2001

MONEY AFFAIRS

VOLUME XIV, NUMBER 1, JANUARY-JUNE

CEMLA

MONEY AFFAIRS is a bi-yearly publication of the Centre for Latin American Monetary Studies (CEMLA), Durango nº 54, Mexico City, D. F., 06700. ISSN-0187-7615.

MONEY AFFAIRS is regularly listed in the International Current Awareness Service: Economics. Selected material is indexed in the International Bibliography of Economics.

MONEY AFFAIRS

VOLUME XIV, NUMBER 1, JANUARY-JUNE 2001

Joel Bogdanski
Alexandre Antônio Tombini
Sérgio R. da C. Werlang

Implementing Inflation Targeting in Brazil

1. INTRODUCTION

Brazil has recently put in place a new framework for monetary policy. After moving to a floating exchange rate system, the government defined inflation targets for the coming years and assigned to the Central Bank the responsibility and the operational independence to conduct monetary policy in order to meet the inflation objective.

Inflation targeting requires that monetary authorities adopt a forward-looking attitude and take preemptive action, given the lags between policy decisions and their effect on output and prices. In Alan Greenspan's words, "Implicit in any monetary policy action or inaction is an expectation of how the future will

Paper prepared by J. Bogdanski, Deputy Head, Research Department, A. A. Tombini, Head, Research Department and S. R. da C. Werlang, Vice Governor, all from the Central Bank of Brazil. *The paper was presented, at the V Meeting of the Network of America Central Banks Researchers, organized by the Banco Central do Brasil, in Rio de Janeiro, Brazil, October 16-17, 2000. The authors want to thank other members of the Central Bank's research team, in particular Fábio Araújo, Paulo Springer de Freitas, and Marcelo Kfoury Muinhos. Needless to say, that the views expressed here and any errors only are responsibility of the authors.*

unfold, that is, a forecast". Indeed, we believe that what inflation-targeting central banks actually do is inflation *forecast* targeting. Rather than reacting to present facts, monetary policymakers make decisions based on conditional forecasts of future inflation, conditional on alternative interest rate paths and on the best estimate of the current state of the economy and the probable future development of exogenous variables.

It is crucial to develop a basic modeling framework to allow policymakers to exercise their judgemental analysis in a structured and quantified way. Economic models are just another tool available to guide policy decisions under uncertainty about the state of the economy and the size and nature of the shocks that constantly hit it. Nonetheless, simple models can help clarify economic problems by focusing on a small number of factors thought essential for their understanding. In this paper, we present the basic modeling approach that has aided the monetary policy decision-making in the initial phase of the inflation-targeting regime in Brazil.

Section 2 describes the general institutional arrangements and operational framework adopted for inflation targeting. Section 3 describes the family of small-scale macroeconomic models that has been used for informing and disciplining discussions about monetary policy within the Central Bank. These models contain few equations and few variables, but carry a considerable theoretical content and provide a stylized representation of the monetary policy transmission mechanism. They are easily understood, and specially suitable for simulation of a wide range of issues. Section 4 deals with the basic requirements for running simulations. Section 5 presents brief conclusions.

2. THE BRAZILIAN IT FRAMEWORK

2.1 In search of a nominal anchor for monetary policy

The stabilization process in Brazil, initiated in mid-1994, successfully brought annual inflation down to one-digit figures in less than three years. This process included a wide program of economic reforms. For instance, the size of the public sector was substantially reduced in this period through privatization of state companies operating in sectors like telecommunications, chemistry, railroads, banking and mining. Likewise, the trade liberalization was deepened through reduction of import tariffs and elimi-

nation of non-tariff barriers. The financial system was submitted to a full-fledged restructuring with unsound institutions liquidated, merged or restructured and prudential regulation updated.

The main source of inflationary inertia, the automatic indexation of prices, wages and other contracts, was substantially reduced. Annual output growth averaged 3.4% in real terms in 1994-1998, even though unemployment started to rise in 1997.

However, despite its relative success, the stabilization process involved a gradualist approach towards many structural economic problems that remained unsolved. A much-needed definitive fiscal adjustment was continually postponed because, in part, the government coalition was not sufficiently convinced of its urgency. So, Brazil remained vulnerable to a confidence crisis, which became a reality when the international financial turmoil culminated with the Russian moratorium in August 1998. The confidence crisis generated a large capital flight from emerging markets. Brazil raised short-term interest rates and announced a strong tightening of the fiscal regime. At the same time, the government negotiated a preventive financial support package with the IMF, totaling US$ 41.5 billion.

The government was initially successful in implementing the fiscal package, but market confidence continued to erode up to January 1999, also reflecting concerns over the newly elected governors' commitments to adjusting their states public finances. Following strong pressures on foreign exchange reserves, the Central Bank was forced to abandon the crawling peg to the dollar.[1] After a brief attempt to conduct a controlled devaluation, the *real* was forced to float on January 15. As a consequence of this abrupt change in regime, most of the Central Bank's Board of Directors was replaced. Due to Brazilian peculiarities, the new Board took office only in the beginning of March.[2]

In the absence of a well-defined guidance for monetary policy, the exchange rate averaged R$1.52/US$1 in January and R$1.91/US$1 in February, compared with R$1.21/US$1 prior to

[1] The official exchange rate policy at that time consisted of an intended nominal devaluation of 7.5% p.a., while annual inflation was near 2%.

[2] In Brazil, the Federal Senate must formally approve the nominees to the Central Bank's Board. The process consists of two steps. The first is a preliminary open hearing in the Committee of Economic Affairs. The second is a discussing and voting session, where the 81 Senators decide by simple majority whether to approve or reject the nominee. Although the Government coalition has a large majority in the Senate, the process is time consuming.

the change in regime. Inflation rose sharply: the wholesale price index increased 7.0% in February, while the consumer price index rose 1.4%. This led private analysts to foresee a huge deterioration of all macroeconomic fundamentals.

The new Board took office on March 4th and immediately worked on two main fronts. The first was to calm down the nervous financial markets. The expectation that an inflation hike could bring the real rates of return on public debt instruments to the negative range was the first to be attacked.

The Monetary Policy Committee (Copom), whose members are the Governor and Deputy Governors, decided to raise the basic short-term interest rate (*Selic*) from 39% p.a. to 45% p.a., taking into account that the future contracts for the next maturity were already trading at 43.5%. An important novelty was introduced, the bias on the interest rates, which delegated to the Central Bank's Governor the power to change interest rates during the period between two ordinary Committee meetings (they used to be 5 weeks, prior to the adoption of the inflation targeting framework). The Copom established a downward bias, meaning that interest rates could be lowered at any time before the next scheduled meeting.[3]

For the first time, also, the Committee released a brief explanation right after the meeting (the minutes used to be released only after 3 months). Its initial words were "*maintaining price stability is the primary objective of the Central Bank*". And it went on to say that: *"(1) in a floating exchange rate regime, sustained fiscal austerity together with a compatible monetary austerity support price stability; (2) as fiscal policy is given in the short run, the control over inflationary pressures should be exerted by the interest rate; (3) observed inflation is due to the currency depreciation, and markets expect a further rise in the price level this month; (4) the basic interest rate should be sufficiently high to offset exchange-based inflationary pressures; and (5) so, we decided to raise the basic interest rate to 45% p.a., but with a downward bias, for if the exchange rate returns to more realistic levels, keeping the nominal interest rate that high would be unjustified.*" Indeed, the bias was used twice before the next meeting: the interest rate was reduced first to 42% and then to 39.5%, following a reversal of the exchange rate overshooting and a reduction both in observed and expected inflation rates.

[3] On the other hand, under a downward bias, if the Governor needs to raise interest rates, an extraordinary Copom meeting must be called to take the decision.

The second front was the initiative to propose the adoption of inflation targeting as the new monetary policy regime. Although it is clear from the Copom's press release that IT was already in the minds of the Board's members, there was a lot of work to do in the institutional area. For example, the Central Bank has never been granted formal instrument independence to conduct monetary policy. Moreover, even at the Bank, very few staff members knew what an IT framework was about. The technical skills needed to develop adequate inflation-forecasting models were scattered unevenly throughout the Bank's departments. In particular, there was no Research Department: each department used to make its own research efforts, usually to solve immediate demands and not devoted to think coherently about the future.

Once these problems were detected, their solution was straightforward. The new floating exchange rate clearly required a new nominal anchor for economic policy. Monetary policy, along with strengthened fiscal adjustment and a firm wage policy in the public sector, would be instrumental in preventing the recurrence of an inflationary spiral and ensuring a rapid deceleration of the rate of inflation. Inflation targeting was the most suited framework to achieve economic stabilization under a flexible exchange rate regime, with the target itself playing the role of the nominal anchor. With sound arguments, it was not difficult to convince the President, the Finance Minister, and their senior economic advisors that IT could work well in Brazil. The IMF staff was most receptive to the proposed new framework for monetary policy, and showed interest in organizing an international seminar on IT, where the discussions could benefit from the experience of a number of central banks and academics.

Within the Central Bank, a Research Department was created by the end of March. Initially, three research areas were opened: IT, financial risk and pricing and microeconomics of banking. The IT group, consisting of 14 researchers, started to study the literature.

Two key books were very useful: Bernanke et al. (1998), *Inflation Targeting: Lessons from the International Experience*, Princeton University Press, and Taylor, John B. (ed.) (1999), *Monetary Policy Rules,* University of Chicago Press. Some other articles and books entered a "minimum kit", a mandatory reading for anyone in the group. (i) General readings and cases: King, Mervyn (1997), *The Inflation Target Five Years On*; Massad, Carlos (1998), *La Politica Monetaria en Chile*; Masson, P. R. et al (1997), *The Scope for Infla-*

tion Targeting in Developing Countries; Taylor, John (1999), *A Historical Analysis of Monetary Policy Rules*. (ii) Optimization models: Backus, David et al (1986) *The Consistency of Optimal Policy in Stochastic Rational Expectations Models*; Currie, David et al (1993*), Rules, Reputation and Macroeconomic Policy Coordination*; Svensson, Lars (1998*), Open-Economy Inflation Targeting.* (iii) Applied work: Taylor, John (1993) *Discretion versus Policy Rules in Practice*; Taylor, John (1994), *The Inflation/Output Variability Trade-off Revisited.*

After careful planning, the IT group started to work in the design of the institutional framework and the modeling of the transmission mechanism of monetary policy. Brazil has greatly benefited from the discussions and consultations held during the Seminar on Inflation Targeting, jointly organized by the Central Bank of Brazil and the IMF's Monetary and Exchange Affairs Department, which took place in Rio de Janeiro (May 3-5, 1999).[4] A general consensus that emerged during that meeting can be summarized as follows:

> "*Low and stable inflation was singled out as the primary long-run objective of monetary policy, and inflation targeting was regarded as an effective framework for guiding monetary policy. In particular, inflation targeting was seen as providing a nominal anchor both for monetary policy and inflation expectations, making this anchor identical to the long-run objective of monetary policy; providing more transparency and accountability to the design and implementation of monetary policy; facilitating its communication, understanding, and assessment; and providing effective policy guidance by focusing policymakers' attention on the long-run consequences of short-term policy actions.*" (Brazil – Selected Issues and Statistical Appendix – International Monetary Fund, July 16th, 1999).

2.2 General setting

On July 1st, 1999, Brazil formally adopted inflation targeting as the monetary policy framework. The President of Brazil issued Decree No. 3088 of June 21, 1999, whose key points are listed bellow.

On June 30th, 1999, the National Monetary Council (CMN) is-

[4] The objective of the seminar was to review the experience of a number of developed and emerging economies in implementing inflation targeting, and to provide an opportunity for Brazilian economists and policymakers to discuss plans to implement a similar framework in Brazil. Experts from Australia, Canada, Chile, Israel, Mexico, New Zealand, Sweden, United Kingdom, and United States made presentations on their country's experiences. Researchers from the Central Bank of Brazil presented their initial work on inflation targeting, entitled "Issues in the Adoption of an IT Framework in Brazil", May 1999.

- *The inflation targets will be established on the basis of variations of a widely known price index;*
- *The inflation targets as well as the tolerance intervals will be set by the National Monetary Council on the basis of a proposal by the Finance Minister;*
- *Inflation targets for the years 1999, 2000, and 2001 will be set no later than June 30, 1999; for the year 2002 and subsequent years targets will be set no later than June 30, two years in advance;*
- *The Central Bank is given the responsibility to implement the policies necessary to achieve the targets;*
- *The price index that would be adopted for the purposes of the inflation targeting framework will be chosen by the National Monetary Council on the basis of a proposal by the Finance Minister;*
- *The targets will be considered to have been met whenever the observed accumulated inflation during the period January-December of each year (measured on the basis of variations in the price index adopted for these purposes) falls within the tolerance intervals;*
- *In case the targets are breached, the Central Bank's Governor will need to issue an open letter addressed to the Finance Minister explaining the causes of the breach, the measures to be adopted to ensure that inflation returns to the tolerated levels, and the period of time that will be needed for these measures to have an effect; and*
- *The Central Bank will issue a quarterly inflation report which will provide information on the performance of the inflation targeting framework, the results of the monetary policy actions, and the perspectives regarding inflation.*

sued a Resolution[5] on the definition of the price index as well as on the inflation targets. The Broad Consumer Price Index (IPCA) reported by the National Bureau of Geography and Statistics (IBGE) was chosen for the purpose of gauging inflation targets. The targets were set at 8% for 1999, 6% for 2000 and 4% for 2001 – accumulated annual variations by the year-end. Tolerance intervals of ±2% for each year were also defined.

The selected price index – IPCA – covers a sample of families with personal income between 1 and 40 minimum wages and has a broad geographical basis. It includes 9 metropolitan areas (São

[5] Resolution No. 2615.

Paulo, Rio de Janeiro, Belo Horizonte, Porto Alegre, Recife, Belém, Fortaleza, Salvador and Curitiba) as well as Goiânia and the Federal District.

The rationale behind the adoption of decreasing targets between 1999 and 2001 had to do with the nature of the recent inflation in Brazil. It is important to distinguish between an inflationary process and a temporary inflation rise due to a shock. In the first case, there is a continuous acceleration in the price level. In the second, there may be only a once-and-for-all change in the price level, with no further upward pressure. The Brazilian case belongs to the second category: the currency devaluation that started in mid-January 1999 was a shock that forced a realignment of relative prices. Before it occurred, Brazil was experiencing price stability: average CPI inflation was 1.7%[6] in 1998.

As there were no indications of the presence of an inflationary process in Brazil, a gradualist disinflation strategy was not recommendable. The CPI inflation rate should return to its 1998 level as soon as the relative prices realignment is finished. Thus, it was not only possible but also desirable for the government to set a decreasing inflation target path.

An important issue to discuss is the choice of the full inflation rate as reference for the target, and not some core inflation measure. Perhaps, the best technical procedure would have been to purge some items from the full index, exempting it from temporary and once-and-for-all shocks. Nevertheless, adopting a headline index was essential for credibility reasons, at least in the beginning of IT implementation. Unfortunately, Brazilian society has experienced several price index manipulations in a not so distant past, and so would be suspicious about any change related to suppressing items from the target index.

Another related issue is the absence of escape clauses in the institutional arrangement. In the case the targets are breached, the Central Bank Governor will be required to issue an open letter addressed to the Minister of Finance explaining the underlying causes, the measures to be adopted to ensure convergence to the targets and the time period required for these measures to have an effect.

The combination of the use of headline inflation and the absence of escape clauses justifies the adoption of the relatively wide 2-percentage point tolerance interval around the central target,

[6] In the case of CPI measured only in São Paulo city by IPC/FIPE, inflation was negative (-1.8%) in 1998.

and certainly makes the announced targets much tighter than they may initially appear.

It is important to emphasize that monetary policy decisions should be taken on the basis of the widest information set available. Therefore, a mix of models should be under consideration when looking for an adequate reaction function, and producing inflation forecasts and their probability distributions. It should also include private sector perceptions about the expected path of economic variables, extra-model information, leading indicators and any other judgmental knowledge that helps predict inflation.

A final issue is the transparency of the IT framework. As part of the initial setting, an effective communication process was established so that the population will be able to understand and monitor the decisions of the Central Bank and to know the reasons why forecasted and accumulated inflation may be deviating from target.

The Copom meets at regular monthly intervals and decisions are taken by majority vote. The decisions are announced immediately after the meeting ends, sometimes followed by a press release explaining briefly the reasons why the decisions were taken. In the second half of 1999, the Copom minutes were published 2 weeks after the meetings. In the beginning of 2000, this interval has been reduced to only one week.

Finally, there is a quarterly inflation report discussing the main issues related to the performance of the inflation-targeting regime.[7] It includes detailed explanations of the results delivered by past decisions and a prospective analysis for future inflation, with special emphasis on the assumptions made in the forecasting process that generated the monetary instrument decisions. Minutes of the previous Monetary Policy Committee meetings are republished in the report.

2.3 Operational framework

The Research Department of the Central Bank of Brazil has developed a set of tools to support the monetary policy decision process. Among them are small-scale structural models of the transmission mechanism of monetary policy to prices, comple-

[7] Copom has already issue three Inflation Reports – June 30th, September 30th, and December 30th. They are available at the Central Bank homepage – http://www.bcb.gov.br.

mented with short-term inflation forecasting models. There are also surveys of market expectations of inflation, growth, and other relevant economic variables, collected by the Economic Department.

In order to build small structural macroeconomic models, the Central Bank studied the various channels of transmission of monetary policy. These include the interest rate (a policy instrument), the exchange rate, aggregate demand, asset prices, expectations, credit and money aggregates, wages, and wealth. Given the macroeconomic characteristics of the Brazilian economy, the main conclusions are the following: (i) interest rate affects consumer durables and investment in a period between 3 to 6 months. Moreover, the output gap takes additional 3 months to have a significant impact on inflation. In sum, the monetary policy transmission through the aggregate demand channel takes between 6 to 9 months to fully operate; and (ii) through a direct channel: changes in nominal interest rate affects contemporaneously nominal exchange rate, and the later affects, also contemporaneously, inflation rate, through imported inflation; (iii) given historical low leverage of the Brazilian corporate sector along with the very strict credit and monetary policies implemented with the *Real* plan, the credit mechanism has not operated and its importance in terms of channeling interest rate impacts on inflation has been negligible.[8]

The structural models are complemented by a set of short-term models. These complementary models include Vector Autoregressive (VAR) models and Autoregressive Moving Average (ARMA) time-series models and serve three basic purposes: (i) providing an alternative short-term forecast for the inflation rate and, therefore, permitting a consistency check with the forecasts resulting from the structural models; (ii) permitting the use of the inflation forecast resulting from these models for the purposes of estimating (with the structural model) the ex-ante interest rate (which is an explanatory variable in the aggregate demand equation in some of the estimated structural models), as well as in the forward-looking interest rate rule (which is one of the equations in the structural models); and (iii) allowing to simulate shocks to

[8] With recent measures aimed at reducing the difference between borrowing and lending rates (bank spreads), the credit channel will certainly become important for the operation of monetary policy under the IT framework. See study published by the Research Department of Central Bank of Brazil *"Juros e Spread Bancário no Brasil"*, October 1999 (available at http://www.bcb.gov.br).

specific components of the IPCA, like for instance, changes in prices set by the public sector.

3. THE BASIC MODELING APPROACH

Benefiting from international advice, gathered during the Seminar on Inflation Targeting and on consultations with the Bank of England, the Central Bank has estimated/calibrated a group of structural models with the main objective of identifying and simulating the mechanism of monetary policy transmission in Brazil, including the main channels of transmission as well as the lags involved.

A simple structural model with the following basic equations can summarize this family of models:

i) an IS type equation expressing the output gap as a function of its own lags, real interest rate (*ex ante* or *ex post*), and real exchange rate;[9]

ii) a Phillips curve expressing the rate of inflation as a function of its own lags and leads, the output gap, and the nominal exchange rate (and imposing the long-term neutrality condition);

iii) an uncovered interest parity condition relating the differential between external and domestic interest rates with the expected rate of devaluation of the domestic currency (the *Real*), and the risk premium; and

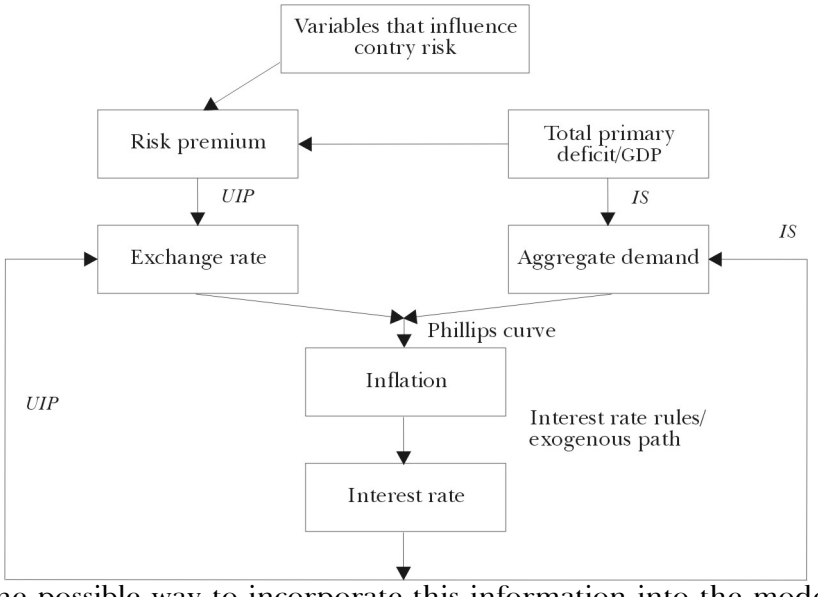
iv) an interest rate rule, alternatively fixed rules on nominal or real interest rates, Taylor-type rules (with weights for contemporaneous deviations in inflation and output), forward-looking rules (with weights for deviations of expected inflation from the target), and optimal deterministic and stochastic rules.

This family of models allows several reduced-form specifications, depending on which issues the Copom wants to discuss in detail. An example may clarify the modeling approach used in Brazil. Suppose that the government is fully committed to a fiscal adjustment, so that the targets for the primary surplus of the con-

[9] Due to the relevant sample period used in the process of estimation, which involved a managed exchange rate regime, and due to the small relative weight of net exports (when compared to the other components of aggregate demand), the real exchange rate was not found statistically significant.

solidated public sector will be observed. In this case, the fiscal policy will produce important effects on aggregate demand, which should be explicitly taken into consideration.

FIGURE 1. MODEL DIAGRAM



One possible way to incorporate this information into the model is to include a fiscal variable directly in the IS equation. In this specification, two variables represent policy instruments: the interest rate and the primary fiscal surplus. The first is a Central Bank instrument and the second is a Treasury instrument. The diagram in Figure 1 summarizes these assumptions, showing the basic relationships involved.

IS curve

The standard specification of an IS curve could be, in a quarterly frequency:

(I) $$h_t = \beta_0 + \beta_1 h_{t-1} + \beta_2 h_{t-2} + \beta_3 r_{t-1} + \varepsilon_t^h$$

where:

$h \rightarrow$ log of output gap
$r \rightarrow$ log of real interest rate [log(1+R)]
$\varepsilon^h \rightarrow$ demand shock.

The addition of a fiscal variable can be accomplished by including the term $pr \rightarrow$ log of (1+) public sector borrowing requirements (PSBR), primary concept, as a percentage of GDP:

$$h_t = \beta_0 + \beta_1 h_{t-1} + \beta_2 h_{t-2} + \beta_3 r_{t-1} + pr_{t-1} + \varepsilon_t^{hf} \quad \text{(II)}$$

$\varepsilon^{hf} \rightarrow$ demand shock.

First of all, the output gap historical series should be constructed. It is usual to start with a measure of potential output. Several techniques are commonly used to calculate potential output: 1) the extraction of a linear time trend from historical GDP data; 2) smoothing out the GDP series through filters like Hodrick-Prescott; 3) Kalman filters; and 4) estimates of production functions. In the Brazilian case, the linear trend and HP filter were preferred since both produced similar results. The output gap was then obtained by the difference between actual and potential GDP, allowing a direct estimate of the "fiscal" IS curve.

Long run calibration of the IS curve

In order to estimate the demand side of the reduced-form structural model, a quarterly data sample between 1992:I and 1999:III was selected. Hence, the estimation results were heavily influenced by post-*Real* Plan data (1994:III to 1998:IV). It should be noted that the *Real* Plan was implemented along with a managed exchange-rate regime that was very instrumental in reducing inflation and keeping it low. However, domestic interest rates were basically set with the objective of maintaining the managed exchange-rate parity.

In this "old regime", the exchange rate had the role of a nominal anchor to stabilize inflation, while monetary policy was conducted to attain a balance of payments position compatible with the desired parity. In sum, without judging the success of this old regime in terms of inflation stabilization and its sustainability over time, it is reasonable to conclude that equilibrium real interest rate were necessarily high. This is not necessarily the case in an environment of high international liquidity. Nevertheless, between the end of 1994 and the beginning of 1999 emerging economies faced several episodes of worsening in the external financial conditions.

Under the floating exchange rate regime (in place since January, 1999) and the inflation-targeting framework (as of July, 1999), it is reasonable to state that equilibrium real interest rates

should differ substantially from what they were in the previous regime. The transition effects due to the new equilibrium level of real interest rates called for a long-term calibration of the demand side reduced-form model.

The calibration is straightforward. In the long-run steady state, the ratio of government debt to GDP should remain constant, along with a balanced budget (zero primary fiscal surplus) and zero output gap. This implies that the long-term equilibrium real interest rate must equal the potential GDP growth rate. In the "fiscal" IS curve specification, this is equivalent to $\bar{r} = -\beta_0/\beta_3$. So, the long-run calibration can be done by estimating the "fiscal" IS curve with the additional restriction on the pair (β_0,β_3), whose ratio must equal the long-term equilibrium real interest rate.

Phillips curve

The supply side of the economy is usually modeled with a Phillips curve specification, directly relating price inflation to some measure of real disequilibrium (typically the output gap), inflation expectations, and real exchange rate changes. Three variants are presented below. The coefficients α on the right side of all equations, except for the output gap one, are constrained to sum to unity to ensure the long-run verticality of the Phillips curve, i.e. that inflation is neutral with respect to real output in the long run.

Backward-looking specification

$$\text{(III)} \qquad \pi_t = \alpha_1^b \pi_{t-1} + \alpha_2^b \pi_{t-2} + \alpha_3^b h_{t-1} + \alpha_4^b \Delta(p_t^F + e_t) + \varepsilon_t^b$$

Forward-looking specification

$$\text{(IV)} \qquad \pi_t = \alpha_1^f \pi_{t-1} + \alpha_2^f E_t(\pi_{t+1}) + \alpha_3^f h_{t-1} + \alpha_4^f \Delta(p_t^F + e_t) + \varepsilon_t^f$$

Combined (average) specification

$$\text{(V)} \quad \pi_t = \frac{(\alpha_1^f + \alpha_1^b)}{2}\pi_{t-1} + \frac{\alpha_2^f}{2}E_t(\pi_{t+1}) + \frac{\alpha_2^b}{2}\pi_{t-2} + \frac{(\alpha_3^f + \alpha_3^b)}{2}h_{t-1} + \frac{(\alpha_4^f + \alpha_4^b)}{2}\Delta(p_t^F + e_t) + \varepsilon_t^n$$

where:

$\pi \rightarrow$ log of price inflation
$h \rightarrow$ log of output gap
$p^F \rightarrow$ log of foreign producer price index
$e \rightarrow$ log of exchange rate
$\Delta \rightarrow$ first-difference operator

$E_t(\cdot)\rightarrow$ expectation operator, conditional on information available at time t
$\varepsilon^b, \varepsilon^f, \varepsilon^n \rightarrow$ supply shock.

The backward-looking specification can be motivated by the assumption of adaptive inflation expectations. It is simple to estimate and, with only two lags, it is able to reproduce fairly well the rich inflation dynamics of past data. However, it is vulnerable to the Lucas critique. Its predictive power should be weak due to the recent changes in monetary policy and exchange-rate regimes, which probably have altered the formation of inflation expectations and the short-run inflation/output tradeoff.

The forward-looking specification is an attempt to overcome the parameter instability commonly found after structural breaks. It is also motivated by the natural assumption that, as the inflation targeting regime gains credibility, expectations tend to converge to the targeted value. However, it raises difficult estimation issues about the appropriate measures of expectations, specially when reliable survey data are not available.

Different assumptions about the expectations mechanism were tested, but in general the estimations led to a weighted average of past and future inflation, with at least 60% on the forward-looking component. Neither the research staff nor the Copom members were comfortable with these results for two reasons. First, they implied a degree of credibility that was not expected to be achieved so early and they did not match the current surveys of market expectations. Second, they generate an inflation/output dynamics with almost no inertia and consequently a fast adjustment of both real and nominal variables, which is not believed to yield a reasonable representation of reality.

A solution to balance out the forward and backward-looking variants was to combine them. The average of the previous two specifications of the Phillips curve (together with the other equations in the complete model) exhibits the desired dynamic properties of the economy, with inflation persistence due to sluggish adjustment forced by the backward-looking terms, while keeping a forward-looking component thought to be increasingly important in the transition period after the changes in monetary policy and exchange-rate regimes.

For the purpose of running simulations to investigate the implications for inflation and output of different monetary policy rules, it is easy to experiment with alternative assumptions about the expectations' formation mechanism. For example, expecta-

tions can be taken exogenously from a market survey, together with an additional hypothesis about how they react to new information. Or expectations can be calculated recursively in order to be model-consistent.

The passthrough

The passthrough of exchange rate changes to domestic inflation is a key issue in the Phillips curve set-up. Several linear and non-linear specifications for the passthrough coefficients have been tested, reducing to four the alternatives implemented in the preferred simulation tool. The first one is a standard constant coefficient; simply estimated from a suitable sample of past data. The second one is a quadratic transfer from exchange rate variations to inflation. The third one is a level-dependent coefficient. It is estimated under the assumption that the passthrough depends also on the level of the (log) nominal exchange rate. The last one is a quadratic function of the nominal exchange rate level, motivated by a simple partial equilibrium model in which exchange-rate devaluations shift the supply curve of competitive producers of tradable goods.[10] All non-linear variants intend to capture more precisely the effects of a temporary exchange rate overshooting.[11] For the small number of observations available in a quarterly frequency, however, their results were very close to the linear variant and consistent with international evidence that the passthrough coefficient is inversely proportional to the degree of real exchange rate appreciation at the moment prior to the devaluation. The equations below summarize the four alternative specifications.

$$\alpha_4 = \text{constant}$$

$$\alpha_4 = (\alpha_{41} + \alpha_{42}\Delta(p^F_{t-1} + e_{t-1}))$$

$$\alpha_4 = (\alpha_{41} + \alpha_{42}e_{t-1})$$

$$\alpha_4 = \alpha_{41}\frac{E^2_{t-1} - \alpha_{42}}{E^2_{t-1} + \alpha_{42}}$$

where:

$p^F \rightarrow$ log of foreign producer price index.

[10] See Goldfajn and Werlang, 1999.

[11] Dornbusch, 1976, presents the overshooting result in a different context.

$e \rightarrow$ log of exchange rate.
$E \rightarrow$ exchange rate (*R$/US$*).

Exchange Rate - Uncovered Interest Parity

The nominal exchange rate is determined by the uncovered interest parity condition, which relates expected changes in the exchange rate between two countries to their interest rates differential and a risk premium:

(VI) $$E_t e_{t+1} - e_t = i_t - i_t^F - x_t$$

where:
$e \rightarrow$ log of exchange rate
$i \rightarrow$ log of domestic interest rate
$i^F \rightarrow$ log of foreign interest rate
$x \rightarrow$ log of risk premium

Taking the first difference $E_t e_{t+1} - E_{t-1} e_t - \Delta e_t = \Delta i_t - \Delta i_t^F - \Delta x_t$ and assuming for simplicity that the expectation change follows a white noise process[12] $E_t e_{t+1} - E_{t-1} e_t = \eta_t$, it is possible to specify the exchange rate dynamics as:

(VII) $$\Delta e_t = \Delta i_t^F + \Delta x_t - \Delta i_t + \eta_t$$

There are two exogenous variables in this equation: the foreign interest rate and the risk premium. Given the relative stability of foreign interest rates, reasonably accurate projections can be obtained from contracts traded in international futures markets. However, the risk premium – which can be measured by the spread over Treasury bonds of Brazilian sovereign debt – has presented high volatility in the last years. The risk premium is usually associated to macroeconomic fundamentals and a number of other subjective factors that are not easily anticipated. Hence, two alternative approaches have been considered. The first is to gather the opinions of Copom members about the future evolution of the country's risk premium, conditional on the overall scenario and based on anecdotal evidence, translating it to an exogenous expected path that will be used in simulations. The second approach is to make assumptions linking the risk premium

[12] This is equivalent to a random walk with monetary surprise, where a surprise is characterized by changes in interest rate differentials or in risk perception.

behavior to the main objective factors thought to influence it, letting it be endogenously determined by the model.

An assumption consistent with the "fiscal" IS curve is that the risk premium will respond to the fiscal stance, with any perceived improvement in the consolidated public sector fiscal position reducing the premium accordingly. Additionally, a number of other factors may have a considerable influence on expectations and hence, on the risk premium. A list of these factors would typically include international liquidity conditions and interest rates, foreign capital markets performance, commodities prices, current account balance perspectives, and country rating. The link with the UIP condition is through the following equation:

$$\text{(VIII)} \qquad \Delta X_t = \gamma_1 \Delta X_{t-1} + \gamma_2 \Delta PR_{t-3} + \sum_{j=3}^{n} \gamma_j \Delta Z_{j,t-t_j}$$

where:

$X\rightarrow$ risk premium in basis points (SoT)

$PR\rightarrow$ PSBR, primary concept, as a percentage of GDP

$Z\rightarrow$ variables that influence country risk.

Monetary policy rules

The primary instrument of monetary policy is the short-term interest rate set by the Central Bank. To run a simulation in any of the model variants, it is necessary to choose a monetary policy rule. The rules can be divided in three basic families: fully exogenous interest rate paths, linear combination of system variables and optimal response functions.

Fully exogenous interest rate path

This family of rules provides a direct way to input any interest rate path in the model. This is useful to analyze the consequences of an expected interest rate trajectory, such as that implied by financial market instruments or the implicit path considered in the government budget.

A particular rule of this family can be very helpful for institutional communication. The quarterly Inflation Report traditionally presents inflation and output growth forecasts constructed under the assumption that the short-term interest rate will remain constant at the current level along the projection period. This projection is made clear by means of an inflation fan chart,

which shows the probability distribution around the central forecast for each quarter. By visual inspection, it is possible to infer whether monetary policy should be altered and in which direction.

Linear combination of system variables

The interest rate rule in this family is a linear function of some system variables. For example, monetary policy can react contemporaneously to output gap and deviations of inflation from target, as shown in the equation below. When $\lambda=1$, this is equivalent to a standard Taylor rule, while when $\lambda\in(0,1)$ this is a Taylor rule with interest rate smoothing. The α´s can be set arbitrarily or using specific optimization procedures available in the simulation tool.

$$\text{(IX)} \qquad i_t = (1-\lambda)i_{t-1} + \lambda(\alpha_1(\pi_t - \pi^*) + \alpha_2 h_t + \alpha_3)$$

where:
$\pi \rightarrow$ log of inflation.
$\pi^* \rightarrow$ log of inflation target.
$h \rightarrow$ log of output gap.
$i \rightarrow$ log of interest rate.

This type of rule is instrumental to analyze the system behavior under the choice of a particular set of α´s. However, the set of α´s obtained by optimization procedures can frequently be very unintuitive.[13]

Optimal Trajectories

An optimal rule can be found using two basic optimization methods available for simulation. The first one is a deterministic optimization made considering the expectation for the system variables equivalent to the model own realizations. The second uses stochastic simulation. In the deterministic case, the objective function is given by equation (X), and in the stochastic case it is given by equation (XI). Notice that due to the certainty equivalence principle, for linear constrains, equations (X) and (XI) are equivalent.

$$\text{(X)} \qquad L = \sum_{r=1}^{N}[\lambda_1(E(\pi_{t+r}) - \pi^*_{t+r})^2 + \lambda_2\left[E(h_{t+r})\right]^2 + \lambda_3(\Delta i_{t+r})^2]$$

[13] See Svensson, 1997.

$$\text{(XI)} \qquad L = \sum_{r=1}^{N} [\lambda_1 E[(\pi_{t+r} - \pi^*_{t+r})^2] + \lambda_2 E(h^2_{t+r}) + \lambda_3 (\Delta i_{t+r})^2]$$

These two optimization methods may be used with a fully arbitrary interest rate trajectory[14] or with a trajectory given as function of inflation, output gap and the lagged interest rate.

The deterministic case is useful for simulating alternative scenarios during a forecast team meeting since this procedure is fast. On the other hand, the stochastic case is more accurate and gives the confidence intervals for the implied interest rate trajectory, though it requires substantial computation time, making this procedure unfeasible during a Copom meeting.

Basic structure

Combining equations (II), (V), (VII), and (VIII), along with a choice of formation mechanism of inflation expectations, passthrough specification, and a monetary policy rule, the basic framework for simulation and forecasting is determined, which is consistent with the relationships shown in Diagram 1.

4. REQUIREMENTS FOR SIMULATION

The Copom members exchange views with the staff and choose relevant possible shocks. These shocks are then stylized and introduced into the structural models. It is important to note that given the simplified nature of the macro models, the staff is required to carefully identify the form, the intensity, as well as the timing of the interventions.

The introduction of shocks in the simulation process involves a previous work on how much the economic agents have already anticipated them. This is particularly true for nominal variables. The Copom members have to carefully assess the set of shocks proposed in the simulation exercises.

Once the Copom defines the relevant shocks and the staff prepares them for introduction in the macro models, some additional definitions are required for simulation purposes. For instance, it is necessary to make the following choices: the interest rate rule (a fixed nominal rate or a Taylor-type rule or a rule based on the deviations of expected inflation from target or a

[14] In both cases the optimization is constrained to the model in use.

predetermined trajectory for nominal or real rates); and (ii) a mechanism for the formation of inflation expectations.

Given these definitions, the following results can be obtained: (i) inflation forecasts (central path and confidence intervals around the median) with definitions of a measure of dispersion (variance) and of risks (asymmetries); (ii) forecasts for output; (iii) the trajectory for interest rates (both nominal and real) resulting from the various reaction functions; and (iv) dynamic simulations of exogenous shocks.

Simulations permit the visualization of the transmission mechanism of monetary policy implicit in these simplified models, with the interest rate affecting the nominal exchange rate contemporaneously and the output gap with a lag; the nominal exchange rate affecting the imported inflation and, thus the inflation rate contemporaneously; and the output gap affecting the inflation rate with a lag.

The simulation of the structural models is based on the selection of a core scenario that involves the most likely hypothesis and a set of alternative scenarios representing the perceived risks of departure from the basic hypothesis. A careful assessment of the various hypotheses is a necessary condition for balanced decisions on the instrument of monetary policy.

Naturally, the results from the simulation exercises are combined with other elements in making policy decisions. In particular, forecasts cannot be limited to those produced by models. Alternative sources such as market surveys and forecasts, and information on inflation expectations embodied in financial instruments need also be considered in the decision process.

5. CONCLUDING REMARKS

Brazil has implemented its inflation-targeting framework in a very short time. Even though the target for 1999 has been met, it is too early to discuss its success, but there are some crucial points that deserve mentioning. First, IT involves several elements that must be properly addressed: a well defined quantitative target for the inflation rate in the medium term; an institutional commitment to this target as the overriding objective of monetary policy; increased transparency of the monetary policy strategy through communication with the public and the markets about the plans of monetary authorities; and increased central bank's accountability for achieving its inflation targets.

Second, the central bank staff engaged in monetary policy advice should focus initially in the following issues: get a clear view of the monetary policy transmission mechanism and decide which channels are best suited to be explored in order to meet the inflation target; develop simple and small structural models of these channels of transmission, being able to understand and explain the behavior key macro variables; use a preferred model to discipline the discussion with the policymakers; monitor incoming data and use judgmental analysis in the first forecasting quarters.

Communication efforts in an IT framework are vital. It is fundamental to explain clearly to the public at large, to financial market participants, and to the politicians the goals and limitations of monetary policy (what the central bank can do in the long run is to control inflation; what it cannot do is to raise economic growth through monetary expansion); the numerical values of the inflation targets and on which grounds they were selected; and how the targets are to be achieved, given current economic stance and expected future developments.

In Brazil, the monetary authorities chose the full disclosure strategy, in the same line as the Bank of England. The publication of Inflation Reports is an integral part of the communication efforts, allowing the general public to understand and assess the quality of the monetary policy decisions, in a continuous process that ultimately leads to earning credibility and permits achieving the inflation targets with lesser costs.

REFERENCES

Backus, D. K., y J. Drifill (1985), "Inflation and Reputation", *American Economic Review*, vol. 75, nº 3, june.

Ball, L. (1997), *Efficient Rules for Monetary Policy*, NBER (Working Paper, nº 5952).

Ball, L. (1998), *Policy Rules for Open Economies*, NBER (Working Paper, nº 6760).

Batini, N., y A. G. Haldane (1999), *Forward-Looking Rules for Monetary Policy*, Bank of England (Working Paper, nº 91).

Blanchard, O. J., y C. M. Kahn (1980), "The Solution of Linear Difference Models under Rational Expectations", *Econometrica*, vol. 48, nº 5, july.

Blanchard, O. J., y S. Fischer (1989), *Lectures on Macroeconomics*, MIT Press.

Britton, E., P. Fischer y J. Whitley (1998), "The *Inflation Report* Projections: Understanding the Fan Chart", *Bank of England Quarterly Bulletin*, nº 38.

Central Bank of Brazil (1999), *Inflation Report*, june, september and december issues.

Dornbusch, R. (1976), "Expectations and Exchange Rate Dynamics", *Journal of Political Economy*, vol. 84, nº 6, december.

Goldfajn, I., y S. R. da C. Werlang (1999), *The Pass-through from Depreciation to Inflation: A Panel Study*, mimeo.

Haldane, A. G. (1997), *Some Issues in Inflation Targeting*, Bank of England (Working Paper, nº 74).

Svensson, L. E. O. (1997), "Inflation Forecast Targeting: Implementing and Monitoring Inflation Targets", *European Economic Review*, vol. 41, nº 6, june.

Anston Rambarran

The scope for inflation targeting in a developing economy: feasibility, implications and design issues for Trinidad & Tobago

I. INTRODUCTION

Prior to the late 1980s most central banks adopted monetary frameworks based on an intermediate target to anchor the price level to a specific value at a given time. Some pursued money supply targets, others chose to maintain the exchange rate at a fixed peg or within some specified band. The former found that their ability to control monetary aggregates and to set appropriate growth targets was weakened due to the instability of money demand resulting partly from financial liberalization. Market pressures forced the latter to abandon their exchange rate strategy. Monetary management in all these countries became less credible as monetary policy lost its nominal anchor. For a period after, many central banks resorted to more discretionary policies, often based on an assessment of a "checklist" of indicators rather than a single intermediate target.

Paper prepared by A. Rambarran, Economist in the Research Department, of the Bank of the Central Bank of Trinidad and Tobago. The views expressed are those of the author and not necessarily those of the Central Bank. *The paper was presented at the V Meeting of the Network of America Central Bank Researchers, organized by the Banco Central do Brasil, in Rio de Janeiro, in October 16-17, 2000.*

In 1988 New Zealand pioneered inflation targeting as a new strategy for monetary policy.[1] It requires the central bank to announce publicly a numerical value target for inflation in the medium term. The bank, which must at least be operationally independent, is then responsible for achieving these targets and must provide regular public information about its strategy and decisions. Since then, a number of industrial and emerging market economies have adopted, or indicated that they intend to set monetary policy through a more or less formal process of inflation targeting.[2] Indeed, most elements of this regime of "constrained discretion" can be found in the practices of the long-standing and well-regarded monetary targeters, namely, Germany and Switzerland. So far, combining floating currencies with an explicit inflation target appears to have been successful in reducing inflation, but it is probably too early to make such declaration as there has also been a general decline in inflation in many industrial countries that did not explicitly operate such a regime.

In Trinidad and Tobago the search for a more sustainable monetary framework has been no different. The Central Bank of Trinidad and Tobago (CBTT) attempts to achieve its general monetary objective of protecting the value of the domestic currency by steadily bringing inflation down over the medium term to a level prevailing in the country's major trading partners. Given this goal, the CBTT gradually shifted from a rules-based approach to more discretionary monetary management based on an assessment of current conditions but continuing to make no public commitments about its objectives or future actions.

Concomitant with this change, inflation fell to an average of 6% during the 1990s from around 12% in the previous decade but still remained highly variable with a standard deviation of about 3 percentage points. Since high and variable inflation can lead

[1] Haldane (1997) asserts that inflation targeting may not be novel since the intellectual roots of price targets can be traced to Marshall and Wicksell in the late nineteenth century. Moreover, in the early twentieth century Fisher and Keynes both put forward monetary schemes, which explicitly targeted an index number for prices, the forerunner to Sweden's experiment with an explicit price level standard during the early part of the 1930s.

[2] In a recent survey of ninety-one industrialized and developing countries (Sterne, 1999), fifty-four have some form of inflation target and thirteen had inflation-only targets. This compares with eight and one, respectively, in the early 1990s.

to inefficient resource allocation and to lower long run growth (Fischer 1993) it is desirable for Trinidad and Tobago to lower its average inflation rate to 3-6% in the near term and to 2-3% over the longer term. Moreover, Sarel (1996) found evidence to indicate that when inflation exceeds the threshold rate of 8% it has an increasingly strong negative effect on growth. Inflation in Trinidad and Tobago was above this level in twelve of the past twenty years, and may have partly contributed to a slower rate of improvement in the country's relative economic performance.

While it would certainly be desirable for Trinidad and Tobago to lower its annual inflation rate on a sustainable basis, this may prove difficult within the present monetary framework. The use of base money as a nominal anchor has not been firmly established which, in conjunction with the pursuit of multiple and conflicting monetary objectives suggest that more effective control of inflation and better prospects for economic growth may not be readily assured. Accordingly this paper considers the feasibility of inflation targeting as a more viable monetary option for Trinidad and Tobago. Alternative monetary strategies that could dominate inflation targeting are not fully considered here but left for future research.

The rest of the study is organized as follows. Section II discusses the current regime of monetary policy that has evolved away from a strict adherence to base money targets. Section III evaluates whether Trinidad and Tobago complies with the prerequisites for inflation targeting, and discusses the implications of inflation targeting for Trinidad and Tobago. Section IV outlines a proposed Inflation Targets Agreement (ITA) to be negotiated between the government and the CBTT that gives rise to the inflation targeting framework. Concluding remarks are made in Section V.

II. THE EVOLVING MONETARY POLICY FRAMEWORK

After dropping the exchange rate as the nominal anchor and turning to a floating rate regime in April 1993, base money became the prime intermediate target for the CBTT. In theory, under a floating exchange rate regime a central bank acquires control over the monetary base, since it does not have to add or subtract liquidity derived from compulsory interventions in the foreign exchange market as under the fixed exchange system. By

acting directly on the monetary base, a central bank supposedly would be able to influence interest rates and exchange rates, and through these, the general level of prices (Jonsson, 1999). Consequently, as inflationary pressures fall, monetary policy becomes the anchor for the evolution of the general price level. In practice, however, the implementation of monetary policy has been eclectic for the CBTT and base money targets have not often been met for a variety of reasons.

Firstly, there has been a tendency at various times to assign multiple and often incompatible objectives to monetary policy. These include controlling monetary expansion, stabilizing tensions in the foreign exchange market, maintaining export competitiveness and keeping interest rates to a level that supports economic growth and reduces fiscal costs. Moreover, the ensuing tradeoffs between inflation and growth have not always been settled in favor of the inflation objective. Even though numerical goals for inflation play a key role in the financial program[3] established jointly between the CBTT and the Ministry of Finance (they are used to derive the monetary and credit targets) they do not have ultimate priority in determining the policy decision.

Secondly, extended periods of nominal exchange rate stability relative to the U.S. dollar have revealed episodes of implicit exchange rate targeting – just below TT$6 in 1996 and below TT$6.30 in most of 1997-1999 and so far into 2000. Changes in reserves rather than changes in the exchange rate have been used to quell ensuing persistent excess demand pressures. Gross sales of foreign exchange by the CBTT to the banking system rose from 2% of total market flows in 1993 to 6 percent in 1999 and in excess of 10% in the first half of 2000. Broad money targets have often been missed because of this concern about the exchange rate and partly because of a growing inability to fully tighten financial conditions on the basis of money growth developments

[3] The annual financial programming exercise sets goals for the balance of payments, prices, and output. An appropriate growth rate for broad money is determined on the basis of projections of real output growth and inflation. The assumption of a relatively stable multiplier gives the target on base money. From this projected path for base money and the floor on net foreign assets a ceiling is then set for the net increase in domestic credit. On a daily basis, the CBTT seeks to satisfy the demand for base money through changes in the reserves of commercial banks, purchases and sales of foreign exchange, and purchases and sales of government securities.

alone. Without a credible commitment to one nominal anchor, the economy has effectively lacked a focal point to moor inflation expectations of the public.

Thirdly, the emergence of new financial instruments and their differential taxation appears to have caused gradual portfolio shifts away from monetary assets. This has altered the stability of both broad money velocity and the multiplier, and reduced the predictability of money demand. Several studies on money demand in Trinidad and Tobago [Nicholls (1995), Rambarran (1996), and Dobson (1999)] have been unable to find a strong and compelling evidence in favor of a stable relation between money, income and interest rates. This has complicated the task of forecasting a growth rate for broad or base money that would be consistent with an inflation objective. Consequently, strict adherence to a money anchor may help achieve lower inflation but only at considerable risk.

Fourthly, the new policy instrument - open market operations (OMO)- has not always achieved the desired effect on banks' reserves. At times, the CBTT has had to rediscount securities and provide reserves to the banking system even though this conflicted with its monetary objective of removing reserves. In addition, in the face of excessive money creation arising from financing the government's deficit spending within the domestic economy, open market interventions have generally been large and highly frequent rather than small and fine-tuning as originally envisaged. This has affected the capacity of the CBTT to intervene in the domestic money market to control the growth of base money. Indeed, by the end of April 2000 the Bank had virtually reached its limit on the stock of treasury bills and notes available for the purposes of OMO. The CBTT therefore continues to rely heavily on the primary reserve requirement, which has been progressively raised despite an announced intention to gradually reduce the ratio to prudential levels. During the 1990s the primary reserve ratio for commercial banks was changed on no less than nine occasions and its base was expanded in 1998 to the current level of 21% of prescribed liabilities. Even though the CBTT recognizes the tax aspect of statutory reserves, it also recognizes the effectiveness of the reserve requirement in lowering banks' credit-granting capacity and diminishing some of the risks associated with non-sterilized intervention.

Finally in the absence of an interest rate strategy and the public disaffection surrounding high interest rates there is need to assess the feasibility of using a short-term interest rate as the operating

target rather than the monetary base. By varying the quantity of reserves supplied to the banking system the CBTT allows short-term interest rates to be determined by commercial banks' demand for reserves. Through its rediscount policy the CBTT also attempts to guide the direction and magnitude of money market interest rates. However, it is unclear whether the resulting interest rate structure is consistent with monetary conditions. In this respect, with an interest rate operating target a positive shock to money demand would lead to a smaller rise in interest rates and a larger change in the money stock, than would generally be the case with a reserve target.

For all these reasons, while the CBTT continues to set monetary and credit targets and conduct reserve programming, it relies more heavily on variables that provide useful information about the state of the economy. However there is no strong commitment to communicate this particular monetary strategy to the general public, especially the relationship between current conditions and the goal of price stability. Economic reports by the Bank cover a wide variety of macroeconomic issues and developments but do not provide an explanation of the performance of the financial program, including whether targets were hit or not. Most notably, there is no clear signal to the public and to the markets as to which inflationary shocks the CBTT plans to accommodate and which it will not.

In light of the problems inherent in the current arrangement, there is need to adopt a monetary strategy with a firm nominal anchor that would not only impart a greater degree of price stability, but also to persuasively communicate the strategy to the general public. Inflation targeting, which is now an orthodox and widely used approach to monetary policy, provides a potential alternative.

III. FEASIBILITY AND IMPLICATIONS OF INFLATION TARGETING

This section discusses, first, whether it is feasible for Trinidad and Tobago to implement inflation targeting; and second, what the implications would be if Trinidad and Tobago moved to such a monetary policy framework.

A. Pre-requisites for Inflation Targeting

Each country that has so far adopted inflation targeting has a

variant based on it own particular circumstances even though there are certain empirical generalizations [Bernanke et al., (1999), Mishkin and Posen (1997)]. Table 1 provides some details about the specific operational aspects in a sample of selected countries. Despite varying approaches, it is evident that all inflation targeting regimes have four main features:

- A nominal variable (such as the price level or inflation rate) which is recognized as the sole achievable medium term objective for monetary policy;
- An attempt to drive policy directly at the medium-term objective via a tightly specified inflation target, rather than indirectly through an intermediate target;
- An institutional structure that clearly articulates the respective roles and responsibilities of the key actors (the central bank and the government); and a
- Heavy reliance on transparency to support the arrangement and cover the weak points in the institutional structure.

On this basis, one could establish six pre-conditions that are desirable for implementing inflation targeting in any country, including Trinidad and Tobago.

A Clear Mandate on Price Stability

The Central Bank of Trinidad and Tobago Act 1964 is the legislation that governs the CBTT. The Act specifies dual objectives in "the promotion of such monetary, credit and exchange conditions as are most favorable to the development of the economy of Trinidad and Tobago" and to "encourage expansion in production, trade and employment." The first step towards establishing an institutional foundation for inflation targeting in Trinidad and Tobago is to provide the CBTT with a more clearly defined mandate on price stability than now obtains. In most inflation targeting economies price stability does not literally mean an inflation rate at or near zero, but is usually synonymous with annual inflation rates closer to 2%. This is to account for the upward measurement bias of price index measures of inflation and the economic risks to targeting inflation at too low a level. For Trinidad and Tobago, the authorities should choose a transition path of inflation targets trending downward over time toward the price stability goal.

TABLE 1. SELECTED ASPECTS OF INFLATION TARGETING REGIMES

Country	*Date of Adoption*	*Prevailing Inflation Rate at adoption*	*Target Rate and Horizon*	*Price Index*	*Weight of Items excluded from headline*	*Institutional Arrangement of the Inflation Target*
New Zealand	Mar-90	5.8%	0-2 % through the 5-year tenure of the Governor	CPI excluding credit services	6.50%	Set in Policy Target Agreements (PTA) between the Minister of Finance and the Governor of the Reserve Bank of New Zealand
Canada	Feb-91	4.8%	1-3 % through 1998	CPI excluding food, energy and indirect taxes	25%	Set by the Minister of Finance and the Governor of the Bank of Canada
United Kingdom	Oct-92	3.8%	2.5 % + or - 1 % 1%	RPI excluding mortgage interest payments (RPIX)	5%	Set by the Chancellor of the Exchequer
Sweden	Jan-93	2.3%	2 % with a tolerance band of + or - 1%	CPI	0%	Set by the Bank of Sweden

Finland	Feb-93	2.60%	About 2 % in 1996 and beyond with no explicit band	CPI excluding indirect taxes, government subsidies, house prices, and mortgage interest payments	33%	Set by the Bank of Finland
Australia	1993	1%	Underlying inflation of 2-3 %, on average, over the cycle	CPI excluding interest rates, indirect taxes, and certain other volatile price items	48.90%	Set by the Reserve Bank of Australia and endorsed by the government in the statement on the Conduct of Monetary Policy by the Treasurer and the Governor of the Reserve Bank
Spain	Nov-94	4.7%	Less than 3 % by 1997, 2 % by 1998	CPI	0%	Set by the Bank of Spain
Brazil	July-99	10%	8% for 1999, 6% for 2000, and 4% for 2001	CPI	0%	Set by the National Monetary Council on the basis of a proposal by the Minister of Finance

SOURCES: A. Hoffmaister, 1999, *Inflation Targeting in Korea: An Empirical Exploration*, International Monetary Fund, Washington (Working Paper 99/7); J. Bogdanski, et al., 2000, *Implementing Inflation Targeting in Brazil*, mimeo.

An Instrument Independent but Goal Dependent Central Bank

There is a worldwide trend toward increased independence for central banks. This is based on the notion that independent central banks, compared to central banks subordinated to the government, deliver better inflation outcomes, as well as output and employment outcomes no worse than less independent central banks. Granting instrument independence to the CBTT is a more effective compromise between insulation from political pressures and direct accountability to the public. In this regard, the Minister of Finance would set the inflation target in consultation with the CBTT, but the CBTT would be responsible for the instrument settings to achieve the desired target. This would increase the credibility of the inflation targeting framework and the role of monetary policy can be reconciled within the government's overall economic policy, including its objectives for growth and employment.

An Accurate, Timely and Easily Understood Inflation Series

In general the practice has been to specify the inflation target in terms of a consumer price index, or some variant thereof, because it is the price index most familiar to the general public, and also because it is timely and not subject to revision. The Retail Prices Index (RPI, Sep.1993=100)[4] which is compiled by the Central Statistical Office (CSO), an agency independent of the monetary authorities, meets these requirements in Trinidad and Tobago. The focus should be on the more transparent published or headline RPI on which most price and wage decisions in the economy are made. Table 2 presents univariate AR models for the eleven main components of the RPI, of which two would appear especially prone to supply shocks, namely food and housing (homeownership). These two components have a combined weight of about 40%. The persistence of the shocks in these categories is similar to that of the other nine components but they stand out in terms of the size. Shocks in the food and homeown-

[4] The Central Statistical Office (CSO) rebased the Retail Price Index (RPI) to September 1993 using information from a 1988 Household Budgetary Survey (HBS). The composition of the market basket may therefore not fully reflect current consumer expenditure patterns. The methodology used by the CSO in constructing the RPI is generally in accordance with international standards except for the treatment of homeownership costs. See Rambarran (1994) for a discussion on the construction of the RPI as well as its associated technical biases.

ership categories are twice as large as those of headline RPI and the confidence interval containing 90% of the shocks is also roughly twice as wide. Thus, food price volatility is likely to have a significant impact on the headline RPI. Indeed, there is a high contemporaneous correlation of food price shocks with headline RPI.

Impulse response analysis (not presented) indicate that food price inflation shocks do increase the short-run volatility of headline inflation in Trinidad and Tobago but the differences in responses of headline and underlying inflation are quite small after the first year. With an inflation target horizon greater than a year, it makes no difference whether food prices are included or not in the RPI that is targeted. If a "core" inflation measure is preferred, the CBTT must explain to the public how this price index is constructed and how it is related to headline RPI.

A Target Range and Bandwidth that Builds Flexibility

Inflation outcomes are likely to be highly uncertain even with the best monetary settings. A narrow range for an inflation target communicates a greater commitment to meeting the inflation goal than does a broader range. At the same time, a narrower range reduces the ability of the monetary authorities to respond to unforeseen events, which may well drive inflation outside of the target range and damage credibility. An inflation band with varying targets over time allows for these uncertainties and increases the flexibility of the regime. The CBTT should choose a range for the inflation target over a point estimate as this would:

- Recognize the inherent volatility in prices, notably for items like food and housing (homeownership) which are more prone to supply shocks;
- Recognize the positive bias in the RPI measure of inflation which arises from a number of sources including the introduction of new goods, substitution of relatively cheaper items and quality improvements, and which is endemic to price indices and cannot be fully remedied by the CSO;
- Recognize the inherent uncertainties about future events when managing in monetary policy; But to
- Place limits which, if breached, require the CBTT to explain inflation developments and the measures taken or proposes to take to ensure that inflation comes back within the range. This

TABLE 2. AUTOREGRESSIVE MODELS FOR MAIN CATEGORIES OF THE RETAIL PRICE INDEX (RPI), 1991:01-1999:12

	Food	*Meals Out*	*Drink & Tobacco*	*Cloth. & Footwear*	*Housing (total)*	*Housing (Home-owner ship)*	*House-hold Opera-tions*	*Household Supplies & Services*	*Health & Personal Care*	*Trans-port*	*Recreation Reading & Education*
Weight in Headline Index	217	14	24	104	216	196	66	77	62	152	68
Annual Percent Change											
Mean	12.67	3.38	6.02	-0.82	1.83	3.91	1.23	1.65	3.46	3.53	5.79
Standard Deviation	5.36	2.85	6.09	1.01	1.61	3.41	2.92	1.94	3.06	3.83	3.11
AR Model											
No of Lags Included	15	15	10	13	9	9	10	9	13	14	13
Adjusted R2	0.86	0.78	0.8	0.78	0.82	0.88	0.74	0.79	0.92	0.86	0.93
Sum of AR Coefficients	0.98	0.93	0.94	0.95	0.96	0.97	0.88	0.9	0.98	0.96	0.98
(standard error)	0.01	0.02	0.03	0.03	0.02	0.02	0.04	0.03	0.01	0.02	0.01
Inflation Innovations											
(standard error)	2	1.3	2.68	0.46	0.67	1.18	1.47	0.88	0.83	1.43	0.81
Jarque-Bera Test of Normality	2.7	2925.8	4898.9	162.8	501.1	155.6	2859.4	1414.9	440.5	1214	1.04
Corr. with headline innovation	0.79	0.52	0.02	0.14	0.61	0.68	0.5	0.43	0.89	0.64	0.99

NOTE: The number of lags included in the AR models is determined using the Akaike Information Criteria where the maximum lag tested is 18.

helps ensure that inflation expectations remain well anchored at about the mid-point of the range, which can be interpreted as the operational definition of price stability.

The combination of the use of headline inflation and the absence of escape clauses justifies the adoption of a relatively wide tolerance interval of three-percentage points around the central target. The need to reduce instability in the instruments of monetary policy is an important consideration in determining this soft-edged and wider band.

A Target Horizon in which Monetary Policy can offset Short-term Shocks

Targets of less than one year or more than four years are unlikely to be operationally meaningful, the former because monetary policy cannot control inflation at such short horizons and the latter because such distant targets would have little credibility. The CBTT consequently needs to be able to forecast inflation reasonably well over the policy horizon (Bernanke et al., 1999). The degree of predictability that is sufficient for the inflation forecast to be used as the operational intermediate target can be benchmarked to the inflation forecasts of inflation targeting countries (Hoffmaister, 1999). Table 3 provides details of univariate autoregression AR (p) models and of the inflationary experiences of Trinidad and Tobago and the inflation targeting countries[5] prior to their adopting the regime. The data suggest that Trinidad and Tobago's inflationary process - the average, volatility and persistence - is similar to that in the sample of inflation targeting countries. Nonetheless, the distribution of inflation innovations in Trinidad and Tobago has fatter tails (positive kurtosis), that is inflation is subject more frequently to larger shocks than would be expected given its standard deviation.

The forecast performance was evaluated over the five years prior to adopting inflation targeting using the AR models in Table 3. The root mean square error (RMSE), a standard measure of forecasting performance, was calculated using out-of-sample forecast errors based on the typical inflation target horizon of be-

[5] New Zealand and Australia are not included in this exercise because their price data are only available at quarterly frequency. Comparing the predictability of inflation in these countries based on quarterly price data to the predictability of inflation based on monthly data in the other inflation targeting countries would be misleading.

TABLE 3. AUTOREGRESSIVE MODELS OF INFLATION FOR TRINIDAD & TOBAGO AND SELECTED INFLATION TARGETING COUNTRIES

	Trinidad	*Canada*	*United Kingdom*	*Sweden*	*Finland*	*Spain*
Sample period						
(10 years ending in)	Dec-99	Jul-91	Oct-92	Jan-93	Feb-93	Jul-94
Inflation						
Mean (annual rate)	5.8	5.67	5.56	6.7	5.22	6.54
Standard Deviation	3.12	12.53	15.63	17.24	14.8	23.04
AR Model						
No. of Lags	16	17	14	13	17	13
Adjusted R2	0.93	0.98	0.96	0.9	0.97	0.94
Sum of AR Coefficients	0.98	0.95	0.96	0.89	0.98	0.95
(standard error)	0.01	0.01	0.02	0.04	0.02	0.02
Inflation Innovations						
(standard error)	0.81	0.3	0.33	0.72	0.3	0.41
Jarque-Bera Test of Normality	2.86	149.62	6.85	63.46	0.16	19.25

NOTE: The AR models are taken from Hoffmaister (1999), and the number of lags is determined using the Akaike Information Criteria where the maximum lag tested was 18.

tween eighteen to twenty-four months. At eighteen months the RMSE in Trinidad and Tobago is about 1.3 percentage points, similar to the RMSE in Finland (1.7). This in turn is somewhere between the UK (2.7) and Sweden (2.7) with worse forecasting performance and Canada (0.8) and Spain (0.8) with better forecasting performance. At twenty-four months the RMSE in Trinidad and Tobago is about 1.2 percentage points, better than all inflation targeting countries except Canada (0.7) and Spain (0.8).

Prima facie, these results suggest that inflation predictability in Trinidad and Tobago during the past five years is comparable to the inflation targeting countries prior to their adopting the new regime. Thus forecasting inflation should not be a major obstacle for the adoption of inflation targeting in Trinidad and Tobago.

An inflation forecast need not wholly depend on a model; at times the CBTT may need to use a large degree of judgement, especially since the economy has undergone a large degree of structural change in recent years. Bivariate Granger-causality tests provide information on the leading indicator properties of potential variables (Baumgartner et. al., 1999). A pragmatic choice of such indicator variables would include: real output, the TT/US dollar selling rate, broad money (M2), broad money plus foreign currency deposits (M2*), base money (M-0), the US inflation rate, the three-month TT treasury bill rate, and the U.S. treasury bill rate.

Table 4 reports p-values for lag lengths one to eight based on the null hypothesis that the indicator variable does not Granger-cause inflation. Movements in the monetary base, M2* growth, the U.S. treasury bill rate and change in real output have a high degree of predictive content on inflation. Broad money and changes in the exchange rate appear to have little predictive information. Surprisingly, there is no evidence that domestic treasury bill rates contain predictive information on inflation within a two-year time horizon.

Since the predictability of inflation in Trinidad and Tobago is comparable to that in inflation targeting countries before they adopted the regime an implementation period of around two years is reasonable given the lags in the operation of monetary policy. This would also allow for some understanding to be developed of how the economy operates in the transition to an inflation targeting regime, and to allow some time to determine what exactly price stability corresponds to in practice.

TABLE 4. LEADING INDICATORS OF INFLATION: BIVARIATE GRANGER-CAUSALITY TESTS

	Lags of VAR						
Indicator Variables	1	2	3	4	5	6	7
Output	0.74	0.011	0.04	0.045	0.024	0.034	0.419
Base Money	0.114	0.161	0.121	0.1	0.334	0.472	0.731
Broad Money (M2)	0.264	0.504	0.55	0.738	0.819	0.748	0.049
Broad Money (M2*)	0.029	0.097	0.02	0.076	0.351	0.607	0.827
TT treasury bill rate	0.893	0.83	0.893	0.311	0.194	0.367	0.151
US treasury bill rate	0.022	0.347	0.005	0.016	0.0186	0.097	0.605
US inflation	0.546	0.404	0.4609	0.461	0.125	0.069	0.345
Exchange Rate	0.744	0.713	0.395	0.22	0.043	0.019	0.111

NOTE: p-values shown for the likelihood ratio tests of the null hypothesis show that the indicator does not Granger-cause inflation.

A More Transparent and Accountable Framework for the Central Bank

The hallmark of an inflation targeting regime is the announcement by government or the central bank, or some combination of the two that in the future the central bank will attempt to hold inflation at or near some numerically specified level (Bernanke and Mishkin, 1997). In the case of Trinidad and Tobago this could be accomplished through the negotiation of an Inflation Targets Agreement (ITA) between the Minister of Finance and the Governor. The credibility of the CBTT would depend as much on the objectivity and plausibility of its communications as on its record of hitting targets. In this regard, the CBTT should publish a *Monetary Policy Statement* approximately every three months to provide information about the economy at large and the monetary strategy and policy intentions. Beyond such information, the communication process can be enhanced through regular speeches and press conferences by senior officials of the Bank about what monetary policy can and cannot do.

In general, it is not difficult for Trinidad and Tobago to satisfy most of the pre-conditions for implementing inflation targeting. Nonetheless, it is important for the authorities to understand that under such a regime the paramount goal of monetary policy is achieving the inflation target. Any other goal can be pursued to the extent that it is consistent with the inflation target. In the recent past there has been strong fiscal dominance of monetary policy as well as a strong attachment to nominal exchange rate stability in Trinidad and Tobago. With inflation targeting, the conduct of monetary policy cannot be subordinated to fiscal needs, nor can monetary policy be used to ultimately target the exchange rate or any other nominal variable. The CBTT would explicitly justify policy changes in the context of achieving the inflation target.

To control inflation (under any monetary policy framework) there must be a reasonably stable relationship between the monetary policy instruments and inflation outcomes. The authorities therefore need access to policy instruments that are effective in influencing the economy, while money and capital markets must be sufficiently well developed so as to react quickly to the use of these instruments. Trinidad and Tobago has a fairly well developed capital market and policy changes are increasingly influencing money market interest rates in a transparent manner. The CBTT's open market operations together with the repo system

constitute an appropriate framework for monetary policy operations. It is possible however that some further experience with the repo system, which was introduced in November 1999, including how changes in the repo rate feed into the inflation forecasts, is needed before the introduction of a fully fledged inflation targeting framework.

Considering the importance of accurate inflation projections in an inflation targeting regime, it might also be necessary to further refine and strengthen the CBTT's forecasting framework in the event that the authorities decide to switch to an inflation targeting framework.

B. Implications of Inflation Targeting for Trinidad and Tobago

Given that the most important underlying conditions for the adoption of inflation targeting in Trinidad and Tobago are in place, or are at least not subject to binding constraints, the next question is whether it would be desirable to implement such a regime, and what the implications would be (Jonsson, 1999).

As mentioned earlier, the current monetary policy framework is in some respects similar to an explicit inflation targeting framework. In particular, the mandate to protect the value of the currency has been interpreted as a mandate to control inflation; the CBTT takes a forward looking approach to monetary policy to achieve this objective; and it uses a set of financial indicators and intermediate targets to achieve the inflation target. Consequently, if Trinidad and Tobago was to implement a more formal inflation targeting framework, the actual conduct of monetary policy may not change in a significant way. The medium-term inflation outlook would still guide policy actions, with due regard paid to the evolution of a set of economic and financial variables.

Nevertheless, the absence of an explicit and well-defined target for monetary policy under the current framework has created some measure of discomfort among the public and the markets about the CBTT's objectives. This credibility problem may have been reinforced by the observations that monetary and credit target have usually not met their programmed benchmarks in recent years, and that the CBTT has intervened heavily in the spot foreign exchange market. Thus, to the extent that a formal or explicit inflation targeting framework would be perceived as a stronger commitment to prudent monetary policy and bring more clarity to the conduct of CBTT's monetary policy through an enhanced communication effort, some uncertainties might be

eliminated. This, would in turn, improve the accuracy and coordination of inflation expectations, and possibly reduce the risk premia on investment in Trinidad and Tobago, implying a lower path for long-term interest rates.

Thus, the main implication and advantage of a formal inflation targeting regime in Trinidad and Tobago would be the associated enhancement of both the transparency of monetary policy and the accountability of the CBTT. Under inflation targeting, the CBTT would need to intensify its efforts in communicating and clarifying to the public its monetary policy. Moreover, with clearly specified targets for monetary policy and more frequent communication of the plans and outcomes of monetary policy, the CBTT would become more accountable about its actions. The enhancement of transparency and accountability, together with a clear mandate to focus on inflation, could also help limit short-term motivated criticism of the CBTT's actions.

In the event that there is a breach of the inflation target, it could be difficult to determine whether the breach reflects policy failure or events outside the control of the CBTT. This is because there is typically a long lag between the change in the instruments of monetary policy and the inflation outcome. On these occasions, or when such occasions are projected, the open letter to the Minister of Finance becomes particularly important.

An alternative policy option to inflation targeting in Trinidad and Tobago would be to return to monetary targeting. However, since the second half of the 1990s there has been substantial financial deepening, partly as a result of the liberalization of the foreign exchange regime, and money demand has increased rapidly. Consequently, there has been a growing demand for monetary liabilities both within and outside the formal banking system. Generally, it can be expected that further financial deepening and other structural changes will cause the demand for any monetary aggregate to be uncertain in the short-run, and the CBTT would have little capacity to control it. In that case, stricter monetary targeting would unlikely yield the desired inflation outcomes, and would not be seen as very credible placing an excessive burden of adjustment on the real economy. Too tight monetary policy may unnecessarily constrain output, while too lose policy may not achieve the inflation target.

A third option would be to gear monetary policy to maintaining the nominal exchange rate within a predetermined path, as currently practiced, notwithstanding having a floating exchange rate system with no restrictions on capital movements. While the

adoption of a nominal exchange rate anchor could be consistent with better inflation control, this would limit monetary independence and weaken the ability to cope with real shocks that generally affect the Trinidad and Tobago economy. Moreover, such a framework might invite speculative attacks because the CBTT would have an exchange rate objective that might not be perceived as credible. It is likely that some of the volatility in the foreign exchange market has been driven by uncertainties about the CBTT's goals regarding the exchange rate. Indeed, to the extent that the adoption of inflation targeting signals a clear commitment to allow the exchange rate to float, namely, not to defend a particular level or path for the exchange rate, such a framework is viewed as the more viable option.

IV. THE INFLATION TARGETS AGREEMENT (ITA)

The Inflation Targets Agreement (ITA) should be a usefully simple and clear negotiated document. It should seek to give some emphasis to the medium term focus of monetary policy, including specification and attainment of the inflation target. At the same time the ITA should acknowledge that occasional breaches of the inflation target should emphasize the CBTT's explanations to the public and the financial markets of developments, over mere compliance with the quantitative inflation target.

A. Proposed Structure of an ITA for Trinidad & Tobago

This agreement between the Minister of Finance and Governor of the Central Bank of Trinidad and Tobago (the Bank) is made under section 3 (3) of the Central Bank of Trinidad and Tobago Act 1964 (the Act), and shall apply for the balance of the Governor's present term.

The Minister of Finance and the Governor agree as follows:

a) Price Stability

i) Consistent with section 3 of the Central Bank Act, the Central Bank shall formulate and implement monetary policy with the intention of maintaining a stable general level of prices, so as to make the maximum contribution to the most favorable growth, employment and development opportunities within Trinidad and Tobago.

b) Inflation Target

i) In pursuing the objective of a stable general level of prices, the Bank shall monitor prices as measured by a range of price indices. The price stability target will be defined in terms of the Retail Prices Index (RPI, Sep.1993=100) as published by the Central Statistical Office (CSO).

ii) The inflation target shall be the accumulated change by year-end in the RPI. The inflation target is to be kept within a 3-6 percent range for 2000-2001. For 2002 and subsequent years targets will be set no later than June 30, two years in advance.

iii) The target will be considered met whenever the observed accumulated inflation during the period January-December measured on the basis of changes in the RPI falls within the stipulated range.

c) Unusual Events

i) There is a range of events that can have a significant temporary impact on inflation as measured by the RPI, and can mask the underlying trend in prices, which is the proper focus of monetary policy. These events may even lead to inflation outcomes outside the target range. Such disturbances include, for example, shifts in the aggregate price level as a result of exceptional movements in the prices of key commodities traded in world markets, changes in indirect taxes, significant government policy changes that directly affect prices, or a natural disaster affecting a major part of the economy.

ii) When disturbances of the kind described above arise, the Bank shall react in a manner that prevents general inflationary pressures emerging.

d) Implementation and Accountability

i) The Bank shall constantly and diligently strive to meet the inflation target.

ii) It is acknowledged that, on occasions, there will be inflation outcomes outside the target range. On those occasions, or when such occasions are projected, the Bank shall issue an open letter addressed to the Minister of Finance explaining why such outcomes have occurred, or are projected to occur,

and what measures it has taken, or proposes to take, to ensure that inflation comes back within the range, and the period of time that will be needed for these measures to have an effect.

iii) The Bank shall issue approximately every three months a *Monetary Policy Statement* which will provide information on the performance of the inflation targeting framework, the results of the monetary policy actions, and the prospects regarding inflation.

iv) The Bank shall implement monetary policy in a sustainable, consistent and transparent manner.

v) The Bank shall be fully accountable for its judgments and actions in implementing monetary policy.

V. CONCLUSIONS

Concomitant with a move to more discretionary monetary management, Trinidad and Tobago's average inflation rate fell to 6% in the 1990s from around 12% in the previous decade but still remained highly variable. While it would certainly be desirable for Trinidad and Tobago to lower its annual inflation rate on a sustainable basis, this may prove difficult within the present monetary framework. The use of base money as a nominal anchor has not been firmly established which, in conjunction with the pursuit of multiple and conflicting monetary objectives suggest that more effective control of inflation and better prospects for economic growth may not be readily assured. This paper there considers the feasibility of inflation targeting as a more viable monetary option for Trinidad and Tobago.

The exploration found that Trinidad and Tobago meets most of the pre-conditions for implementing inflation targeting. Indeed, its inflation process appears to be just as predictable as in the inflation targeting countries prior to their adoption of the regime. Movements in the monetary base, M3 growth, the US treasury bill rate and change in real output have a high degree of predictive content on inflation to guide to policy makers reasonably well into the forecast horizon. The appropriate target should be headline RPI as long as the inflation target horizon spans eighteen to twenty-four months. Targeting headline RPI would allow foster better coordination of economy-wide inflationary expectations because of its pervasive use as an escalator for wage

and benefit payments. A transition path of inflation targets trending downward from around 3-6% in the short to medium term to 2-3% in the longer term seems feasible. The central target could then remain well anchored at about the mid-point of the range, which can be interpreted as the operational definition of price stability.

The preferred design option which balances insulation from political pressures and public accountability is reflected in an Inflation Targets Agreement (ITA), negotiated between the Minister of Finance and the Governor. Such a framework would clarify the monetary policy objectives of the instrument-independent CBTT, enhance transparency of its operations, and strengthen the CBTT's accountability. This could contribute to more accurate and coordinated inflationary expectations, which would help in reducing and stabilizing actual inflation. Inflation targeting could also lead to a better cyclical performance of the economy, and thereby improve the outlook for growth and development. However, in practice inflation targeting can be better, similar, or worse than other monetary policy frameworks depending on the specific manner in which the CBTT conducts monetary policy.

Adopting inflation targeting demands that monetary policy must focus primarily on the inflation forecast. Movements in other nominal variables, especially the nominal exchange rate, would enter into the monetary policy realm only to the extent that they affect the inflation forecast. Moreover, the CBTT should publish a *Monetary Policy Statement* every three months to provide detailed assessments of the inflation situation, including current forecast of inflation and discussions of the policy response that is required to keep inflation on track. Regular speeches by senior officials of the Bank on the inflation outlook would also enhance the communication process.

The impetus for the adoption of inflation targeting has varied across countries. The collapse of the exchange rate peg in the United Kingdom and Sweden led to the search for an alternative nominal anchor for monetary policy. Some countries such as Canada came to it after unsuccessful attempts with monetary targeting. Other countries that had reduced their core rate of inflation adopted inflation targeting as a means of locking in their inflation gains (Bernanke and Mishkin, 1997). Trinidad and Tobago falls into the latter category having already achieved some measure of success on the inflation front. From this perspective, once the necessary legal and technical requirements are sorted out a move to inflation targeting can be accomplished within a

year or so. Political support however remains crucial to the success or failure of such an institutional change. Whether the political administration would buy-in to a new monetary strategy may depend on whether the impetus for change emanates from the highest echelons or is initiated in a crisis situation.

REFERENCES

Baumgartner, J., R. Ramaswamy and G. Zettergren, 1999, *Monetary Policy and Leading Indicators of Inflation in Sweden*, International Monetary Fund, Washington (Working Paper 97/34).

Bernanke, B., and F. Mishkin, 1997, "Inflation Targeting: A New Framework for Monetary Policy", *Journal of Economic Perspectives,* vol. 11, nº 2, pp. 97-116.

Bernanke, B. S., T. Laubach, F. Mishkin and A. Posen, 1999, *Inflation Targeting: Lessons from the International Experience*, Princeton University Press, Princeton, New Jersey.

Central Bank of Trinidad and Tobago, 1995, *Proposals for the Independence of the Central Bank of Trinidad and Tobago*, mimeo, Central Bank of Trinidad and Tobago.

Christoffersen, P., and R. Westcott, 1999, *Is Poland Ready For Inflation Targeting?,* International Monetary Fund, Washington (Working Paper 99/41).

Debelle, G., 1997, *Inflation Targeting in Practice*, International Monetary Fund, Washington (Working Paper 97/35).

Debelle, G., and C. Hoon Lim, 1998, *Preliminary Considerations of an Inflation Targeting Framework for the Philippines*, International Monetary Fund, Washington (Working Paper 98/39).

Dobson, C., 1999, *Long Run Money Demand in Trinidad and Tobago*, mimeo, Central Bank of Trinidad and Tobago.

Haldane, A., 1997, *Some Issues in Inflation Targeting*, mimeo, Bank of England.

Hoffmaister, A., 1999, *Inflation Targeting in Korea: An Empirical Exploration,* International Monetary Fund, Washington (Working Paper 99/7).

Jonsson, G., 1999, *The Relative Merits and Implications of Inflation Targeting for South Africa*, International Monetary Fund, Washington (Working Paper 99/116).

Masson, P., M. Savastano and S. Sharma, 1997, *The Scope for Inflation Targeting in Developing Countries*, International Monetary Fund, Washington (Working Paper 97/130).

Mishkin, F., and A. Posen, 1997, "Inflation Targeting: Lessons from Four Countries", *Economic Policy Review* (Federal Reserve Bank of New York), August, pp. 9-110.

Nicholls, J., 1995, *The Estimation of Money Demand in Trinidad and Tobago, 1982-1994*, mimeo, Central Bank of Trinidad and Tobago.

Rambarran, A., 1994, "Technical Bias and the Retail Prices Index (RPI)", *Quarterly Economic Bulletin* (Central Bank of Trinidad and Tobago), vol. 12, nº 3, September.

Rambarran, A., 1996, *Financial Liberalization and Monetary Dynamics: The Case of Trinidad and Tobago*, mimeo, Central Bank of Trinidad and Tobago.

Sterne, G., 1999, "The Use of Explicit Targets for Monetary Policy: Practical Experiences of 91 Economies in the 1990s", *Bank of England Quarterly Bulletin,* vol. 39, nº 3, pp. 272-81.

Hernán Rincón Castro

Exchange rates and trade balance: testing the short-and-long-run relationship using data for Latin American countries

1. INTRODUCTION

Studying the relationship between trade balance and exchange rates is especially important for many developing economies where trade flows still continue to drive balance of payments accounts due to the low development of capital markets. In addition, exchange rate behavior, whether determined by exogenous or endogenous shocks or by policy, has been a common, yet controversial, policy issue in most of those countries. Economic authorities in developing countries have repeatedly resorted to nominal devaluations as a means to correct external imbalances and/or *misalignments* of real exchange rates, to increase competitiveness, to increase revenues, to be a key element of adjustment programs, and/or to respond to pressures from interest groups

Paper prepared by H. Rincón Castro, Economist of the Banco de la República, Colombia, who presented it at the IV Meeting of the Network of America Central Bank Researchers, organized by the Banco Central de Chile in Santiago, in October 20 and 21, 1999, and afterwards submitted it to the Rodrigo Gomez Central Banking Prize in 2000. The views expressed in this paper are those of the author and do not represent those of the Banco de la República or the Directive Board. He remains the only responsible for any errors of omission or commission. E-mail: hrincoca@banrep.gov.co

(exporters, bureaucracy, etc.). The decision to devalue has been taken many times even if the devaluation might cause inflationary spirals, domestic market distortions, disruptive effects on growth, and undesirable redistributive effects.

Conventional wisdom says that a nominal devaluation improves the trade balance. This conjecture is rooted in a static and partial equilibrium approach to the balance of payments that has come to be known as the *elasticity approach* (Bickerdike, 1920; Robinson, 1947; Metzler, 1948). The model, commonly known as the *BRM model*, has been recognized in the literature as providing a sufficient condition (the *BRM condition*) for a trade balance improvement when exchange rates devalue. The hypothesis that devaluation can improve the trade balance has been also rooted in a particular solution of the *BRM condition*, known as the *Marshall-Lerner condition* (Marshall, 1923; Lerner, 1944). This condition states that for a positive effect of devaluation on the trade balance, and implicitly for a stable exchange market, the absolute values of the sum of the demand elasticities for exports and imports must exceed unity. Accordingly, if the *Marshall-Lerner condition* holds, there is excess supply for foreign exchange when the exchange rate is above the equilibrium level and excess demand when it is below. The BRM and Marshall-Lerner conditions have become the underlying assumptions for those who support devaluation as a means to stabilize the foreign exchange market and/or to improve the trade balance.

Empirically, the evidence has been inconsistent in either rejecting or supporting the BRM or Marshall-Lerner conditions. In the vast number of cases where these conditions have been deduced, drawing primarily on data from developed countries, the testing procedure has relied on direct estimation of elasticities (see Artus and McGuirk, 1981; Artus and Knight, 1984; Krugman and Baldwin, 1987; Krugman, 1991). As is well known in the literature, estimated elasticities suffer problems ranging from measurability to identification. As a consequence, the evidence is suspect. Moreover, the results have been contradictory, depending on whether data from developed and developing countries are used (see Cooper, 1971; Kamin, 1988; Edwards, 1989; Paredes, 1989; Rose and Yellen, 1989; Rose, 1990, 1991; Gylfason and Radetzki, 1991; Pritchett, 1991; Bahmani-Oskooee and Alse, 1994).

With regard to lessons of experience, historical data for developed and developing countries have shown that devaluation may cause a negative effect on the trade balance in the short run but an improvement in the long run; that is, the trade balance fol-

lowed a time path which looked like the letter "J". The main explanation for this *J-curve* has been that, while exchange rates adjust instantaneously, there is lag in the time consumers and producers take to adjust to changes in relative prices (Junz and Rhomberg, 1973; Magee, 1973; Meade, 1988). In terms of elasticities, domestically, there is a large export supply elasticity and a low short-run import demand elasticity.

The primary objective of this paper is to examine the role of exchange rates in determining short-and-long-run trade balance behavior for a sample of Latin American countries (Chile, Colombia, Mexico, Paraguay, Venezuela) in a model which includes money and income. That is, the aim is to examines whether the trade balance is affected by exchange rates and whether hypotheses such as the BRM or the Marshall-Lerner conditions hold for the data. In addition, to test the empirical relevance of the *absorption* and *monetary* approaches for the current data.

Following the introduction, this paper has four sections. Section 2 presents and discusses the theory of the three main views of the balance of payments: elasticity, absorption, and monetary. Section 3 develops the econometric framework, which includes the presentation of a general econometric procedure, the presentation of a regression model formulation which includes the relevant variables for modeling the trade balance according to the theory, the data, and the tests for stationarity and order of integration of the relevant series. The econometric procedure has two main characteristics. (1) It avoids important specification and misspecification problems borne by most of the applied literature that have studied the relationship between exchange rates and trade flows. (2) It permits testing short-run behavior such as the J-curve's path and equilibrium hypotheses such as the BRM and Marshall-Lerner conditions. Section 4 tests the relevant hypotheses, discusses the estimations, and comments on the results. The regression model is tested, first, for specification, misspecification, and cointegration. Then the pertinent hypotheses are examined. Finally, section 5 summarizes the main findings, comments the limitations, and suggests directions for future research.

2. THE THEORY

This section, first, gives an exposition of the *BRM model* and its theoretical implications and presents the *BRM* and *Marshall-*

Lerner conditions. Second, it discusses the literature that has interpreted, reformulated, and incorporated the criticisms of the *elasticity approach*. This is focused on two views of the balance of payments: the *absorption* and the 'modern' *monetary approaches*.

2.1 The Bickerdike-Robinson-Metzler BRM Model and the BRM and Marshall-Lerner Conditions

The literature that has modeled the relationship between the trade balance and exchange rates, appeared first with the seminal paper of Bickerdike (1920), and then continued with Robinson (1947) and Metzler (1948). These are the sources of what has become known as the Bickerdike-Robinson-Metzler (BRM) model, or the *elasticity approach* (referred to here as EA) to the balance of payments. The core of this view is the substitution effects in consumption (explicitly) and production (implicitly) induced by the relative price (domestic *versus* foreign) changes caused by a devaluation.

The BRM model (or *imperfect substitutes model*) is a partial equilibrium version of a standard two-country (domestic and foreign), two-goods (export and imports) model.[1] The effects of exchange rate changes are analyzed in terms of separate markets for 'imports' and 'exports'.[2] The equations that define the model are

[1] It is necessary to clarify two basic assumptions underlying this model. First, there is perfect competition in the world market. Second, both countries are "large" countries. The model says nothing explicitly with respect to the equilibrium of the domestic market (e.g. economies are releasing and contracting resources for the export or import sectors but without making explicit where they are coming from), nontraded goods, and monetary or financial assets. These markets are relegated to the background.

[2] A conceptual note is necessary before continuing. Most of the literature that has analyzed the balance of payments has used different names for labeling a country's foreign variables of interest. Labels such as "foreign accounts," "balance of payments," "trade balance," and "current account" have been often used without distinction, even though these terms may have a different meaning for theoretical and/or empirical purposes, as well as for accounting purposes. Therefore to have a better understanding of what practical concept may be meant by the different approaches, this paper attempts to proxy the theoretical concepts to standard definitions used by balance of payments and national income accounts. Here is the first one. The terms underlying the BRM model seems to correspond to that definition of "trade balance" given balance of payments accounts. Thus, 'imports' and 'exports' should be understood to refer to imports and exports of goods.

given as follows.[3] The domestic demand for imports (foreign exports) is a function of the nominal price of imports measured in domestic currency,[4]

$$M^d = M^d(P_m) \tag{2.1}$$

Observe that P_m is nothing but $P_m = EP_m^*$, where E is the nominal exchange rate; that is, the domestic currency price of foreign exchange and P_m^* is the foreign currency price (level) of domestic imports (the symbol "*" refers to the analogous foreign variable). Now, the foreign demand for imports (domestic exports) can be similarly defined as,

$$M^{d^*} = M^{d^*}(P_x^*) \tag{2.2}$$

where M^{d*} is the quantity of foreign imports and P_x^* is the foreign currency price (level) of domestic exports. Analogous to the definition above, P_x^* is $P_x^* = P_x/E$, where P_x is the domestic currency price (level) of exports.

Similarly to the demand functions, the export supply functions are defined depending only on nominal prices. The domestic and foreign export supply functions are defined as,

$$X^s = X^s(P_x) \tag{2.3}$$

$$X^{s^*} = X^{s^*}(P_m^*) \tag{2.4}$$

where X^s and X^{s*} are the quantity of domestic and foreign supplies of exports, respectively. The market equilibrium conditions for exports and imports are then,

[3] The current presentation of the model draws heavily on the analysis of Dornbusch (1975). Some of the conditions arising from it, in addition to the general BRM condition, are discussed in Vanek (1962), Magee (1975), and Lindert and Kindleberger (1982). For alternative discussions of the model see Stern (1973) and Lindert and Kindleberger (1982). A primary algebraic discussion and interpretation is presented by Alexander (1959).

[4] The demand functions below are assumed to be Marshallian demands with negative and positive price and income elasticities, respectively. Even though the model is not built upon explicit microfundations, one may assume that those demand functions are derived from an agent utility maximization problem, that is, they satisfy the properties such as homogeneity of degree zero in prices and income, budget constraint equality, and that the Slutsky matrix is negative semidefinite. Criticisms of this model have emphasized that, for example, the budget constraint is not satisfied by the present model, at least explicitly.

(2.5) $$M^d = X^{s^*}$$

(2.6) $$M^{d^*} = X^s$$

Given equations (2.1)-(2.4), the domestic trade balance, in domestic currency, is

(2.7) $$B = P_x X^s - P_m M^d$$

Assuming that there is equilibrium, that is, $B=0$, the relevant question is, does devaluation of the domestic currency improve the trade balance (B)?[5] A sufficient condition for trade balance improvement, and drawing from it, for stability of the foreign exchange market under the model, is provided by the *BRM condition*.[6] Differentiating (2.7) and putting the results in elasticity form, a general algebraic condition is derived.[7] This condition relates the response of the trade balance to exchange rate changes and the domestic and foreign price elasticities of imports and exports:[8]

[5] Observe two important points about exchange rates under the current model. First, since nontraded goods do not exist, the real exchange rate is measured by the terms of trade. Second, any nominal devaluation (assumed to be exogenous) becomes a real devaluation. The explanation lies, as is well known by the literature, in that implicit assumption that domestic and foreign price levels remain constant, or they are determined exogenously. Kenen (1985, p. 643) points out that the distinction between nominal and real exchange rates makes this model Keynesian in nature in the sense that goods markets are cleared by output changes, not by price changes.

[6] Exponents of the elasticity approach have said that if there are sources of stability or instability characteristic to foreign exchange markets, they have to rest in trade responses to exchange rate changes. Lindert and Kindleberger (1982, p. 272) claim that the reasons are: (1) "the channeling of trade-flow transactions through an asset market, in which money assets are traded for each other, has no direct analogue in domestic asset markets, making it dangerous to infer exchange-rate stability or instability from the way domestic markets behave;" and (2) "trade-flow behavior seems more likely to bring cumulative changes in exchange rates than do international capital movements. The latter have a built-in element of self-reversal, since each flow brings a later reverse flow as interest and principal are repaid."

[7] See derivation in Appendix A.1.

[8] One can show that, by *Walras's Law*, it is sufficient to find equilibrium in one market. This is so because by the market clearing conditions (2.5) and (2.6) the excess of demand in any one market would be offset by the excess of supply in the other market. Thus, without loss of generality, the solution could be given in terms of any of the two markets.

$$\frac{dB}{dE} = P_x X^s \left[\frac{(1+\varepsilon)\eta^*}{(\varepsilon+\eta^*)}\right] - P_m M^d \left[\frac{(1-\eta)\varepsilon^*}{(\varepsilon^*+\eta)}\right] \tag{2.8}$$

where η and ε denote the price elasticities (in absolute values) of domestic demand for imports and supply of exports. Analogously, η^* and ε^* denote the respective foreign price elasticities.[9] As can be shown, if $B=0$ (initial equilibrium), then $dB/dE > 0$ if and only if

$$\frac{\eta\eta^*(1+\varepsilon+\varepsilon^*) - \varepsilon\varepsilon^*(1-\eta-\eta^*)}{(\varepsilon+\eta^*)(\varepsilon^*+\eta)} > 0 \tag{2.9}$$

Notice that a relevant case for this paper is that where $\varepsilon^*=\eta^*=\infty$, that is, a "small country" case (Lindert and Kindleberger, 1982, ch. 15). Here the foreign export supply and export demand are perfectly elastic. Under this case, condition (2.9) becomes $(\varepsilon+\eta)$. Another way to state this case is to say that a country is a price-taker in both its import and export markets. Accordingly, a country's currency devaluation has no effect on the world prices (in foreign currency), of its exports and imports. This implies that only changes in volumes affect its trade balance. Thus, without considering the algebraic result, the effect of a country's currency devaluation on the trade balance would be the following. One knows that if a country's currency devalues, exporters would receive more units of domestic currency for their exports. Accordingly, one would expect they respond exporting more at the given foreign price. On the other hand, importers would face higher domestic currency prices for their imports. Consequently, they would reduce their imports. Thus, "with export volumes rising and import volumes falling at fixed …[foreign prices], the devaluation would unambiguously improve the balance of trade" (Lindert and Kindleberger, 1982, p. 287). Therefore, under this case, and assuming export and import volumes respectively in-

[9] As interpreted by Alexander (1959), two very important implicit assumptions have been contained in the derivation of the demand elasticities. The first assumption is that domestic and foreign nominal incomes are held constant. The second is that "domestic prices" remain constant ("domestic" should be understood as the general domestic price level). Dornbusch's (1975) interpretation of the first assumption is that one can assume those elasticities are compensated elasticities. Negishi (1968) and Kemp (1970), among others, emphasized first that, in addition to those assumptions, the model assumes implicitly that all cross price elasticities (between exports and imports) are set equal to zero. Thus, the Slutsky matrix becomes a diagonal matrix.

crease and decrease, a devaluation must improve the domestic trade balance in foreign currency.[10]

If the trade balance is measured in domestic currency, the story might be quite different. The reason is that the increase in the value of domestic exports could be smaller than the decrease in the value of domestic imports, that is, the final effect on the trade balance would depend on the domestic price elasticity of supply and demand. A domestic country's devaluation should improve the trade balance, in domestic currency, if $\varepsilon > |\eta|$ (remember that by assumption there are no qualitative or quantitative trade restrictions). But does $\varepsilon > |\eta|$ hold for developing economies such as the current Latin American's? They export mainly raw products (e.g., agricultural products) and import durable goods, raw materials, and intermediate and final capital goods (e.g., equipment). With respect to exports, they may have 'low' short-run price elasticity of supply for some goods (e.g., oil, livestock, copper, tree crops, or goods with low domestic consumption) and 'large' elasticities for others, for example for those goods being produced with excess of capacity (some manufactures such as textiles), or goods with large stocks (e.g., some manufactures or grains, or goods with high participation in domestic consumption so that exports can be increased by reducing it if needed). In the long run, one may expect 'large' elasticity for both types of goods. As for imports, durable goods should have a large import price-demand elasticity both in the short and long run and for most of the intermediate and many of the capital goods, one may expect low import-price elasticity, at least for the short run. It follows that the answer is not that straightforward. Of course, if it is true that the current economies export primarily products with large price elasticity of supply and import, intermediate and final industrial products, then $\varepsilon > |\eta|$ should hold. Therefore, a devaluation should improve their trade balance. Otherwise, the answer is not direct.

Another result that can be derived from condition (2.9) is the so-called *Marshall-Lerner condition* (Marshall, 1923; Lerner, 1944). This condition (referred to here as the ML condition) comes from letting $\varepsilon \to \infty$ and $\varepsilon^* \to \infty$. This assumption implies that the left-

[10] In practice, however, this is not always the case. A devaluation might actually worsen in the period immediately following devaluation, when measured in foreign currency (Cooper, 1971). This worsening "would occur if …[for instance,] import liberalization takes effect immediately, giving rise to an increase in imports, while the stimulus to exports occurs only with a lag" (*Ibid.*, p. 15).

hand side of condition (2.9) becomes $\eta^{*}+\eta-1$. Thus, for a trade balance improvement when a country's currency devalues, $\eta^{*}+\eta > 1$ must hold. Or, in the standard presentation of the ML condition, $|\eta+\eta^{*}| > 1$. In words, this condition states that if domestic and foreign supply elasticities are strictly elastic and if income remains constant, then a devaluation causes an improvement of the trade balance when the domestic plus the foreign import demand elasticities for imports, in absolute value, exceeds one. This has been considered by the literature as a sufficient condition for stability of the foreign exchange market. Thus, if the ML condition holds, "then there is an excess of demand for foreign exchange when the exchange rate is below the equilibrium value and excess of supply when it is above the equilibrium rate. Under these conditions the exchange rate will move to its equilibrium value and the market will be cleared"(Hallwood and MacDonald, 1994, p. 30).[11] The question that is relevant for the purposes of this paper is whether or not the ML condition empirically holds for a developing country such as Colombia. As was discussed above, at least as derived from theory, it seems that it does not. The Colombian economy might be better characterized by the "small country" case. Thus, a devaluation might or might not improve the trade balance (in domestic currency).[12]

2.2 The Absorption and Monetary Approaches

Two different approaches to the balance of payments emerged from the beginning of 1950s: The absorption and monetary approaches. Authors such as Harberger (1950), Meade (1951), and Alexander (1952, 1959) came to be part of a new body of analysis known as the *absorption approach* to the balance of payments (Krueger, 1983; Kenen, 1985).[13] The second approach was the

[11] One can understand the term "equilibrium rate" in this quote as that given by the *purchasing power parity* (PPP) equilibrium exchange rate.

[12] Different arguments that claim that the ML condition may not hold come from partial equilibrium studies (Dornbusch, 1987; Krugman, 1987; Krugman and Baldwin, 1987). They say that there may exist market failures like *elasticity pessimism*, *hysteresis*, *pricing to market behavior*, or *uncertainty* that may prevent the ML condition from holding.

[13] Kenen (1985, ch. 3) presents a static model which puts together the elasticity and absorption approaches. There income and substitution effects of monetary (e.g., the effects of a devaluation) and fiscal policy are derived in elasticity form.

monetary or global monetarist approach (Polak, 1957; Hahn, 1959; Pearce, 1961; Prais, 1961; Mundell, 1968, 1971).[14]

The absorption approach (referred to as AA) shifted the focus of economic analysis to the balance of payments and solved some of the original criticisms of the EA.[15] While the EA based its results on the effects of exchange rate changes on individual microeconomic behavior (Marshallian supply and demand analysis), this approach focuses its analysis mainly on economic aggregates, typical of Keynesian analysis. The core of this approach is the proposition that any improvement in the trade balance requires an increase of income over total domestic expenditures.[16,17] One

[14] Two monetary perspectives has been distinguished by the literature: the monetary approach, which is referred to in this paper, and the Keynesian monetary view. Some of the basic assumptions underlying each of the these perspectives are the following. With respect to the former: (1) there is full employment; (2) there is perfect arbitrage in the world markets, that is, PPP holds; (3) money and other assets may exist, which are close substitutes for domestic and foreign goods or assets. This approach have been also called the "global monetarist" (Whitman, 1975). With regard to the Keynesian view: (1) there is unemployment, (2) price sluggishness occurs so that PPP may not hold, (3) and money is a close substitute for other assets. For a full discussion of the monetary view, see Whitman (1975), Frenkel and Johnson (1977), Hallwood and MacDonald (1994), and Frenkel and Razin (1996).

[15] Some of the initial criticisms of the EA are: (a) the import demand and export supply functions, defining the structural model, depend only on the nominal prices (measured in domestic currency units) rather than on relative prices and appropriate scale variables such as real income, real expenditures, real money balances, or productive capacity; (b) there are markets or goods not accounted for explicitly. For example, a trade deficit implies that goods are paid for with an asset (e.g., money) or income that has not been explicitly included in the analysis; (c) it relies overly on a partial approach for analyzing a problem that should use a general equilibrium framework.

[16] Two points have to be kept in mind: first of all, in a similar manner to that of the EA, in AA the current account is reduced to the trade balance and the countries referred to are "large" countries. Second, unlike the EA, income and money are introduced. Though the latter is slightly discussed.

[17] As for the trade balance, it is necessary to clarify some points. The absorption approach takes implicitly the Keynesian income-expenditure assumption that export volumes are independent (*autonomous*) of national income, and that imports depend directly and positively on national income. This positive dependence is said to happen in two ways. One is that often a country's production needs imported inputs; the other is that imports respond to the total absorption (Alexander, 1952). The more a country spend on goods and services, the more a country will be inclined to spend on that portion that is bought from

can state what the nominal and real effects of a devaluation are under the absorption approach as follow (only effects on the domestic economy are discussed). It is assumed that there exists a Keynesian short-run world. Devaluation reduces the relative prices of domestic goods in domestic currency. This reduction produces two direct effects. First, there is a substitution effect that causes a shift in the composition of demand from foreign goods towards domestic goods; that is, the exchange rate change causes an *expenditure-substituting* effect. Assuming unemployment (as is characteristic of any Keynesian analysis), domestic production increases. Observe that up to now this substitution effect is what the EA would predict happens when devaluation is present. Second, there is an income effect which would increase absorption, and then reduce the trade balance. The income effect is related to both the increase in domestic output (income), which acts through the "marginal propensity to absorb" (consume) and "marginal propensity to invest," and the change in the terms of trade (TOT). The absorption approach argues that, in general, a country's devaluation causes a deterioration in its terms of trade, and thus a deterioration in its national income. The presumption is that a devaluation will result in a decrease in the price of exports measured in foreign currency.[18] Of course, the fact that TOT deteriorates does not necessarily imply that the trade balance is going to deteriorate. "It can worsen the trade balance if the foreign currency price of exports sinks far enough relative to the price of imports to outweigh the trade balance improvement implied by the rise in export volumes and the drop in import volumes" (Lindert and Kindleberger, 1982, p. 312). In all, the final net effect of a devaluation on the trade balance will depend on the combined substitution and income effects. As predicted by the AA, the trade balance will improve, but it would be smaller (because of the income effect on absorption) than that predicted by the BRM model.

---

abroad. This behavior is summarized by the well known Keynesian *foreign trade multiplier*.

[18] Since countries are "large" countries with elastic supplies, then under the assumption of constant domestic prices (in other words, strictly elastic export supply), a devaluation will reduce the relative price of domestic exports in foreign currency (because the domestic export supply schedule shift down). The price of imports in foreign currency remains constant, or it can decrease if the foreign export supply is not perfectly elastic. The key condition for a worsening of the domestic TOT is that the decrease in the price of exports is greater than the decrease of the price of imports.

The monetary approach (referred to as MA) also shifted the focus of economic analysis to the balance of payments and sough to solve some of the criticisms of the EA and AA.[19] The core of the monetary approach is the claim that "the balance of payments is essentially a monetary phenomenon" (Frenkel and Johnson, 1977, p. 21).[20] That is, under the MA any excess demand for goods, services and assets, resulting in a deficit of the *balance of payments*, reflects an excess supply or demand of the stock of money. Accordingly, the balance of payments behavior should be analyzed from the point of view of the supply and demand of money: "surpluses in the trade account and the capital account respectively represent excess flow supplies of goods and of securities, and a surplus in the money account …[that is, in a country's foreign reserves account] reflects an excess domestic flow demand for money. Consequently, in analyzing the money account, …, the monetary approach focuses on the determinants of the excess domestic flow demand for or supply of money" (Frenkel and Johnson, 1977, p. 21). The fundamental implication of this claim is that to analyze what happens in the (overall) balance of payments one should just concentrate on the analysis of what happens with the central bank's balance of foreign reserves.[21] What does the MA says about the nominal (or real) effects of devaluation? Unlikely to the EA and AA, the monetary approach says little about the underlying behavioral relationships. Moreover, it says little about the effects of exchange rate changes and the transmission mechanisms on those relationships. The role of the exchange rate is reduced to its temporary effects on the money supply. The reason is that MA assumes "a change in the exchange rate will not systematically alter relative prices of domestic and foreign goods and it will have only a transitory effect on the balance of payments" (Whitman, 1975, p. 494). The relevant question for the purposes of this paper is: what is the 'transitory' (or

[19] Corden (1994, p. 59) argues that the monetary approach is useful "as a supplement to approaches … that focus on the real economy: on absorption, savings, investment, and the real exchange rate. It comes into play when the concern is with the ability of the central bank to defend a fixed nominal exchange rate."

[20] The term "balance of payments" is understood by this approach to be all those items that are *below the line*. Those items constitute what is called the *money account*.

[21] This highlights "a controversial philosophy of how the balance of payments should be analyzed" (Isard, 1995, p. 103).

short run) effect of the devaluation under the MA? In the short run, this approach predicts that an increase in prices (e.g., caused by a nominal devaluation) may reduce the real money stock, and then improve the trade balance. The mechanism works as follows. A devaluation will increase (proportionally) the domestic prices.[22] Then, people will reduce spending/absorption relative to income in order to restore their real money balances and holding of other financial assets. In brief, hoarding will increase (along the hoarding schedule).[23] As a result, the trade balance, and directly the money account, will improve. As stated, this effect will be entirely temporary. Once people have restored their desired financial holdings, real money balances "expenditures will rise again and … [any] new surplus … [in the stock of money caused by the trade balance surplus] will be eliminated" (Cooper, 1971, p. 7).[24]

3. THE ECONOMETRIC FRAMEWORK

The main goal of this section is to develop testable hypotheses from the theoretical models presented in section 2 and present an econometric technique to distinguish among those hypotheses. This section begins introducing a general econometric procedure, which provides the statistical approach to hypothesis testing of this paper. Second, this section presents a regression model formulation which includes the relevant variables for modeling the trade balance according to theory discussed in section 2. Third, it introduces the data along with some initial evaluation. Finally, this section tests whether the time series are *stationary* or *nonstationary* processes, and examines their *order of integration*.

3.1 The Econometric Procedure

Though cointegration is a statistical characteristic, whether it

[22] The small country assumption is implicit here.

[23] Notice, however, that if the monetary authorities increase the money supply, e.g., through an increase in the domestic credit, the effect on the money account may be undetermined.

[24] This result assumes that the monetary authority keeps the domestic credit constant. This is a typical presumption of the IMF's type of adjustment program for developing countries. If the domestic credit increases after a devaluation to satisfy the new demand for money, the effects of the devaluation on the trade balance would be undetermined.

exists among economic variables of interest is a question that has significant implications for understanding the behavior of those variables. Cointegration simply implies that there is a linear combination (or *cointegrating vector*) of nonstationary variables that is stationary.[25] In terms of the time series jargon, stationarity means that neither the mean nor the *autocovariance* of a time series depend on the date t (Hamilton, 1994).[26] In other words, a time series is stationary if it exhibits mean *reversion* and the variance is finite.[27] If cointegration does not exist, the linear combination is not stationary or has an infinite variance and a there is no mean to which it returns. From the economic point of view, this suggests that "any paradigm linking …[the variables of interest] has no empirical content in time series data, evidence that would serve as a strong rejection of popular explanations used to predict the behavior …[of those variables in a particular economic theory formulation]" (Hoffman and Rasche, 1996, p. 33). Evidence of cointegration in this paper means that a stationary long-run (equilibrium) relationship among jointly endogenous random variables of interest is present. This will imply, for the purposes of this study, that quantifiable stationary relationships, such as the BRM or ML conditions, hold. Indeed, these conditions will be met if both cointegration and the expected signs hold.[28]

The econometric procedure used in this paper is a version of analyzing multivariate cointegrated systems developed originally by Johansen (1988, 1991), then expanded and applied in Johansen (1995a, 1995b) and Johansen and Juselius (1990, 1992, 1994).[29] It consists of a full information maximum likelihood estimation (FIML) of a system characterized by r cointegrating vectors (CIVs).[30] The statistical model is the following. Assume z_t,

[25] A simple algebraic and geometric interpretation of the concept of cointegration is that of Granger and Engle (1991).

[26] In time series analysis a stochastic process having these two characteristics is called *covariance stationary*. The literature refers to it as a *weakly stationary*, *second-order stationary*, or simply stationary process.

[27] The term "mean reversion" means that that a time series sequence fluctuates around a constant 'long-run' mean. For a strict definition see Hamilton (1994).

[28] In an Engle and Granger (1987)'s context, Jones and Joulfaian (1991) and Bahmani-Oskooee and Payestesh (1993) have an interpretation for the error-correction model similar to that presently given.

[29] The notation currently used follows closely Johansen and Juselius'.

[30] A related approach to Johansen's is that of Stock and Watson (1988), and Ahn and Reinsel (1990). These approaches, which rely on the relationship be-

$t=1,\ldots,T$, which denotes a ($px1$) vector of random variables, follows a p-dimensional VAR model with Gaussian errors (p is the number of jointly endogenous variables); the conditional model, conditional on the observations $z_{-k+1},\ldots, z_0$ which are fixed (k is the lag length for the system), can be written then as,

$$z_t = A_1 z_{t-1} + \cdots + A_k z_{t-k} + \mu + \Psi D_t + \varepsilon_t \tag{3.1}$$

where A_1, A_2, …, A_k are p by p matrices, μ is a vector of constants, and D_t is a vector of nonstochastic variables, orthogonal to the constant term, such as seasonal dummies, "dummy-type" variables, and/or stochastic "weakly exogenous" variables, and $\varepsilon_1,\ldots, \varepsilon_T$ are *i.i.d* $N(0,\Sigma)$.[31,32] Now, assuming cointegration between variables in z_t, one writes the model in error correction form,

$$\Delta z_t = \Gamma_1 \Delta z_{t-1} + \cdots + \Gamma_{k-1} \Delta z_{t-k+1} + \Pi z_{t-k} + \mu + \Psi D_t + \varepsilon_t, t = 1,\ldots, T \tag{3.2}$$

where $\Gamma_i = -(I - A_1 - \ldots - A_i)$, for $i=1,\ldots,k-1$; and $\Pi = -(I - A_1 - \ldots - A_k)$. This model defines hypothesis H_1. The model stated by the system in (3.2) is also known in the literature as the vector error-correction model (VECM). Here the short-run dynamics of the variables in the system are represented by the series in differences and the long-run relationships by the variables in levels. Under (3.2) any deviation from the long-run equilibrium may influence the short-run dynamics.[33] Now, if z_t is integrated of order one,[34] that is $I(1)$, then the matrix Π is of reduced rank,

---

tween the rank of a matrix and its characteristic roots, generalize the procedure of Engle and Granger (1987). Remember that the Engle and Granger procedure is characterized by the existence of exactly one cointegration relation and a normalization given by a nonzero coefficient of the chosen 'dependent' variable.

[31] The term "weakly exogenous" variables follows that definition in Engle et al. (1983). In simple, rather informal terms, weak exogeneity means the following. Assume y is a random variable thought to be explained by the random variable x. The variable x is said to be weakly exogenous if y does not also explain x.

[32] Dummy-type variables are also included as recommended in Johansen and Juselius (1992) and Hendry and Mizon (1993) to take account of short-run shocks, structural changes, or outliers, to the system in order not to violate the *i.i.d.* and Gaussian assumptions of the error term.

[33] Observe that if the vector z_t has a VECM representation, estimating (3.2) without the term Πz_{t-k}, even as a VAR in first differences, entails a misspecification error (Engle and Granger, 1987).

[34] Strictly speaking, what is needed is z_t at most $I(1)$, so that "not all the individual variables included in z_t need to be $I(1)$, as is often incorrectly assumed. To

(3.3) $\Pi=\alpha\beta'$

where α (weights or *error correction* parameters, or *speed of adjustment* parameters)[35] and β (cointegration vectors) are (*pxr*) matrices of rank *r*.[36] Under this hypothesis, denoted $H_2(r)$, the process Δz_t is stationary, z_t is nonstationary but $\beta' z_t$ is stationary (Engle and Granger, 1987; and Johansen, 1988, 1991).[37] In other words, under $H_2(r)$ one or more *r* linear combinations of variables included in z_t exist and have a finite variance. These linear combinations are called cointegrating vectors or long-run equilibrium relationships.[38]

3.2 The Regression Model[39]

---

find cointegration between nonstationary variables, only two of the variables have to be *I*(1)" (Hansen and Juselius, 1995, p. 1).

[35] For the purposes of this paper, these three terms are taken to mean the same. In economics, the applied rational expectations literature would say that the interpretation of those parameters as "speed of adjustment" parameters is not appropriate because in those models, by construction, there no partial adjustment mechanisms exist (Hoffman and Rasche, 1996).

[36] Note that "the space spanned by β is the space spanned by the rows of the matrix Π, which we shall call the cointegration space" (Johansen, 1988, p. 233).

[37] Under $H_2(r)$, for example, the reduced form in equation (3.2) can be written then as $\Delta z_t = \Gamma_1 \Delta z_{t-1} + \alpha\beta' z_{t-2} + \mu + \Psi D_t + \varepsilon_t$, for k=2. From the VECM representation we know that Γ_1, μ , Ψ, Σ represent the unrestricted short-run parameters, and α and β the long-run parameters.

[38] Observe that the *rank condition* implicit in $H_2(r)$ is that $0<rank(\Pi)=r<p$. However, two other cases may emerge. First, $rank(\Pi)=0$. This implies that each element of Π must be zero. Accordingly, no long-run equilibrium exists. In other words, since any linear combination of those independent *I*(1) variables is itself *I*(1), variables cannot be cointegrated (for estimation purposes, this case implies that one can use a standard VAR model with the series in first differences). Second, $r=rank(\Pi)=p$, that is, the matrix Π is of full rank. This implies that the vector process z_t is jointly stationary. In other words, each series in z_t is stationary and each linear combination of z_t is stationary as well. Under this case, the long-run solution to the VECM system (3.2) is given by *p* independent equations (that is, no cointegration exists), where each equation is an independent restriction on the long-run solution of each of the variables (this case implies one can use directly a standard VAR model with the series in levels, since they are already stationary).

[39] Rincón (1995) uses the present econometric methodology and tests for the ML condition and J-curve in data from Colombia for the period 1970 through 1994. He finds, using only two variables in the VECM system (the real exchange

The variable formulation of the statistical model stated by equation (3.1) is given by the vector $z_t = (\text{TB,REER,MI,RGDP})'_t$, where TB is a trade balance measurement, REER is a real exchange rate index, MI is a (real) money stock, and RGDP is the real GDP. This vector is thought to capture the effects of the exchange rate on the trade balance in a model that puts together (nets) the elasticity, absorption, and monetary approaches to the balance of payments. The author is not aware of any literature that has included income and money in trade balance estimations and has used the current econometric procedure on the issue being analyzed.

It is useful to summarize the hypotheses about the exchange rate-trade balance and income- and-money-trade-balance relationships developed in section 2. With the elasticity approach, the exchange rate is the primary determinant of the trade balance. Devaluation improves the trade balance by changing the relative prices between domestically and foreign sourced goods. In the absorption approach an exchange rate change can only affect the trade balance if it induces an increase in income greater than the increase in total domestic expenditures (absorption). Thus, both relative prices and income are primary determinants of trade balance behavior. The monetary approach asserts that exchange rate changes have only temporary effects. Hence, there should be no long-run equilibrium relationship between the trade balance and exchange rates. Finally, as referred to in the introduction, the lessons of experience have shown that devaluation may cause a negative effect on the trade balance in the short run but an improvement in the long run; that is, the trade balance follow a time path which looks like the letter "J".

With respect to the income variable what is expected is a negative/positive under the absorption/monetary approach. As said above, one of the effects of devaluation under the absorption approach is an income effect. This is related to both an increase in domestic output (income) and a change in the terms of trade. Both changes might increase absorption (consumption and investment) and then imports. This would worsen the trade balance. From the point of view of the monetary approach, "if …[an] economy is growing over time … it will ceteris paribus run a …[trade balance] surplus"(Hallwood and MacDonald, 1994, p.

---

rate and the trade balance), that a behavior such as that claimed by the ML condition holds. Evidence of the J-curve is not detected.

148). The reason is the implicit assumption that income growth raises expenditures by less than output, therefore improving the trade balance.

As for the money variable, the following is expected. Under the absorption approach (following Keynesian assumptions) the money supply is an exogenous variable; it is a policy instrument. Thus, the monetary authorities offset, or sterilize (through open market operations), the impact on the domestic money stock of foreign exchange market intervention.[40] It follows that, there should be no effect of the money stock on the balance of payments (and on expenditures). On the other hand, the monetary approach argues that in a fixed exchange rate regime the money supply is endogenously determined by the interaction of the supply and demand of the money stock. This implies that, assuming the domestic credit is exogenously determined and equal to a constant, the nominal money stock change equals the change of foreign reserves. Hence, it is equal to the trade balance surplus or deficit. This implies, that under the monetary approach (with no changes in domestic credit) one expects a zero coefficient for the money variable in the trade balance equilibrium equation. That is, the trade balance explains the money stock, and not *vice versa*.[41]

3.3 The Data and a Graphical Inspection[42]

The data set of this paper consists of quarterly time-series data for Chile, Colombia, Mexico, Paraguay, and Venezuela. The

[40] For example, a country with a trade balance surplus (buying foreign exchange, and hence expanding the money supply) may sterilize the extra money supply by open market sales of bonds that balance the money supply. From the monetarist point of view, this sterilization policy is possible but only in the short run.

[41] Another way of explaining a zero coefficient for the real money stock in the real trade balance equation is using the monetarist assumption of money neutrality. In the long run, money has no real effects because it is assumed that the effect of an increase of money on the domestic price level is proportional. This implies that $\Delta(M/P)$, where M is a money stock and P is the price level, will be a constant. Therefore, in the trade balance equation, the coefficient of the money stock should be zero. Any effect of this variable should be captured by the constant term of the regression.

[42] All the estimation results and plots reported in this paper come from outputs of RATS, CATS, and SHAZAM softwares and procedures from the Estima's *Home Page*.

sample varies slightly with country and variable, specially with the money aggregate, but in general it covers the period 1979:1 through 1995:4. Appendix A.2 reports the span of the data by country and by variable.[43] Since the aim of this paper is to produce general conclusions, the countries chosen range from the largest countries of Latin America (Mexico) to the smallest countries (Paraguay). This implies that important structural, institutional, and policy differences exist across those countries. These differences are captured through the introduction of some proxy variables by country.[44] No comparison, however, is made among countries, the study of which is beyond the scope of this paper. Of course, the choice of the countries and the sample also reflect data availability. As is well known in the applied literature, most of the data from developing countries suffers from uneven quality, short samples, and limited coverage. The data sources are the *International Financial Statistics*, IMF (CD Rom), *Direction of Trade Statistics Yearbook*, IMF, and the respective monthly bulletins and *home pages* of the central banks.

The time series include observed values of exports, imports, a real effective exchange rate index, narrow money (M1), the real gross domestic product (RGDP) (an index of oil production was used for Venezuela because no income indicator was available), the consumer price index, and an index of the real world price of coffee and oil.[45] The measure of trade balance (called TB) is represented by the ratio of exports to imports. This ratio, or its inverse, has been also used in similar settings by Haynes and Stone (1982), Bahmani-Oskooee (1991), and Bahmani-Oskooee and Alse (1994). The use of this ratio has several advantages. First, it is invariant to units one is measuring for exports and imports, in other words, whether they are in real or nominal terms or in domestic or foreign currency. Second, the regression equations can

[43] Even though the IMF's data set on money aggregates was available for the full sample and all countries, it suffers from inconsistencies due to constant changes in the methodology of classification. Accordingly, only the periods where series were consistent, or were able to be completed or substituted from other sources, have been considered.

[44] For example, according to IMF standards Mexico and Venezuela are major fuel exporters, and Colombia is a major coffee exporter. Thus, dummy-type variables are respectively included in the estimation exercises to control for oil and coffee price shocks. Also a proxy variable to capture the respective country´s closedness to international trade was included.

[45] The latter two variables will be included in the statistical system to capture exogenous shocks which may affect the statistical properties of the system.

be expressed in *log-linear* form or *constant elasticity* form. Accordingly, the estimated coefficients are elasticities. The real effective exchange rate index (REER) was calculated for the case of Mexico, which was not available from the sources. Its construction followed the procedure used by Edwards (1989) to build a "multilateral" real exchange rate index (see Appendix A.3 for details of its calculation).[46] Finally, all series are logged (natural logs). This is indicated by preceding the name of the variable with "L".

Figure 1 plots the observed trade balance and the real effective exchange rate, and Figure 2 plots the real money stock and the real GDP. The data reveal the following empirical regularities:[47]

(1) the trade balance and the real exchange rate seem to behave as nonstationary series, specifically, as random walks. That is, both series have no particular tendency to revert to a specific mean. Observe that the real exchange rate seems to go through sustained periods of appreciation, depreciation, and again appreciation without a tendency to revert to a long-run mean. An exception is Mexico where it seems to return to its mean. It is noticeable the deep appreciation at the beginning of the 80s for all countries, which coincides with the beginning of the well-known period of the "debt crisis" in most of the Latin American economies. In most of the cases, the trade balance has gone from deep deficits to elevated surplus, and then to deep deficits again, with no tendency to revert to an equilibrium or to a specific value;

(2) the real money stock and the real GDP (or the proxy) seem to contain linear trends. This implies that these series might have a stochastic time-variant mean. This would make them nonstationary series. Noticeable cases seem to be Chile and Colombia;

(3) the trade balance measurement and the real exchange rate, and the real money stock and the real GDP, seem to share co-

[46] See Edwards (1989, ch. 4) for theoretical and empirical reasons for why one should use a multilateral rate instead of a bilateral one. He shows empirical evidence from developing countries which corroborates his claim.

[47] Graphical analysis allows one to make a preliminary approach to the model and to identify the possible presence of deterministic components. Remember, for example, that if there are linear trends in the data, "both the estimation procedure and the rank inference will differ compared to the case with no linear trends" (Johansen and Juselius, 1992, p. 218). The root of the problem is that the cointegrating space is affected.

movements. For example, the trade balance appears to mimic closely the real exchange rate movements for Chile, Colombia, and Mexico. For Venezuela the trade balance moves inversely to changes in the real exchange rate most of the time. The real money stock and the real GDP seem to be similarly timed for all countries;

(4) all variables and for all countries seem to display a high degree of persistency. That is, a shock to a variable persists for a long period of time. For instance, a high depreciation of the Colombian peso at the middle of 1980s remained for almost six years.

Figure 1

TradeĎBalanceĎvs.ĎRealĎEffectiveĎExchangeĎRate

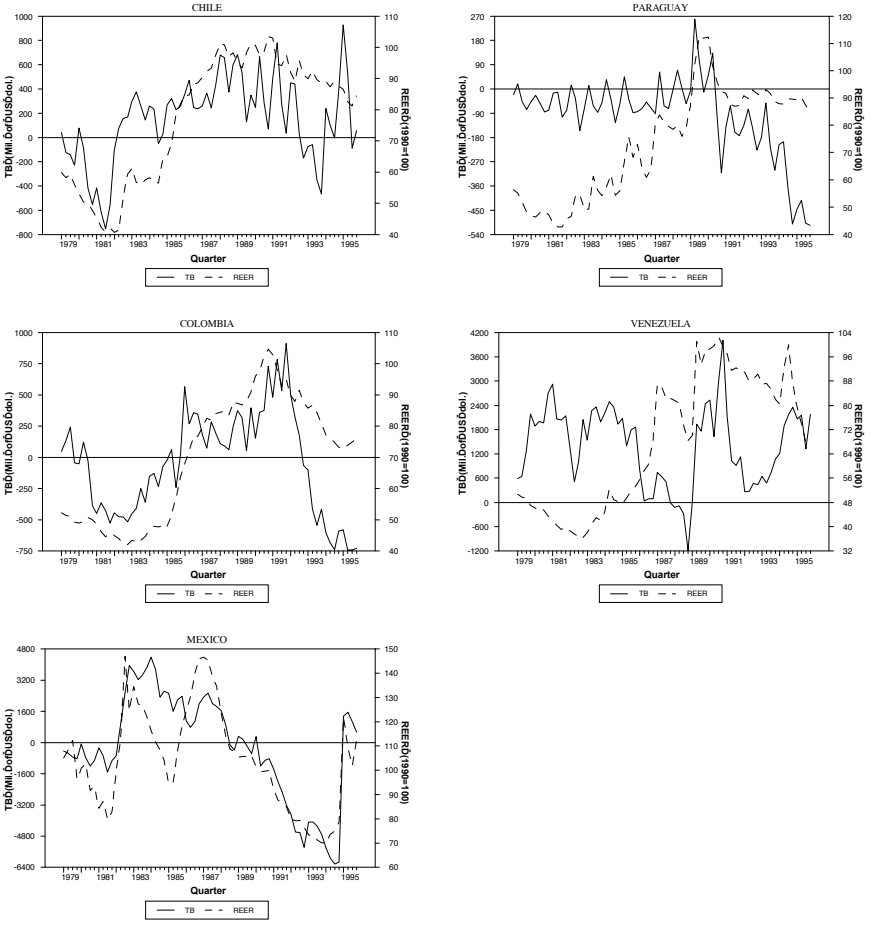
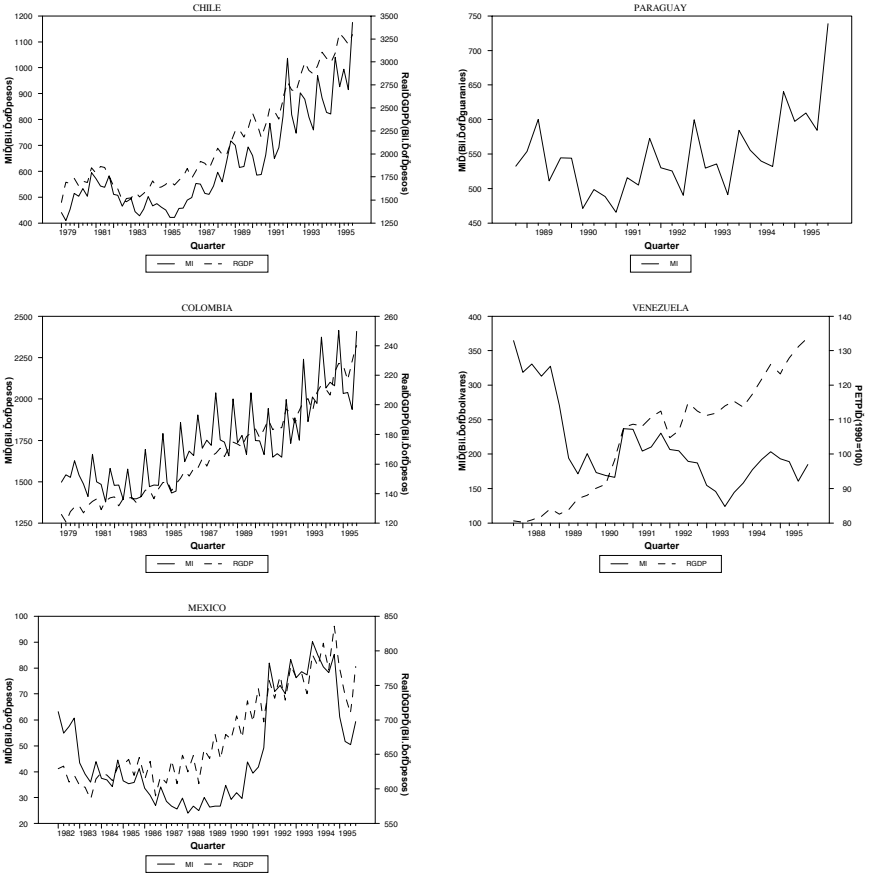


Figure 2

RealĎMoneyĎStockĎandĎRealĎGDP



3.4 The Unit Roots Tests

To cross-check the results for the series, several unit root tests were computed.[48] First, the standard augmented version of the Dickey-Fuller (ADF) unit root test was implemented in all series in levels. Then, the Schmidt-Phillips (Schmidt and Phillips, 1992), referred to here as SP, unit root test was calculated in all series

[48] Blough (1992, p. 299) argues that when testing for unit roots, there is a trade-off between size and power because the test must have either a high probability of falsely rejecting the null of nonstationarity when the true DGP is nearly stationary process or low power against any stationary alternative.

that seemed to have a trending behavior. The Dickey-Fuller (DF) test (a parametric statistic) controls directly for serial correlation. The SP test provides semi-parametric-based corrections to the Dickey-Fuller test, which are asymptotically robust to error autocorrelation and heteroskedasticity. Besides these properties, an advantage of the SP test over the DF test is that it allows for a trend under both the null and the alternative hypotheses, without introducing irrelevant parameters under either. That is, the distribution of this test under both the null (a unit root) and alternative hypothesis (a trend stationary process) is independent of the nuisance parameters (constant, trending coefficient and variance).

Table 1 reports the results. It shows that the null hypothesis of unit root cannot be rejected at 5% level of significance for all series and countries when the ADF test is used. Using the SP test, the null is not rejected in half of the cases, supporting the results of the ADF test. For the other half, however, the null hypothesis is rejected contradicting the results of the ADF test. A contradictory situation is found for the money stock (Colombia y Paraguay) and real GDP (Colombia and Mexico). To test for the presence of more than one unit root, in all those series where the unit root hypothesis was rejected by one of the tests, two types of tests were implemented. The one was the 'standard' unit root test in the series' first differences.[49] The other was the Dickey and Pantula (1987) *sequential* procedure (referred to here as DP procedure). Only the former is reported. Table 1 shows that the null hypothesis is rejected for most of the series, which actually indicates that they seem to behave as *I(1)* processes. The exception was the Mexican's real GDP. When the DP procedure was computed, the following occurred.[50] For Colombia, the money stock has two unit roots and the real GDP has effectively one; for Mexico, the real GDP has admittedly two unit roots; and for Paraguay, the money stock has effectively one. The findings of more than one unit root in the Colombian money stock and

[49] Observe that here one wants to test the null of series behaving as *I(2)* processes against them being *I(1)* processes.

[50] Dickey and Pantula (1987, p. 456) argue that, if a process has more than one unit root, the 'standard' ADF procedure "is not valid." Their argument is that "the order of testing should begin with the highest (practical) degree of differencing and work down toward a test on the series levels rather than starting, …[as the ADF procedure does], with the levels test and working up through the differencing orders" (*ibid.*).

TABLE 1. UNIT ROOT TESTS[a]

Country	*Variable*[b]	*ADF test (Level)*	*Q(12)*[c]	*ADF test (First Diff.)*	*Q(12)*	*SP test*
Chile	$LPTB_t$	τ_μ=-1.76	5.27(.26)	-5.70*	5.72(.33)	---
	$LREER_t$	τ_μ=-0.86	17.07(.11)	-5.68*	15.23(.17)	---
	LMI_t	τ_τ=-1.92	9.22(.23)	3.54*	10.87(.21)	-2.97
	$LRGDP_t$	τ_τ=-2.58	7.87(.10)	-5.06*	5.04(.41)	-1.97
Colombia	$LPTB_t$	τ_μ=-2.20	11.33(.41)	-10.42*	10.59(.48)	---
	$LREER_t$	τ_μ=-1.06	12.60(.25)	-4.52*	12.13(.35)	---
	LMI_t	τ_τ=-3.22	12.93(.07)	3.47*	9.45(.31)	-7.37*
	$LRGDP_t$	τ_τ=-3.27	7.72(.05)	-3.45*	12.24(.09)	-4.84*
Mexico	$LPTB_t$	τ_μ=-1.51	10.02(.52)	-6.50*	9.54(.57)	---
	$LREER_t$	τ_μ=-1.77	11.84(.37)	-7.74*	11.65(.39)	---
	LMI_t	τ_τ=-1.29	17.67(.06)	-11.03*	17.87(.08)	-1.51
	$LRGDP_t$	τ_τ=-2.67	8.43(.29)	-2.70	10.33(.24)	-4.02*

Paraguay	$LPTB_t$	τ_μ=-1.21	8.61(.38)	-10.83*	8.26(.51)	---
	$LREER_t$	τ_μ=-1.12	3.95(.68)	-6.03*	4.03(.78)	---
	LMI_t	τ_τ=-1.85	9.49(.22)	-5.17*	13.17(.68)	-3.63*
Venezuela	$LPTB_t$	τ_μ=-2.68	17.16(.14)	-6.30*	14.19(.29)	---
	$LREER_t$	τ_μ=-1.01	11.01(.44)	-6.83*	9.05(.62)	---
	LMI_t	τ_μ=-2.59	13.08(.40)	-3.58*	8.50(.38)	---
	$LPETPI_t$	τ_τ=-1.35	8.15(.52)	-12.56*	8.40(.59)	-1.91

[a] The τ_μ test is the τ-test for a regression equation that includes an intercept or drift term and the τ_τ test is the τ-test for a regression equation that includes both a drift and a linear time trend. This may avoid misspecification problems such as those reported in Campbell and Perron (1991). They stated that when the regression models do not mimic the actual DGP, the power of tests can go to zero. For purposes of reading the critical values, the sample size is stated as equaling 100 for both tests and the level of significance at 5%. The asymptotically critical values for τ_μ and τ_τ are -2.89 and -3.45, respectively. The critical value for the SP's $\tilde{\tau}$ test is -3.06. [b] LTB is the log of the trade balance measurement, LREER is the log of the real exchange rate index, LMI is the log of real money stock (real M1), and LRGDP is the log of the real GDP (or the log of its proxy). [c] Q(12) is the Ljung-Box statistic. This tests against higher than order one serial correlation. It is based on the estimated autocorrelations of the first 12 lags. Its marginal significance level (or p-value) is in brackets. 5% was chosen as the minimum acceptable significance level.

the Mexican real GDP seemed to be related with seasonal unit roots in the series.[51] To test for this possibility, a seasonal unit root test was implemented (the output is not reported here).[52] The test corresponds to the HEGY (for Hylleberg, Engle, Granger, and Yoo) procedure, expanded by Ghysels and Noh (1994).[53] What was found is that effectively, for the case where the DP procedure indicated the presence of more than one unit root, the HEGY test corroborated them. For Colombia, the money stock, in fact, seems to have unit roots at zero and semiannual frequencies; and for Mexico, the real GDP seems to have unit roots at zero and semiannual frequencies. These seem to show that for those countries, the series real money stock and real GDP exhibit some form of seasonality which is nonstationary.[54] This could be related with specific structural characteristics of those economies, for example, for seasonal patterns resulting from shocks (that have permanent effects) of the money stock or the retail trade at the end of the year. That seasonal variation in those series may account for the preponderance of its total variance which seem to be time-dependent.

According to the tests and the initial graphical conjectures, it seems that all series, for all countries, are integrated of order one, at least at zero frequency.[55] That is, series seem to behave as *I(1)* processes. These results are similar to findings in the literature working with macroeconomics data. A unit root behavior of the trade balance and the real exchange rate is found in similar settings by Rose and Yellen (1989) and Rose (1991) using data

[51] Ilmakunnas (1990, p. 80) argues that even though the Dickey-Pantula procedure "dealt with zero frequency unit roots, …, one can conjecture that this holds also in the seasonal case."

[52] Ghysels et al. (1994) show that the ADF test can be used to test the null of a unit root at the zero frequency, even in the presence of unit roots at other seasonal frequencies.

[53] The HEGY procedure is sought to capture the presence of seasonal unit roots at frequencies other than at *zero frequency*, which might not have been revealed by the ADF and SP tests due to uncontrolled seasonality in the series (Hylleberg et al., 1990; Ghysels et al., 1994). Notice that the ADF and SP tests are built to capture unit roots at zero frequency (or *long-run frequency*). For full theory and applications on seasonal unit roots, see Frances (1991, 1996).

[54] Some examples of seasonal unit roots could be seasonal patterns in the money stock caused by a trending economic growth and real shocks that have permanent effects.

[55] This conclusion is supported by the multivariate unit root tests *à la* Johansen (no reported) which were implemented as additional exercises.

for developed countries; Bahmani-Oskooee and Alse (1994) using data from both developed and developing countries; and Rose (1990) using data for developing countries.[56] Unit root behavior is also found for the real money stock and real GDP series. A classic paper with similar results for those variables is Nelson and Plosser (1982). One of the main implications of money supply and output variables behaving as unit roots, as stated by Nelson and Plosser, is that, contrary to the traditional real business cycles analysis, secular movements of those time series are of a stochastic rather than deterministic nature.[57] Thus, "models based on time trend residuals are misspecified" (Nelson and Plosser, 1982, p. 140). Then, the empirical evidence in this paper on the behavior of those series cautions the literature using developing-country data for any business cycles analysis without properly filtering the data.

Thus, the implementation of the econometric procedure will be carried out on the assumption that most series exhibit nonstationary behavior, in particular, that they behave as *I(1)* processes. For Mexico, in which one of its series seemed to contain unit roots both at zero and seasonal frequencies, a different procedure for testing cointegration, to account for seasonal unit roots, will be carried out. This procedure will follow a "strategy" suggested by Hylleberg et al. (1990) and Ilmakunnas (1990).[58]

[56] Observe that, in another context, the fact that the real exchange is found to be a random walk process can be considered as adding evidence against the relative PPP real exchange rate hypothesis for the current cases.

[57] Remember that standard real business cycle assumes that the time series trend of macro variables is deterministic, that is, the trend is not changing over time. This implies that current economic shocks will not have any long-run effect on the series. Hence, for practical purposes, one could simply *detrend* the series and use the residuals for macro analysis. The problem with this type of analysis is that the trend may be stochastic rather than deterministic. That is, the series may be difference stationary instead of trend stationary processes. If this is the case, it is inappropriate to subtract a deterministic trend from a series that is difference stationary.

[58] This consists in seasonal differencing the series to get rid of the seasonal unit root and leaving the root at the zero frequency. When the exercise was implemented in the money stock series for Colombia, it continued showing a behavior between $I(1)$ and $I(2)$ process. The choice was consider LMI as unit root process, which is a standard result in the Colombian empirical literature. In the case of Mexico, such as "strategy" was followed.

4. HYPOTHESES TESTING AND ESTIMATIONS

This section tests the hypotheses about the relationship between the exchange rate and the trade balance discussed in the introduction and section 2 and estimate the statistical model under the specification defined in section 3, that is, under $z_t = (\text{LTB,LREER,LMI,LRGDP})'_t$.[59] This section starts testing whether the error-correction model representation given by the equation (3.2) correctly describes the structure of the data. In short, whether H_1 actually holds. Second, it tests if the matrix Π is of reduced rank, that is, whether $H_2(r)$ holds. This hypothesis shows whether empirical evidence of cointegrating relations between the variables in the vector z_t exists.[60] Moreover, given the VECM presentation, short-run deviations such as the J-curve hypothesis can be tested. Finally, this section presents and discusses the estimations under the revealed *r*.

4.1 Specification and Misspecification Tests

One of the most critical parts of the Johansen and Juselius approach is determining the rank of matrix Π since the approach depends primarily upon having a *well-specified* regression model. Therefore, before any attempt to determine this rank or to present any estimation, the empirical analysis begins with specification and misspecification tests. The specification and misspecification tests are based on the OLS residuals of the unrestricted model in equation (3.1) for the vector z_t.[61] The endogenous variables are modeled conditionally on variables in D_t.[62]

[59] The implicit assumption (which was tested) is that the trade balance is homogeneous of degree zero with respect to all the individual components of the real exchange rate index, that is, with respect to prices (domestic and foreign) and the nominal exchange rate.

[60] This step is at the core of the current econometric procedure. Briefly, once one knows *r*, the statistical system can be separated into stationary and nonstationary processes. That is, into cointegrating relationships and stochastic trends. In economic words, in terms of the steady-state relationships governing the behavior of the relevant variables in the system and the distinct (permanent) structural innovations governing the long-run properties of all those variables.

[61] This result is equivalent to that of estimating equation (3.2) under the assumption of matrix Π being of full rank, that is, assuming $r=rank(\Pi)=p$.

[62] Centered seasonal dummy variables and dummy-type variables are included. These variables "are centered to ensure that they sum to zero over time and thus they do not affect the underlying asymptotic distributions upon which

The specification and misspecification tests are used primarily to choose an 'appropriate' lag structure and to identify the deterministic components to be included in the model (e.g., whether or not to include an intercept in the cointegration space to account for the units of measurement of the endogenous variables, or to allow for deterministic trends in the data). Certainly, these two aspects are critical for the current econometric procedure. With respect to the lag structure, if k (or the lag length for each system) is 'too' small, the model may be misspecified; if k is 'too' large, one loses degrees of freedom and power. Therefore, the lag length is chosen according to three criteria: (1) what economic theory would say about the impact and lagged effect of the exchange rate on the trade balance; (2) what model selection strategies would recommend; and (3) that normality and nonserial correlation are satisfied.[63] The Schwarz and Hannan-Quinn selection criteria were used. Also, a likelihood ratio test to check lag significance is used. A *testing-down* type procedure is followed to test the lag significance from a long-lag structure to a more parsimonious one. The testing procedure started with k=8, that is, with a lag length of two years. This lag length is recommended in the literature studying the effects of exchange rates on the trade balance. For example, Bahmani-Oskooee (1985) and Himarios (1989) suggest that if there an improvement in the trade balance when devaluation exists, a period of about two years is needed for observable effects to occur. The choice of the deterministic components of the model has substantial consequences for the asymptotic distributions of the cointegration rank statistics. This paper follows the procedure suggested by Johansen (1992).[64] This consists of testing the joint hypothesis of both the cointegration rank order and the deterministic components.[65] Once

---

tests (including tests for cointegration rank) depend" (Harris, 1995, p. 81).

[63] Of course, in the testing procedure a trade-off among all three criteria was needed.

[64] Hansen and Juselius (1995, p. 66-68) have an nice example that illustrates how the procedure works.

[65] The procedure uses the *Pantula principle* and some economic intuition for choosing the relevant models to test. It starts with the most restrictive alternative (that is, r=0 and the intercept is restricted to the cointegration space) through to the least restrictive one (that is, r=p-1 and the model includes linear trends in the variables and in the cointegration space). Thus, the rule is the following. Move through from the most restrictive model, compare the rank test statistic to its critical value and only stop at the first point the null hypothesis is not ejected.

TABLE 2. SPECIFICATION AND MISSPECIFICATION TESTS[a]

		Univariate Statistics		*Multivariate Statistics*			
Country	*Equation*	*ARCH(k)*	*Normality*	*Q(j)*	*LM(1)*	*LM(4)*	*Normality*
Chile		k=4		j=16;264(.00)	29(.02)	17(.33)	5(.77)
	$\Delta LPTB_t$	2.32	0.77				
	$\Delta LREER_t$	1.06	2.59				
	ΔLMI_t	0.66	0.81				
	$\Delta LRGDP_t$	4.20	0.36				
Colombia		k=5		j=15;240(.00)	15(.51)	20(.19)	10(.26)
	$\Delta LPTB_t$	4.27	2.25				
	$\Delta LREER_t$	10.11	0.12				
	ΔLMI_t	4.87	0.04				
	$\Delta LRGDP_t$	7.13	2.40				
Mexico		k=4		j=13;171(.06)	7(.96)	15(.49)	27(.00)
	$\Delta LPTB_t$	4.63	14.51				
	$\Delta LREER_t$	1.87	30.60*				
	ΔLMI_t	3.52	3.15				
	$\Delta LRGDP_t$	2.34	0.81				

Paraguay		k=2		J=6;65(.00)	11(.22)	6(.66)	6(.37)
	$\Delta LPTB_t$	3.62	3.49				
	$\Delta LREER_t$	2.41	3.88				
	ΔLMI_t	0.03	1.67				
Venezuela		k=1		j=8;150(.01)	11(.82)	12(.71)	21(.01)
	$\Delta LPTB_t$	0.20	20.97*				
	$\Delta LREER_t$	0.02	12.55				
	ΔLMI_t	0.27	0.09				
	$\Delta LRGDP_t$	0.01	3.28				

[a] LTB is the log of the trade balance measurement, LREER is the log of the real exchange rate index, LMI is the log of the real money stock, and LRGDP is the log of the real GDP (or the log of the proxy). All tests are asymptotically χ^2-distributed with the following degrees of freedom (df): ARCH(k) with k df; normality with $2d_0$ df, where d_0 is the number of endogenous variables in the vector; Q(j) with d_0^2 ([T/4] - k + 1) - $d_0 r$ df; and LM (1) and LM(4) with d_0^2 df. For the univariate tests "*" means significant at the 5% level. For the multivariate tests their marginal significance level is in brackets. The dummy-type variables included were the world price of coffee and oil in real terms. At the beginning a variable that was thought to capture structural and policy changes of the current economies were included. That variable was a proxy of the respective country´s degree of closedness to international trade (see Edwards (1989) for the construction of this type of variable). However, it resulted insignificant for most of the countries and it was discarded.

the lag structure and the deterministic component of the model are chosen, additional specification and misspecification tests are implemented.

The tests were implemented in two levels. The first tests are multivariate tests, that is, tests on the residuals of the total system. They are the Ljung-Box Q test, which was described in Table 1, a Godfrey LM test for serial correlation up to the first and fourth lag, and finally a multivariate normality test suggested by Hansen and Juselius (1995) in a modified version of the Doornik and Hansen (1994) test. The second tests are univariate tests, that is, tests on the residuals of the individual equations in the system.[66] The tests are the autoregressive conditional heteroskedastic ARCH test proposed by Engle (1982), which tests homoskedasticity against an ARCH of order *k*, and the normality test referred to above for the univariate case.

Table 2 reports the results. The multivariate tests for serial correlation shows that serial correlation is present in cases of Chile, Colombia y Paraguay when the Q test is used. However, no serial correlation of order one and four seems to be present in most of the cases.[67] The multivariate normality assumption holds for all countries except Mexico. The univariate tests are all met except the normality test for the real exchange rate equation and the trade balance equation for Mexico and Venezuela, respectively. To complement the formal tests, the actual and fitted values for each equation and country, and the correlogram of the residuals were plotted (the results are not reported here). They indicated that the performance of the VECM representation of the actual data for each country is generally satisfactory.

4.2 Finding the Rank of Matrix Π

Table 3 shows the tests of the rank of matrix *Π*. The first column represents the estimated eigenvalues λ_i. The null hypothesis of $r=0$ (no cointegration) is rejected in favor of $r=1$ by both tests at the 10% level of significance except Venezuela. The null hypothesis of $r=1$ (or $r\leq 1$ using the λ_{Trace} test) in favor of $r=2$ is not

[66] Observe that the system in (3.1) is composed by equations for z_{it}, where $i=1, \ldots, p$. For example, z_{1t}, is the corresponding equation for the trade balance.

[67] Later on, it will be shown that when the model is conditioned on the weakly exogenous and excluded variables, the specification of the model does improve for most of the countries. For example, the *i.i.d.* assumption is fully met(see Appendix A.4).

rejected by both tests in all cases. The null hypotheses of $r=2,3$ (or $r\leq 2$, $r\leq 3$ using the λ_{Trace} test) in favor of $r=3,4$ are not rejected by both tests.[68] Thus, Table 3 indicates the presence of one cointegrating relationship for all countries but Venezuela. Therefore, there is a long-run equilibrium relationship between the trade balance, real exchange rate, real money stock, and real income. This would imply that a model that seeks to explains the long-run behavior of the current countries' trade balance should include at least the exchange rate, money, and income. Based on the evidence r was set equal one for all countries but Venezuela.[69]

To improve the statistical specification of the model for all countries, tests of exclusion from the cointegration space and tests of weak exogeneity were carried out (they are not reported here). The tests showed that none of the variables should be excluded in every case. Also, they indicated that the trade balance was endogenous and the real exchange rate, the money stock, and the real GDP were weakly exogenous for Chile and Mexico; the trade balance and the real GDP were endogenous, and the real exchange rate and money stock were weakly exogenous, for Colombia; and the trade balance and the money stock were endogenous and the real exchange rate were weakly exogenous for Paraguay. Thus, the estimations corresponds henceforth to the respective conditional (on the weakly exogenous variables) model. Notice that, for example, the fact the real GDP is endogenous and the money stock is exogenous for Colombia seems to agree with the absorption view, and contradict the monetary arguments, which states that income is endogenous while money is exogenous to the model.

4.3 The Estimations

Since $r=1$ the problem of identification of the cointegration space

[68] In addition to these formal tests, the plots of the eigenvalues of the companion matrix, the unrestricted estimates coefficients β, the estimated residuals of R_{kt}, and the graphs of estimates of $v_i' z_t$ and $v_i' R_k$ were drawn in order to recheck the rank of matrix Π (see Hansen and Juselius (1995) for definitions). First, no root was found outside of the unit circle for all countries. Second, the reported cointegrating relationship was found stationary.

[69] One possible explanation to the fact that for Venezuela was found no 'empirical content' to the theory may be due to the economic structure of Venezuela. This economy depends heavily upon only one good (oil), which causes that the foreign market and the economic behavior as a whole depends upon what happens with that market and not upon arbitrage conditions in other markets.

TABLE 3. TESTS OF COINTEGRATION RANK[a]

Country	$\hat{\lambda}_i$ *(i=1,2,3,4)*	*Ho:*	*Ha:*	λ_{max}	*ACV (10%)*	*Ho:*	*Ha:*	λ_{Trace}	*ACV (10%)*
Chile	0.45	*r=0*	*r=1*	29.91*	29.12	*r=0*	*r >0*	61.56*	59.14
	0.28	*r=1*	*r=2*	15.59	23.11	*r≤ 1*	*r >1*	32.65	39.06
	0.20	*r=2*	*r=3*	11.07	16.85	*r≤ 2*	*r >2*	17.06	22.76
	0.12	*r=3*	*r=4*	5.99	10.49	*r≤ 3*	*r >3*	5.99	10.49
Colombia	0.65	*r=0*	*r=1*	45.47*	25.56	*r=0*	*r >0*	71.10*	49.65
	0.27	*r=1*	*r=2*	13.59	19.77	*r≤ 1*	*r >1*	25.63	32.00
	0.19	*r=2*	*r=3*	9.19	13.75	*r≤ 2*	*r >2*	12.04	17.85
	0.06	*r=3*	*r=4*	2.85	7.52	*r≤ 3*	*r >3*	2.85	7.52
Mexico	0.62	*r=0*	*r=1*	35.37*	29.12	*r=0*	*r >0*	62.52*	59.14
	0.29	*r=1*	*r=2*	12.18	23.11	*r≤ 1*	*r >1*	27.14	39.06
	0.25	*r=2*	*r=3*	10.27	16.85	*r≤ 2*	*r >2*	14.96	22.76
	0.12	*r=3*	*r=4*	4.69	10.49	*r≤ 3*	*r >3*	4.69	10.49

Paraguay	0.69	*r=0*	*r=1*	24.63*	19.77	*r=0*	*r >0*	35.97*	32.00
	0.27	*r=1*	*r=2*	6.68	13.75	*r≤ 1*	*r >1*	11.35	17.85
	0.20	*r=2*	*r=3*	4.67	7.52	*r≤ 2*	*r >2*	4.67	7.52
Venezuela	0.56	*r=0*	*r=1*	22.79	25.56	*r=0*	*r >0*	43.65	49.65
	0.37	*r=1*	*r=2*	13.01	19.77	*r≤ 1*	*r >1*	20.86	32.00
	0.19	*r=2*	*r=3*	5.80	13.75	*r≤ 2*	*r >2*	7.85	17.85
	0.07	*r=3*	*r=4*	2.04	7.52	*r≤ 3*	*r >3*	2.04	7.52

[a] The test statistics have a small sample correction as suggested by Reinsel and Ahn (1992). It consists of using the factor $(T\text{-}kp)$ instead of the sample size T in the calculation of the tests. "ACV" stands for Asymptotical Critical Value. When a country's VECM system included weak exogenous and/or dummy variables, the ACVs were taken from Table 1*, or Table 1, or Table 2* in Osterwarld-Lenum (1992) depending on the deterministic component in the model. "*" means significant at the 10% level.

need not to emerge. Thus, one can make direct inference from both the long-run and short-run estimates. If only one cointegrating relationship exists, it is *just identified* (Johansen and Juselius, 1994). Table 4 reports the estimated long-run relationships between the trade balance, the real exchange rate, money, and income for the countries where cointegration was found.[70] The equations are normalized by the coefficient of the trade balance, and then they are solved. Table 4 reveals that the estimated long-run exchange-rate elasticity has a positive sign for all countries. Accordingly, (real) devaluation will lead to an improvement in the (real) trade balance. For instance, the estimated coefficient says that for a one percent increase in the real exchange rate, keeping the other variables constant, the Chilean's real trade balance on the average increases by about 0.25 percent. Thus, the empirical evidence shows that the BRM or ML conditions seem to hold in all four cases.[71] The money stock variable is present in the long-run equation for all countries. This is inconsistent with what the monetary approach would predict for the long run relationship between trade balance and money. As said above, one would expect an inverse causality. In equilibrium, trade balance explains the money stock not *vice versa*.[72] Notice that in 3 out of 4 cases, an increase in the money stock worsens the trade balance. The positive sign of the estimated coefficient for the income variable for Colombia and Mexico is consistent with what the monetary view would say, income has a positive relationship with the trade balance.

The speed of adjustment coefficient is significant for all countries. This means that the speed at which the rate of variation of the trade balance $\Delta LPTB_t$, the dependent variable in the first equation of the VECM system, adjusts towards the single long-run cointegrating relationship differs from zero. In other words,

[70] Table A.1(Appendix A.4) reports the specification and misspecification tests of the conditional models.

[71] To double-check these results, a proportionality (homogeneity) restriction on the trade and exchange rate coefficients for each country, that is $\beta_{11}=-\beta_{21}$, were tested (notice that in terms of the Johansen and Juselius notation, the hypothesis $\beta_{1i}=-\beta_{2i}$ is written as $\beta_{i,1}= -\beta_{i,2}$. That is, "*1*" and "*2*" are the first and second coordinate of the cointegrating vector β_i, respectively). The Likelihood Ratio test did reject the null for all cases but Colombia.

[72] The significance of the money variable in the cointegrating vector was separately examined for each country through a test of exclusion. The null hypothesis was rejected using standard level of significance in all cases.

TABLE 4. SOLVED LONG-RUN EQUILIBRIUM EQUATIONS OF THE TRADE BALANCE *LPTB*[a]

	Long-Run Equation (s)					*Speed of Adjustment*
Country	*LREER*	*LMI*	*LRGDP*	*Constant*	*Trend*	$\hat{\alpha}$
Chile	0.25	-0.01	-1.84	---	0.02	-0.63* (-4.9)
Colombia	1.09	-7.71	3.49	34.34	---	-0.06* (-2.2)
Mexico	1.96	0.62	0.01	---	-0.01	-0.33* (-3.05)
Paraguay	3.92	-2.51	---	-2.47	---	-0.42* (-2.19)

[a] LPTB is the log of the trade balance measurement, LREER is the log of the real exchange rate index, LMI is the log of the real money supply, LRGDP is the log of the real GDP (or the log of the proxy). The values in brackets for the speed of adjustment coefficient are simple t-tests. "*" means significance at the 5% level. Only the estimated speed of adjustment coefficients for the respective trade balance equations are shown.

TABLE 5. SHORT-RUN ESTIMATES OF THE TRADE BALANCE EQUATION[a]

		Variables				
Country	*Lag*	*ΔLPTB*	*ΔLREER*	*ΔLMI*	*ΔLRGDP*	*Constant*
Chile	*t-1*	.27*	.13	.24	.25	---
		(1.8)	(.47)	(1.4)	(.5)	---
	t-2	.26*	-.14	.04	-.12	---
		(1.8)	(-.52)	(.2)	(-.3)	---
	t-3	.07	.3	-.02	.12	---
		(.49)	(1.2)	(-.14)	(.32)	---
Colombia	*t*	---	.96*	.56*	---	---
		---	(1.74)	(1.81)	---	---
	t-1	-.29*	.23	.87*	-1.12	---
		(-2.4)	(.38)	(2.47)	(-1.05)	---
	t-2	-.26*	.54	.55	1.33	---
		(-2.37)	(.95)	(1.63)	(1.17)	---

Mexico	*t-1*	.03	-.21	-.42*	.00	---
		(.23)	(-.71)	(-1.79)	(.04)	---
	t-2	-.16	.12	-.2	-.00	---
		(-1.17)	(.36)	(-.84)	(-.29)	---
	t-3	.03	-.21	-.35	-.01	---
		(.27)	(-.73)	(-1.4)	(-1.16)	---
Paraguay	*t-1*	.13	2.35*	.56	---	---
		(.5)	(1.97)	(.72)	---	---
Venezuela	*t-1*	.53*	-.78	-.13	-.7	.02
		(2.6)	(-1.42)	(-.48)	(-.57)	(.49)

[a] The calculated t-tests are in brackets. The symbols "*" mean significance at the 10% level. The coefficients for the dummy variables are not reported. The output for Venezuela corresponds to equation (3.2) under $r=0$, that is, a standard VAR of its series in first differences.

the equation of the trade balance $\Delta LPTB_t$, for each of the countries in Table 4, contains information about the long-run relationship since the cointegrating vector does enter into this equation.

According to the estimates a short-run trade balance disequilibria is corrected for Chile and Mexico to a speed of 63% and 33%, respectively, per quarter. For Colombia, such an adjustment is corrected only to a rate of 6%. Possible explanations for these differences can be found in the theory exposited in Section 2. For example, that the Chilean and Mexican foreign sector (the supply of exports and/or demand for imports) responds more rapidly to any chock to relative prices than the Colombian sector. Another is that in Chile and Mexico there are present more arbitrage mechanisms which allows market forces to act freely or, at least, those mechanisms work to diminish market restrictions. These conditions make that a new equilibrium after a shock can be reached sooner for Chile and Mexico than for Colombia.

Table 5 displays the short-run estimates. The variation of the real exchange rate is significant and positive (contemporaneously) for Colombia and (with a lag) for Paraguay. The variation of the real money stock is significant and positive (contemporaneously an with a lag) for Colombia and negative (with a lag) for Mexico. Income results insignificant for all countries. Thus, the short-run estimates indicates that the trade balance responds positively to real devaluation for Colombia and Paraguay, and it has no short-run response to devaluation for Chile, Mexico, and Venezuela. This evidence seems to go against the J-curve hypothesis since neither the impact or lagged effect of devaluation is negative (Colombia and Paraguay) nor the short-run effects resulted significant (Chile, Mexico, Venezuela).[73]

The trade balance responds positively to variations of the money stock for Colombia. This result implies that for Colombia the 'impact' and lagged effect of an increase in the real money stock is an improvement of the trade balance. This could happen, following the monetarist arguments, if there is a rapid increase in prices that offset the increase in the nominal money stock. People would have a shortfall of real money balances, which will result in hoarding (agents want to restore their real money balances) and in a trade balance improvement.

[73] Evidence of the J-curve from developing countries, using a different econometric methodology, is found in Bahmani-Oskooee (1985).

5. CONCLUSIONS

This paper has examined empirically the role of exchange rates in determining the short-and long-run behavior of the trade balance for a sample of Latin American countries under alternative approaches to the balance of payments. In particular, it tested the validity of the Bickerdike-Robinson-Metzler and Marshall-Lerner conditions, as well as the J-curve hypothesis, using a regression model which included the trade balance, exchange rate, money, and income. Indirectly, it tested the empirical relevance of the absorption and monetary approaches for the data used. The econometric technique consisted of a relatively new approach for analyzing multivariate cointegrated systems originally developed by Johansen. This econometric approach avoids important specification and misspecification problems borne by most of the relevant applied literature studying the current issue. The data analyzed corresponded to quarterly time series from Chile, Colombia, Mexico, Paraguay, and Venezuela for the period 1979 through 1995.

The major findings of this paper are as follows. The variable specification of the statistical model showed that exchange rates do play a role in determining the long equilibrium behavior of the trade balance for all countries in the sample except Venezuela. Therefore, the trade balance cannot be treated as exogenous with respect to the exchange rates in those countries. These findings constitute evidence against the literature claiming that no direct relationship between trade balance and exchange rates exists and the monetary view which claims that exchange rates have only temporary effects. The estimations reported that there is one cointegrating relationship between the trade balance, exchange rate, money, and income for all countries but Venezuela. That is, a long-run equilibrium relationship between those variables exists. The results also showed that for most of the countries the BRM or ML conditions were supported by the data. This implied that (real) devaluation improves the equilibrium trade balance. Moreover, the positive effect of exchange rate devaluation on the trade balance seemed enhanced if accompanied by reduction of stock of money (for Chile, Colombia, and Paraguay) and an increase in income (Colombia and Mexico). With respect to the short-run estimates, estimations revealed a significant positive short-run relationship between the trade balance and the exchange rate for Colombia and Paraguay. This is considered evidence against the J-curve hypothesis.

The findings with respect to income and money variables did not fully reject or accept hypotheses from the absorption or monetary approaches either for the short run or for the long run. What was generally found, however, was that money stock and income are important determinants of the long-run trade balance behavior. From the point of view of trade balance modeling, these results suggest that a model that seeks to explains the long-run behavior of the trade balance should include at least exchange rates, money, and income.

The main limitation of this paper was that capital markets are not considered. Several directions for future research are suggested in this paper. One direction is to use the current technique or alternative econometric techniques (e.g., *impulse response functions*) to analyze the short-run effects more thoroughly. This should shed light about why this paper finds opposite results to those hypothesized by the J-curve. Another direction is to extend the econometric methodology to a sample of developing countries.

Appendix

A.1 Derivation of the BRM Condition

The trade balance B, defined in foreign currency, is[74]

$$B = S - D = X - M = P_x^* X^s - P_m^* M^d \tag{A.1.1}$$

where S and D are the supply and demand of foreign currency, which are equal to the value of exports and imports, respectively. Differentiating yields

$$dB = dS - dD \tag{A.1.2}$$

One can express equation (A.1.2) in terms of imports so that

$$dB / M = dS / M - dD / M \tag{A.1.3}$$

Now define the following elasticities with respect to the nominal exchange rate E:

$$E_B = \hat{B}/\hat{E}$$

$$E_S = \hat{S}/\hat{E} \tag{A.1.4}$$

[74] Only the new notation is defined here. The rest of the notation is as defined in the text.

$$E_D = \hat{D}/\hat{E}$$

where E_B, E_S, E_D are the elasticities of the trade balance, the value of exports, and the value of imports, respectively. The symbol "^" states the percentage change of the respective variable (e.g., $\hat{E} = dE/E$). Dividing both sides of equation (A.1.3) by dE/E yields

$$\frac{dB/M}{dE/E} = \frac{dS/M}{dE/E} - \frac{dD/M}{dE/E} \tag{A.1.5}$$

and now expressing equation (A.1.5) in terms of elasticities (using the fact that in equilibrium $S=X$ and $D=M$),

$$E_B = \frac{X}{M} E_S - E_D \tag{A.1.6}$$

Now that the elasticities in the foreign exchange market have been defined, the next step is to define the elasticities of prices and quantities with respect to the exchange rate. The solution for the export market is firstly derived. The price of exports, in domestic currency, is $P_x = EP_x^*$. From the export market equilibrium condition (2.6) we can write

$$X^s = X^s(E.P_x^*) = M^{d^*}(P_x^*) \tag{A.1.7}$$

Differentiating, it yields

$$dX^s = \frac{\partial X^s}{\partial P_x}(EdP_x^* + P_x^* dE) = \frac{\partial M^{d^*}}{\partial P_x^*} dP_x^*$$

or (given the equilibrium condition),

$$\frac{dX^s}{X^s} = \frac{\partial X^s}{\partial P_x}\frac{1}{X^s}(EdP_x^* + P_x^* dE) = \frac{\partial M^{d^*}}{\partial P_x^*}\frac{1}{M^{d^*}} dP_x^*$$

Now multiplying throughout by $P_x/E = P_x^*$ and dividing by dE/E yields

$$\frac{dX^s/X^s}{dE/E} = \frac{\frac{\partial X^s}{\partial P_x}\frac{1}{X^s}\frac{P_x}{EP_x^*}(EdP_x^* + P_x^* dE)}{dE/E} = \frac{\frac{\partial M^{d^*}}{\partial P_x^*}\frac{P_x^*}{P_x^*}\frac{1}{M^{d^*}} dP_x^*}{dE/E}$$

and rearranging yields the response of the quantity of exports to exchange rate,

(A.1.8) $$\frac{dX^s / X^s}{dE/E} = \varepsilon(\frac{dP_x^* / P_x^*}{dE/E} + 1) = \eta^* \frac{dP_x^* / P_x^*}{dE/E}$$

where ε ($\varepsilon = \partial X^s / X^s \big/ \partial P_x / P_x$) is the price elasticity of domestic supply of exports and η^* ($\eta^* = \partial M^{d^*} / M^{d^*} \big/ \partial P_x^* / P_x^*$) the price elasticity of foreign demand for imports. Solving (A.1.8) for the percentage change of the foreign price of (domestic) exports to the exchange rate, one has

(A.1.9) $$\hat{P}_x^* \big/ \hat{E} = \left[\varepsilon / (\eta^* - \varepsilon)\right]$$

But one needs the percentage change of the domestic price of exports to the exchange rate. This is nothing but (A.1.9) plus one (as can be read in equation (A.1.8)). Then, after adding one and rearranging, one has

(A.1.10) $$\hat{P}_x \big/ \hat{E} = \left[\eta^* / (\eta^* - \varepsilon)\right]$$

Now, we use the following mathematical fact: the percentage change of the product of two variables equals the sum of the respective percentage changes. Thus, since the supply of foreign exchange, or the value of exports (in foreign currency), equals price time quantity, one can express the total percentage change in the value of exports as

(A.1.11) $$\hat{X} = \hat{P}_x^* + \hat{X}^s$$

and dividing (A.1.11) throughout by $\hat{E}$ to find an expression in terms of elasticities with respect to the exchange rate

(A.1.12) $$E_S = \hat{X} \big/ \hat{E} = \hat{P}_x^* \big/ \hat{E} + \hat{X}^s \big/ \hat{E}$$

Equation (A.1.9) defines the first term on the RHS of (A.1.12). Since one needs to express the result in domestic prices (currency), one can use directly (A.1.10). The second term in the RHS is then obtained by substituting (A.1.9) in the RHS of (A.1.8). Thus, the response of the quantity of exports is

(A.1.13) $$\frac{\hat{X}^s}{\hat{E}} = \frac{\varepsilon \eta^*}{\eta^* - \varepsilon}$$

Hence, putting together equations (A.1.10) and (A.1.13)

(A.1.14) $$E_S = \frac{\eta^*}{\eta^* - \varepsilon} + \frac{\varepsilon \eta^*}{\eta^* - \varepsilon} = \frac{(1+\varepsilon)\eta^*}{\eta^* - \varepsilon}$$

Following the same steps, one can derive the solution for the import market. The homologous solutions for equations (A.1.10), (A.1.13), and (A.1.14) are

(A.1.15) $$\hat{P}_m / \hat{E} = \left[\varepsilon^* / (\varepsilon^* - \eta) \right]$$

(A.1.16) $$\frac{\hat{M}^d}{\hat{E}} = \frac{\varepsilon^* \eta}{\varepsilon^* - \eta}, \text{ and}$$

(A.1.17) $$E_D = \frac{\varepsilon^*}{\varepsilon^* - \eta} + \frac{\varepsilon^* \eta}{\varepsilon^* - \eta} = \frac{(1+\eta)\varepsilon^*}{\varepsilon^* - \eta}$$

Finally, substituting solutions (A.1.14) and (A.1.17) in (A.1.6)

$$E_B = \left[\frac{(1+\varepsilon)\eta^*}{\eta^* - \varepsilon} \right] \frac{X}{M} - \left[\frac{(1+\eta)\varepsilon^*}{\varepsilon^* - \eta} \right]$$

or,

$$\frac{dB/M}{dE/E} = \left[\frac{(1+\varepsilon)\eta^*}{\eta^* - \varepsilon} \right] \frac{P_x^* X^s}{P_m^* M^d} - \left[\frac{(1+\eta)\varepsilon^*}{\varepsilon^* - \eta} \right]$$

Now, multiplying throughout by *M*, one can express the response of the trade balance to exchange rate changes (after defining elasticities in absolute values), in domestic currency, as follows

$$\frac{dB}{dE} = P_x X^s \left[\frac{(1+\varepsilon)\eta^*}{(\varepsilon + \eta^*)} \right] - P_m M^d \left[\frac{(1-\eta)\varepsilon^*}{(\varepsilon^* + \eta)} \right]$$

This is the BRM condition stated in equation (2.8).

A.2 Span of the Data by Country

Chile: 1979:1 to 1995:4
Colombia: 1979:1 to 1995:4
Mexico: 1979:1 to 1995:4. The span of the money aggregates is 1982:1 to 1995:4
Paraguay: 1979:1 to 1995:4. The span of the money aggregates is 1988:4 to 1995:4
Venezuela: 1979:1 to 1995:4. The span of the money aggregates is 1987:4 to 1995:4

A.3 The REER index

To construct the REER index for Mexico, the following equation was used (see Edwards, 1989, ch. 4):

$$REER_{ft} = \sum_{l=1}^{n} \omega_l E_{lt} P^*_{lt} \Big/ P_{ft}$$

where $REER_{ft}$ is the index of the *multilateral* real exchange rate in period t for country f (Mexico); ω_l is the weight corresponding to partner l in the computation of $REER_{ft}$; E_{lt} is an *index* of the nominal rate between country l and country f in period t; l=1, …, n refers to the n partner countries used in the construction of the REER index; P^*_{lt} is the price index of partner l in period t; and P_{ft} is the price index of the domestic country in period t. The partner countries' whole price index were used as the P^*_{lt} and the domestic country's consumer price index as P_{ft}. The "average nominal exchange rate" (*line* "…RF.ZF…") of the IMF's statistics was used to construct E_{lt}. The actual trade weights were built using data from *Direction of Trade Statistics Yearbook*, IMF. The 12 (that is, n=12) Mexican largest trade partners whose price indexes were available in 1990 were used (several years were considered as the base and the results did not significantly change). The estimated trade weights (in percentage) were: U.S.A (75.7), Belgium-Luxembourg (1.8), Canada (1.2), Japan (5.5), France (2.5), Germany (3.9), Italy (1.3), Netherlands (1.1), Spain (3.8), Switzerland (1.2), UK (1.5), Venezuela (0.5).

A.4 The Conditional Model

TABLE A. 1. SPECIFICATION AND MISSPECIFICATION TESTS[a]

		Univariate Statistics		*Multivariate Statistics*			
Country	*Equation*	*ARCH(k)*	*Normality*	*Q(j)*	*LM(1)*	*LM(4)*	*Normality*
Chile		k=4		j=16;250(.01)	27(.03)	25(.06)	10(.23)
	$\Delta LPTB_t$	2.32	1.99				
	$\Delta LREER_t$	2.04	6.35				
	ΔLMI_t	4.12	4.79				
	$\Delta LRGDP_t$	3.88	2.23				
Colombia		k=3		j=16;253(.01)	45(.00)	24(.08)	5(.67)
	$\Delta LPTB_t$	1.15	0.55				
	$\Delta LRGDP_t$	1.51	2.24				
	ΔLMI_t	3.63	5.31				
	$\Delta LRGDP_t$	2.62	5.79				
Mexico		k=4		j=13;172(.17)	28(.02)	22(.12)	26(.00)
	$\Delta LPTB_t$	1.44	7.31				
	$\Delta LREER_t$	0.46	53.60*				
	ΔLMI_t	7.00	2.17				
	$\Delta LRGDP_t$	7.12	0.55				
Paraguay		k=2		J=6;57(.06)	13(.14)	8(.47)	8(.18)
	$\Delta LPTB_t$	4.71	5.58				
	$\Delta LREER_t$	0.56	15.95*				
	ΔLMI_t	8.18*	8.67				

[a] LTB is the log of the trade balance measurement, LREER is the log of the real exchange rate index, LMI is the log of the real money stock, and LRGDP is the log of the real GDP (or the log of the proxy). All tests are asymptotically χ^2-distributed with the following degrees of freedom (df): ARCH(k) with k df; normality with $2d_0$ df, where d_0 is the number of endogenous variables in the vector; Q(j) with d_0^2 ([T/4] - k + 1) - $d_0 r$ df; and LM (1) and LM(4) with d_0^2 df. For the univariate tests "*" means significant at the 5% level. For the multivariate tests their marginal significance level is in brackets.

REFERENCES

Ahn, S. K., and G. C. Reinsel (1990), "Estimation for Partially Nonstationary Multivariate Autorregressive Models," *Journal of the American Statistical Association*, vol. 85, pp. 813-23.

Alexander, S. S. (1952), "Effects of a Devaluation on a Trade Balance," *IMF Staff Papers*, 2, pp. 263-78.

Alexander, S. S. (1959), "Effects of a Devaluation: A Simplified Synthesis of Elasticities and Absorption Approaches," *American Economic Review*, 49, pp. 21-42.

Artus, J. R., and A. K. McGuirk (1981), "A Revised Version of the Multilateral Exchange rate Model," *IMF Staff Papers*, 28, pp. 275-309.

Artus, J. R., and M. D. Knight (1984), *Issues in the Assessment of the Exchange Rates of Industrial Countries,* IMF (Occasional Paper 29).

Bahmani-Oskooee, M. (1985), "Devaluation and the J-Curve: Some Evidence from LDCs," *The Review of Economics and Statistics*, pp. 500-04.

Bahmani-Oskooee, M. (1991), "Is There a Long-Run Relation Between the Trade Balance and the Real Effective Exchange Rate of LDCs?" *Economic Letters*, pp. 403-07.

Bahmani-Oskooee, M., and J. Alse (1994), "Short-Run Versus Long-Run Effects of Devaluation: Error-Correction Modeling and Cointegration," *Eastern Economic Journal*, 20, 4, pp. 453-464.

Bahmani-Oskooee, M., and S. Payesteh (1993), "Budget Deficits and the Value of the Dollar: An Application of Cointegration and Error-Correction Modeling," *Journal of Macroeconomics*, pp. 661-77.

Bickerdike, C. F. (1920), "The Instability of Foreign Exchanges," *The Economic Journal*, March.

Blough, S. R. (1992), "The Relationship between Power and Level for Generic Unit Root Tests in Finite Samples," *Journal of Applied Econometrics*, vol. 7, pp. 295-308.

Campbell, J. and P. Perron (1991), "Pitfalls and Opportunities: What Macroeconomists Should Know About Unit Roots," in O. J. Blanchard and S. Fischer (eds.), *NBER Economics Annual 1991*, MIT Press.

Cooper, R. N. (1971), *Currency Devaluation in Developing Countries,* Princeton University (Essays in International Finance, nº 86).

Corden, W. M. (1994), *Economic Policy, Exchange Rates and the International System*, The University of Chicago Press.

Dickey, D., and S. Pantula (1987), "Determining the Order of Differencing in Autorregressive Processes," *Journal of Business and Economic Statistics*, vol. 5, pp. 455-461.

Doornik, J., and H. Hansen (1994), *An Omnibus Test for Univariate and Multivariate Normality*, Nuffield College, Oxford (Working Paper).

Dornbusch, R. (1975), "Exchange Rates and Fiscal Policy in a Popular Model of International Trade," *The American Economic Review*, 65, pp. 859-71.

Dornbusch, R. (1987), "Purchasing power parity," in J. Eatwell, M. Migare, and P. Newman, eds., *The New Palgrave Dictionary*, Stockton Press.

Edwards, S. (1989), *Real Exchange Rates, Devaluation, and Adjustment: Exchange Rate Policy in Developing Countries*, Cambridge, MIT Press.

Engle, R. F. (1982), "Autorregressive Conditional Heteroscedasticity with Estimates of the Variance of United Kingdom Inflation," *Econometrica*, vol. 50, pp. 987-1007.

Engle, R. F., and C. W. Granger (1987), " Co-integration and Error Correction: Representation, Estimation, and Testing," *Econometrica*, vol. 55, pp. 251-76.

Engle, R. F., D. F. Hendry, and J. F. Richard (1983), "Exogeneity," *Econometrica*, vol. 51, pp. 277-304.

Frances, P. H. (1991), *Model Selection and Seasonality in Time Series*, Thesis, Amsterdam.

Frances, P. H. (1996), *Periodicity and Stochastic Trends in Economic Time Series*, Oxford.

Frenkel, J. A., and A. Razin (1996), *Fiscal Policies and Growth in the World Economy*, Third Edition, The MIT Press.

Frenkel, J. A., and H. G. Johnson (1977), "The Monetary Approach to the Balance of Payments", in J. A. Frenkel and H. G. Johnson (eds.), *The Monetary Approach to the Balance of Payments.*

Ghysels, E., H. S. Lee, and J. Noh (1994), "Testing for Unit Roots in Seasonal Time Series: Some Theoretical Extensions and a Monte Carlo Investigation," *Journal of Econometrics*, 62, pp. 415-444.

Granger, C. W., and R. F. Engle, eds. (1991), *Long-run Economic Relationships: Readings in Cointegration*, Oxford.

Gylfason, T., and M. Radetzki (1991), "Does Devaluation Make Sense in the Least Developed Countries?," *Economic Development and Cultural Change*, University of Chicago.

Hahn, F. H. (1959), "The Balance of Payments in a Monetary Economy," *Review of Economic Studies*, 26, pp. 110-25.

Hallwood, C. P., and R. MacDonald (1994), *International Money and Finance*, Second Edition, Blackwell.

Hamilton, James D. (1994), *Time Series Analysis*, Princeton University Press.

Hansen, H. and K. Juselius (1995), *CATS in RATS: Cointegration Analysis of Time Series*, Estima.

Harberger, A. C. (1950), "Currency Depreciation, Income, and the Balance of Trade," *Journal of Political Economy*, 58, pp. 47-60.

Harris, R. (1995), *Cointegration Analysis in Econometric Modeling*, Prentice Hall, Harvester Wheatsheaf .

Haynes, S. E., and J. A. Stone (1982), "Impact of the Terms of Trade on the U.S. Trade Balance: A Reexamination," *The Review of Economics and Statistics*, pp. 702-06.

Himarios, D. (1989), "Do Devaluations Improve the Trade Balance? The Evidence Revisited," *Economic Inquiry*, pp. 143-68.

Hoffman, D. L., and R. H. Rasche (1996), *Aggregate Money Demand Functions: Empirical Applications in Cointegrated Systems*, KAP.

Hylleberg, S., R. F. Engle, C. W. Granger, and B. S. Yoo (1990), "Seasonal Integration and Cointegration," *Journal of Econometrics*, 44, pp. 215-38.

Ilmakunnas, P. (1990), "Testing the Order of Differencing in Quarterly Data: An Illustration of the Testing Sequence," *Oxford Bulletin of Economics and Statistics*, 52, 1, pp. 79-88.

Isard, P. (1995), *Exchange Rate Economics*, Cambridge University Press.

Johansen, S. (1988), "Statistical Analysis of Cointegration Vectors," *Journal of Economic Dynamics and Control*, vol. 12, pp. 231-54.

Johansen, S. (1991), "Estimation and Hypothesis Testing of Cointegration Vectors in Gaussian Vector Autoregressive Models," *Econometrica*, 59, pp. 1551-80.

Johansen, S. (1992), "Cointegration in Partial Systems and the Efficiency of Single-Equation Analysis," *Journal of Econometrics*, 52, pp. 389-402.

Johansen, S. (1995a), "Identifying Restrictions of Linear Equations: with Applications to Simultaneous Equations and Cointegration," *Journal of Econometrics*, 69, pp. 111-32.

Johansen, S. (1995b), *Likelihood-Based Inference in Cointegrated Vector Autorregressive Models*, Oxford University Press.

Johansen, S., and K. Juselius (1990), "Maximum Likelihood Estimation and Inference on Cointegration with Applications to

the Demand for Money," *Oxford Bulletin of Economics and Statistics*, 52, pp. 169-210.

Johansen, S., and K. Juselius (1992), "Testing Structural Hypothesis in a Multivariate Cointegration Analysis of the PPP and the UIP for UK," *Journal of Econometrics*, 53, pp. 211-44.

Johansen, S., and K. Juselius (1994), "Identification of the Long-Run and the Short-Run Structure: An Application to the ISLM model," *Journal of Econometrics*, 63, pp. 7-36.

Jones, J. D., and D. Joulfaian (1991), "Federal Government Expenditures and Revenues in the Early Years of the American Republic: Evidence from 1792 to 1860," *Journal of Macroeconomics*, pp. 133-55.

Junz, H. B., and R. R. Romberg (1973), "Price Competitiveness in Export Trade among Industrial Countries," *American Economic Review*, 63, pp. 412-18.

Kamin, S. B. (1988), "Devaluation, External Balance, and Macroeconomic Perfomance: A Look at the Numbers," *Princeton Studies in International Finance*, 62, Princeton, Princeton University.

Kemp, M. C. (1970), "The Balance of Payments and the Terms of Trade in Relation to Financial Controls," *Review of Economic Studies*, 37, pp. 25-31.

Kenen, P. B. (1985), "Macroeconomic Theory and Policy: How the Closed Economy Model was Opened," in R. Jones and P. Kenen (eds.), *Handbook of International Economics*, vol. 2, Amsterdam, North-Hollan, pp. 625-77.

Krueger, A. O. (1983), *Exchange-Rate Determination*, Cambridge University Press.

Krugman, P. R. (1987), "Pricing to Market when the Exchange Rate Changes," in S. Arndt and J. D. Richardson (eds.), *Real-financial Linkages Among Open Economies*, MIT Press.

Krugman, P. R. (1991), "Has the Adjustment Process Worked?," *Policy Analyses in International Economics*, 34, IIE.

Krugman, P. R. and R. E. Baldwin (1987), "The Persistence of the U.S. Trade Deficit," *Brookings Papers on Economic Activity*, 1, pp. 1-43.

Lerner, A. P. (1944), *The Economics of Control: Principles of Welfare Economics*, The Macmillan Company, N.Y.

Lindert, P. H., and C. P Kindleberger (1982), *International Economics*, Irwin Series in Economics, Homewood, IL.

Magee, S. (1973), "Currency Contracts, Pass-Through, and Devaluation," *Brookings Papers of Economic Activity*, 1, pp. 303-23.

Magee, S. (1975), "Prices, Incomes and Foreign Trade," in P. B.

Kenen (ed.), *International Trade and Finance: Frontiers for Research* , Cambridge.
Marshall, A. (1923), *Money, Credit and Commerce*, London, Macmillan.
Meade, E. E. (1988), "Exchange Rates, Adjustment, and the J-Curve," *Federal Reserve Bulletin*, 74, 10, pp. 633-44.
Meade, J. E. (1951), *The Balance of Payments*, Oxford, Oxford University Press.
Metzler, L. (1948), *A Survey of Contemporary Economics*, vol. I, Richard D. Irwin, INC, Homewood, IL.
Mundell, R. A. (1968), *International Economics*, NY, Macmillan.
Mundell, R. A. (1971), *Monetary Theory*, Pacific Palisades, Goodyear.
Negishi, T. (1968), "Approaches to the Analysis of Devaluation," *International Economic Review*, 9, pp. 218-27.
Nelson, C. R., and C. I. Plosser (1982), "Trends and Random Walks in Macroeconomic Time Series: Some Evidence and Implications," *Journal of Monetary Economics*, 10, pp. 139-62.
Osterwald-Lenum, M. (1992), "A Note with Quantiles of the Asymptotic Distribution of the Maximun Likelihood Cointegration Rank Test Statistics", *Oxford Bulletin of Economics and Statistics*, 54, 3, pp. 461-72.
Paredes, Carlos E. (1989), "Exchange Rates, the Real Exchange Rate and Export Perfomance in Latin America," *Brookings Discussion Papers in International Economics*, nº 77.
Pearce, I. F. (1961), "The Problem of the Balance of Payments," *International Economic Review*, 2, pp. 1-28
Polak, J. J. (1957), "Monetary Analysis on Income Formation and Payments Problems," *IMF Staff Papers*, 6, pp. 1-50.
Prais, S. J. (1961), "Some Mathematical Notes on the Quantity Theory of Money in a Small Open Economy," *IMF Staff Papers*, 2, pp. 212-26.
Pritchett, L. (1991), *The Real Exchange Rate and the Trade Surplus: An Empirical Analysis for Non-Oil Exporting LDCs*, World Bank, Washington, D. C.
Reinsel, G. C., and S. K. Ahn (1992), "Vector Autoregressive Models with Unit Roots and Reduced Rank Structure: Estimation, Likelihood Ratio Test, and Forecasting," *Journal of Time Series Analysis*, 13, pp. 353-75.
Rincón C., H. (1995), "Exchange Rates in a *Popular Model of International Trade*, Again: The Case of a Small Open Economy," unpublished term paper, University of Illinois at Urbana-Champaign.

Robinson, J. (1947), *Essays in the Theory of Employment*, Oxford, Basil Blackwell.

Rose, A. K. (1990), "Exchange Rates and the Trade Balance: Some Evidence from Developing Countries," *Economic Letters*, 34, pp. 271-75.

Rose, A. K. (1991), "The Role of Exchange Rates in a Popular Model of International Trade: Does the 'Marshall-Lerner' Condition Hold?," *Journal of International Economics*, 30, pp. 301-16.

Rose, A. K., and J. L. Yellen (1989), "Is There a J-curve?" *Journal of Monetary Economics*, 24, pp. 53-68.

Schmidt, P., and C. B. Phillips (1992), " LM Test for a Unit Root in the Presence of Deterministic Trends," *Oxford Bulletin of Economics and Statistics*, 54, 3, pp. 257-87.

Stern, R. M. (1973), *The Balance of Payments: Theory and Economic Policy*, Macmillan.

Stock, J., and M. Watson (1988), "Testing for Common Trends," *Journal of the American Statistical Association*, vol. 83, pp. 1097-1107.

Vanek, J. (1962), *International Trade: Theory and Economic Policy*, Homewood, IL, Richard D. Irwin.

Whitman, M. V. (1975), "Global Monetarism and the Monetary Approach to the Balance of Payments," *Brookings Papers on Economic Activity*, 3, pp. 491-536.

Peter Adrien

Shifting intermediation in a bank centric environment: the case of the OECS financial system

1. INTRODUCTION

As economic growth proceeds, financial institutions tend to increase in relative importance. The changing character of the financial system is reflected in an increasing diversity in the types of financial institutions, an increasing share of the intermediaries both in the issuance and ownership of financial assets, and a diversification of the types of instruments in which the intermediaries specialise. At the early stage of development, banks tend to dominate the financial structure. As development advances, the financial superstructure may grow at about the same rate as with the real sector (Gurley and Shaw (1995). The "ratio of outstanding primary securities to income rises sharply in the early stages of the financial development of a capitalist economy, but then eventually reaches a plateau" (Bryant, 1987:11).

Paper prepared by P. Adrien, Deputy Director, Eastern Caribbean Central Bank (ECCB) and presented at the V Meeting of the Network of America Central Bank Researches, organized by the Banco Central do Brasil, in Rio de Janeiro, in October 16-17, 2000. The views expressed in this paper are those of the author and do not necessarily reflect these of the ECCB.

The character of the financial system in the Organisation of Eastern Caribbean States countries[1] has been fundamentally altered; financial intermediation is becoming increasingly complex. Non-bank institutions are supplementing the financial services supplied by banks, and some larger ones are competing with banks on the retail markets.

This paper contributes to the discussions on "financial intermediation" and "financial restructuring", which emanates from the longstanding debate on the nexus between finance and growth.[2] Financial restructuring denotes a rearrangement of the structural relationship between financial assets and tangible assets, a re-organisation of the distribution of the aggregate financial assets in the financial system amongst the financial intermediaries, particularly between banks and non-banks, and the changing importance of the financial institutions (banks and non-banks) in the process of economic development.

The literature on the financial system in the OECS countries suggests that developments in both the real sector and in the financial sector were significantly influenced by the openness of the small and dependent economies, slavery and colonialism, the process of political decolonisation, the role of the state in the market, the fluctuating fortunes of respective economies, and developments in the money and capital markets. While there is an obvious relationship between the development of the financial system and the changes in aggregate economic activity, there were several factors of an institutional and financial nature, which

[1] The member countries of the Organisation of Eastern Caribbean States (OECS) are Anguilla, Antigua and Barbuda, Dominica, Grenada, Montserrat, St Kitts and Nevis, St Lucia and St Vincent and the Grenadines. The sub-regional body, which forms part of the currency union often referred to as the Eastern Caribbean Currency Union or the ECCU region, is mandated to co-ordinate, harmonize and pursue common policies with respect to finance, trade and other matters. The member states co-ordinate, harmonize and pursue joint policies in the field of currency and central banking. The Eastern Caribbean central Bank (ECCB), a multi-state central bank regulates money and credit and promotes monetary stability, credit exchange and balanced growth and development. Since 1976, the EC dollar has remained pegged to the US dollar at EC$2.70 to US$1.00.

[2] Economists and economic historians are divided on the importance of the financial system for economic growth, and are engaged in a lively debate on the nexus between financial intermediation and economic growth. See Joseph Schumpeter (1912); Joan Robinson (1952); Lucas, (1988); Meir and Seers, (1984); Gurley and Shaw (1995).

contributed to the financial re-arrangement in the post-war period. As the economies "took off" in the 1960's, the financial system became more varied. The foreign banks extended their branch network; new banks from North America entered the market; and mortgage and finance companies were licensed, thereby supplementing the services offered by the established banks. Indigenous banks (commercial and development banks) were licensed, and competed with the established foreign banks. Non-bank institutions begun to mushroomed providing retail credit services to a largely neglected clientele in the lower income stream.

Growth in national income increased demand for outlets and loanable funds. This created the conditions for new financial intermediaries to enter the system and the opportunities for enterprises to differentiate their products to ensure a greater share of the savings and loans market. Credit unions became entrenched in the 1970's and 1980's and begun to compete with banks in the retail markets. Influenced by its peculiar ownership structure, philosophy of operation, liberal lending policy and service-orientation, the sector experienced persistent growth throughout the 1970s and the 1980s. Its liberal loan policy and emphasis on systematic savings contributed to significant growth in deposits, loans and assets.

The entrance of a number of insurance companies from the regional and international markets resulted in a rapid expansion of the insurance industry. The life insurance companies benefited from certain advantages over banks, such as the ability to combine life insurance with savings. Insurance companies are involved in mortgage lending, investments in securities, equities and real estate.

During the 1970's and 1980's, the state became more active in the marketplace. With increasing demand for funds for infrastructural development, some governments began to crowd out other users of funds by borrowing from the domestic banking system and selling securities. In addition, national commercial banks, development banks and social security schemes (SSS) were established. The national banks were set up to provide funds on suitable terms and conditions for the private sector, and to create additional sources of productive enterprises. The pension funds, which were established to provide a measure of security for the aged, became significant mobilisers of funds.

Moreover, entry into the banking system became more restrictive with the establishment of the central bank in 1983. Entry re-

quirements acted as a barrier to entry[3] and ensured that banks were well capitalised" (Bank Supervision Department, 1992:3). Banks are obligated to keep reserves against their deposits, as "required reserves" became mandatory, restricting the banks' lending capacity, and consequently, their assets growth.

The non-bank sector, on the other hand, remained relatively unregulated. Credit unions, which operated in a relatively lax regulatory and supervisory environment, expanded their customer-base, as the developments allowed them to compete freely with banks on the retail savings and credit markets. As the non-bank institutions became more sophisticated, business confidence and customer confidence increased. The result was a noticeable shift from banks to non-banks for retail banking services. The changing character of the bank centric system was accelerated by the pace of economic growth, influenced by the role of the state in the market, and increasing important of the non-bank sector.

This paper seeks to examine four assumptions emanating from the literature on "financial re-structuring" and "financial intermediation." They are:

i) The financial superstructure expands with economic growth. Financial intermediaries get larger as measured by the total assets or liabilities of financial intermediaries relative to GDP.

ii) The structure of the financial system changes with growth as evidenced by an increasing diversity in the types of financial institutions as well as the types of instruments in which they specialise.

iii) The character of intermediation changes, reflecting a shift from the dominance of traditional commercial banks to non-bank financial intermediaries. That is to say, non-banks financial institutions increase in relative importance.

iv) Non-banks assume an increasingly important role in economic development as intermediation changes.

The analyses, which follow, seek to investigate whether there is empirical evidence of a shift in intermediation and a re-arrangement of the financial superstructure. The rest of the pa-

[3] With the enactment of the Banking Act 1991, bank supervision was enhanced, as stricter prudential guidelines were put in place. The paid up capital of fourteen of the seventeen locally incorporated banks was less than the minimum capital specified by the Act.

per assumes the following organisation. Section II, which immediately follows, presents an overview of the OECS financial system. Section III, the analytical subdivision, deals with the issue of shifting intermediation by examining the four assumptions above. The policy issues are articulated in Section IV.

2. AN OVERVIEW OF THE OECS FINANCIAL SYSTEM

The OECS region is an under-developed and a relatively unsophisticated currency union dominated by foreign banks. The financial system is largely driven by a "savings culture", which was associated with the agrarian and peasant economies. While money and capital market developments have been significant in the 1990s, there is still no formal exchange and investment opportunities are restricted to periodic trade in government securities and public offerings by cash-strapped public and private companies wishing to raise capital.

The Eastern Caribbean Currency Union (ECCU) is really a bank centric system with banks mobilising capital and playing a major role in corporate governance, insofar as there is an absence of a strong institutional infrastructure. A bank centric system is different from a market centric system where there are well developed stock markets with an associated market for corporate control that addresses corporate governance, a mix of institutions with banks playing a limited role in corporate governance, a strong venture capital industry, and private equity being the source of risk capital. However, financial intermediation is no longer the sole preserve of banks. The financial system includes a large number of non-bank intermediaries, which are at varying stages of development and sophistication.

The Eastern Caribbean Central Bank (ECCB), the monetary authority for the Eastern Caribbean Currency Area[4] stands at the apex of the Eastern Caribbean financial system. Established in 1983, the multi-state central bank is empowered to regulate banking business, monitor the availability of money and credit, promote and maintain monetary stability and economic develop-

[4] The Eastern Caribbean Currency Area is the financial space which includes all the British dependencies and former British colonies of the Eastern Caribbean. It includes Anguilla, Antigua and Barbuda, Dominica, Grenada, Montserrat, St Kitts and Nevis, St Lucia and St Vincent and the Grenadines. It is the only monetary union in the Caribbean and Latin America.

ment. It is an atypical central bank, in the textbook sense, as the Banking Act, which governs its operations, gives it jurisdiction over all registered and licensed financial institutions.

The rest of the formal system includes commercial banks (referred to in this paper as banks), a newly established Eastern Caribbean Home Mortgage Bank (ECHMB), Development Banks, National Development Foundations (NDFs), Finance Companies, Building Societies, Credit Unions, Life and Non-life Insurance Companies, Social Security Schemes, Friendly Societies and School Co-operative/Thrift Societies. (Table 1). In addition, there are a number of private pension funds established by private business houses, and a few other savings banks and finance houses, which supplement the investment services offered by the established financial institutions. Consistent with the uniform 1991 Banking Act, some of the co-operative banks are classified with the NBFIs.

Commercial banks (herein referred to as banks) are the most important financial enterprises in the financial system, that is, with respect to savings mobilisation, credit creation, sources of investment capital, other retail and wholesale banking business, and corporate governance.

TABLE 1. NUMBER OF FINANCIAL INSTITUTIONS IN THE OECS COUNTRIES, 1997

Banking Institutions	46
Central Bank	1
Home Mortgage Bank	1
Commercial Banks	44
Non-Bank Financial Intermediaries	568
Credit Unions	78
School Co-operatives	282
Friendly Societies*	100
Building Societies	4
Finance Companies	20
Insurance Companies	62
Development Banks	7
National Development Foundations	7
Social Security Schemes	8
Total number of institutions	*614*

SOURCE: ECCB Statistics.
* Number understated.

The ECHMB was established to purchase residential mortgage loans from primary lenders, providing additional mortgage financing to homeowners.

Development banks are significant financiers of development projects. They finance educational, housing and agricultural projects, and extend credit to enterprises involved in productive activities. Inasmuch as they do not generally function as depositories, in this paper, they are classified as non-banks.

National Development Foundations (NDFs) and Development Banks are the two major types of Development Finance Institutions (DFIs) operating in the OECS countries. The NDFs provide short-to-medium-term funds mainly to micro and small businesses. They package projects for micro and small entrepreneurs for funding by commercial banks, and may guarantee up to 80 per cent of commercial bank loans to small enterprises, which lack the required collateral.

Finance Companies and Building Societies raise funds directly in the local market, concentrating on savings and time deposits. For example, mortgage institutions obtain funds to offer loanterm real estate loans and finance companies, extend loans to households, and differ from commercial banks in that they do not offer checking facilities. Building Societies like Savings and Loans Associations mobilise funds for lending to the housing sector. They are retail lenders and supplement the housing services offered by mortgage institutions and development banks.

Credit unions are important NBFIs, competing with commercial banks offering retail-banking services, and supplementing the financial services offered by other financial intermediaries.

The insurance industry is the largest and most important subsector of the Non-Bank Financial sector. The market is dominated by agencies of companies incorporated in other CARICOM countries or in the metropolitan centres. Life insurance companies mobilise large volumes of funds and play an important role in domestic capital formation.

Social Security Schemes (SSS), formerly National Provident Funds, are among the largest NBFIs in the OECS countries. They are capitalised by compulsory payroll deductions. These funds are used for claims payments, for meeting operations costs and for building reserves, and, as is the case in most countries, some of the funds are utilised for development purposes. These schemes mobilise domestic savings, which are used to provide a measure of security for the aged, and for financing investment.

Friendly Societies are welfare institutions established mainly in social organisations to provide for the precautionary demands of members of the fraternity. Most societies are formed within religious organisations and function, to some extent, as an insurance carrier, providing sickness and death benefits among other services. There are also a number of informal and non-formal financial and welfare institutions[5] providing a measure of security to persons in the lower income group.

School Savings Co-operatives or Thrift Societies are financial co-operative enterprises organised to promote thrift and to encourage savings mobilisation amongst minors.

3. SHIFTING INTERMEDIATION

The structure of the financial system in the OECS countries has changed with economic growth as evidenced by an increasing diversity in the types of financial institutions as well as the types of instruments in which they specialise. The literature uses a number of yardsticks to measure financial structure. In this paper we utilise four of these tools to measure financial structure: i) the change in the number of and size of financial institutions; ii) the shift in the distribution of financial institutions; iii) the change in the share of the financial institution in the stock of financial assets and; iv) the change in the ratio of financial assets to GDP.

Since the decolonisation process started in the post-war period, the number of financial institutions have mushroomed and intermediation has become increasingly more complex. The rearrangement of the financial system is becoming more evident with the development of the money and capital markets. These developments have been driven by expansion in education, an emerging middle class and an increasing demand for investment opportunities.

i) Change in number of institutions

The rudiments of the formal financial system were established

[5] Sou Sou, called by other names in some countries, is one such important informal arrangement among individuals who have entered into informal contract to contribute a fixed amount of money in a set period to a collective fund. The savings mobilised are distributed on a rotating basis to contributors. There is no administration cost and the contract is base on trust.

during the British occupation. The financial system was designed primarily to advance commerce with the metropolitan centre, and to facilitate intermediation. Financial intermediaries, mainly commercial banks and insurance companies were established to supply the increasing demand of expatriate personnel for depositories, credit institutions and insurance facilities. The banking and insurance industries were dominated by Multi-national Financial Corporations (MFCs), as they tended to follow Multinational Corporations (MNCs) overseas because of their preference in dealing with businesses in which they developed an expertise.

Initially the OECS region was dominated by foreign entities. The market was dominated by a few subsidiaries of parent firms located in Europe, and later on, in North America. Foreign banks issued their own notes that circulated side by side with coins issued by the United Kingdom government. Later on, the British Caribbean Currency Board (BCCB) was established in 1950 as the sole issuer of notes and coins. The quasi-monetary authority issued local British West Indian currency equivalent to any intake of foreign exchange. The banks however served primarily as a "store of savings and a source of short-term working capital" for the small mercantile class.

The growth of the financial system was already evident in the immediate post-war period, with the expansion of the banking and insurance industries, and the entrance of more foreign banks and insurance companies from Europe and North America. In most cases, the only indigenous financial institutions were cooperative banks and savings banks (usually referred to as penny banks) and credit unions which provided retail services to those in the lower income group.

The landscape of the financial system was radically altered with the process of decolonisation. The re-arrangement of the financial system was already evident by the 1970's, with the expansion of the credit union sector, the registration of a number of indigenous non-life insurance companies, and the licensing of local banks in several of the countries.

By 1997, the OECS financial system had expanded significantly with economic growth and development. Compared with the few dominant foreign subsidiaries of the pre-war period, the system comprised more than 10 types of financial institutions and more than 600 financial entities. The rapidly changing system included one (1) multi-state central bank, the Eastern Caribbean Central Bank (ECCB) - the monetary authority for the Eastern Caribbean

Currency Area commonly referred to as the ECCB area, one (1) newly established mortgage bank, the Eastern Caribbean Home Mortgage Bank (ECHMB), forty-four (44) commercial banks,[6] seven (7) Development Banks, seven (7) national development foundations (NDFs), twenty (20) finance companies, four (4) building societies, seventy-eight (78) credit unions, sixty-two (62) life and non-life insurance Companies, eight (8) social security schemes (SSS), more than one hundred (100) registered friendly societies and two hundred and eighty-two (282) school co-operative/thrift societies. (Table 1). In addition, there are a number of private pensions, savings banks and finance houses, which supplement the services offered by the established financial institutions. The changes in the number, and type of financial institutions as well as the mushrooming of the non-bank institutions reflect the increasing monetisation of the OECS economies (Haynes and Craigwell, 1991:33), a shift in the pattern of intermediation, the differentiation of financial superstructure, and the increasing competitiveness of non-banks in the financial system.

The shift in intermediation is also reflected in the degree of institutional penetration.[7] While the number of persons accessing the services offered by all financial institutions increased by 64.7 percent in the period 1983-95, the customer base of banks grew by 63.60 percent relative to 68.71 percent for the non-banks.[8] (Table 2). The number of persons accessing non-bank services from 1983 to 1995 grew by five percentage points, from 21.4 per-

[6] There are twenty-three licensed banking institutions and twenty-one branch banks. The central bank supervises the branch banks as separate institutions. Therefore, in this paper, the banking sector includes forty-four banks. With the establishment of local banks, the dualistic nature of the banking system became more evident. Six foreign-owned and controlled banks operate forty branches while eight newly established locally owned and controlled banks operate ten branches.

[7] The penetration rate reflects the relative presence or geographical spread and importance of the financial institutions in the financial system.

[8] Figures were only available for credit unions, life insurance companies, building societies and national development foundations. Moreover, for comparative purposes, only non-bank institutions involved in deposit-taking and/or credit creation are analysed. For, example, the activity of the Home Mortgage on the credit market is excluded, since as a secondary mortgage institution, it does not add to the stock of financial assets through its lending activity. Several of the non-banks institutions such as the building and loan associations, finance companies, friendly societies, national development foundations and credit unions provide mainly for the lower end of the market.

cent to 21.9 percent, while the number of persons served by banks declined by five percentage points in the same period, from 78.6 percent to 78.1 percent. The evidence suggests that the customer-base of non-bank sector grew at a faster rate than that of banking sector, reflecting the growing importance of the non-banks. While there were 42 banks offering banking services to 598,766 clients in 1990, five years later, there were only 44 banks serving 823,681 customers. In 1990, some 600 non-banks provided services to 175,923 clients compared to 619 serving 231,605 customers in 1995.[9]

TABLE 2. NUMBER OF CUSTOMERS BY FINANCIAL SECTOR, 1983 AND 1995

	1983	*1995*	*Percentage Change*
Banks	503,478	823,681	63.60
Non-Banks	137,220	231,605	68.71
Total	*640,698*	*1,055,187*	*64.69*

SOURCE: Quarterly and Annual Reports.

The increasing importance of credit unions as intermediaries is well established. Between 1975 and 1995, membership grew by 546.6 per cent, from 20,646 to 133,492. That is to say, the number of persons who accessed credit union services in 1995 was more than six times that of 1975. The area penetration rate moved from 8.6 per cent in 1975 to 21 per cent in 1995, which was 14 percentage points higher than the global rate.[10] (Table 3).

TABLE 3. OECS COUNTRIES: CREDIT UNIONS MEMBERSHIP/POPULATION (15+), 1975 AND 1995

Mem (1975)	*Pop (1975)*	*Mem/Pop (1975)*	*Mem. (1995)*	*Pop (1995)*	*Mem/Pop (1995)*
22,030	257,631	8.6	132,802	633,023	21.0

SOURCE: ECCB Statistics; Central Statistical Offices.

[9] While they have established branches, the operations of banks have tended to be concentrated in the urban and commercial centres. Non-banks, particularly credit unions, have mushroomed in both rural and urban communities where retail-banking services are demanded.

Given the differential in the number of institutions in each sector, the number of customers per bank would be significantly larger than the number of customers per non-bank. The comparison however is more useful when analysed in the context of changing demand for services in each sector.

[10] See 1995 Statistical Report, World Council of Credit Unions Inc.

The significantly large customer-base of the banking sector is a reflection of its dominance, its historical role in the financial system, its goodwill, and the wide variety of financial services its offers.[11] The geographical distribution of banks reflects their colonial experience, commercial interest and profit motive. Insofar as most banks are involved in wholesale and retail banking, they tend to benefit from economies of scale and economies of space. Credit unions and other non-formal financial institutions, for example, are influenced by their field of membership.[12]

ii) Growth in Deposits and Loans

It must be borne in mind that banks have held their own largely because they are depositories for the rest of the financial system. Movements in the banks' loans and assets would be significantly influenced were they not depositories for security schemes and credit unions, since banks' deposits have the multiplier effect on their loan portfolio and, consequently, their asset portfolio. A useful indicator of changing market share (for banks and non-banks) is the comparative movement in deposits and loans. The unavailability of data for the rest of the non-bank institutions allows only a partial comparison between banks and credit unions. Credit union activity is largely restricted to the retail savings and credit markets, as it transacts primarily with the households.[13] Comparisons with commercial banks are therefore restricted to these markets.

[11] The size of the banks' customer base is likely to be overstated due to the problem of dual and multiple accounts. This is also a concern for the non-banks, and particularly for credit unions, where dual and multiple membership is prevalent.

[12] Patronage in a credit union is limited to bonding in an association (e.g. trade union), through occupation (e.g. teaching), and through residence (e.g. community). Credit unions' common bond limits their business operations to a particular clientele, community or locale. Banks on the other hand, are not limited by geographical boundaries, and serve the entire population.

[13] A credit union is firstly a depository and secondly a credit institution. The size of its loan portfolio is largely dependent upon the volume of deposits mobilised. Shares and deposits make up more than 80 per cent of the total liabilities of the credit union. Shares are utilised for credit creation while savings deposits are used to meet transactional demands. Insofar as the share capital can be withdrawn at any time or with notice, it is not treated as a stock, but rather as a "call deposit". Hence in our financial evaluation, the term savings refer to total shares and saving deposits.

Since the 1970's, credit unions have been competing with small banks and other thrift institutions for retail banking business, evidenced by a persistent double-digit growth in deposits and loans (in the 1970s and 1980s). Deposits grew from EC$1.9m in 1975 to EC$310.3m in 1995, and loans expanded from EC$1.8m to EC$299m in the same period, suggesting a significant increase in non-banks' share in the retail savings and credit markets. Movements in credit unions' deposits and loans, between 1975 and 1995 compared favourably with that of banks.

While banks' (household) deposits and (household) loans grew by 315.9% and 209.3% respectively, credit unions' deposits and loans expanded by 588.9% and 486.3% respectively in the same period. The trend has persisted into the 1990s, with banks' deposits growing at a slower rate (9.4%) than credit unions' deposits (17.8%) between 1993 and 1999. Loans disbursement by two types of credit institutions grew at the same annualised rate, 11% and 11.4% respectively, reflecting the supplementary role of non-banks in the retail credit market. (Table 4).

TABLE 4. GROWTH IN HOUSEHOLD DEPOSITS AND HOUSEHOLD LOANS, 1993-1999 (IN PERCENTAGES)

	Households Deposits		*Households Loans*	
	Banks	*Credit Unions*	*Banks*	*Credit Unions*
94/93	9.2	22.7	3.3	15.8
95/94	12.6	16.9	9.2	16.6
96/95	4.5	19.6	13.0	10.2
97/96	8.1	15.2	20.1	7.6
98/97	12.4	19.1	8.5	9.8
99/98	9.5	13.2	11.8	8.4
Average Rate	*9.4*	*17.8*	*11.0*	*11.4*

SOURCE: ECCB Statistics.

The shift in intermediation is particularly evident in Dominica, where penetration rate is about 75 per cent. For the period 1993-1999, credit unions deposits averaged 19 per cent of banks household deposits but 73.6 per cent of banks household loans. (Table 5). Credit unions and retail banks are engaged in an unrelenting competition in the retail market.

Credit unions provide a range of services that is both competitive and innovative, helping them to maintain their position

among the leading financial institutions. The range of financial products and services include savings accounts; checking accounts; term deposits; consumer, business and mortgage loans; retirement funds; insurance and utility-bill paying services and Automated Teller Machines (ATMs), among other services. Credit unions write million of cheques and transact over one million of dollars in business through (ATMs) monthly and have endorsed a number of insurance companies to provide to their members a range of insurance products.

TABLE 5. DOMINICA: GROWTH IN CREDIT UNIONS (CUs) DEPOSITS AND LOANS RELATIVE TO BANKS, 1993-1999

	Household Deposits			*Household Loans*		
	CUs	*Banks*	*CU/B (%)*	*CUs*	*Banks*	*CU/B (%)*
1993	32.9	207.0	15.9	108.1	167.4	64.6
1994	38.1	221.9	17.2	118.5	157.9	75.0
1995	45.9	274.5	16.7	135.0	168.1	80.4
1996	55.4	287.0	19.3	139.4	173.8	80.2
1997	65.9	298.9	22.0	141.7	198.7	71.3
1998	66.3	313.5	21.1	154.3	215.0	71.7
1999	72.5	343.9	21.1	171.6	238.6	71.9
Average (%)			*19.4*			*73.6*

SOURCE: ECCB Statistics.

iii) Growth in Financial Assets

The relative movements in the share of the financial assets in the banking and non-bank sectors indicate the relative importance of the two sectors in the financial system (Bryant, 1987) and a shift in intermediation from banks to non-bank intermediaries. Table 6 points to an appreciation of the value of the stock of financial assets by 419.2 percent in 1983-1997, reflecting phenomenal growth in non-bank assets and a significant increase in bank assets. While the stock of financial assets of banks grew by 404.8 percent over the fourteen-year period, aggregate assets of non-banks grew by 811.3 percent, reflecting four figure growth rates recorded by credit unions (4,100%) and development banks (1009.7%) and triple figure growth rates registered by all other non-bank intermediaries. Banks, the most significant intermediary in the financial system, hold

the largest share of the consolidated asset stock, followed by social security schemes, the largest mobilisers of compulsory savings, insurance companies, credit unions and development banks. Finance companies, which have become important actors in the retail credit market, have accumulated significant financial assets. (Table 6).

TABLE 6. TOTAL ASSETS OF FINANCIAL INSTITUTIONS (EC$M), 1983-1997

	1983	*1986*	*1989*	*1992*	*1995*	*1997*	*83/97 (%)*
Commercial Banks	1,480	2,207	3,551	4,701	6,232	7,471	404.8
Social Security Schemes	249	426	655	967	1,377	1,717	589.6
Insurance Companies*	126	173	237	325	452	547	334.1
Finance Companies*	75	94	117	145	180	208	177.3
Building Societies *	29	36	46	76	89	97	234.5
Development Foundations	5	6	8	14	19	24	380.0
Development Banks	31	96	186	297	302	344	1009.7
Credit Unions	99	136	186	256	381	468	4100.0
Friendly Societies	1.3	1.5	1.9	2.4	3.7	4.9	276.9
Schools Coop Societies	0.7	0.9	1.1	1.4	1.7	2.1	200.0
Total	*2,096*	*3,176*	*4,989*	*6,784.8*	*9,037.4*	*10,883*	*419.2*

SOURCE: ECCB Annual and Quarterly Reports; Various Reports; *Estimated figures for 1990-1992.

Activity in the financial sector reflected developments in the real sector, the changing consumption pattern and savings behaviour of households as well as an increasing demand for financial services. Developments in the financial system in the period 1983-1997, took place against the backdrop of economic crises or recessions, brief periods of economic upswings, a short but sustained period of growth driven by robust performance of the banana industry in the Windward Islands, and a general slowdown in economic activity in the first half of the 1990s. The economies of the OECS countries were severely affected by the global recession of the 1970's. The 1980's was a period of transition and recovery. The stability of the pound sterling in the latter half of the 1980's along with the absence of severe winters in Europe contributed to

the rising price of bananas on the United Kingdom market. High levels of capital formation gave rise to expanding investments in the building and construction sector. Increases in the level of national deposits resulted in high levels of liquidity in the banking system.

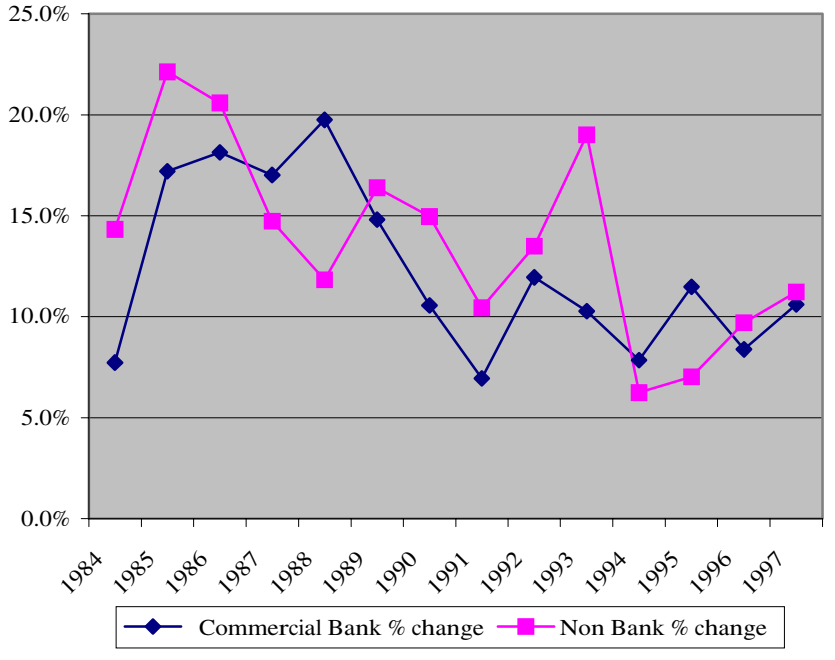
TABLE 7. CHANGES IN ASSETS STOCK OF BANKS AND NON-BANKS (IN EC$1000S), 1984 – 1997

	Banks	*% Change*	*Non-Banks*	*% Change*
1983	1,479,743		549,333	
1984	1,594,126	7.7	627,981	14.3
1985	1,868,237	17.2	766,863	22.1
1986	2,207,203	18.1	924,695	20.6
1987	2,582,749	17.0	1,060,790	14.7
1988	3,092,786	19.7	1,186,303	11.8
1989	3,550,979	14.8	1,380,702	16.4
1990	3,926,037	10.6	1,587,342	15.0
1991	4,198,868	6.9	1,753,211	10.4
1992	4,700,815	12.0	1,989,794	13.5
1993	5,183,782	10.3	2,367,902	19.0
1994	5,590,653	7.8	2,515,593	6.2
1995	6,232,096	11.5	2,692,326	7.0
1996	6,754,382	8.4	2,953,502	9.7
1997	7,470,649	10.6	3,284,931	11.2
Average growth Rate		*12.3*		*13.7*

SOURCE: Computed from Table 4.

Since the 1980s non-banks have been growing at a faster rate than banks, the average growth rate of non-banks financial assets (between 1983 and 1997) being 13.7 percent compared with 12.3 percent for banks. In the review period, except for two years (1987/88 and 1994/95), when the movements in sectoral growth were noticeably different, non-banks financial assets grew at a faster rate than that of banks. (Table 7 and Figure 1). Inasmuch as loans and investments are the major components of the asset portfolio of banking institutions, the analysis tend to suggest a slower growth rate for the banks on the credit market in the fourteen-year period relative to non-banks. Non-banks compete with and supplement the services offered by banks.

FIGURE 1. CHANGES IN TOTAL ASSETS, 1984 - 1997



iv) Sectoral Contribution to Economic Growth

A useful indicator of financial re-arrangement is the relationship between financial intermediation and economic growth, which reflects the relative importance of each institutional type and indicates the improvement of the financial sector relative to the growth of the real sector – establishing a nexus between finance and growth. This ratio is comparable to the financial interrelation ratio (FIR),[14] and is used interchangeably in the literature. Haynes and Craigwell (1991:33) who have done substantive work on finance and growth in the Caribbean, confirmed that "crude indicators of their (non-banks) economic importance are the ratio of their assets to national income and the ratio of loans and advances to national income."

[14] The FIR is a measure of the degree of institutionalisation in a financial system. It may be defined as the ratio of intangible assets to tangible assets. In some cases, the FIR is discussed as being reflective of the economic structure of a country.

The proportion of bank assets to GDP increased from 91.6 percent to 137.2 percent between 1983 and 1997 while that of non-banks moved from 33.9 percent to 56.4 percent in the same period, confirming the dominance of the banking system. (Table 8). However, it must be noted that the relationship between the financial system and the real sector is influenced by the degree of monetisation of the economy and the size and the maturity of the sector would influence the growth rates. And unlike the cases in some developing countries, the OECS economies are highly monetized,[15] and the non-bank sector is small and immature relative to the banking sector.

Moreover, the large ratios for banks reflect statistical differences associated with the measurement of flows (GDP) and stocks (assets) and the generally faster growth rate of banks' assets in a bank centric environment.

TABLE 8. TOTAL STOCK OF ASSETS TO GDP, 1983 – 1997 (PERCENTAGE)

	1983	*1986*	*1989*	*1992*	*1995*	*1997*
Banks	91.6	91.7	102.1	108.8	125.7	137.2
Non- Banks	33.9	38.4	39.7	46.1	54.2	56.4

SOURCE: Calculated from Table 5; ECCB Statistics.

The increasing importance of the financial system however to real sector developments is established. Since the 1980s non-banks have continued to fuel activity in the real sector. The lending policies have emphasised mortgages, agriculture and tourism-related services and other productive sectors. Their asset portfolio reflects a diversity of financial instruments – bonds, term deposits, government securities and equities. But the increasing contribution of the non-bank sector does not indicate a declining importance of banks, but an increasing competitiveness and differentiation of the financial system.

Lewis (1970) argues that the volume of savings mobilised partly depends on the geographical spread of savings institutions, as people tend to save more when the savings institutions are close to them. The growth of credit unions, for example, has been sig-

[15] The degree of monetisation is conventionally measured as the ratio of the broad money stock to GDP. In most developing countries a low degree of monetisation is associated with the underdevelopment of the financial system. The large number of financial institutions in the OECS countries contributes to the relatively high degree of monetisation.

nificantly influenced by the formation of these enterprises in factories, organisations and communities.

4. CONCLUSION AND POLICY ISSUES

The financial system in the OECS countries has undergone a significant re-arrangement. The rudimentary system established by the colonial powers to facilitate cross-border commerce and to provide basic banking facilities to the local community, has been transformed into a relatively modern financial system, and with globalisation and liberalisation (driven by developments in telecommunications and computerisation), is rapidly being transformed into a sophisticated financial system. The following evidence points to a restructuring of the OECS financial system:

i) The financial superstructure is much more diversified; the operations of the financial institutions are more complex;

ii) The institutions have moved way from the pure function of intermediation, and like other firms, are seeking profit from any function for which there is a demand. Some of the non-traditional functions include, risk management, trading in assets, and participating in non-financial companies;

iii) While the banks remain the most important intermediaries, they are losing their dominance, as non-bank intermediaries are becoming more and more important in the financial system.

iv) The customer-base of the non-bank intermediaries has broadened to include all income groups, as these institutions become more sophisticated.

The last vestige of the traditional distinction between banks and non-banks is already being eroded; the boundaries are indeed becoming very blurred.

a) Some Policy Issues

The policy mix of the monetary authority and the governments must seek to develop the financial system and to increase its competitiveness. To ensure efficiency in the system, institutional strengthening and institutional integration would be necessary in the non-bank sector given the large number of intermediaries in

that sector. Monetary policy could be frustrated by the existence and unregulated activity of non-bank of financial intermediaries, many of them with weak managerial and technological capability. In light of the fact that the financial system is relative under-developed and the financial intermediaries are at varying stages of development, efforts at developing money and capital markets must be carefully, if not judiciously, pursued. The system must be brought to a certain level of sophistication to ensure participation.

The openness of the economies, the adoption of a fixed exchange rate, the access of branch banks to idle reserves from parent bodies, and the network of informal and non-formal institutions which mobilise funds outside of the control of the monetary authority, could have implications for the monetary policies of the central bank, as "monetary policy is facilitated by, among other things, the maturity and depth of the financial market" (Sandiford, 1994:27).

With the virtual drying up of concessional finance, the re-direction of investment flows from north-south to north-north, the prohibitive cost of investment capital, and the likely erosion of the revenue due to liberalisation, governments would have to rely more and more on domestic savings to finance investment projects. Policy makers would need to place more emphasis on the domestic savings. Savings mobilisation would have to be rationalised to increase efficiency in the sources and uses of funds. That is to say, savings vehicles should be developed in order to allow financial intermediaries to allocate resources efficiently among competing users.

REFERENCES

Adrien, P., *The Credit Union Movement in the OECS Countries, A preliminary Appraisal,* Mimeo, Eastern Caribbean Central Bank, St Kitts, 1992.

Adrien, P., *The Credit Union Sector in the ECCB Area: A Social, Economic and Financial Impact Study,* Mimeo, Eastern Caribbean Central Bank, St Kitts, 1991.

Adrien, P., *The Financial Services Industry: Emerging Trends in the Credit Union Sector,* XXVIII Annual Conference on Monetary Studies, Trinidad and Tobago, October 28-November 1, 1996.

Alleyne, F. W., "Facing the Challenge of Growth in the Local Credit Union Movement", in *Facing the Challenge of Growth*, The Barbados Co-operative Credit Union League Ltd, Barbados, 1989.

Banking Act, *An Act to Provide for Regulating Banking Business in the ECCB Territories*, nº 23 of 1983.

Bank Supervision Department, *The Move Towards a Central Supervisory Authority - A Case for Integrated Supervision of the Financial Institutions*, Mimeo, Eastern Caribbean Central Bank, St Kitts, 1995.

Barbados Credit Union, *Short History of the Caribbean Credit Union Movement*, Letchworth Press Ltd, Barbados, 1989.

Beckles, H., "The Question of Economic Democracy in Barbados Today", in *Facing the Challenge of Growth*, The Barbados Cooperative Credit Union League Ltd, Barbados, 1989.

Bencivenga, V. A., and B. Smith, "Financial Intermediation and Endogenous Growth", *Review of Economic Studies*, vol. 58, nº 2, 1991.

Bollenbacher, G. M., *The New Business of Banking*, Irwin Professional Publishing, Illinois, 1995.

Burke, B., "A Brief History of the Credit Union, in *Saver*, vol. 2, nº 1, 1992.

Bryant, R., *International Financial Intermediation*, The Brooking Institution, Washington, 1987.

Cameron, R. (ed.), *Banking and Economic Development: Some Lessons of History*, Oxford University Press, New York, 1972.

Carmichael, T., *Development of Financial Services in Barbados*, Mimeo, Conference on Financing Development in the Caribbean, 1989.

Feiwell, G. R., *Joan Robinson and Modern Economic Theory*, New York University Press, New York, 1989.

Gardener, E. P. M., *Towards European Financial Supermarkets*? North Wales Institute of European Finance, England, 1989.

Gart, A., *The Insider's Guide to the Financial Services Revolution*, McGraw-Hill Book Company, New York, 1984.

Gertler, M., "Financial Structure and Aggregate Economic Activity: An Overview", *Journal of Money, Credit and Banking*, vol. 20, nº 3, pt. 2, 1988, pp. 559-88.

Goldsmith, R. W., *Financial Structure and Development*, Yale University Press, New Haven, 1969.

Gomez, T., *Human Resource Development in the Financial Sector*, Mimeo, 1993.

Gupta, K. C., *Financial and Economic Growth in Developing Countries*, Groom Helm, London, 1984.

Gurley, J. G., "Financial Structures in Developing Economies", in D. Krivine (ed.), *Fiscal and Monetary Problems in Developing States*, Praeger, New York, 1967.

Gurley, J. G., "Review of Banking in the Early Stages of Indus-

trilisation", *American Economic Review*, vol. 57, nº 4, September, 1967.

Haynes, C., and R. Craigwell, *Financial Intermediation and Economic Development*, Mimeo, Central Bank of Barbados, 1991.

Holdip, M. P., *The Eastern Caribbean Central Bank - An Historical Analysis of a Sub-regional Monetary Institution,* Master Thesis, University of the West Indies, 1992.

John, L., and T. Polius, *Changes in the Financial System of the OECS Territories 1980 - 1994*, Mimeo, University of the West Indies, St Augustine Campus, 1995.

Kirton, C., *Credit Unions in Jamaica: Structure, Performance and Prospects*, paper presented at Conference on Financing Development in the Caribbean, Barbados, Dec. 4-8, 1989.

Kennedy, L., *Economic Theory of Co-operative Enterprises*, The Plunkett Foundation for Co-operative Studies, Oxford, 1983.

Lepp, A., "Financial Products for MSEs - The Municipal Savings and Loans Banks of Peru", *Small Enterprise Development*, vol. 7, nº 2, 1996.

Levine, R., "Financial Development and Economic Growth: Views and Agenda", *Journal of Economic Literature,* vol. XXXV, June, 1997, pp. 688-726.

Liburd, E. E., *Financial Markets: The ECCB Experience,* Mimeo, Eastern Caribbean Central Bank, St Kitts, 1988.

Liburd, E. E., *Commercial Bank Asset Behaviour in ECCA Area Countries,* Eleventh Conference of Regional Programme of Monetary Studies, St Kitts, October 29-31, 1979.

McKinnon, R. (ed.), *Money and Finance in Economic Growth and Development*, Marcel Dekker Inc, New York, 1976. .

McKinnon, R. (ed.), *Financial Deepening in Economic Development*, Oxford University Press, New York, 1973.

McClean, A. W. A., *Money and Banking in the Eastern Caribbean*, Institute of Social and Economic Review, Barbados, 1975.

Moody, J.C., et al., *The Credit Union Movement: Origins and Development 1870-1970*, University of Nebraska Press, Lincoln, 1973.

Moran, M., *The Politics of the Financial Services Revolution*, Macmillan Academic and Professional Ltd, London, 1991.

Moshirian, I. F, "Trade in Financial Services", *The World Economy*, vol. 17, nº 3, 1994.

Nicholls, P. N., *Implications for Financial Stability: Social Security Schemes*, Mimeo, Eastern Caribbean Central Bank, 1996.

Odle, M., *The Significance of Non-Bank Financial Intermediaries in the Caribbean*, Institute of Social and Economic Review, Jamaica, 1972.

Page, S. (ed.), *Monetary Policy in Developing Countries*, Routledge, London, 1966.

Patrick, H., "Financial Development and Economic Growth in Underdeveloped Countries", in *Economic Development and Cultural Change*, vol. 14, 1966.

Sandiford, W., *Finance and Economic Growth in the Eastern Caribbean Central Bank Area,* Mimeo, Eastern Caribbean Central Bank, 1994.

Schumpeter, J. A., *The Theory of Economic Development*, Harvard University Press, Mass., 1949.

Smith, D., "A Brief Study of Three Credit Unions in Kingston, Jamaica", in *Caribbean Finance and Management*, vol. 6, n^{os} 1 & 2, 1990.

Central Bank Award "Rodrigo Gomez": 2002 call for papers

As a means of honoring the late Rodrigo Gomez, general director of Banco de Mexico, S. A., the governors of the Latin American central banks have established an annual award to encourage research projects of general interest to central banks.

The bases of the 2002 call for papers are as follows:

1. Papers dealing with topics of direct interest to Latin American central banks should be focused on any of the following themes:

- Monetary policies and programming (experiences in Latin America).
- The role of financial institutions in economic development.
- Capital market analysis.
- Balance of payments policy and international capital movements.
- Financial cooperation among Latin American nations.
- International monetary problems and their repercussions on Latin America.

2. Submitted papers should be original versions and may include university degree theses that have not been published commercially. The latter should be written in Spanish, French, English or Portuguese, and not exceed 30,000 words (approximately 100 pages, double space).

3. Competing authors should be citizens of the countries of central banks included in the meetings of governors of the central banks of Latin America[1] and Spain. Administrative personnel of the Centre for Latin American Monetary Studies (CEMLA) may not take part (director and deputy director).

[1] Argentina, Aruba, Barbados, Belize, Bolivia, Brazil, Cayman Islands, Chile, Colombia, Costa Rica, Cuba, Dominican Republic, Eastern Caribbean (Anguilla, Antigua and Barbuda, Dominica, Grenada, Montserrat, St. Kitts and Nevis, St. Lucia, and St. Vincent and the Grenadines), Ecuador, El Salvador, Guatemala, Guyana, Haiti, Honduras, Jamaica, Mexico, Nederlandse Antillen, Nicaragua, Panama, Paraguay, Peru, Suriname, Trinidad and Tobago, Uruguay and Venezuela.

4. The jury shall be made up by the governors of the central banks forming part of the CEMLA Board of Governors or their representatives. The Centre for Latin American Monetary Studies, in its role as permanent Secretary of Governors meeting, shall act as consultant for the jury in whatever form deemed appropriate, and shall take charge of all competition administrative aspects.

5. There will be only one prize, consisting of ten thousand US dollars, which shall be awarded to the winning paper or papers, in accordance with criteria of the jury. In the event of a tie, the prize shall be divided in equal parts. The decision cannot be appealed, and the jury may declare the award vacant if it so chooses.

6. Nine copies of each study should be sent to CEMLA Administration (Durango nº 54, México, D. F., 06700) no later than January 15, 2002, and the jury's decision will be forth-coming no later than 90 days from that date.

7. CEMLA shall omit the names of the authors when submitting the work to the jury, assigning a code that shall be the only means of identification available to the latter for the subsequent qualification of papers.

8. Each member of the jury shall send his or her qualifications to CEMLA in order of preference, for at least for the first three places. CEMLA shall make the appropriate calculations and report the results to the members of the jury; once it has acknowledged receipt of said information, the Board of Governors shall authorize CEMLA to notify the winning author or authors. If more than two papers should tie for first place, CEMLA shall immediately ask the jury for a new evaluation of the tied studies.

9. The award-winning author or authors shall cede publication rights to CEMLA, that shall undertake publication of the latter, making every effort to ensure that the first edition, in the original language, be published in time for the September, 2002 meeting of the governors of the central banks of Latin America and Spain.

10. Should the jury so recommend and should CEMLA consider such a measure pertinent to its goals, it may enter into agreements with the author or authors of papers accepted for the competition, but not awarded any distinction, for their subsequent publication. In the ensuing edition, due mention shall be made that said paper was published on the basis of its acceptance under the terms of the competition.

The **CENTRE FOR LATIN AMERICAN MONETARY STUDIES** (**CEMLA**) was founded in 1952, by the following seven Latin American central banks: Banco Central de Chile, Banco de la República (Colombia), Banco Nacional de Cuba, Banco Central del Ecuador, Banco de Guatemala, Banco Central de Honduras, and Banco de México, S. A. Nowadays, all the central banks of Latin America and the Caribbean, as well as some extraregional central banks and other regional entities of the financial sector are members of the Centre. The complete list of CEMLA's members is published in the last page of this review. **CEMLA** focuses its activities on the monetary, financial and banking fields, where it promotes research, organizes international meetings and seminars about operative and technical problems, and analyzes experiences that are sistematized through the design and administration of technical assistance and training programs oriented to capacity-building and up dating of the staff of its associated and collaborating members.

One of its main aims is to inform about the evolution of economics thought inside and outside the Latin American and Caribbean region, as well as to publish the main international and regional facts in monetary, banking, and exchange policies. Its books, reviews and bulletins contain a wide stock of information for analysis and represent a permanent source of data for people interested in these matters.

MONEY AFFAIRS

Annual subscription: 30.00 dollars (students and teachers in the Caribbean and Latin American countries: 16.00 dollars). Single copy: 18.00 dollars (students and teachers in the Caribbean and Latin American countries: 9.00 dollars). Financial institutions, Universities, Libraries and other institutions in the Caribbean and Latin American countries: 20.00 dollars. Single copy: 12.00 dollars.

Subscription and requests:
Claudio Antonovich *Phone: (525) 533-03-00, ext. 255*
CEMLA, Public Relations Department *Fax: (525) 525-44-32*
Durango nº 54, Mexico City, 06700, Mexico *Internet: http://www.cemla.org*

ASSOCIATES

Banco Central de la República Argentina
Centrale Bank van Aruba
Central Bank of the Bahamas
Central Bank of Barbados
Central Bank of Belize
Banco Central de Bolivia
Banco Central do Brasil
Eastern Caribbean Central Bank
Cayman Islands Monetary Authority
Banco Central de Chile
Banco de la República (Colombia)
Banco Central de Costa Rica
Banco Central de Cuba
Banco Central del Ecuador
Banco Central de Reserva de El Salvador
Banco de Guatemala
Bank of Guyana
Banque de la République d'Haïti
Banco Central de Honduras
Bank of Jamaica
Banco de México
Bank van de Nederlandse Antillen
Banco Central de Nicaragua
Banco Central del Paraguay
Banco Central de Reserva del Perú
Banco Central de la República Dominicana
Centrale Bank van Suriname
Central Bank of Trinidad and Tobago
Banco Central del Uruguay
Banco Central de Venezuela

COLLABORATORS

Central Banks

Bank of Canada
Banco de España
Banque de France
Deutsche Bundesbank (Germany)
Banca d'Italia
Bank of Japan
Bangko Sentral ng Pilipinas
Banco de Portugal
Federal Reserve System (United States)

Other Institutions

Superintendencia de Bancos y Entidades Financieras (Bolivia)
Superintendencia de Bancos (Dominican Republic)
Superintendencia del Sistema Financiero (El Salvador)
Comisión Nacional de Bancos y Seguros (Honduras)
Superintendencia de Bancos (Panama)
Banco Centroamericano de Integración Económica
Banco Latinoamericano de Exportaciones, S. A.
Fondo Latinoamericano de Reservas