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THE STABILITY OF THE DEMAND FOR BROAD MONEY IN ARGENTINA

IN THE POST FINANCIAL LIBERALIZATION PERIOD

BY

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TABLE OF CONTENTS

Pages

CHAPTER III

SPECIFICATION OF THE MODELS AND METHODS OF DATA ANALYSIS

CHAPTER IV

LIST OF TABLES

Pages

LISTS OF GRAPHS

Pages

CHAPTER I

Financial Liberalization in Argentina:

Introduction and Overview

Financial deregulation or liberalization was an important trend in the financial system of developed and developing countries in the 1990s. The trend towards liberalization began earlier in the advanced industrial economies, notably in the United States, Great Britain, Japan, etc. In the OECD economies, financial liberalization conducted under the rubric of "deregulation" was mainly motivated by the necessity to remove a number of regulations that impeded the efficiency of the financial industry.

In Argentina, financial liberalization and deregulation of banks was mainly motivated by an overriding nee to reduce chronic and high inflation. Inflation that reached near hyperinflation rates in 1989 when the government became paying local salaries by printing short-term bonds. High inflation has a negative impact on economic growth, and the longer inflation lasts, the more profound are its effects on economic activity (Braumann, 2000). In fact, the Argentine economic policy of the 1970s and 1980s was characterized by fiscal irresponsibility, financial repression related to the desire of the governments to collect seignorage, and repeated attempts to stabilize prices. Because of chronic fiscal imbalances, each stabilization program resulted in higher inflation and greater public debt and usually ended with a currency crisis. Argentina's average inflation rate was already above 30 percent in the 1960s. In the next 25 years, Argentina implemented 8 major stabilization programs. All the programs but the last one ended with the devaluation of the peso. Most of these plans were centered on a fixed (or

a pre-announced exchange rate depreciation) and included plan of fiscal and monetary austerity. They often made use of income policies and price and wage controls. While in most cases inflation initially declined, it rarely converged to world levels, which inevitably lead to a real appreciation of the domestic currency and current account deterioration. Strong expectations of devaluation soon emerged, along with losses of reserves by the central bank. The loss of fiscal and monetary discipline often fueled inflation and external imbalances further, precipitating the currency crashes. According to Uribe (1996, P.3) by the end of 1989, the situation was at a critical point. In the first half of that year, prices grew at an average monthly rate of 38% and the fiscal deficit was above 20% of GDP. It was this situation that prompted the Argentine authorities to implement the large scale financial liberalization program of April 1991 known as the "Convertibility Plan".

As in the OECD countries, deregulation reinforced a wave of technological innovation in the financial sector that made prior regulation obsolete and ineffective. These regulations were so binding that they reduced profit opportunities in the financial sector. Financial institutions reacted by seeking for ways to circumvent them in order to enhance profit. This tendency gave rise to improvement in financial technology and also to the creation of a wide range of new financial products and services.

The emergence of such strategies has made the regulation in force so weak that they could not achieve the goals that they were intended to achieve. Deregulation is necessary in order to liberalize the financial industry and make it more competitive. Edwards (1988, P.118) argued that the technological and market developments coupled

with the erosion of legal barriers have redefined the boundaries of banking and financial markets and made the traditional local market old-fashioned.

In developing countries, financial liberalization was mainly driven by the seminal work of McKinnon (1973) and Shaw (1973) according to which, immediate financial liberalization of countries under financial repression is the key to increased and more efficient investment and hence to higher rate of economic growth. According to McKinnon (1973) and Shaw (1973), financial repression generally involved some combination of controls on interest rates and foreign exchange rates and credit allocation, government imposition of non-interest bearing reserve requirements, various legislative obstacles to the development of financial markets, and controls on inward and outward capital movements.

Financially repressive policies were seen to have a number of adverse consequences on economic activity by discouraging financial intermediation, and maintaining a low financial depth of the economy as indicated by the ratio of M2/GDP. During the 1980s, financially repressive policies generated a lot of controversy and research, which resulted in a growing consensus on the needs for financial reforms in order to boost economic growth. This, in turn, has led a number of financially repressed economies to liberalize their domestic financial markets by allowing interest rates to be market-determined, eliminating reserve requirements, removing capital controls, promoting competition in the financial industry, and by privatizing inefficient state enterprises. The financial liberalization movement in developing countries was widely interpreted by economists. But, Fanelli (1998,P.8) stated that the main reason why

financial liberalization was so widely implemented in developing countries is the recognition that finance matters for development. It was this point that the work of McKinnon (1973) and Shaw (1973) emphasized that made it so influential in policy-making in developing countries. Indeed, a survey of the literature (see Levine 1997; and Levine and King 1993) comes to the conclusion that financial development can effectively boost economic growth.

II- Financial Liberalization In Argentina: The 1991 Convertibility Plan

Argentina is selected for this study because it exhibits a number of characteristics that make it a particularly interesting case study of financial liberalization, In particular,

- Argentina is an upper middle-income developing country with a per capita GDP of (PPP) $10,000 in 1999. The average rate of growth of real GDP was 4.4% for the period 1993-1997, 3.9% in 1998, -3.3% in 1999, -0.5% in 2000, and –2.1% during the first quarter of 2001. Though the Argentine economy has been mired in a recessionary malaise for more than two years mainly caused by the Brazilian devaluation of 1998, economic growth in Argentina was very impressive from 1991 to 1998.
- It has a fixed exchange rate. The currency board arrangement established in 1991 requires the central bank to exchange U.S. dollars for new pesos at a fixed rate of 1:1. According to Zarazaga (1995), a currency board is a policy rule for monetary base creation that guarantees that a country will not devalue under any circumstance while following that rule. Monetary policy is run according to a

simple rule: the monetary authority issues money only against a designated reserve currency at a fixed exchange rate. A currency board mechanism for expanding and contracting the monetary base ensures that its relation to the amount of foreign reserve remains constant at the fixed exchange rate.

This policy rule for monetary expansion can be expressed as follows:

$M_B = keR$

Where M_B is the level of monetary base, e the nominal exchange rate, R is the level of foreign reserves. The parameter k should assume the value of one when a pure currency board is implemented such that the monetary base is fully backed by the stock of reserves. Therefore, k = 1 becomes the policy rule for monetary base creation that guarantees that a country will not devalue the domestic currency under any circumstances while following this rule. The economic interpretation of the rule is obvious: the monetary base should be fully backed by the designated foreign reserve currency.

The currency board arrangement has successfully achieved a tremendous reduction in inflation from over a one thousand percent annual rate in 1989 and 1990 to under 5% by the end of 1994, and around 1% from 1996 to 1999 (Mishkin, 1999, p,582; J.P. Morgan, 2000, p.64).

- More importantly, Argentina liberalized its domestic financial sector over the past three decades and undertaking certain in-depth structural reforms since 1989 (privatization, deregulation, trade liberalization, labor reform, fiscal adjustment,

and so on), The capital market has benefited from a series of deregulatory measures and the reestablishment of stability. The domestic financial markets are now completely integrated with the international financial markets since there are no restrictions of any kind on capital movements. In general, the economic reform program, especially the financial liberalization program, brought about a drastic change in the structure of the financial system. Though affected by the "Tequila Effect" in late 1994, and by other contagious financial crisis from Asia, Russia, Brazil in 1997, 1998, and 1999 respectively, the depth of financial reforms in Argentina and the monetary discipline entailed by the currency board arrangement, make it an interesting case study.

The Argentine financial liberalization program attempted to quickly transform the whole structure of capital markets, by increasing participation of the private sector in the allocation of loanable funds and in the pricing of risk; by rapidly eliminating both the distortions existing within each market and the barriers that could limit competition between the different segment of the capital market. Integration with the international capital market was reinforced with the convertibility law, which allows contracts to be denominated in any currency. The foreign exchange market was completely deregulated and currently, there are no restrictions on selling and buying currencies ((Fanelli et al (1998); and Rozenwurcel et al (1996)).

The 1991"Convertibility Plan" was an Exchange-Rate-Based Stabilization program. This program used the exchange rate as a nominal anchor in order to stabilize high inflation in Argentina. They are a number of reasons that explain why an exchange-rate-

based program may be preferable to a money-based stabilization program. Unlike the money supply, the nominal exchange rate anchor is readily observed by all participants in the economy and may be more effective in reducing high inflation in the face of unstable money demand, large movements in velocity, and high degree of dollarization. A fixed exchange rate may induce greater financial discipline on the part of the authorities since it places their foreign reserve holding at risk. Indeed, evidence presented by Sahay and Vegh (1996) suggests that exchange rate anchors have generally been superior to money anchors in reducing inflation. On the other hand, if the underlying fiscal and political conditions are not right, a fixed exchange rate strategy can quickly lead to major distortions and defeat the basic objectives of the program.

The empirical regularities observed in exchange-rate-based stabilization programs are summarized as follows:

1- Remonetization of the economy occurs accompanied by a strong increase of private sector credit.

2- The rate of inflation converges slowly to the new lower rate of devaluation and is accompanied with a rise in the relative price of non-traded goods—that is, an appreciation of the real exchange rate

3- The trade balance and the current account of the balance of payments deteriorate, with the current account deficits being financed by large capital inflows.

4- There is an initial expansion of economic activity (output and investment) relative to trend, which is accompanied by a private consumption boom and an increase in real wages.

5- There is a boom-bust cycle in the sense that the stabilization program, more often than not, culminates in a financial crisis, capital flight, and a forced devaluation of the currency followed by a severe recession.

When a country embarks on a well-designed stabilization program anchored by fixing the nominal exchange rate, the ensuing disinflation increases the demand for domestic monetary assets and improves the liquidity position of the banking sector. A remonetization of the economy occurs increasing the supply of loanable funds.

Although financial liberalization or deregulation is recognized to have a number of positive effects on economic activity, many view the structural and institutional change it brought as a mixed blessing. On the one hand, deregulation is said to enhance the competitive efficiency of the financial sector, expanding the scope of financial intermediation,..., etc. On the other hand, deregulation supposedly undermines the central bank's ability to control nominal magnitudes and increases the likelihood of catastrophic financial system failure (Selgin, 1996; Gibson and Tsalakos, 1994; Diaz-Alejandro, 1988; Stiglitz and Weiss, 1981). Indeed, it has been observed that financial liberalization leads to a shift in the demand for money function and, therefore, complicates the task for central banks to conduct monetary policy that has long relied on the stability of the money demand function to predict the effect of a given money supply on some other economic aggregates.

Research Issues

There is a wide consensus among economists and policy makers that a stable and predictable money demand function is a crucial precondition for the effectiveness of monetary policy. But, there is a large set of evidence suggesting that structural and institutional changes occurred in the financial system distort the stability of the money demand function, and as a consequence, impair the effectiveness of monetary policy. This research intends to examine the extent to which financial reforms occurred in Argentina during the financial liberalization process of April 1991 has affected the behavior of broad money demand in this country and seeks to draw the implications for monetary policy.

Key Hypotheses

The main research question that will direct our investigation is: "Did the adoption of the 1991 Convertibility Law that pegged the Argentine peso one-to-one to the U.S. dollar and legalized dollar deposits in the Argentine banking system affect the stability of the demand for broad money (M2) in Argentina"?

The monetarist theory of aggregate demand is based on a demand function for monetary assets that is claimed to be stable in the sense that successive residual errors are generally offsetting and do not accumulate (Cagan, 1989, P.199). Indeed, evidence shows that certain widely accepted formulations of the money demand function have performed very well until the 1970s. During this period, it was possible to be much more confident about the robustness of our knowledge of the money demand function; and, it is this confidence upon which was based the feasibility of an effective monetary policy.

But, in the mid-1970s, the demand for money function began to fail a certain kind of prediction test by an increasing amount. The test in question involved fitting the function to an initial time period and then using the parameters thus obtained to forecast the demand for money beyond the end of the sample (Laidler, 1985, p.146-147). This transitional shift in the traditional money demand function created difficulties for the conduct of monetary policy that has long relied on a strong and stable link between money and nominal GDP.

As Judd and Scadding's (1982a) survey of the U.S. literature on this problem shows, there has been no shortage of attempts to explain these difficulties, and they may be grouped into three categories. First, there are those that suggest that the basic demand-for-money functions that generated the puzzle was mis-specified to begin with. Second, there those that suggest that, although it might have been properly specified for the 1950s and the 1960s, the relationship in question needs to be modified to take into account the institutional changes that took place in the 1970s. Finally, there are those that suggest that the fundamental problem lies not with the specification of the long-run function, but with the modeling of the adjustment process of the short-run relationship. But, in both the popular and the professional press the problem has been incorrectly interpreted as a shift in the velocity of money (ratio of nominal income to money stock) caused by a shift in money demand. For the monetarist theory, the velocity of circulation posits a stable demand function for money since velocity is constant or steady. Indeed, in the United States, the trend of velocity was fairly stable and predictable from the early 1950s to the mid-1970s, but money demand equations based on that period showed a large over-prediction after the 1970s (Judd and Scadding, 1982). This shows

clearly that the Fed cannot rely on the velocity of money remaining stable for the conduct of monetary policy.

Though the United States suffered from the problem first of all, instability in previously satisfactory demand for money functions plagued other economies too as the 1970s progressed. Boughton (1981) investigated the instability of the demand for money in six of the larger OECD countries and three of the major western European countries and found out that all of them have been affected by the problem, though with varying extent. The common explanation of this phenomenon is to be found in the structural and institutional changes occurred in the financial system of these countries during the 1970s. Edwards and Higgins (1996, p.109) both argued that macroeconomic factors, rising interest rate in particular, could cause a rise in the velocity of money. But, since the 1980s, short-term interest rates have been fallen substantially, which should have caused velocity to fall rather than to rise. Therefore, they concluded that there is no obvious explanation for the sharp rise in velocity that has occurred since the 1980s , other than structural changes in financial markets. Boughton (1981, p.587) reaches similar conclusions. Structural and institutional changes in financial markets have not only resulted in the emergence of new varieties of liquid financial assets, but also have made non-bank assets more substitutable for bank deposits. With the rise in market interest rate, as a result of deregulation, households switched their financial investment from low return assets to high return ones. This series of events contributed to the increase in the velocity of money and, by the same token, have distorted the traditional money demand relationship and therefore making the manipulation of the quantity of money a poor target for monetary policy.

In developing countries, similar factors could be used to understand the shift in the money demand function. As Jansen (1990, P.19) put it, financial development leads to a change in the way people use money, and, therefore, affects the demand for money in developing countries. With financial development, there is an increase in the availability of financial institutions and financial assets, and also a reduction in the transaction costs related to income earning financial assets. Financial development stimulates a shift out of unproductive or even productive physical assets with low returns, high risk, and no liquidity into financial assets. In addition, with financial development, funds that were previously used in the unregulated money market are now deposited with banks or with other non-bank financial institutions.

Research Objectives

This research is intended to achieve the following purposes:

1- To investigate the effects of the 1991 Convertibility Plan more especially the use of the exchange rate as a nominal anchor and the legalization of dollar deposits in the banking sector on the stability of broad money demand (M2) in Argentina.

2- To understand and explain the behavior of seigniorage revenue in Argentina after disinflation.

3- To compare the Argentine's 1991 Convertibility Plan with Mexico's 1987 "Pact of Economic Solidarity", and Brazil's 1994 Real Plan.

4- To explore the reasons behind the legalization of dollar deposits in the Argentine banking system.

It is widely agreed that the broad goals of monetary policy in developing countries have been have been (1) domestic price stability, (2) reducing pressures on the external reserves, that is, maintaining a healthy international balance, (3) exchange rate stability, and (4) promoting employment and real economic growth at a reasonable level. Knowledge of a well-behaved money demand equation in any given country is a prerequisite for implementing an effective monetary policy aimed at achieving the above mentioned goals. Cagan (1989, p.200) mentioned that the definition of money for policy purposes depends on two considerations: the ability of the monetary authorities to control its quantity, and the empirical stability of a function describing the demand for it. Hendry (1996) shows that constancy has long been regarded as a fundamental requirement for empirical modeling generally, since models with no constancy cannot be used for forecasting, analyzing economic policy, or testing economic theories. Therefore, the usefulness of a money demand function depends crucially on its stability.

The stable link between money demand and other economic variables are important as they provide a rule for monetary policy that tights the hands of central bankers in their fight against inflation. Friedman and others argue that an activist monetary policy leads to an inherent inflationary bias in central bank behavior. In a world of rational expectations, a rule, that is, a stable process, would do better in the sense that it would yield a higher expected utility for the private sector. When the authorities violate that rule by creating a monetary surprise because of political pressure or other reasons (seignorage), the private sector will react by revising their expectations upward. As a result, the system will settle with a higher inflation rate without any

alteration of the average output growth of the economy. This is the problem of time inconsistency brought by Kydland and Prescott (1977).

The issue of financial liberalization and deregulation and its effects on monetary policy, though widely investigated, will continue to be relevant especially because the deregulatory trend will continue as financial systems around the world are becoming increasingly integrated. In addition, financial innovation can be considered as a fundamental component of a complex process of financial evolution and not merely as an isolated episode in modern history. Podolski (1986) argued that financial innovation is the ancient art of overcoming constraints by creative reaction that reshape financial markets, making them more perfect. As a matter of fact, most experts believe that the technology-induced innovation in the financial sector to date is only the tip of the iceberg.

It is interesting to study the behavior of the demand for money in a dollarized economy as is the case of Argentina. Indeed, Argentina is the first country to legalize dollar deposits in the banking system. The dollarization trend is expected to continue in a number of countries confronted with high inflation and the prospects of achieving the stability of the financial system in order to integrate the global financial system. In general, a good understanding of the issue raised in this research is important for people interested in monetary and financial development.

The remainder of this study is divided into five chapters. Chapter II presents the review of the most relevant theoretical and empirical works on money demand. Chapter III discusses the specification of the models and the methods used to analyze the data.

Chapter IV reports the results with the appropriate analyses and also the comparison of Argentina's 1991 Convertibility Plan with Mexico's 1987 Pact of Economic Solidarity, and Brazil's 1994 Real Plan. Chapter V summarizes the main findings and their related policy implications followed by some recommendations.

CHAPTER II

Theoretical and Empirical Literature on Money Demand

In any research, theory provides guides for empirical studies and empirical studies test the assumptions and conclusion of models. Because of its central role in issues of monetary policy effectiveness and other crucial aspects of macroeconomic policy, the demand for money remains a subject of continuing theoretical and empirical scrutiny. This chapter reviews the most important theoretical and empirical works on money demand.

Most empirical work on money demand use variations of the partial adjustment or semi log money demand model pioneered by the Cagan (1956). Cagan developed this model to study hyperinflation in post WWI Europe. The Johansen cointegration procedure and Hendry's error-correction model, is also often used to test the stability of the money demand function.

Theoretical Models Of Money Demand

Theory plays the dominant role in applied research by providing the framework within which the relationships to be measured are identified and the research findings are to be evaluated. Though it is difficult to retrace exactly where and when money was used for the first time, studies on the demand for money has a long history starting at least with the classical economic tradition.

Money demand is usually explained in terms of a demand for transactions, precaution, and speculation balances. The transactions demand rests on models developed by Baumol (1952) and Tobin (1956). These models assume that wealth is held in money and interest-yielding financial assets, and that receipt and payment flows are not synchronized. There is a cost attached to holding money rather than the interest bearing alternative asset, but there is a cost involved in switching assets. When deciding what share of their income to hold in cash, economic agents minimize asset management costs by taking into account the number of times they will have to trade assets. Stochastic extensions of these models, such as Miller and Orr (1966) and Whalen (1966) amount to including precautionary motive in the explanation of the demand for money.

The demand for money, derived from the transactions and precautionary motives is a demand for real cash, m_d, that can be written as a positive function of income, y, and a negative function of the rate of interest, i, :

$$m_d = f(y, i) \qquad (2.1)$$

Strictly interpreted, the transactions demand theory implies that the rate of inflation does not enter the money demand function. This variable could be excluded if we were certain that financial assets (as opposed to commodity inventories) are the only relevant alternatives to money, the inflation rate being relevant only in so far as it affects the nominal interest rates. If we assume that commodity inventories are relevant alternatives to fixed yield financial assets, there is, therefore, a role for the inflation rate independently and in addition to nominal interest rates. Under these conditions, equation (1) should be rewritten as:

$$m_d = f(y, i, P^e) \qquad (2.2)$$

Where P^e is the expected rate of inflation.

The most used models in money demand studies are:

1-The Partial Adjustment Model,

2-The Cagan (1956) Model,

3-The Cointegration And Error-Correction Model

The Partial Adjustment Model

Considering the fact that desired real cash levels may differ from those actually held due to the existence of adjustment costs, one type of log-linear specification extensively used for estimating money demand is the so-called partial adjustment model. This model was introduced by Chow (1966) and latter popularized by Goldfield (1973). In this model, the money market is assumed to be in equilibrium. When the original equilibrium is disturbed, either income or interest rate or both are necessary to adjust to restore the market back to the equilibrium so that the desired money balances equal the actual money stocks. However, the presence of portfolio adjustment costs prevents a full and immediate adjustment of actual money holdings to desired levels, and is assumed to take place through a partial scheme as suggested by Chow (1966).

Assuming that the long-run or desired level of money balances (md*) at period t is a linear function of gross domestic product denoted by y, and some opportunity cost variables represented by i, with all the variables in natural logarithm as follows:

$$m_d^* = a_0 + a_1 y_t + a_2 i_t + u_t \qquad (2.3)$$

In this framework, actual money balances adjust to the gap between the desired or long-run demand for real money balances and previous period's holdings such that:

$$m_d^*(_t) - m_d^*(_{t-1}) = d\,[(m_d^*(_t) - m_d^*(_{t-1})\,] \qquad (2.4)$$

Where m_d^* is the actual money balances in real terms demanded in period t, and d is the partial adjustment coefficient with $0 < d < 1$. By combining the expressions (2.3) and (2.4), one can derive the following equation:

$$m_d^* = da_0 + da_1 y_t + da_2 i_t + (1-d)m_{t-1} \qquad (2.5)$$

Where the coefficients a_1 and a_2 provide the long-run elasticities of money demand with respect to income and interest rate respectively while da1 and da2 give short-run elasticities with $0 < (1-d) < 1$.

A generic and broader version of the partial adjustment model is provided in Goldfield and Siechel (1990):

$$\log m_d^* = b_0 + b_1 \log y_t + b_2 \log i_t + b_3 \log md_{(t-1)} + b_4 \Pi_t + u_t \qquad (2.6)$$

Where m_d is real money balances, y_t is a transactions variable, it represent one or more interest rates, and $\Pi_t = \log(p_t/p_{t-1})$ is the rate of inflation associated with the price index pt. Π_t is included in the equation to differentiate between the real partial adjustment model in which $b_4 = 0$, and the nominal partial adjustment model framework in which $b_4 = -b_3$.

The partial adjustment model worked well using the postwar data for up until 1973; but did very poorly when the data after 1974 were included. Specifically, it was unable to explain the apparent instability in the money demand experienced since the early 1970s to what is called the "missing money episode". The empirical estimates have

produced inaccurate predictions of real money balances (Boughton, 19991). Further research indicated that the partial adjustment model failed both on theoretical and empirical grounds.

THE CAGAN MODEL

The Cagan (1956) model ascribes a prominent role to the rate of inflation in the demand for money. This has been justified on the basis that in an inflationary environment, variations in the yield of financial assets are likely to be dominated by variations in expected inflation. This model has been largely utilized to study the demand for money in countries that experienced high inflation during the 1970s and 1980s.

The Cagan model can be written as :

$$(m-p)_t = \psi_o - \alpha\Delta P^e_{t+1} + n_t \qquad (2.7)$$

where m and p denote the logarithms of nominal money balances and prices respectively, Ψ_0 denotes the elements of money demand not captured by the model, α is the semi-elasticity of real money demand with respect to expected inflation, P^e_{t+1} denotes expectations of inflation formed at time t, and n_t is a zero mean random walk of the form:

$$n_t = n_{t-1} + e_t \qquad (2.8)$$

Where e_t is white noise.

Cagan's insight is that under extreme inflationary conditions real money holdings will be largely determined by inflationary expectations with the components of Ψ_0 playing a relatively minor role in their determination.

Replacing expected inflation by actual inflation in equation (2.7), we have:

$$(m\text{-}p)_t = -\alpha\Delta P_{t+1} + \epsilon_{t+1} \qquad (2.9)$$

$$\text{Where: } \epsilon_{t+1} = [\psi_t + \alpha(\Delta P_{t+1} - \Delta P^e_{t+1})] \qquad (2.10)$$

Now, suppose that under conditions of very high and accelerating inflation, the growth rate in real money balances and the rate of change of inflation are each stationary processes; this would imply that $(m\text{-}p)_t$ and ΔP_{t+1} are each first difference stationary or, in the terminology of Engle and Granger (1987), integrated of order one, I(1). Assuming that errors in expectations are stationary, regardless of the particular method used to form expectations, hence, real money balances and inflation are cointegrated with a cointegrating parameter just equal to the parameter of interest (that is, the semi-elasticity of money demand with respect to expected inflation). Thus, a simple test of the applicability of the hyperinflation model lies in testing whether or not real money balances and inflation are cointegrated. If they are, then a "super consistent" estimate of α can be obtained by applying ordinary least squares to equation (2.9) (Stock, 1987).

The Cagan (1956) model allows for substitution between domestic and foreign assets. Abel et al (1979) and Blejer (1978) suggest that under conditions of high inflation, there will be strong incentives for agents to substitute foreign for domestic assets in their portfolios. Abel et al (1979) and Taylor (1991) test for this in the context of the German interwar hyperinflation by including the expected rate of exchange rate depreciation in the money demand schedule. In doing so, Abel et al (1979) use the forward exchange premium as a proxy for the expected rate of depreciation while Taylor (1991) uses the actual rate of depreciation as a proxy for the expected rate. Blejer (1978) assumes that the foreign rate of inflation will also be a significant determinant of the expected return to holding foreign real and nominal assets. If we denote the return, in

domestic terms, to holding foreign real and nominal assets as F^*_{t+1}, then, to a close approximation we have:

$$F^*_{t+1} = \Delta S_{t+1} + \Delta P^{e^*}_{t+1} \qquad (2.11)$$

Where the asterisk denotes a foreign variable and, because of the important degree of exchange control exercised by countries, S denotes the natural logarithm of the black market exchange rate (domestic price of foreign currency). Including the expected return to foreign asset holdings as an additional explanatory variable of the domestic demand for real money balances in equation (2.9), we have:

$$(m-p)_t = \Psi_0 - \alpha\Delta P_{t+1} - \varphi F^*_{t+1} + n_t \qquad (2.12)$$

Cointegration And Error-Correction Models

The concept of cointegration, first proposed in Granger and Weiss (1983) and extended in Engle and Granger (1987), is fundamental to the use of the error-correction model (ECM) formulation. In particular, the Granger representation theorem establishes that for a valid error-correction model (ECM) to exist, the set of variables must cointegrate, and if the variables do cointegrate, then a valid ECM form of the data must exist. This suggests that tests of cointegration should be a necessary component of estimation exercises conducted with ECM models. Cointegration involves examining the stationarity of the residuals from the long-run relationship. If this is established then the residuals from the long-run relationship can be used as the error-correction term to explain short-run dynamics. Testing for cointegration involves testing first of all to establish that the variables in question are integrated of the same order.

The simplest, and most utilized tests for cointegration were developed by Fuller (1976), and Dickey and Fuller (1979). These tests are generally referred to as Dickey-Fuller (DF) tests or Augmented Dickey-Fuller (ADF) tests. Other cointegration tests are the Phillips-Perron test and the Johansen and Juselius method to test for cointegration. Given the following money demand function:

$$m_t = f(y_t, i_t, \Pi_t) \qquad (2.13)$$

Where m_t is the demand for real money balances, y_t denotes the gross domestic product and i is the rate of interest, whiel Π_t represents the rate of inflation. All variables are expressed in natural logarithm and defined at time period t. According to Engle and Granger (1987), the following procedure is necessary to specify a dynamic error-correction model:

First, the appropriate cointegration test is applied to each of the variables to determine if they contain a unit root (non-stationary), or if they (variables) possess the same order of integration. This is usually done by using the Dickey-Fuller (DF) and the Augmented Dickey-Fuller (ADF) tests. Once it has been determined that the variables have the same order of integration, a cointegration regression is estimated with ordinary least squares (OLS), and the error term is tested for its stationary property.
Second, the residual from the cointegration regression (error-correction term) lagged one period is placed into a general dynamic model of the form:

$$\Delta(md)t = B0 + \beta 1\Delta(md)t-1 + \beta 2\Delta yt-1 + \beta 3\Delta it-1 + \beta 4\Pi t-1 + \beta 5ECt-1 + ut \qquad (2.14)$$

In this model, the term (EC_{t-1}) is viewed as the "error" from the long-run equilibrium relation and its coefficient gives the "correction" to money demand caused by this error. If the error term in the dynamic long-run model has the correct (negative) sign and is statistically significant, then, the demand for money is stable during the period under consideration.

The error-correction model has proved to be one of the most successful tools in applied money demand research. This type of formulation is a dynamic error-correction representation in which the long-run equilibrium relationship between money and its determinants is embedded in an equation that captures short-run variations and dynamics (Meade, 1995).

Review Of Empirical Studies

This review summarizes the empirical works on broad money demand that use the partial adjustment model, the Cagan (1956) model, and cointegration and error-correction models. It covers studies conducted in countries that have experienced an episode of financial reforms (liberalization, deregulation, innovation), or affected by some types of economic shocks at a certain period. The main purpose of most of these studies is to test the stability of the money demand function in order to assess the implications for the conduct of monetary policy. Since the 1980s, the recognition of a diminishing stability or temporary instability of the money demand function has given rise to a growing stream of research on this subject, first of all, in developed countries and then in developing countries. Worldwide interests in this subject has been heightened in recent years, triggered primarily by the concern among central banks and researchers on the impact of

the movement towards flexible exchange rate regime, globalization of capital markets, ongoing domestic financial liberalization and innovation, and also country specific issues such as high inflation. Therefore a large body of literature exists that has analyzed this subject extensively for an increasing number of countries.

Phylaktis et al (1993) examine the demand for money under conditions of high inflation in Argentina, Bolivia, Brazil, Chile, and Peru during the 1970s and the 1980s. The objective is to test, whether the monetary and inflationary experiences of these countries can be adequately characterized by the Cagan (1956) model. They also look at the importance of foreign asset substitution in domestic portfolios and the hypothesis that monetary policy was tantamount to maximization of the inflation tax revenue. The results of the study suggest that Cagan's (1956) model of money demand under hyperinflation does indeed provide an adequate characterization of the salient features of the inflationary and monetary experiences of the above countries during the 1970s and 1980s. Although they find evidence to support the view that the expected return to holding foreign assets to some extent determined real money holding, their tests suggest that the dominant factor was inflation expectations. Moreover, it appears that monetary policy in these countries over this period was tantamount to maximization of the inflation tax revenue. This latter finding is broadly in accordance with much of the literature concerning these countries.

Feliz and Welch (1997) develop a classical model of inflation with rational expectations and use cointegration techniques to test this model during the high-inflation experiences of Argentina, Bolivia, Brazil, Mexico, and Peru. All these countries

experienced high inflation during the 1970s and 1980s and attempted a number of stabilization programs. The goal of the study is to see if a simple classical model successfully describes the inflationary process across these experiences. The model starts with a version of the Cagan (1956) money demand specification to which rational expectations were added, that is , individuals use all available information to form expectations about future inflation rates. Augmented Dickey-Fuller tests and Phillips-Perron tests of cointegration were used on money growth and inflation. The results confirm that the inflationary process of the above countries generally conforms to the implications of the new classical model and that forward-looking expectations do play a part in the inflation process of all countries. However, the authors recognize that further research on inflation and money demand that incorporates new techniques on evaluating cointegrated times series is needed in order to improve the understanding of inflation in Latin America.

Melnick (1990) studies the demand for money in Argentina from 1978 to 1987: the period before and after the austral program. The purpose of the study is to estimate a money demand curve for Argentina for a period ending May 1985, the month before the stabilization program was launched, and to evaluate the stability of the estimated relationship for the period after the stabilization program. Money demand is estimated by two alternative approaches, a traditional approach, based on Goldfield (1973), and a modern time series approach based on Hendry (1980) and including some new developments in the theory of cointegration presented by Engle and Granger (1987). The results indicate that when the cointegration approach to time series analysis is combined with a correctly specified behavioral equation, a reasonable stable empirical relationship

can be obtained. This contradicts the common view of unstable behavioral relationships; unlike with the traditional approach , no major structural breaks were detected in the money demand estimated by the cointegration approach. The reduction of inflation did not change the basic elasticity of the money demand function. Therefore, the change in policy regime did not affect the demand for money as suggested by theory. This is an important finding considering the Argentina's highly unstable economy.

Kiguel et al (1995) study the relationship between seignorage and high inflation in the case of Argentina in the 1970s and 1980s. Very high inflation is usually explained by the need to raise revenue from money creation (that is seignorage) to finance the budget deficits. In Argentina, government budget deficits were large in the 1970s and 1980s, and seignorage played an important role in financing them. The main purpose of the study was to determine whether the rate of inflation was beyond the revenue-maximizing rate in the 1970s and 1980s. Using the Cagan's money demand function with monthly data estimated under the assumptions of partial adjustment and market clearing. The results revealed that there was a strong linkage between high inflation and seignorage revenue. When seignorage becomes excessive, higher than the revenue-maximizing rate especially in 1989, the government was not able to control a full-blown inflation.

Sriram (1999) analyzes the demand for broad money in Malaysia from August 1973 to December 1995 under both a closed and an open economy framework. The main purpose of the study was to evaluate the long and short-run determinants and stability of money demand in Malaysia. This country has been liberalizing its domestic financial markets and fostering financial innovation over the past three decades. Major efforts were directed at liberalizing interest rates, boosting competition in the financial system,

undertaking institutional reform, promoting growth and deepening in the financial and capital markets. Based on cointegration and weak-exogeneity test results, two short-run dynamic error-correction models were specified and estimated: one for an open economy and one for a closed economy. The two models were similar except that in the open economy model are included two additional variables (foreign interest rate and the expected depreciation of the domestic currency) to take into account the currency substitution literature. The most important finding of this study is that both in the long and short-run, the demand for real money M2 appears to be almost stable. The parameter constancy tests indicate that the financial system as a whole shows signs of structural break during 1994 as a result of measures taken to stem capital inflows.

Rother (1998) studies the impact of regional monetary integration and financial liberalization on the stability of the money demand function in African countries which are members of the West African Economic and Monetary Union. With financial liberalization, new financial instruments may develop widening the array of financial assets at the agent's disposal. In response, economic agents will be able to substitute money holdings for other financial assets and vice versa, in case of changes in the economic environment. An error-correction model that links the demand for narrow and broad money with the traditional explanatory variables was specified and estimated. The results of the study indicated that the relationship between real money (M1) and the explanatory variables remains stable over time and yields accurate forecast, while the relationship of broad money demand (M2) with the explanatory variables is found to be unstable.

Ericsson et al. (1996) used an error-correction specification to model the empirical relationship between broad money, prices, real output and interest rates in an attempt to test the effects of financial liberalization on the stability of broad money demand in Greece for the period 1974-1996. Greece has undergone some changes in its financial system, including the removal of most external capital control and of restrictions on the portfolios of deposit-taking institutions. Capital market liberalization was introduced in the early 1990s and financial innovation started to take place in the country's financial sector during that period. In addition, the inter-bank market has deepened, interest rates have been more flexible, and indirect instruments of monetary controls are being developed. Such financial reforms are assumed to have some impacts on the stability of the money demand function in Greece. The results of the study showed that the money demand function in Greece remained remarkably stable during 1976-1994 in the face of large fluctuations in the inflation rate and a progressive financial liberalization.

Rossi (1989) investigated whether or not the demand for money shifted in Brazil during the 1980s. This was a period characterized by high inflation rate and some financial innovations. In addition, Brazil was affected by some serious problems such as the oil price shock of 1979, the adverse agricultural supply shock of 1979 and 1983, and the foreign debt crisis of 1982, that have had some severe impacts on the economy. Two models were specified and estimated to test the hypothesis of a shift in the money demand function in Brazil. The first model linearly relates the log of the demand for real money balances to the log of the variables such as real income, nominal interest rates, and the inflation rate. The second specification merely assumes a real partial adjustment

process to the preceding model, which thus enables a comparison between the short and the long-run. The results revealed that money demand for Brazil has shifted downward in the 1980s. As a matter of fact, it was found that the prediction errors (defined as the predicted log of real money balances minus the actual log of real money balances) are increasingly positive, which indicated a downward shift of the function. The implication of these results is that the estimated parameters of the money demand based on data of the preceding period can no longer be used to predict the present effects of monetary policy on the aggregate demand in Brazil.

This review of few empirical works on money demand analysis provides important insights and guidelines regarding the procedures used in this type of research from the identification of the relevant variables, the specification of the model, to the interpretation and implication of the results. The works reviewed suggest that the error-correction model is the most appropriate model used in testing dynamic stability. The Cagan (1956) model is only used in periods of high inflation. We found a mixed result regarding the stability of the money demand function after an episode of financial liberalization, and the result depends greatly on the type of money definition used. Most of the works reviewed show that the money demand remained stable, and only a few indicate that there was a shift in the money demand function. Countries that maintain the stability of their money demand function, maintain their ability to conduct monetary policy; otherwise, they lose their ability to conduct monetary policy by using direct instruments. It is important to note that in the case of Argentina, even if the country maintains its ability to conduct monetary policy after the liberalization episode of April

1991, the country has chosen to use the currency board as a credibility technology to fight inflation effectively. This literature review has some important relevance for our study the objective of which is to test the stability of the money demand function in Argentina in the post financial liberalization period. Our model will be based on these previous empirical works. However, we will focus more on models that take into account the currency substitution literature because Argentina has dual currency economy since 1991 and announced in January 1999 that it was considering adopting the U.S. dollar as its sole medium of exchange. This decision was made in order to eliminate uncertainty about Argentina's commitment to its currency board and the fears of devaluation that has affected the economy in the past.

CHAPTER III

Empirical Model and Data Analysis

I- Introduction

This chapter sets out the basic model used to test for the stability of money demand, defines the concept of stability and discusses the available data. The chapter is organized as follows: first, a review of the objectives and the definition of the concept of stability are presented. Second, we specify the empirical models that will be utilized for the estimation of the relevant parameters. Third, we present the techniques to carry out the cointegration and stability tests. Fourth, we describe the data used to test our hypotheses and indicate its source.

The purpose of this study is to test the stability of the demand for broad money in Argentina in the post financial liberalization period. In this regard, it is important to define the concept of stability. In the money demand literature, stability refers to the approximate constancy of the regression coefficients over time. A stable equation should be able to forecast adequately outside the sample period. But, concerning the stability of money demand and its relevance for monetary policy, it is useful to distinguish four different concepts of stability as discussed in Clausen (1998).

The first concept of stability is "additive stability", which requires that the error term (u_t) to play a minor role in the explanation of money demand. Additive stability is reflected in a small standard error of the regression. Poole (1970) demonstrates that this

type of stability has implications for the choice between alternative intermediate targets of monetary policy.

The second concept of stability is "multiplicative stability" that denotes the uncertainty about the coefficients. Multiplicative uncertainty is measured by the estimated standard error of the parameters. Brainard (1967) discusses the implications of multiplicative stability for monetary policy. He concludes that the use of policy instruments ought to be more conservative, that is, quantitatively less aggressive, the larger the uncertainty about the effect of policy is.

The third concept of stability is "structural stability" that requires the underlying parameters to be constant or at least to behave in a predictable fashion. The constancy of structural parameters may be evaluated over time or with respect to changes in explanatory variables. Tests for structural stability include the Chow and the CUSUM tests. These tests rely on the assumptions that the underlying time series are stationary. Structural changes in the money demand function imply that the explanatory power of the money demand equation deteriorates and that the coefficients as well as the lags are estimated with less precision.

The fourth concept of stability is "dynamic stability" based on the cointegration methodology advanced by Engle and Granger (1987). Cointegration requires that a linear combination of I(1) variables, the cointegrating vector, leaves a residual which is stationary or an I(0) variable. If cointegration is found, money demand behavior is dynamically stable and the cointegrating vector may be interpreted as the equilibrium relationship. In this study, we will be mostly concerned with the concepts of structural and dynamic stability.

Ii- Model Specification

Very high inflation – that is when monthly inflation rates reaches 5% or more—can usually be explained by the need to raise revenue from money creation (seignoirage). Typically this seigniorage is driven by the need to finance a large budget deficit or an effort to make external debt payments by using local currency to buy up foreign exchange. The literature on inflationary finance provides the underpinnings to study this issue (Friedman, 1971). Depending on the shape of the demand function, steady state seignorage may follow a Laffer curve (as in the case of conventional taxation), where seignorage first rises, reaches a maximum, and then falls with higher inflation. The models in this literature show that in general there are two steady state equlibria each on opposite sides of the maximum-revenue point of the Laffer curve. When the equilibrium is at the wrong side of the Laffer curve, the government can increase the revenues from seignorage by reducing the rate of inflation. The above can be illustrated using a simple model developed by Cagan (1956) that establishes the relationship between inflation and seignorage.

Deficit finance implies that monetary creation equals government expenditures (ignoring all other sources of finance including taxation).

$$\mu M = G \qquad (3.1)$$

Where M is the money supply and μ is the monetary growth rate, and G is the government expenditures.

Following the quantity theory of money:

$$MV = Y \qquad (3.2)$$

Where V is the velocity of money (assumed to be stable in steady state) and Y is nominal output. In the long-run, the inflation rate equals the rate of monetary growth less the growth rate in output $(\Delta Y/Y)$

$$\Pi = \mu - (\Delta Y/Y) \qquad (3.3)$$

The Cagan (1956) model states that:

$$S = \mu L(\Pi^e) \qquad (3.4)$$

This equation says that government expenditure financed through inflation tax (S), which is equal to the rate of money growth (μ) multiplied by the monetary base or money supply (L).

Assuming equilibrium in the money market, money supply equals money demand; then:

$$L(\Pi^e) = \exp(-\alpha\Pi^e) \qquad (3.5)$$

Where S is the seignorage or inflation tax, L is money demand, Π^e is expected inflation, μ is the rate of monetary growth, and α is a coefficient.

In the steady state, the expected rate of inflation is equal to the actual rate of inflation, and therefore:

$$\Pi^e = \Pi = \mu - \Delta Y/Y \qquad (3.6)$$

Substituting (5) and (6) into (4) and taking its first order differentiation gives:

$$dS/d\mu = \exp(-\alpha\mu + \alpha.\Delta Y/Y)[1-\alpha\mu] \qquad (3.7)$$

For maximum revenue from inflationary finance, $dS/d\mu = 0$ and $\mu = 1/\alpha$ for $\mu > 0$. The parameter α is the semi-elasticity of the demand for money. This parameter can be estimated for individual countries, given some specific assumptions about the formation of inflationary expectations.

The above shows that seigniorage revenues initially rise with monetary expansion, reaches a maximum at $1/\alpha$, and then decreases. In fact, empirical work by Edwards and Tabellini (1990) suggests that in a number of countries, increase in the rate of inflation resulted in a reduction of the inflation tax.

In general, the demand for money is usually modeled as a function of an opportunity cost variable, which reflects the store-of-value motive of money holdings and a scale variable, which reflects the transaction motive of the demand for money and some structural and seasonal variables. The general specification begins with the following functional relationship for the long-term demand for money;

$$m_d = f(S, C) \qquad (3.8)$$

Where the demand for real balances ($m_d = M/P$) is a function of the chosen scale variable (S) to represent the economic activity and the opportunity cost of holding money, C, which reflects the store-of-value motive for holding money "M" stands for the selected

monetary aggregates (narrow or broad money) in nominal term and "P" for the price level.

The money demand function can be expressed as:

$$\log m_d = \alpha_0 + \alpha_1 \log Y_t + \alpha_2 \log R_t + u_t \qquad (3.9)$$

Where m_d is the real money balances, Yt is real income and is used to represent the scale variable, and $R_t = r_t + \Pi_t$ is the nominal interest rate and is used as the opportunity cost variable, and Ut is a stochastic disturbance term. The money demand function can be rewritten as:

$$\log m_d = \alpha_0 + \alpha_1 \log Y_t + \alpha_2 r_t + \alpha_2 \Pi_t + u_t \qquad (3.10)$$

In countries with high inflation, there is a strong incentive for economic agents to substitute the domestic currency for foreign currencies (frequently the U.S. dollar) in their portfolios in order to evade the inflation tax. This phenomenon, known as currency substitution, has been extensively documented in Latin American countries experiencing high inflation during the 1970s and 1980s. Therefore, it is important to include in the money demand function a variable that takes into account this phenomenon. In the money demand literature, there are two main factors that are thought to drive the process of currency substitution: the expected rate of exchange rate depreciation, and the interest rate differentials between the U.S. dollar and domestic currency deposits in the banking system. In the case of Argentina where there is a fixed exchange rate system, the interest rate differentials seem to be the most appropriate variable. Indeed, although the Argentine peso has remained pegged to the U.S. dollar at $1 per peso since 1991, currency crises elsewhere in the world have prompted speculation on a possible devaluation of the peso, in spite of limited trade links between the affected countries and

Argentina. Interest rates rise with each speculative attack. Further more, the premium in interest rates on peso-denominated loans over dollar-denominated loans rises as well, suggesting that the perceived risk of devaluation is much higher (Kettel, 2000). Adding a currency substitution variable in the money demand function above, it becomes:

$$\log \mathbf{m_d} = \alpha_0 + \alpha_1 \log Y_t + \alpha_2 r_t + \alpha_2 \Pi_t + \alpha_3 CS + u_t \qquad (3.11)$$

DUMMY VARIABLES

Many economic time series exhibit a seasonal pattern that might be modeled by seasonal dummies. Furthermore, real world data underlying empirical research often exhibit structural breaks. If the time of the structural break is known, it can be modeled by including dummy variables in the system analyzed. Because we are investigating if the money demand shifted after the implementation of the 1991 Convertibility Plan, we will introduce in the model some step dummies (sometimes also called shift dummies) of the form:

$$\Phi_t = 0 \text{ if } t \leq 1991{:}Q1$$

$$\Phi_t = 1 \text{ if } t > 1991{:}Q1$$

With the inclusion of the dummy variables, the money demand function will finally become:

$$\log \mathbf{m_d} = \alpha_0 + \alpha_1 \log Y_t + \alpha_2 r_t + \alpha_3 \Pi_t + \alpha_4 CS + \alpha_5 \Phi_t + \mu_t \qquad (3.12)$$

But, under conditions of extreme inflation, as it was the case in Argentina in the 1970s and 1980s, real money holdings are largely determined by inflationary expectations, and

that movements of all other variables can be neglected. In such circumstances, the money demand function can be written as:

$$\log \mathbf{m_d} = \Psi_0 + \alpha\Pi^e_{t+1} + \eta_t \qquad (3.13)$$

Where $\Psi_0 = \alpha_0 + \alpha_1 \log Y_t + \alpha_2 r_t + \alpha_3 CS$

Equation (3.13) is a simplified version of the Cagan money demand function that directly relates the demand for money to the expected rate of inflation. The semi-logarithmic Cagan specification implies that the inflation elasticity of the demand for money is a rising function of the level of inflation. The expected rate of inflation is computed as: $\Delta P_{t+1} - P_t$. Under the assumption that inflation expectations are formed rationally, and by imposing the rational expectations assumption, we specify:

$$\Delta P^e_{t+1} = E(\Delta P_{t+1} / \Omega_t)$$

Where: ΔP^e_{t+1} denotes the subjective expectations formed in period t of ΔP_{t+1}, the inflation rate between t and t+1. Finally, the Cagan Model can be written:

$$\log \mathbf{m_d} = - \alpha\Delta P^e_{t+1} + \eta_t \qquad (3.14)$$

The advantage of the formulation of equation (3.14) is that it offers a direct link between inflation and seignorage.

The Dynamic Specification And Error-Correction Modeling

The error-correction model is a dynamic formulation in which the long-run equilibrium relationship between money and its determinants is embedded in an equation that

captures the short-run variations and dynamics. According to the Engle-granger procedure, the specification of the error-correction model involves four steps:

1- Determine the orders of integration of each of the variables under consideration; that is, difference each series successively until stationarity is achieved.

2- Estimate cointegration regressions with ordinary least squares.

3- Test the residuals of the cointegration regressions for stationarity

4- Construct the error-correction model and test the coefficient of the error-correction term. This involves regressing the first difference of each variable in the cointegration equation onto lagged values of the first differences of all the variables including the error-term, plus the lagged value of the first difference of the dependent variable. Using the long-run money demand relationship specified in equation (3.12), we construct the following error-correction model:

$$\Delta\log(\mathbf{m_d})t = \beta_0 + \beta_1\Delta\log(\mathbf{m_d})_{t-1} + \beta_2\Delta\log Y_{t-1} + \beta_3\Delta r_{t-1} + \beta 4\Delta\Pi_{t-1} + \beta_5\Delta(CS)_{t-1} + \beta_6\Delta(EC)_{t-1} + \beta_7\Delta\Phi_{t-1} + \eta_t \qquad (3.15)$$

The stability property is confirmed when the coefficient of the error-correction term (EC) is negative and is statistically significant.

While the Engle-Granger procedure is easy to to implement, it is well known that it has some defects. In particular, its results depend on which variable is put on the left hand-side when estimating the cointegrating equation, it does not permit to investigate the number of cointegration equations that may be present in the data, and it relies on a two step estimator so that any error introduced in the first step is carried

into the second step. Fortunately, the above problems can be dealt with by using the Johansen procedure that we will apply in this study.

III- UNIT ROOT TESTS

The concept of cointegration plays an important role in economic models involving time series and is widely used in money demand studies. Economic theory often suggests that certain pairs of economic variables should be linked by a long-run relationship. Although the variables may drift away from the equilibrium for a while, economic forces may be expected to act as to restore equilibrium. This is exactly the case of series that are cointegrated. Such series do not deviate much from each other over time, because a linear combination is "stable" and fluctuates around a certain mean with a fixed variance. On the other hand, series that are not cointegrated deviate from each other over time without a bound. A non-stationary time series is said to be integrated of order one, I (1), if stationarity is achieved by differencing the original series. A (weakly) stationary, I (0), series, on the other hand, is defined to have constant mean, variance, and auto-covariance over time. Therefore, testing for cointegration involves examining whether the variables in question have a unit root or if they are integrated of the same order. Granger (1986) and Engle and Granger (1987) have introduced and popularized the concept of cointegration, while Dickey and Fuller (1987), Phillips and Perron (1988), Johansen (1988), Johansen and Juselius (1990), and others have developed statistical procedures for its estimation and test.

Dickey-Fuller And Augmented Dickey-Fuller Tests

The Dickey-Fuller (DF) approach is based on the least squares estimation of the following time series:

$$Yt = \alpha + \beta Yt - 1 + \upsilon t \qquad (3.16)$$

Where Yt is an AR(1) process, α and β are parameters and ut is assumed to be white noise. Y_t is a stationary series if $-1<\rho<1$. If $\rho = 1$, Y_t is a nonstationary series (a random walk with drift). The hypothesis of a stationary series can be evaluated by testing whether the absolute value of ρ is strictly less than one. This test considers the unit root as the null hypothesis (H0: $\rho = 1$) to test against the one-sided alternative hypothesis (H1: $\rho < 1$). For cointegration to exist, the test should not reject the hypothesis of stationarity. The test is carried out by estimating an equation with Y_{t-1}, subtracted from both sides of the equation above such as:

$$\Delta Yt = \mu + \theta Yt\text{-}1 + \varepsilon t$$

Where $\theta = \rho$-1, and the null and alternative hypothesis are:

H0: $\theta = 0$, there is a unit root (there is no cointegration)

H1: $\theta < 0$, there is no unit root (there is cointegration)

While it may appear that the test can be carried out by performing a t-test on the estimated γ, the t-statistic under the null hypothesis of a unit root does not have the conventional t-distribution. Therefore, these statistics are referred as to τ-statistics rather than t-statistics.

Unit root tests are valid under the assumption that the error terms in the test regressions are serially uncorrelated such as in the case of the AR(1) series above. If the series is correlated at higher order lags, the assumption of white noise disturbances is violated. In the presence of serial correlation of unknown form, a modified version of the Dickey-Fuller (DF) test known as the Augmented Dickey-Fuller (ADF) test is used.

The Augmented Dickey-Fuller (ADF) approach controls for higher order correlation by adding lagged difference terms of the dependent variable Yt to the right hand side of the regression:

$$\Delta Yt = \mu + \theta Y_{t-1} + \delta_1 \Delta Y_{t-1} + \delta_2 Y_{t-2} + \ldots + \delta \rho_{-1} \Delta Y_{t-\rho+1} + \varepsilon_t \qquad (3.17)$$

This augmented specification is then used to test, H_0: $\theta = 0$ and; H_1: $\theta < 0$. The ADF version of the τ-statistic referred to as the τ'-statistic is simply the ordinary t-statistic for the coefficient of Y_{t-1} to be zero in the above equation.

The Phillips-Perron Test For Unit Roots

Another way to obtain unit root test statistics that are valid despite the presence of serial correlation of unknown form is to use the nonparametric unit root tests of Phillips (1987) and Phillips and Perron (1988). Phillips and Perron (1988) propose a nonparametric method for controlling for higher order serial correlation in a series. The test regression for the Phillips-Perron test is an AR(1) process:

$$\Delta Y_t = \alpha + \beta Y_{t-1} + \varepsilon_t \qquad (3.18)$$

While the ADF test correct for higher order serial correlation by adding lagged differenced terms on the right hand side, the PP test makes a correction to the t-statistics

of the γ coefficient from the AR(1) regression to account for serial correlation in ε. The correction is nonparametric since we use an estimate of the spectrum of ε at frequency zero that is robust to heteroskedasticity and autocorrelation of unknown form. The asymptotic distribution of the PP t-statistic is the same as the ADF t-statistic.

The Johansen Cointegration Test.

Generally, cointegration means that non-stationary time series variables tend to move together such that a linear combination of them is stationary. Cointegration has been interpreted as representing a long-run equilibrium relationship. Differencing X_t d times to generate a stationary time series and then estimating a VAR based upon the differenced series is inappropriate in the presence of cointegration. Recall that if a Px1 vector time series X_t is first difference stationary, that is I(1), and cointegrated, that is b=1, there exists an error-correction form:

$$\Delta X_t = A_1 \Delta X_{t-1} + \ldots + A_{k-1} \Delta X_{t-k+1} + \Pi X_{t-1} + \varepsilon_t \qquad (3.19)$$

Where: $\Pi = \alpha\beta'$ and $\beta' = [\beta\pi, \beta\mu]$ is the cointegrating vector, $\alpha' = [\alpha\Pi, \alpha\mu]$ is the error-correction coefficient or the speed of adjustment.

A weakness in the Engle-Granger (1987) approach is that it offers no clear criterion for choosing the number of cointegrating vectors. Johansen and Juselius (1990) and Johansen (1988) take a general maximum likelihood approach to choosing the number of independent cointegrating vectors, estimating π, α, β, and testing restrictions on α and β. Their technique is based upon the following general version of equation (3.19) :

$$\Delta X_t = \mu + \Gamma_1 \Delta X_{t-1} + \Gamma \Delta_{k-1} \Delta X_{t-k+1} + \Pi X_{t-k} + \Phi D_t + \varepsilon_t \qquad (3.20)$$

Where:

X is a p-variate vector comprised of money demand and p-1 set of real and monetary variables.

$Đ_t$ is a set of seasonal dummies that sum to zero.

The terms $\Gamma_1 \Delta X_{t-1} + \Gamma_2 \Delta X_{t-2} + \ldots + \Gamma_{k-1} \Delta X_{t-1-k}$ describe the short-run dynamics.

The terms ΠX_{t-k} denotes the long-run impact coefficient matrix in the equation above that summarizes information on the long-run relations among the variables.

We formulate tests that allow us to infer the rank of Π, and by doing so determine those variables that contribute to the trend shifts in money demand. We test for the significance of the cointegration relations using Johansen likelihood ratio trace test for the significance of the cointegration vectors.

$$\text{Likelihood Ratio (LR)} = -2\ln(Q) = -T\sum_{i=r+1}^{P} \ln(1-\lambda t)$$

P is the number of variables in the system,

R is the largest number of cointegration vectors under the null hypothesis and (λi) are the (p-r) smallest eigenvalues. The null hypothesis for the trace is that there are at most r cointegrating vectors present in a p-variable system, thus implying at least (p-r) unit roots. The maximum likelihood estimates for the cointegrating vector β' can be obtained from the following eigenvalue problem:

$$[\lambda S_{kk} - S_{ko} S_{oo}^{-1} S_{ok}] = 0$$

Where:

S_{ij} are the residual moment matrices from the ordinary least squares regressions of ΔX_t and X_{t-k} on ΔX_{t-j}; $j = 1, \ldots, k-1$. The estimates of β' are just the corresponding eigenvectors while the maximum eigenvalue along with the trace (computed from the eigenvalues) are used as test statistics for the rank of Π. Notice that if rank $(\Pi) = r = p$, any vector is a cointegrating vector and hence the original vector time series X_t is stationary. If rank $(\Pi) = r < p$, then the data are I(1) and we have r cointegrating vectors. If rank $(\Pi) = r = 0$, then we find no cointegrating vectors and a VAR based purely on the first difference of X_t is appropriate. The critical values and sizes of the test statistics appear in the appendix of Johansen and Juselius (1990).

The Johansen procedure has several advantages over other methods (such as the Engle-Granger procedure). First it tests for all the cointegrating vectors among the variables. Two test statistics are used to evaluate the number of cointegrating relationships: the trace test and the maximum eigenvalue test. With three variables, the Johansen procedure yields at most two cointegrating vectors. Second, it treats all the variables included in equation (1) as endogenous, thus avoiding an arbitrary assumption of exogeneity. Third, it provides a unified approach for estimating and testing cointegrating relations within the framework of a VEC model. Providing one or more cointegrating relationships exist, the third step involves the estimation of a VEC specification containing the cointegrating relationship(s), current and lagged first differences of the variables in the cointegrating relationship, and any stationary variables thought to influence money demand.

STABILITY TESTS

We are mainly interested in testing the structural and dynamic stability of the money demand function. In this regard, they are a number of tests that are appropriate for this purpose. Among the most important of these tests are: the Engle-Granger test that will be performed on the coefficient of the error-correction term, and the CUSUM test that we will briefly describe below

The CUSUM Test:

The CUSUM test (Brown, Durbin, and Evans, 1975) is based on the cumulative sum of the recursive residuals. This option plots the cumulative sum together with the 5% critical lines. The test finds parameter instability if the cumulative sum goes outside the area between the two critical lines.

The CUSUM test is based on the following statistic:

$$Wt = \sum_{r=k+1}^{t} wr / st, \ldots\ldots t = k+1, \ldots, T$$

Where w is the recursive residual defined above, and s is the standard error of the regression fitted to all sample points. If the b vector remain constant from period to period, E[Wt] = 0, but if β changes, Wt will tend to diverge from the zero mean value line. The significance of any departure from the zero line is assessed by reference to a pair of 5% significance lines, the distance between which increases with t. The 5% significance lines are found by connecting the points:

[k, ± 0.948 (T-k)½] and [T, ± 3 x 0.948(T-k)½]

Movement of Wt outside the critical lines is suggestive of coefficient instability.

Data and Data Sources

The data for this study come from the" International Financial Statistics"(IFS), a statistical publication of the International Monetary Fund (IMF). It is a monthly publication that shows the major economic aggregates used in the analysis of economic developments and generally includes data on a country's exchange rates, interest rates, international liquidity, money and banking, government accounts, production and prices. In this study we use quarterly data from 1985:Q1 to 2000:Q4. The definition of the main variables follows the terminology of the IMF. Thus, we define broad money (M2) as the sum of money M1 which, comprises currency outside deposit money banks, and transferable deposits, and quasi-money which includes time, savings, and foreign currency deposits of resident sectors other than central government. Inflation is defined by the change in the consumer price Index (CPI) that reflects change in the cost of acquiring a fixed basket of goods and services by the average consumer. There are two interest rates, one for the peso and one for the dollar. The money market rate for the peso represents the average rate on loans denominated in peso of up to 15 days between domestic financial institutions. The rate is weighted by daily loan amounts. The money market rate for the foreign currency is the average rate on loans denominated in U.S. dollars of up to 15 days between domestic financial institutions. Gross Domestic Product (GDP) is generally presented in IFS as the sum of final expenditure. The exchange rates are classified into three broad categories, reflecting the role of the authorities in the

determination of the exchange rates in a country. Market rate is used to describe an exchange rate determined largely by market forces; official rate is used to describe an exchange rate determined by the authorities sometimes in a flexible manner. For countries maintaining multiple exchange arrangements, the rates are labeled principal rate, secondary rate and tertiary rate.

CHAPTER FOUR

REPORTS AND ANALYSIS OF THE RESULTS

This chapter reports the main results found in this study together with the appropriate analysis. In this chapter, we present and analyze the behavior of the financial intermediation ratios (M1/GDP and M2/GDP), the seignorage revenue, the estimation of the money demand function using the Cagan (1956) model for the period 1985-1991, the estimation of the money demand function for the period 1991-2000 and 1985-2000 in which we include all the relevant explanatory variables. In addition, the results of the unit root tests using the Dickey-Fuller, the augmented Dickey-Fuller, and the Phillips-Perron tests for a unit root are presented followed by the Johansen cointegration test used to determine the number of cointegrating vectors. Are also presented, the estimation and analysis of the error-correction model and other stability tests applied to detect the existence of structural break in the money demand function.

The first evidence with regard to the stability of money demand is reflected in the financial intermediation ratios such as M1 to GDP (an expression of monetary depth) and M2 to GDP (an expression of financial depth). These ratios indicate the importance of the financial sector in an economy and also provide important insights concerning portfolio adjustments of economic agents over the course of a stabilization program. These two ratios (M1/GDP and M2/GDP), because they are defined as the inverse of the velocity of money, are likely to display different patterns before and after the

implementation of a financial liberalization program. With the liberalization of the interest rates and the reduction of the inflation rate, savers/investors are offered longer-term interest-yielding financial assets, and they shift their currency holdings into those assets. At the same time, more advanced payment techniques are introduced and reduce the needs to hold transaction balances. The reduction of the level of inflation and inflation uncertainty contributed to some capital repatriation as Argentine assets, which were deposited abroad (flight to safety), returned to the domestic financial system. Taking these two effects into consideration, financial depth is likely to rise and monetary depth to decline as a response to domestic financial liberalization.

Graph 4.1 depicts the behavior of the financial intermediation ratios for Argentina from 1970 to 2000. These ratios increased moderately from 1970 to 1975, followed a declining trend since after 1975 until 1991. It is important to note that this period (1975-1991) was characterized by high inflation, failed stabilization plans, currency substitution, and capital flight that led to increased disintermediation in the Argentine financial system. The financial depth indicator has largely increased since 1991 from 1% of GDP in 1991 to over 30% of GDP in 2000, but showed signs of the effects of the Mexican balance of payments crisis of 1995 (Tequila Crisis). During this period, broad money declined sharply for a short period of time, reflecting the anxiety of economic agents about the probability for Argentina to maintain the fixed exchange rate arrangements. The indicator of monetary depth (M1/GDP) remained almost constant from 1991 to 2000. This is an indication of the willingness of the monetary authority to restrain from printing money to remonetize the economy during this period.

Another good indicator that provides some evidence regarding the stability of money demand during an episode of inflation stabilization is the income velocity of money defined as the ratio of nominal GDP over broad money, either including or excluding foreign currency deposits.

Graph 4.2 shows the behavior of the income velocity of money in Argentina from 1969 to 1999. The graph shows that the income velocity of money follows an upward trend marked by periods of fluctuations from 1969 to 1990. The income velocity reached a peak in 1990-1991 and then declined considerably until 1999. This behavior of the income velocity of money in Argentina accords with the stylized facts regarding velocity developments in the course of stabilization programs. According to De Broeck (1997), these stylized facts are:

1- First, velocity has a general tendency to increase early on in the implementation of stabilization programs.
2- Second, following stabilization, velocity starts gradually to decline.
3- Third, velocity movements during stabilization depend upon the people's perception about the program success or failure to stabilize inflation, previous inflation level and the degree of remonetization of the economy.

Allen (1999) explained that the decline in income velocity following the 1991 financial liberalization program, could be attributable to improved financial technology,

deregulation and liberalization, and internationalization and expansion of financial markets. Fluctuations in income velocity before 1991 could be explained by the effects of many different programs implemented since the 1970s to stabilize inflation. At the start of each program, velocity declined but when people's perception about the program success shifted, velocity increased, because the shift in perception led to substantial changes in the size and direction of portfolios. Concerning the steady decline of income velocity since 1991, it could be explained by the commitment of the Argentine authorities not to use the inflation tax as a source of revenue as implied by the adoption of the quasi currency board arrangements. The rigidly fixed exchange rate system together with the other financial and fiscal reforms established the credibility of the program and enhanced its chance of success as economic agents believed that inflation will remain low and stable in the future. The dissipated fears of unanticipated inflation contributed to tie down private sector expectations, and thus, to a sustained decline in the velocity of money.

SEIGNORAGE REVENUE IN ARGENTINA AFTER LIBERALIZATION

One major cause of inflation in developing countries, and also in Argentina, is the desire of governments to collect seignorage. Seignorage is usually measured as the annual change in high-powered money as a percentage of GDP. Seignorage is expected to increase with the reduction in inflation, and decrease with financial liberalization. The most common measure of seignorage used in the literature follows Fischer (1982) whose calculations of seignorage as a percentage of GDP are based on the following formula:

$$\frac{SE}{Y} = \frac{c}{y} = \frac{c}{c} \cdot \frac{c}{y} = (ny \cdot \frac{\dot{y}}{y} + np \cdot \frac{\dot{p}}{p}) \cdot \frac{Ct}{y}$$

Where:

SE = seignorage revenue

Y = real income or real GDP

ny = real income elasticity of the demand for currency

np = price elasticity for the demand for currency

$\frac{\dot{y}}{y}$ = growth rate of real GDP

$\frac{\dot{p}}{p}$ = rate of inflation

Ct = currency in circulation.

But, we know that high-powered money (H) is equal to currency in circulation and required reserves. However, empirical studies of seignorage or the inflation tax using the Fischer (1982) formula have not incorporated a role for variable reserve ratios. Existing approaches either have specified a demand for high-powered money directly without consideration of reserve requirements (Cagan, 1956), or focused on the demand for real money (M1) and assumed a constant "multiplier" ratio to exist between M1 and H (Easterly et al., 1995 ; Phylaktis and Taylor, 1993). Only Bali et al. (2000) realize that the reserve ratio is an important part of the calculation of seignorage revenue or inflation tax. Therefore our calculation of seignorage revenue will follow Bali et al (2000).

According to Bali et al. (2000, P.531), the current flow of seignorage revenue is typically measured relative to GDP:

$SE = (dH/dt) / GDP$

Where dH/dt is the flow of government monetary base issued. If we let $h = H/GDP$, Π, g, and n, represent inflation, real GDP per capita growth, and the population growth rate, respectively. In the steady state, with Π constant, $SE = (n + \beta g)h + \Pi h$, where β is the elasticity of per capita real monetary base demand with respect to per capita real income. The first term $\{(n+\beta g)h\}$ reflects a component of R that is due to growth in the economy, and could be collected at zero inflation. The second term (Πh) is the inflation tax.

The demand for the "inflation tax base" (h) can further be broken down into a demand for currency (relative to GDP) denoted by (m), and reserves held against deposits denoted by (ud), where d represents deposits relative to GDP and U is the reserve ratio (reserves to deposits). Thus, the inflation tax is:

$$SE = \Pi h = \Pi(m + ud)$$

This equation embodies two conflicting effects of (u) on seignorage collection. : the more obvious is the direct impact of (u) has on the reserve component of h. A second effect of (u) is that it widens the spread between bank lending rates and rates offered to depositors. This tends to reduce the deposit base in amounts that depends on the

elasticity of deposit demand with respect to its opportunity cost. Higher reserve ratios thus indirectly reduce the demand for reserves.

REASONS FOR LOW SEIGNORAGE REVENUE IN ARGENTINA AFTER DISINFLATION.

It has been found that seignorage revenue has been very low in Argentina after the financial liberalization episode of April 1991 (Graph 4.3). Seignorage revenue that had been between 2 to 6% of GDP from 1970 to 1991 declined tremendously after the implementation of the Convertibility program in April 1991 and has remained to almost 0% thereafter. Knowing that some seignorage will arise after liberalization from the growth of demand for real money balances that accompanies output growth, we seek to explain what accounts for this low seignorage revenue. There are at least six factors that explain why seignorage revenue has remained so low after inflation stabilization.

1) The first factor is that one of the relevant stylized facts of the period is a dramatic change in the process of money creation, which has become more dependent on capital inflows. Capital inflows not only financed the increase in domestic absorption, but also the remonetization of the economy after hyperinflation. Argentina increased its use of foreign savings after liberalization since there is no increase in net domestic savings (Fanelli, 1998).
2) The second factor is that by granting contracts in dollar full legal status, the government discouraged the intermediation of domestic savings abroad, and such a measure gave an additional stimulus to the dollarization process. Thus, while the

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private holdings of deposits in pesos grew by 200 percent during 1991-94, those denominated in dollars grew by 248 percent over the same period. The Mexican crisis of December 1994 reinforced the dollarization trend, because it provoked a deeper contraction in peso than in dollar denominated deposits (Fanelli, 1998). The dollarization process combined with the elimination of capital account restriction, allowing residents to switch freely between onshore and offshore asset holdings, reduce the scope of monetary policy discretion and the base for seignorage. Furthermore, experience suggests that dollarization in many countries has become a structural phenomenon that does not decrease immediately when inflation rates decrease to a normal level. This can be explained by the fact that for economic agents, foreign currency provides a higher degree of purchasing power stability and is therefore more desirable than domestic money even after inflation stabilization.

3) The third factor that explains the low level of seignorage revenue is monetary hysteresis. The memories of protracted high inflation, past stabilization failures, and the more recent hyperinflation episodes, massive capital flights had a permanent impact on the financial behavior of the domestic agents and impose severe constraints on the performance of the Argentine financial sector. After several years of increasing price stability, demand for domestic financial assets and other banking services in Argentina has still remained significantly lower than before the high inflation periods, and much lower than most other countries with comparable inflation levels (Fanelli, 1998). This shows the existence of monetary hysteresis. This phenomenon, coupled with the increasing dollarization

of the banking system tends to accentuate the vulnerability of the financial system to macroeconomic shocks, and particularly to volatile capital flows. As a consequence, depositors were still strongly risk averse, and consequently choose to keep very flexible financial position with a much higher international diversification of domestic portfolios.

4) The fourth factor is that evidence from a number of countries suggests that demonetization and remonetization are asymmetric process: higher inflation leads rapidly to lower money demand, but a lower inflation rate does not automatically raise money demand or does so gradually. The intuition for this asymmetry is straight forward: faced with high inflation, households and business firms will find ways to conserve on money holdings. In effect, they will have the incentive to discover new technologies for operating with lower money holdings. Once inflation falls, there may be little reason to revert the previous habits (Ghosh, 1997).

5) The fifth reason is that financial liberalization lowers the average and marginal seignorage capacity of governments by increasing the elasticity of substitution between base money and other financial assets. Liberalization lowered the transaction costs and increased the opportunities for substitution between base money and foreign currency holdings. Both factors therefore reduced the revenue maximizing inflation rate. In addition, currency substitution affects the shape of the seignorage Laffer curve since it makes its tax base (real money demand) sensitive to exchange rate expectations and other macroeconomic shocks. Christopher et al.(1996) studied he relationship between financial liberalization

and seignorage revenue in Kenya, Gana, and Tanzania, and found that he post-liberalization Laffer curve lies everywhere below the pre-liberalization Laffer curve, reducing the average seignorage per unit of inflation at every inflation rate, and the curve is flatter at every point, lowering the marginal seignorage yield at each inflation rate.

6) The sixth factor that explains low seignorage revenue after inflation stabilization is concerned with the position of the country on the seignorage Laffer curve before stabilization. One of the ways in which the real revenue from seignorage may be expected to increase in the post-liberalization period is if previously the economy had been operating significantly above their revenue maximization rate, that is on the wrong side of the Laffer curve. In this situation, disinflation will increase the seignorage revenue. Otherwise, countries that had been operating on the correct side of their seignorage Laffer curve should not expect an increase in seignorage revenue from inflation stabilization. In this case, seignorage can only increase if liberalization produces a significant increase in real income. But, according to the IMF (1999, P.12), the amount of non-inflationary seignorage arising from output growth is likely to be fairly small, perhaps no more than ½ of 1% of GDP.

There are other factors that may explain the level of seignorage revenue form disinflation. Among these other factors are initial inflation, and also how far the base of taxation through inflation has been eroded as a result of inflation, etc. As a matter of fact, Aschauer (1997) studies the seignorage loss from monetary stabilization in

Ukraine and finds that from the total loss in seignorage of some 12% of GDP by the first quarter of 1996, only 4% is due to monetary stabilization and 8% to other forces.

COMPARING ARGENTINA WITH OTHER COUNTRIES IN TERMS OF LOW SEIGNORAGE REVENUE

The experience of Argentina, in term of low seignorage revenue, compares well with other countries which experienced chronically high inflation and which also implemented exchange-rate-based disinflation programs (IMF,1996, P.113). Among these countries with chronically high inflation, recent well-known cases of exchange-rate-based stabilization programs are: Israel (1985), Mexico (1987), Brazil (1986, 1994), and Ukraine (1996).

Israel experienced a rate of inflation of 445 % in 1984, the exchange-rate-based stabilization program implemented in 1985 reduced the rate of inflation to 18 percent after three years and to 2 % after 10 years. Seignorage revenue that fluctuated from 1% to 4% of GDP from 1970 to 1980 reached a peak of more than 8% in 1984, and considerably declined to remain very low (less than 1%) from 1985 to 2000.

In Mexico, the rate of inflation that reached 159 % in 1987 was reduced to 30 % three years later after the implementation of an exchange-rate stabilization program in 1987. Seignorage revenue that was very low (close to 1% of GDP) from 1950 to 1970 increased

a great deal since 1970 to reach a peak of 12% in 1980-82. Since 1987, seignorage revenue significantly shrunk to remain between 1 to 2% of GDP from 1990 to 2000.

From 29.5 % in 1960, the inflation rate in Brazil reached 2,379.8% in 1990. In 1994, Brazil implemented an exchange-rate-based stabilization program that considerably reduced the rate of inflation to single digit. Seignorage revenue, as a percentage of GDP, which reached a peak of 3.5 % in 1994 was largely reduced to close to 0% from 1995 to 2000.

As a result of monetary stabilization in Ukraine in 1996, inflation dropped from over10,000% per annum in 1993 to around 40 % per annum in 1996. Consequently, the level of seignorage revenue dropped from 13% of GDP to around 1% of GDP.

ESTIMATION OF THE CAGAN MODEL FOR THE PERIOD 1985:Q1-1991Q:1

To study money demand for the period before the Convertibility Plan (1985:Q1-1991:Q1) we use the Cagan model. The main idea underlying this model is that under extreme inflationary conditions, real money holdings will be largely determined by inflation expectations. The parameter of interest in the Cagan model is the semi-elasticity of real money demand with respect to expected inflation. A simple test of the applicability of the hyperinflation model lies in testing whether or not real money balances and inflation are cointegrated. If they are, then a "superconsistent" estimate of α can be obtained by applying ordinary least squares to equation (3.14) (Stock, 1987).

The results of the cointegration test reported in table 4.1 indicate that real money balances and inflation are cointegrated applying the likelihood ratio test for cointegration due to Johansen (1988), the hypothesis of at most one cointegrating vector (Ho : $r \leq 1$) is not rejected while the hypothesis of zero cointegrating vectors (H0: $r = 0$) is easily rejected at the 5 percent level of significance. This constitutes evidence in favor of the Cagan (1956) model to study the demand for money in Argentina for the period under consideration.

The results of the OLS estimation in Table 4.2 shows that the estimated coefficient that is the semi-elasticity of money demand with respect to inflation is correctly signed and is statistically significant a t the 1 percent and 5 percent levels of significance. Thus, Cagan's (1956) model of money demand under hyperinflation does indeed provide an adequate characterization of the salient features of the inflationary experience of Argentina from 1985 to 1991. The low inflation-elasticity of money demand could be explained by the fact that Argentina was already largely dollarized during this period. High inflation and the failure of past stabilization programs encouraged currency substitution and capital flight (flight to safety) that considerably reduced the peso-denominated component of the monetary base.

ESTIMATION OF THE CONVENTIONAL MONEY DEMAND FOR THE PERIODS 1991:Q1-2000:Q2 AND 1985Q1-2000Q2.

Because inflation was successfully stabilized since after the implementation of the 1991 Convertibility Plan, the Cagan (1956) model is no longer appropriate to study the money demand in Argentina for this period. Therefore, we estimate another money demand functions for the period 1991:Q2 - 2000:Q2 and, for the purpose of comparison we estimate the same money demand function for the period 1985Q1-2000Q2 . For this purpose, we regress the logarithm of real money balances on five explanatory variables: logarithm of real GDP, inflation rate, money market rate in peso, U.S. three-month Treasury bill rate, and the exchange rate. The income variable (real GDP) is used as a proxy for the influence of the volume of transactions on the demand for money, the inflation rate can be interpreted as the opportunity costs of holding money compared to investments into real capital or physical assets, the money market rate in peso represents the short-term interest rate or the own rate of return on M2, the U.S. T-Bill rate is taken as the opportunity cost of holding foreign currency usually the U.S. dollar instead of the domestic currency, and the exchange rate is used to capture the effect of currency substitution in the money demand function. In the direct currency substitution literature, portfolio shifts between domestic and foreign money is influenced by the expected exchange rate changes. In this study, actual exchange rate is used as a proxy for the expected exchange rate. Because of the quasi currency board arrangements that peg the Argentine peso 1 to 1 to the U.S. dollar since April 1991,we could have used the interest rate spread between the peso and dollar to capture the effects of the exchange rate

changes. Fixed exchange rates always present credibility problems and are subject to self-fulfilled speculative attacks. As a matter of fact, although the Argentine peso has remained pegged to the U.S. dollar since 1992, currency crises elsewhere in the world have prompted speculation on a possible devaluation of the peso, in spite of limited trade links between the affected countries and Argentina. Interest rate in Argentina is not different from that in the U.S. most of the time; but, when doubts are raised about the convertibility of the Argentine peso, interest rates rose sharply. Further more, with each speculative attack, the premium on interest rate on peso denominated loans over dollar denominated loans rises as well, suggesting that the perceived risk of devaluation is much higher (Verlde, 2000). This shows how sensitive interest rates are to the perception of a possible devaluation and explains the use of the interest rate spread as a proxy for the expected changes in the exchange rate.

We do not have a long-term interest rate to include in the model to represent the opportunity costs of holding money with respect to holding other financial assets. Governments in developing countries have had difficulties issuing long-term debts at fixed interest rates in the domestic currency. This has certainly been the case in Argentina that has only issued domestic currency fixed interest rate for short maturities. The only alternative that governments with low reputation and credibility have found to issue longer-term financial instrument, is by offering floating interest rate instruments, indexed debts, or dollar linked-debts. The long history of high inflation and lack of rules, the recurrent episodes of inflation and devaluation have essentially eliminated the role of the Argentine peso as a saving instrument for a long time.

The results of the estimated equations appear in Table 4.2. The results of the 1991Q1-2000Q2 sample show that all the estimated coefficients have the correct signs, but not all of them are significant at the 1 percent and 5 percent significance levels. The income variable has the correct (positive) sign and is not statistically significant at the 1 percent and 5 percent significance levels. The income elasticity of money demand is greater than 1. An income coefficient greater than one can be due to wealth effects; monetary wealth does grow faster than GDP with inflation reduction and stabilization, causing the transaction volume to be stronger than the increase in GDP. This accords with the assumption of falling velocity (Hubrich, 2001, p.139). An income coefficient greater than one may also reflect the remonetization of the economy after the implementation of the convertibility plan. Indeed, Rozenwurcel (1998) reported that the monetary aggregate M2 jumped from five percentage points of GDP in 1990 to slightly over 20 percent in 1994. The inflation variable has the correct (negative) sign and is statistically significant. This means that even after the implementation of the Convertibility Plan, inflation continue to be a factor that determines the demand for money in Argentina. The inflation-elasticity of money demand is very close to the one found in the estimation of the Cagan (1956) model for the 1985-91 Period. The foreign interest rate variable (three-month U.S. T-bill rate) has the correct (negative) sign and is statistically significant at the 5 percent level. Fluctuations in world interest rates proxied by the U.S. T-Bill rate has a major impact on foreign exchange reserves and on money demand in Argentina during the 1990s. The decline of the U.S. short-term interest rate was a blessing for the early success of the Convertibility plan. But, when the decision was taken by the Federal

Reserve to raise short-term interest rates during the first quarter of 1994, this has produced a decline in capital inflows, harming Argentina's economic and financial performance. Depositors run away from local currencies whenever they expect losses associated with the holdings of domestic currency and, when the expected return on foreign currency deposits abroad is higher compared to the return on foreign currency deposits at home, this leads to capital flight that reduces the demand for money. The money market rate (peso) variable has the correct (negative) sign but is not statistically significant from zero.

It is important to consider that the period 1991-2000 has been characterized by a continuous process of reforms that cover almost all areas of the economic and financial sectors in Argentina. The reform efforts were directed towards ensuring and reinforcing the success of the free convertibility of the currency by maintaining and adapting the quasi currency board arrangements to internal and external shocks. Thus, during this period, economic and monetary variables respond not only to policy but also to market-determined elements. In addition, the effects of financial innovation and technological improvement brought in the financial system, which, would have occurred regardless of the regulatory environment, will stay in the system after disinflation.

The results for the sample 1985Q1-2000Q2 show that the inflation variable has the correct sign and is statistically significant. The same thing can be observed for the real income variable and the exchange rate. The dummy variable has the wrong sign, but is statistically significant. The relative fit of the two samples is very good with an adjusted

R-square of 0.87 for the sample 1991Q1-2000Q2, and 0.90 for the sample 1985Q1-2000Q2.

RESULTS OF THE UNIT ROOT TESTS FOR NONSTATIONARITY

We investigate the stationarity of the variables of the long-run money demand function estimated above using the Dickey-Fuller (DF) and the Augmented Dickey-Fuller (ADF) tests and also the Phillips-Perron (PP) tests. We apply the tests on each variable in levels and first differences. The DF, ADF, and the Phillips-Perron tests are used to test whether a series is integrated of order d or I(d), where I(d) series requires differencing d times to remove all of its unit roots. We will employ the findings of the unit root tests to estimate appropriate cointegration equation.

Table 4.4 lists the results of DF and ADF tests for the stationarity of each variable over the 1985:Q1 to 2000:Q2 time period. The test statistics for each variable indicate that the null hypothesis of a unit root cannot be rejected for all the variables in levels either for the DF or for the ADF. The null hypothesis is consistently rejected for all variables in first differences except log of real broad money, the exchange rate, the inflation rate, which are significant in first differences at the 1 percent significance levels for the ADF with two lags.

Table 4.5 reports the results of the Phillips-Perron (PP) tests for a unit root in levels and first differences. We accept the null hypothesis of a unit root for all the variables in

levels at the 1 percent significance level. The inflation rate is the only variable which is significant both in levels and also in first differences at the 1 percent significance level.

RESULTS OF THE JOHANSEN COINTEGRATION TESTS

As unit root tests show that the variables are all I(1), thus, the cointegration technique is appropriate to estimate the long-run demand for money. In this study, we apply the method developed by Johansen (1988) and Johansen and Juselius (1990) to test for the number of cointegrating vectors. The variables log of real broad money, rate of inflation, log of real GDP, interest rate spread, exchange rate, U.S. T-bill are entered as endogenous variables in that order. We also introduce a dummy variable (STD) to capture the shift in regime and a constant term. The analysis covers the period 1985:Q1-2000:Q2, and the lag intervals are 1 to 2.

The results of the cointegration test are reported in table 4.6. The table shows the eigenvalues, the likelihood ratios, the 5 and 1 percent critical values, and the rank of the Π matrix denoted by (r). Both trace and maximum eigenvalue tests strongly reject the null hypothesis of no cointegrating vector ($r = 0$) against the alternative hypothesis of one or more cointegrating vectors ($r > 0$) at the 95 percent confidence level. In all cases, the results of the rank test indicate that the Π matrix is rank = 4, that is, $r = 4$ at the 5 percent level of significance. In other words, there are four (4) cointegrating vectors in the time series.

ESTIMATION OF THE ERROR-CORRECTION MODEL FOR ARGENTINA: 1985:Q1 – 2000:Q2.

Since the variables in the money demand function are found to be cointegrated using the Johansen procedure (1990), the dynamic relationship between real money balances and the explanatory variables can be expressed in terms of an error-correction model (ECM). The error-correction model involves regressing the first difference of each of the variables in the cointegration equation onto lagged values of the first differences of all the variables plus the lagged values of the error-correction term, that is the error-term from the cointegration regression. The vector error-correction specification restricts the long-run behavior of the endogenous variables to converge to their cointegrating relationships while allowing a wide range of short-run dynamics. The cointegration term is known as the error-correction term since the deviation from long-run equilibrium is corrected gradually through a series of partial short-run adjustments. The coefficient of the Error-correction term indicates the speed of adjustment, that is, the speed with which deviations from the long-run equilibrium (the cointegration equation) will be corrected. The estimated error-correction model has the following form:

$$\Delta(\text{logmd})_t = \alpha_0 + \alpha_1\Delta(\text{logmd})_{t-1} + \alpha_2\Delta(\Pi)_{t-1} + \alpha_3\Delta(\text{logY})_{t-1} + \alpha_4\Delta(\text{MMRP})_{t-1} + \alpha_5\Delta(\text{USTB})_{t-1} + \alpha_6\Delta(\text{ExR})_{t-1} + \alpha_7\Delta(\text{STD})_{t-1} + (\text{EC})_{t-1} + \eta_t$$

Where:

$\Delta(\text{logmd})_t$ = is the first difference of the log of real money demand (M2)

$\Delta(\text{logmd})_{t-1}$ = is the first difference of the real money demand (M2) with one lag.

$\Delta(\Pi)_{t-1}$ = is the first difference of the inflation rate with one lag.

$\Delta(\log Y)_{t-1}$ = is the first difference of the real GDP with one lag.

$\Delta(MMRP)_{t-1}$ = is the lagged first difference of the interest rate(money market rate in peso)

$\Delta(USTB)_{t-1}$ = first difference of the three-month U.S. T-bill rate with one lag.

$\Delta(STD)_{t-1}$ = first difference of the standard dummy variable with one lag.

$(EC)_{t-1}$ = is the error-correction term with one lag.

η_t = the residual term.

The results of the estimation of the error-correction model are reported in Table 4.7. The ECM term has the correct (negative) sign but is not statistically significant at the 1% and 5% level of significance. Before drawing any final conclusion on the stability of the demand for broad money in Argentina based on the results of the error-correction term, we conduct other stability tests especially the recursive residual tests and the recursive coefficient tests and the CUSUM test for structural break. The results of these tests reveal that the demand for broad money in Argentina has been unstable since after the implementation of the Convertibility Plan. Especially, broad money demand shifted upward following the financial reforms of April 1991.

To confirm our results, we construct two other variables for inflation using the inflation variable and the standard dummy variable. One of these variables measures the inflation rate after April 1991 and is obtained by multiplying the actual inflation rate by the standard dummy variable. The other one measures the inflation rate before 1991 and is obtained by taking the difference between the actual inflation rate and the post

stabilization inflation rate. Using these two variables in the regression, the new results found revealed the presence of a structural break in broad money demand after the second quarter of 1991.

Another point of interest concerns the statistical and economic significance of the dummy variable that captures the effects of the financial reforms of April 1991. The coefficient of the dummy variable is positive and is not statistically significant at the 5% level. Again, this result suggests that the financial reforms of April 1991 have had some effect on the broad money demand in Argentina. In addition, we expect the sign of the dummy variable to be negative since financial liberalization is supposed to reduce the demand for money.

The estimates of the cointegrating vectors or relations both the money demand function with the inflation rate and the dummy variable and the money demand function with the two inflation rates (Pre-April 1991 and Post-April 1991) are reported for Argentina in Table 4.8. and 4.8A respectively. The cointegrating vector is not identified unless we impose some arbitrary normalization such that the first r series in the Y_t vector are normalized to an identity matrix. The normalized cointegrating relation assumes that r =1 since we are most likely to be interested in the first r estimates where r is determined by the likelihood ratio test. The numbers in parentheses under the estimated coefficients are the asymptotic standard errors. Some of the normalized coefficients will be shown without standard errors. This is the case for coefficients that are normalized to 1.0.

CHAPTER V

SUMMARY AND CONCLUSION

This study examines the stability of the demand for broad money in Argentina in the post financial liberalization period. The main purpose of the study is to test whether the financial reforms of April 1991 known as the "Convertibility Plan" have contributed to a structural break in the demand for broad money in this country. The results of this study will help us understand and explain why Argentina adopted the quasi currency board arrangements fixing the peso to the dollar and legalizing dollar deposits in the banking system.. To achieve the objective of the study, the Johansen cointegration techniques and error-correction modeling have been used after testing the stationarity of the variables using the Dickey-Fuller (DF) tests, the augmented Dickey-Fuller (ADF) tests, and the Phillips-Perron (PP) test for unit root. We also use the Cagan(1956) model utilized in the study of money demand in countries experiencing high inflation. The data for this study consist of quarterly observations of the variables from 1985 to 2000, and come from the "International Financial Statistics", a monthly publication of the International Monetary Fund. The results of the estimated error-correction model indicate that the demand for broad money may become unstable following the financial reforms that pegged the peso to the dollar and legalized dollar deposits in Argentina. This is indicated by the error-correction term not being significant at the 1% and 5% level of significance, though having the correct (negative) sign. A number of alternative stability tests are conducted to confirm the results found for the error-correction specification, and almost all of them

reveal that there is some sign of structural break in the money demand function after 1991. The results obtained are in contrast with those obtained by other researchers regarding the behavior of the money demand function in Argentina for other periods. Indeed, Choudry (1995) find a stable relationship of the demand for broad and narrow money in Argentina from the mid-1970s to late 1980s. Ahumada (1992) find a stable relationship for the demand for currency in Argentina from 1978 to 1989, even during major policy changes from July 1985 to 1988. Similar results are found by Melnick (1990) who, studied the demand for money in Argentina for the period 1978-1987, that is, before and after the Austral Program.

Whether the demand for broad money is stable or unstable, we conclude that the Argentine authorities use the quasi currency board arrangements and more especially the legalization of dollar deposits in the banking system not because of problems related to a structural break in the money demand function, but as the only mechanism that can help reduce and stabilize inflation effectively. As a matter of fact, the currency board arrangement has been very successful in the reduction and stabilization of inflation that has been the main problem of the argentine economy for a long period of time and which has resisted different forms of inflation stabilization programs. The currency board arrangements provide to the Argentine authorities the required credibility and reputations they need to solve the time inconsistency problem raised by Kydland and Prescott (1983). The time inconsistency problem resulting from policy makers to be inconsistent over time, leads private decision makers to distrust policy announcements. In this situation, policy announcements have no effects on inflation expectations, and therefore are

ineffective to reduce and stabilize inflation. That is in part what explains the failure of all the anti-inflationary programs implemented in Argentina before the April 1991 Convertibility Plan. The quasi currency board arrangements that pegged the peso one to one to the U.S. dollar and legalized dollar deposits were the most important element in the financial liberalization program of 1991. With this technology, policy makers showed that they were strongly committed to eliminate all kinds of discretion in the conduct of monetary and exchange rate policies, and they will adhere to a fixed policy rule. The message was well received by private agents that understand the kind of monetary discipline that a currency board entails and how far the government is willing to go; this enhances their confidence and leads them to reduce their inflation expectations. The lesson drawn from this study is that without a strong commitment to combat inflation by implementing the most appropriate and necessary policies, inflation will remain an important challenge for economic activity with its detrimental effects on a number of important macroeconomic variables such as GDP, investment, and unemployment.

By implementing the Convertibility Plan that pegged the Argentine peso one-to-one to the U.S. dollar by law and legalized dollar deposits in the banking system, Argentina has shown that the characteristics they want in their currency are those that the dollar has: low inflation, full convertibility, international acceptability, and the prospect for continued good performance in the future (Hanke, 2000). Indeed, the Convertibility Law succeeded by bringing inflation down quickly and made the peso a close substitute for the U.S. dollar. But, although the peso-dollar exchange rate has remained absolutely fixed at one-to-one, there has been speculation that the peso will be devalued as indicated by the

high spread between the short-term interest rates of dollar and peso loans. In addition, Argentina has been faced with severe financial crises since 1995 and plagued by a severe recession since 1998. In the year 2001, Argentina's economic hardship has reached a point to jeopardize the Convertibility Law that has been amended in June 2001. This shows that the use of the exchange rate as a nominal anchor and the legalization of dollar deposits helped Argentina solve the time inconsistency problem and regain its credibility in its efforts to combat high inflation. But, these devices are no panacea, they do not protect indefinitely against severe external shocks that can lead to sudden currency crisis and are no substitutes for sound monetary and fiscal management.

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GRAPH 4.1 : FINANCIAL INTERMEDIATION RATIOS (M1/GDP AND M2/GDP) FOR ARGENTINA FROM 1970 to 2000.

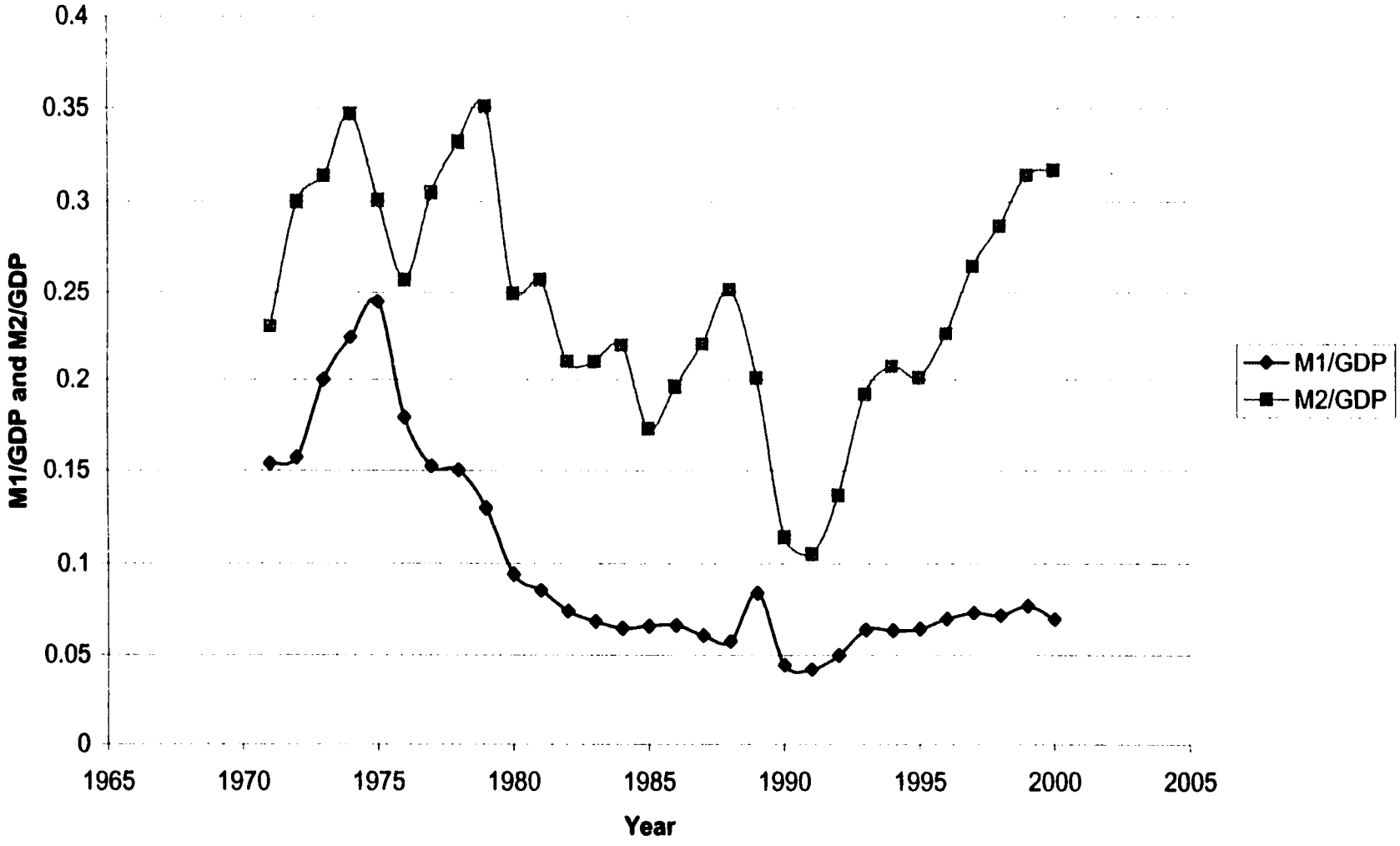
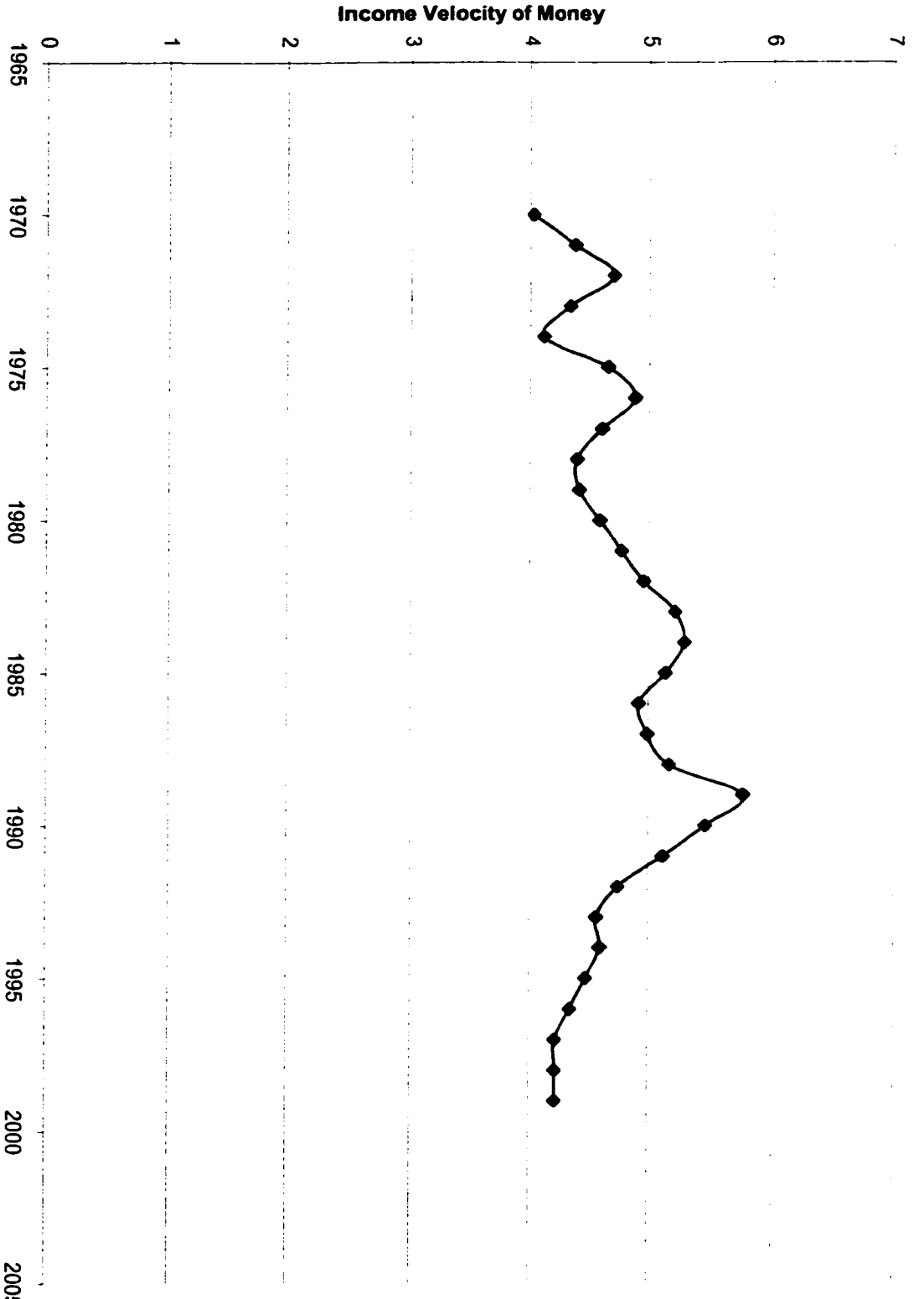


CHART 4.1: Behavior of the Income Velocity of Money and Quasi-Money in Argentina (1969-2000)



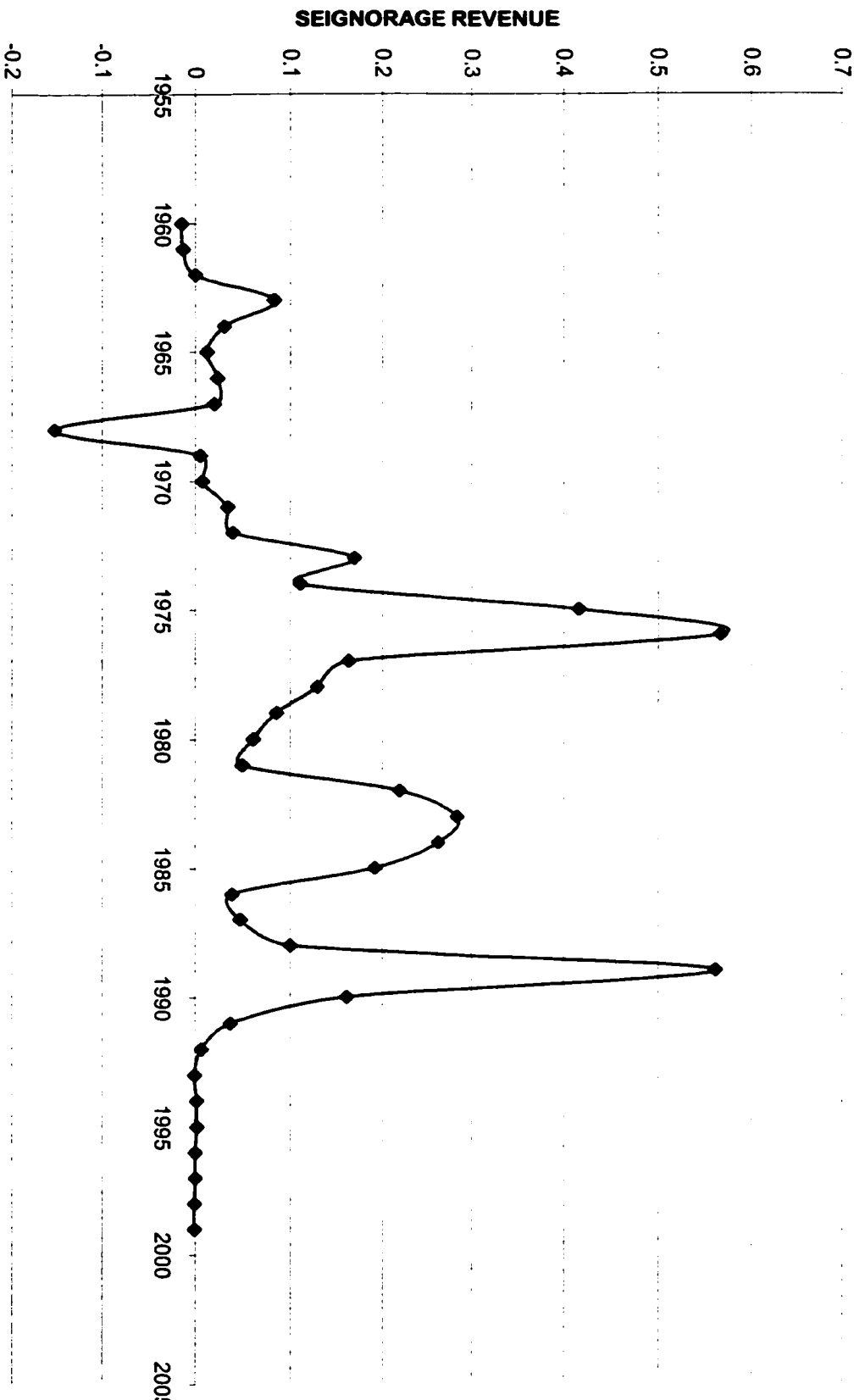


CHART 4.3 : SEIGNORAGE REVENUE IN ARGENTINA FROM 1960 to 2000

TABLE 4.1

RESULTS OF THE JOHANSEN COINTEGRATION TEST

SAMPLE PERIOD 1985:Q1-1991:Q1

Eigenvalue	L.R. Ratio	5% Critical Value	1% Critical Value	Ho : rank = ro
0.431243	16.04883	15.41*	20.04	None
0.152267	3.634174	3.71	6.65	At most 1

- (*) denotes rejection of the hypothesis at 5% level of significance.
- L.R. test indicates 1 cointegrating equation at 5% level of significance.
- Variables: log of real broad money and inflation rate.

TABLE 4.2

ESTIMATION OF THE CAGAN MODEL OF MONEY DEMAND

SAMPLE PERIOD 1985:Q1-1991:Q1

Dependent Variable: Log of Real Broad Money (M2)	
Constant Term	7.10 (20.79)
Inflation Rate	-0.52 (-2.31)
Adjusted-R^2	0.16
D.W.	0.29
F-statistic	5.37
Number of Observations	24

Note: Values in parenthesis are the t-statistics.

TABLE 4.3

ESTIMATION OF THE MONEY DEMAND FOR ARGENTINA

SAMPLE PERIOD : 1991Q1 – 2000Q2; 1985Q1-2000Q2

Dependent Variable: Log of Real Broad Money (M2)		
Regressor	OLS Coefficient	
	Sample:1991Q1-2000Q2	Sample: 1985Q1-2000Q2
Constant Term	7.91 (1.49)	4.54 (3.11)
Inflation Rate	-0.40 (-3.62)	-0.43 (-5.38)
Log of Real GDP	1.64 (0.35)	3.62 (2.49)
Exchange Rate	-4.11 (-13.10)	-4.81 (-12.99)
Money Market Rate In Peso	-2.72 (-0.15)	2.52 (0.20)
U.S. Treasury Bill (Three-months)	-0.29 (-2.24)	-0.07 (-1.17)
Standard Dummy Variable	-	1.32 (2.99)
R^2-Adjusted	0.87	0.90
D.W.	1.38	1.86
F-Statistic	50.43	96.62
Number of Observations	35	58

Note: Values in parenthesis are the t-statistics.

TABLE 4.4

UNIT ROOT TESTS FOR NONSTATIONARITY

ARGENTINA, SAMPLE PERIOD: 1985Q1-2000Q2

VARIABLE	DF TEST		ADF TEST			
			ONE LAG		TWO LAGS	
	LEVELS	FIRST DIFF	LEVELS	FIRST DIFF	LEVELS	FIRST DIFF
Log of real money(M2)	-0.94*	-8.93	-0.51*	-7.71	-0.58*	-7.36
Exchange Rate Change	-1.21*	-6.12	-1.27*	-4.42	-1.32*	-3.49*
Inflation Rate	-1.02*	-2.13	-1.48*	-2.47	-1.32*	-1.70*
Money Market Rate(P)	-7.84	-13.18	-5.51	-10.21	-3.88*	-7.26
Log of Real GDP	-1.55*	-11.80	-0.88*	-7.32	-0.75*	-8.67
U.S. T-Bill	-2.20*	-4.82	-2.26*	-4.39	-2.13*	3.53*
Standard Dummy	-1.20*	-7.74	-1.21*	-5.43	-1.22*	-4.39

- *Indicates significance at the 1% level.
- "P" stands for peso.

TABLE 4.5

PHILLIPS-PERRON TESTS FOR UNIT ROOTS

ARGENTINA, SAMPLE PERIOD: 1985Q1-2000Q2

Variables	Level	First Differences
Log of Real Broad Money (M2)	-1.190*	-10.285
Rate of Inflation	-0.927*	-2.186*
Exchange Rate	-1.210*	-6.134
Log of Real GDP	-1.030*	-13.842
U.S. T-Bill Rate (Three Months)	-1.403*	-4.806
Money Market Rate In Peso	-7.843	-17.775
Standard Dummy Variable	-1.201*	-7.746

* indicates significance at 1% level

TABLE 4.6

JOHANSEN COINTEGRATION TEST

ARGENTINA,SAMPE 1985:Q1 – 2000:Q2

Eigenvalues	Likelihood Ratio (trace statistics)	5 Percent Critical Values	1 Percent Critical Values	H0: rank = r0
0.992054	404.4466	124.24	133.57	R = 0**
0.748419	157.8542	94.15	103.18	R = 1**
0.473652	87.47467	68.52	76.07	R = 2**
0.405071	54.74323	47.21	54.46	R = 3**
0.329458	28.25829	29.68	35.65	R = 4
0.140279	7.875195	15.41	20.04	R = 5
0.003263	0.166682	3.76	6.65	R = 6

- *(**) denotes rejection of the hypothesis at 5% (1%) significance level.
- LR test indicates 4 cointegrating equations at the 5% level of significance.
- The variables tested are the same as in tables 4.5 and 4.6.

TABLE 4.7

VECTOR ERROR-CORRECTION ESTIMATES
ARGENTINA, SAMPLE PERIOD:1985Q1-2000Q2

Dependent Variable: Δ(logmd)t	
Regressor	Coefficient
Constant Term	0.018 (3.178)
$\Delta(logmd)_{t-1}$	0.053 (0.246)
$\Delta(INF)_{t-1}$	-0.085 (-1.99)
$\Delta(\log Y)_{t-1}$	-0.082 (-0.565)
$\Delta(MMRP)_{t-1}$	4.93 (0.767)
$\Delta(USTB)_{t-1}$	.0.008 (-0.726)
$\Delta(ExR)_{t-1}$	-0.060 (-0.567)
$\Delta(STDUM)_{t-1}$	0.031 (0.197)
$(EC)_{t-1}$	-7.23 (-1.171)
R^2-Adjusted	0.19
Number of Observations	52

TABLE 4.8

COINTEGRATING EQUATION I

SAMPLE 1985:Q1-2000:Q2

Log of Real Broad Money	1.000
Log of GDP	-0.244 (3.739)
Inflation Rate	11.333 (10.726)
Money Market Rate In Peso	-0.009 (0.008)
U.S. T-Bill (three-month)	-0.043 (0.068)
Standard Dummy Variable	-6.796 (4.82)
Official Exchange Rate	9.943 (4.664)
Constant Term	6876.42

* Values in parentheses are the standard errors.

TABLE 4.8A

COINTEGRATING EQUATION II

SAMPLE 1985:Q1-2000:Q2

Log of Real Broad Money	1.000
Log of Real GDP	-1.418 (0.915)
Pre-1991 Inflation Rate	11.333 (10.726)
Post-1991 Inflation Rate	8.25 (2.56)
Money Market Rate In Peso	-0.0018 (0.009)
U.S. T-Bill (three-month)	-0.003 (0.020)
Standard Dummy Variable	3.58 (4.82)
Official Exchange Rate	6.51 (0.896)
Constant Term	1374.71

* Values in parentheses are the standard errors.

ABSTRACT

Jovis Wolfe Bellot

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The Stability of The Demand for Broad Money in Argentina In The post Financial Liberalization Period.

Dissertation directed by Professor Darryl McLeod, Ph.D.

This study examines the stability of money demand in Argentina before and after the 1991 financial reform and convertibility program. Unlike a number of previous studies, we find empirical evidence that the Convertibility Plan of April 1991 led to a positive shift in money demand in Argentina. This result is particularly interesting in that Argentina not only fixed its exchange rate to bring down inflation but it also liberalized its financial system by removing capital controls and legalized dollar deposits. These reforms created a strong rightward shift in the money demand function, but because dollar deposits were legalized and inflation fell, seignorage revenues decreased despite the increase in money demand. The structural break in money demand is confirmed by a variety of tests for coefficient stability including the recursive residual test, the recursive coefficient test, and the CUSUM test. These results suggest that mix of financial liberalization, and fixing the exchange rate were very successful in remonetizing the banking system and in reducing inflation, but the switch to dollar deposits eliminated much of the seignorage windfall governments often enjoy following successful exchange rate based stabilizations. This meant fiscal deficits had to be financed largely by foreign borrowing, contributing to the build up of external debt that created debt service difficulties in the late 1990s.

VITA SHEET

Jovis Wolfe Bellot, son of Isalem and Rosemelie Bellot, was born on July 3, 1958 in Hinche, Haiti. After completing his secondary education in 1980, Jovis entered the School of Science of the State University of Haiti (UEH) and graduated with a Diploma in Topographic Studies in 1982. The same year, he entered the School of Law and Economics (UEH) and graduated with a B.S. in Economics with distinction in 1986. From November 1986 to December 1987, he worked for the Haitian Institute of Statistics and Computing as supervisor of the "Haitian Household Expenditures and Consumption Survey". In February 1989, he was hired as economist by the Haitian Ministry of Planning And External Cooperation. From May 1989 to August 1991, Jovis attended Southern Illinois University at Carbondale where he completed his masters of science (M.S.) in Agribusiness Economics. From 1991 to 1997, Jovis was teaching at several universities in Haiti, especially the State University of Haiti (UEH) and the American University of the Caribbean in Haiti where he was the director of the business program. In September 1997, he entered the Ph.D. program in economics at Fordham University and specializes in Financial economics, Development Economics, and International economics. His dissertation topic is: "**The Stability of Broad Money In Argentina Following The 1991 Financial Liberalization**. His mentor is **Dr. Darryl McLeod**. While working on his dissertation, Jovis has been an adjunct professor in the Department of Economics at Fordham University and has done his internship at Bank One Corporation in New York. Jovis held two Fulbright Scholarships (1989-1991) and (1997-1999) and the Presidential Scholarship at Fordham University (1997-2001).