satisfy consumer spending and the requirements of the expanding construction, tourist and service sectors.

During 1981 and 1982, Central Bank policy became more restrictive with the recession in the world economy and maintained tight credit policies to restrain consumer spending. Real output declined on average by 3.4% over the above-mentioned period.

Indirect tax receipts, after growing by $32 million in 1980, expanded by $25 million in 1981 but contracted by $7.6 million in the following year. This decrease in 1982 was reflected in a cutback in imports which lowered revenue from import duties by approximately 20% while hotel and restaurant taxes were virtually unchanged from the number of the previous year. Consumption taxes, on the other hand, were higher by $11.3 million in 1982, after rising by $13.4 million one year ago.

In 1983, in anticipation of a recovery in the world economy, the Central Bank's strategy for that year was to create conditions for the resumption of sustainable growth, such as a reduction of the public sector deficit. Real output, however, was sluggish and rose by a mere 0.5%, following the contraction of the previous year. Nevertheless the fiscal objective was achieved with the fiscal deficit falling from 5.0% of GDP in 1982 to 4.1% of GDP one year later. The performance of the fiscal deficit occurred on the strength of a pick-up in indirect taxes. Consumer imports yielded a $47 million expansion in consumption taxes and import duties. Imports of motorcars, which doubled in 1982, were primarily responsible for the upsurge. It was also the first time that consumption taxes had overtaken import duties as the leading component of indirect taxes.

The rise in economic activity of 1983 continued into 1989, resulting in seven consecutive years of economic growth. During these years, indirect taxes rose on average by 13% with a high of 18.0% in 1985. Its ratio to tax revenue reached the highest level of 67% in 1987. In addition to consumption taxes and import duties, stamp duties played an important part in boosting Government revenue during this period especially after its rate was raised from 3% in 1983 to 5% in April 1984 and again in October 1984 to 10 percent. Indeed in 1982, the ratio of stamp duties to indirect taxes amounted to a mere 1.9% but seven years later, this ratio had risen to as much as 17.4%. Also, by end-1989, indirect taxes accounted for 58% of total revenue.

At the same time that Barbados' major trading partners entered a recession, real output in Barbados contracted by 3.3% in 1990, ending seven years of economic expansion. This was also a year characterized by large fiscal as well as external current account deficits. During this year, indirect taxes went down by almost 10%. According to the Annual Central Bank Report (1990), consumption taxes were the most affected by the contraction in dutiable imports, decreasing by 10%. Stamp duties went down by $3.9 million as a result of the decline in dutiable imports and

shifts to CARICOM goods, which carried much lower duties than non-CARICOM products. Import duties fell by $18 million, a reflection of lower consumer imports that attracted a higher rate of duty. The $3 million decrease in hotel and restaurant taxes mainly reflected the contraction in tourism activity.

The foreign exchange difficulties experienced by Barbados in 1990 deepened in 1991 as output in the export sectors remained depressed. In an effort to correct the foreign exchange deficiency, Government implemented an eighteen-month stabilization programme with the support of the International Monetary Fund (IMF). The programme sought, among other things, to reduce spending on imports in the short term through reductions in the fiscal deficit and private sector credit. Indirect taxes made a worthwhile contribution to the reduction of the fiscal deficit from 8.2% in 1990 to 1.6% one year later. This expansion of 5% was achieved even in the face of the introduction of the Common External Tariff (CET), on account of new revenue measures. Three separate increases in the rate of consumption tax boosted receipts from this category by 12% while miscellaneous revenue inflows were up by 11%. On the contrary, import duties fell by 10% as dutiable imports decreased and the CET took effect. Revenue from stamp duties was lower than in 1990, reflecting a drop in imports in the last half of 1991 while revenue from hotel and restaurant sales tax contracted by $1.2 million as the tourism sector remained depressed.

One year later, in 1992, indirect tax receipts were affected by declining activity and decreased by 6.9%. The only major category that expanded was consumption taxes, up by 0.8%. Import duties suffered from the combined effect of the reduction in the CET introduced in 1991 and a severe downturn in the demand for dutiable imports. Hotel and restaurant taxes once more declined in line with sluggish tourist expenditure while stamp duties also contracted. The ratio of indirect taxes to tax revenue fell to 52.3% from 53.5% one year earlier.

The Barbadian economy recorded eight consecutive years of growth from 1993 to 2000. During this period, indirect taxes grew an average by 8.8%. The most significant increase in indirect taxes occurred in 1997 when they expanded by 36.1%. It was during this year that a major reform in indirect taxation took place with the implementation of the broad based value-added tax (VAT) on virtually all goods and services in January. The tax was supposed to be almost revenue neutral but revenue growth exceeded expectations because of strong economic activity and ef-

ficient tax administration. Consequently, the VAT and excise taxes, which replaced consumption taxes and stamp duties as the principal source of indirect tax revenue, yielded $557.8 million. Import duties went up by $35 million while, despite its abolition in 1997, residual consumption taxes yielded some $33 million (mainly arrears from 1996). Indirect taxes now accounted for 62% of total tax revenue.

The years 2001 and 2002 were marked by a weak economic outturn with real gross domestic product (GDP) declining on average by 2%. Indeed the fiscal deficit moved from 3.5% of GDP in 2001 to a huge 6.1% of GDP in the next year. Indirect taxes decreased by 1.6% in 2001 and remained virtually unchanged one year later. The major performance of indirect taxes during these two years occurred in the increased collection of import duties in 2002 (23.6%). These additional collections reflected the impact of a 60% tariff on certain categories of imports introduced in 2001. VAT increased on average by 0.2% while excise taxes fell sharply by 26.3% largely as a result of a decline in motorcar sales. At the end of 2002, indirect taxes constituted 56.3% of tax revenue.

The weak fiscal performance improved significantly in 2003 with the fiscal deficit falling to 3.1% of GDP. The resurgence in economic activity played a major role in this outturn. Direct taxes rose on the strength of a large pick-up in corporation taxes but indirect taxes increased by just over 11%, driven primarily by VAT revenues, import duties and excise taxes. The performance of excise taxes reflected rising motorcar imports while the expansion in import duties was due to increased demand for imported products.

## 3. MODEL SPECIFICATION, METHODOLOGY AND DATA

### a) Model specification

Following the above discussion, a model of indirect taxes can be expressed as follows:

$$LIT = F(LY, Dummy) \quad (1)$$
$$\qquad\qquad +\qquad -$$

where IT represents indirect taxes adjusted for the retail price index of Barbados, Y represents real domestic income and DUMMY is a dummy variable representing the period when the

indirect tax system was reformed. Real domestic income has been proxied by using real GDP of Barbados. It is expected to impact positively on indirect taxes for reasons explained earlier. The sign of dummy variable is assumed to be negative. When the new indirect tax structure was introduced in 1997, it was felt that it should be tax neutral. However, one can assume that if all other things remain constant, it may have a negative effect on indirect taxes given that some outstanding taxes will not be collected.

**b) Methodology and data**

A cointegration approach is being used for the estimation of the model. This involves (a) testing for cointegration, (b) testing over and exact identifying restrictions, and (c) using generalized impulse response analysis. This procedure is based on the maximum likelihood estimation of a vector autoregressive (VAR) system. Consider the following VAR of order p in the (n+1)- vector of variables $z_t$:

$$(2) \qquad z_t = a + ct + \sum_{i=1} \phi_i z_{t-1} + \xi_t, \; t = 1,2,3,....$$

where a and c are (n+1) –vector of intercepts and trend coefficients and $\phi_i$ , i = 1,…p, are (n-1) × (n+1) matrices of coefficients. $Z_t$ is partition as $z_t = [E_t X'_t]$ where $E_t$ represents the dependent variable indirect taxes and $X_t$ is an n-vector of forcing variables, t = 1, 2, … $\xi_t$ is a vector of Gaussian errors. The very important assumption made here is that the roots of:

$|I_{n+t} - \sum_{i=1}^{p} + \Phi_i z^i| = 0$ either lie outside the circle unit $|z| = 1$ or satisfy the condition z = 1. Such an assumption allows the elements of $z_t$ to be of order zero, one or cointegrated. By the process of re-parameterizing, the unrestricted vector error correction form of (2) is given by:

$$(3) \qquad \Delta z_t = a + ct + \Pi z_{t-1} + \sum_{i=1}^{p-1} \acute{\Gamma}_i \Delta z_{t-1} + \xi_t, \; t = 1, 2,...,$$

where $\Pi = - (I_{N+1} - \sum_{i=1}^{p} \Phi i)$ and $\acute{\Gamma} = \sum_{j=t+1}^{p} \Phi j$, i = 1, …, p-1, are the (n+1)×

(n+1) matrices of long-run multipliers and short-run dynamics coefficients respectively.

Since the matrix Π controls the cointegration properties, the rank (r) of Π determines the number of cointegrating vectors in the system. There are three cases :

— Case 1: Π has full rank and any linear combination of $z_{t-1}$ is stationary. This allows us to estimate our normal VAR in levels.

— Case 2: Π has reduced rank, which implies that there are some linear combinations of $z_t$ that are stationary, so that $z_t$ is cointegrated. VAR in levels is consistent but inefficient (Koop et al, 1996) and a VEC must be estimated.

— Case 3: Π has zero rank, so that no linear combinations of $z_{t-1}$ are stationary. $\Delta z_t$ is stationary with no integration. In this case, a normal VAR in first differences can be estimated.

In case 2, the matrix Π can be expressed as $\Pi = \alpha\beta'$ where α and β are both (k+1) × (r ) matrices of full column rank; β is the matrix of cointegrating vectors and α is the matrix of "weighting elements".

The test statistics for determining the cointegrating rank, based on the hypothesis that the rank is at most (k-r) against the alternative that the rank is (k-r-1), are the trace statistics given by :

$$Q_t = -T \sum_{i=T-1}^{k} \log (1- \lambda_i)$$

and the maximum eigenvalue statistic given by $Q_{max} = -T \log (1-\lambda_{T-1}) = Q_t - Q_{t-1}$ where $\lambda_i$ is the largest eigenvalue. The critical values in both cases can be found in Osterwald-Lenum (1992).

Once the model has been estimated, its dynamics are investigated with the use of the impulse response (IR) functions to measure the time profile of the effect of shocks on future states of the system. An IR Function traces the effect of a one standard deviation shock to one of the innovations on current and future values of the endogenous variables. The responses which occur in the initial periods after the shock will explain the behaviour of the system in the short run, whereas the responses which occur in later periods will provide insights about the long run effects.

Two different IR functions can be computed, namely the standard Orthoganalised IR function popularized by Sims (1980) and

the Generalised IR function by Koop et al (1996) and Pesaran and Shin (1996). The Orthogonalised IRs are not unique and depend on the particular ordering of the VAR. This is so because the orthogonalised IRs are obtained by first employing a Cholesky decomposition of the covariance matrix of the shocks $\xi_t$ in equation 2 above, which creates a problem because the Cholesky decomposition is non-unique. Generalised IRs, by construction, circumvent the problem of dependence of the orthogonalised IRs on the ordering of the VAR. Emphasis is therefore being placed on the Generalised IR in this study.

This study utilizes annual data from the Annual Statistical Digest of the Central Bank of Barbados and the International Financial Statistics Yearbook of the IMF, from 1970 to 2003. The model is being estimated in logarithms. The data comprise indirect taxes, the retail price index of Barbados, real GDP of Barbados and real GDP of Barbados. The dummy variable is assigned values of zero prior to 1997 and values of one (1) thereafter.

**c) Results**

Since the main justification for embarking on cointegration analysis is to study the long-run co-movement of a group of variables. An investigation of the order of integration of the individual series has to be undertaken. All of the variables have been found to be integrated of the first order, that is, I(1). The results, with the use a study by Perron (1990) which looked at the mean changing unit root test, are shown in Table 1. Our attention is now turned to selecting the order of the VAR, $\rho$. Since our time period is short (thirty-three (33) observations), we cannot run the risk of over-paramerterisation and therefore choose to restrict the order of the VAR to two (2). In this case, care must be taken to ensure that the individual equations do not exhibit problems of serial correlation. The Akaike Information (AIC) and the Schwarz Bayesian Criteria (SBC) each select the order of one (1) with an intercept and trend. Furthermore, an examination of the residuals of the error correction model for serial correlation provide a

**TABLE 1.** AUGMENT DICKEY-FULLER (ADF) UNIT ROOT TEST

| | *Intercept and Trend (Level)* | *95% critical value* | *Intercept and Trend (First Difference)* | *95% critical value* |
|---|---|---|---|---|
| LIT | -0.23 | -3.595 | -4.31 | -3.612 |
| LY | -3.45 | -3.557 | -4.67 | -3.557 |

**TABLE 2.** TESTS FOR THE NUMBER OF COINTEGRATING VECTORS (TRACE STATISTICS)

| *Null* | *Alternative* | *Statistic* | *95% Crit. Value* |
|---|---|---|---|
| *r=0* | *r = 1* | *45.036* | *35.010* |
| *r < 1* | *r = 2* | *14.668* | *18.397* |
| *r < 2* | *r = 3* | *4.648* | *3.841* |

clean bill of health for the order of one (1). Hence this order has been chosen.

Table 2 provides the results for the test for cointegration based on the trace eigenvalue statistics. These strongly reject the null hypothesis that there exists no cointegration relationships between the variables (namely that r = 0), but indicate that there is one cointegration relationship between them. The maximum eigenvalue statistics were also calculated but not reported since they yielded the same conclusions. Maximum likelihood estimates of the cointegrating vector are obtained by imposing Johansen Exactly Identifying Restrictions. The main interest in these esti-

**TABLE 3.** LONG-RUN COINTEGRATING EQUATION (NORMALISED ON INDIRECT TAXES)

| | |
|---|---|
| LIT | 1.0000 |
| LY | 0.720<br>(0.098) |
| DUMMY | -0.108<br>(-0.048) |
| INTERCEPT | 8.7509 |

NOTE: Standard errors are given in parentheses.

**TABLE 4.** SPEED OF ADJUSTMENT FROM DISEQULIBRIA

| | |
|---|---|
| LIT | -0.709<br>(0.168) |
| LY | 0.542<br>(0.181) |
| DUMMY | -0.514<br>(0.513) |

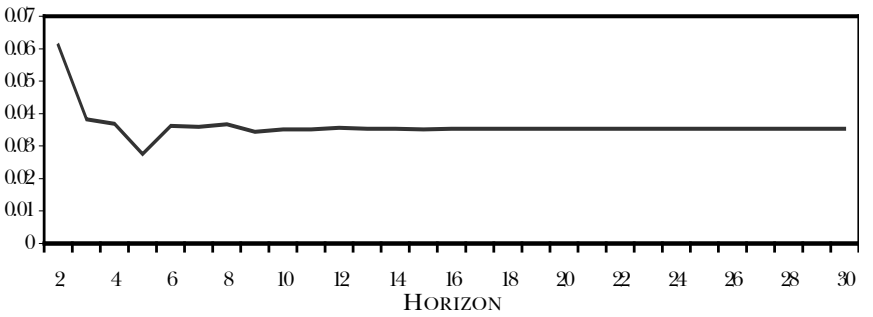
NOTE: Standard errors are given in parentheses.

mates is that all of the variables are statistically significant. It should be noted that the explanatory variables, foreign and local income are forcing variables (or weakly exogenous), since, when the system is in disequilibrium, equilibrium will then be achieved by the response of one or a combination of these variables.

Table 3 provides the results of the long-run cointegration equation normalized on real indirect taxes. It shows that real domestic income impacts positively on indirect taxes. A per unit increase in domestic income will boost indirect taxes by 0.73%. Also, domestic income has been found to be highly significant as indicated by the standard error value. There is an inverse relationship between the dummy variable and indirect taxes and the dummy variable is also significant at the 5% level. The error correction coefficient is negative and significant and its coefficient of 0.709 (shown in table 4) indicates that any disequilibria experienced by this model as a whole will be corrected by around 71% each year for a period of just over one year.

We now turn our attention to the impulse response function analysis, which in this case is the response of real indirect taxes arising from a shock to domestic income. The results are shown in figure 2. A standard error or unit shock to real domestic income (BY) will cause indirect taxes to rise above the original equilibrium by 6% in the first two years. Then there seems to be a downward movement in the three years that follow. This is indicated by a fall off to 3.8% in year 3, followed by a further fall-off to 3.6% in year 4 and 2.6% in year 5. This is followed by upward movements in indirect taxes between years 6 and 8 before some slowing down occurs in the ninth year. The new equilibrium of 3.4% is achieved in the tenth year. It means that any positive shock

**FIGURE 2.** RESPONSE OF INDIRECT TAXES TO DOMESTIC ECONOMIC ACTIVITY




SOURCE: Central Bank of Barbados.

to domestic income will increase indirect taxes by 3.4% in the long run.

What do this result imply? This model suggests that any positive shock to real domestic income will affect indirect taxes for a period of ten years prior to achieving equilibrium. The mere fact that the new equilibrium reached surpasses the original equilibrium is desirable since a higher indirect tax intake will occur. This result implies that it is in Barbados' interest to ensure that domestic economic activity can be boosted for as long a period as possible, since rising activity can lead to an expansion in incomes, which can in turn boost indirect tax revenues. However if such a reality is to occur, then it is imperative that good performances be required from the foreign exchange earning sectors. Foreign exchange is the lifeblood of the Barbadian economy and if the country is not earning adequate foreign inflows, then domestic incomes will have the potential to erode the country's foreign reserves and there would be a need in the circumstances to slow down economic activity. This also implies that the performance of the global economy will have a bearing on the policies used by Barbados to stimulate its domestic activity and by extension, domestic income.

## CONCLUSION

This paper has attempted to determine how indirect taxes respond to real domestic income with the use of an impulse response function using annual data from 1970 to 2003. The study shows that indirect taxes respond positively to changes in domestic income and that this explanatory variable is highly significant at the 5 percent level. When the impulse response was introduced, it showed that when a positive standard error shock was applied to domestic income, after a period of ten years, it caused indirect taxes to settle at a higher level of equilibrium than before, which is desirable. It is clear therefore from this model that domestic income earned by individuals in Barbados is important to Barbados if it attempts to address its fiscal issues by way of its indirect tax intake.

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