

**MACROECONOMETRIC STABILIZATION AND IMF POLICIES: A SURVEILLANCE OF  
INFLATION**

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**Abstract**

This paper uses time series data from 1960 to 2012 to evaluate the long-run relationship between aggregate money supply and changes in the general price level (inflation) for a selected group of countries with historically stable prices and episodes of very high inflation. Recent paradigmatic shifts from exchange-rate-based stabilization policies to conditionalities involving price stability have greatly influenced the empirical work of this paper. Empirical results indicate that the money supply and inflation are cointegrated in some countries with high spells of inflation, such as Argentina, Brazil, and Mexico, but that the variables may not be cointegrated with each other for countries with prices that are generally and historically stable, such as the UK and the US. The paper highlights the need for good quality governance, employment, and productivity in surveillance measures that are designed to obtain external balance.

**Keywords:** Devaluation, Flexible Exchange Rate, Inflation, Stabilization, Surveillance

**JEL Classification - F31, F32, F33, F34, G01**

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**1. Introduction**

This paper uses time series data from 1960 to 2012 to evaluate the long-run relationship between aggregate money supply and changes in the general price level (inflation) for a selected group of countries with historically stable prices and episodes of very high inflation. Recent paradigmatic shifts from exchange-rate-based stabilization policies to conditionalities involving price stability have greatly influenced the empirical work of this paper. Empirical results indicate that the money supply and inflation are cointegrated in some countries with high spells of inflation, such as Argentina, Brazil, and Mexico, but that the variables may not be cointegrated with each other for countries with prices that are generally and historically stable, such as the UK and the US. The paper highlights the need for good quality governance, employment, and productivity in surveillance measures that are designed to obtain external balance.

Stabilization efforts in the wake of the 2007/8 global crises have focused on inflation and financial market reforms. The new paradigmatic shift to the surveillance of inflation has coincided with the failure to maintain fixed exchange rate regimes and the problems that are associated with the management of floating rate regimes. Yet, with the inability to precisely pin down the triggers of inflation, stabilization mechanisms are equally challenging. They could easily crowd out the need for higher levels of employment and productivity over extended periods of time beyond the IMF conditionality mandate.

As a general theory, the relationship between inflation and monetary aggregates over a longer period of time has not been well established, especially because of currency mismatches, the inability of countries with inconvertible currencies to borrow in their own currencies, and exogenous conditions or shocks. Some of these countries are normally plagued by corruption, inordinately high public debts, and underdeveloped financial markets. The quest to target inflation was first utilized by more advanced economies, but

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unlike the new set of countries with money supply and inflation that are cointegrated over extended periods of time, they have convertible currencies.

This study has focused on inflation partly because it is a relatively recent approach to the IMF surveillance obligation when exchange rates are refractory, but also because financial markets are not very well established in low income or developing economies over an extended period of time to undertake significant comparative analysis (the survivor bias syndrome). The questionable depth of time series data makes it rather impractical to estimate long-term relationships. However, the correlation between asset prices and the performance of the US real sector has been dealt with elsewhere (Warburton, 2013).

By its empirical findings and analyses, this paper is an extension of Warburton (2014) and it makes the following additions to the literature. It finds: (a) that the growth of money supply and inflation are more likely to be cointegrated in countries with higher spells of inflation than those with historically stable prices, (b) that the concentration on short-term inflation as prescribed by IMF conditionality mandate may compromise the ability of countries to prevent long-term unemployment and cause diminishing levels of productivity, and (c) that by using short-term fiscal policy—assuming that governance is of good quality—without significant exchange rate adjustments, internal and external balance could be achieved in the long-run (a corroboration of Mundell and Fleming).

The rest of the paper is structured to reflect discussions of the following topics: (i) The contending perspectives of IMF surveillance before and after the 2008 global financial crises within the meaning of the Article IV mandate, (ii) The interaction of money supply, inflation, national output, and surveillance, (iii) The empirical findings, and (iv) A conclusion that evaluates the role of inflation targeting vis-à-vis the policy implications for good governance, long-term employment, and productivity.

## **2. A review of the surveillance literature**

Surveillance is the IMF's implementation of bilateral and multilateral oversight over policies that threaten the stability of the international financial system. The member countries of the IMF undertake an obligation to foster policies that are not disruptive to the international financial system and to that end, consents to a scrutiny of their economic policies for the sake of global financial stability. Financial surveillance is the oversight that is exercised over the financial sector obligations of the IMF members in the areas of technical assistance, crisis management and the IMF supported programs, the bilateral and multilateral surveillance over fiscal policy, exchange rate policies, and structural policies (Sahay et al. 5).

The legal basis for the IMF to conduct surveillance is provided in Article IV, Sections 1 and 3. Mussa (1997) observes that in the function of surveillance, the IMF's responsibilities were substantially redefined by the second amendment of the Articles of Agreement in 1977. Specifically, Section 3 of Article IV defines three important and related areas for Fund surveillance: (i) general oversight of the international monetary system to ensure its effective functioning, (ii) oversight of the compliance of members with the obligations specified in Section 1 of Article IV, and (iii) firm surveillance over members' exchange-rate policies.

In practice, the main focus of IMF surveillance has been on members' economic policies that influence the international monetary system and the behavior of exchange rates. According to Section 1 of Article IV, members' economic and financial policies which are subject to Fund surveillance: (i) should endeavor to foster orderly economic growth with reasonable price stability, (ii) should seek to promote orderly underlying economic and financial conditions that do not tend to produce erratic disruptions, and (iii) should avoid

manipulating the international monetary system in order to prevent effective balance-of-payments adjustment or to gain unfair competitive advantage (Mussa, 28).

The broad procedures that mandate members to fulfill their obligations under Article IV have also been variously discussed by Mussa and Savastano (2000), Mussa (2007), Lastra (2011), Ciobanasu (2012), Sahay et al. (2012), Weiss (2013), and Lane et al. (2014). To carry out its surveillance mandate, the IMF conducts Article IV consultations with each member country. The Fund's staff (mission) team visits countries to collect information about macroeconomic policies (fiscal, monetary and exchange rate), the soundness of the financial system and other relevant issues, including employment levels, and the environment.<sup>1</sup>

Lastra observes that the IMF's surveillance has evolved significantly over the last decades, with an increased focus on financial sector issues and policies. While surveillance in the past was typically focused on the jurisdiction over the exchange arrangements of members and macro-economic policies, surveillance nowadays also takes into account other issues, often involving the workings of the private sector ('micro' issues), such as good governance (both political and corporate governance), legal and institutional reform, bank restructuring, financial reform, etc. This view has been echoed by Sahay et al (2012) who identified two triggers for the urgency of financial surveillance: (i) the explosion of credit growth and the financial crises of the 1990s, which revealed that external and financial stability were closely linked, and (ii) the global financial crisis of 2007/8, which showed that unfettered financial sector expansion in advanced economies could have far-reaching destructive effects. For a concise review of the literature on surveillance, this paper will focus on a three-dimensional analysis: (i) the literature on the interpretation of Article IV, (ii) literary evaluation of oversight preceding the 2007/8 global crisis, and (iii) the literature in the aftermath of the 2007/8 global crisis.

Some authors have interpreted the Article IV mandate more sparingly or conservatively than others. A narrower interpretation of the mandate could easily translate into a rather ambitious extension of the authority of the Fund. On the other hand, the literature also reflects that the Fund has exercised too much restraint. By so doing, the conversation in the literature is somewhat dichotomous and it has raised controversy over the authoritative limits of the Fund in exercising its Article IV mandate. Under both circumstances, there seems to be an unusual consensus that neither of the two approaches has produced the desired results.

Apprehension about the ability of the Fund to fully utilize its Article IV mandate before the 2007/8 crisis has been extensively discussed in the work of Mussa (2007). Describing the IMF's "firm surveillance" over exchange rate policies "as about as firm as an overripe

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<sup>1</sup>After a review of policies, the Fund team holds discussions with the authorities about policy effectiveness, balance of payments situation, and prospective changes. At the conclusion of the discussions, and prior to the preparation of the staff's report to the Executive Board, the IMF mission often provides the authorities with a statement of its preliminary findings. After the IMF's Executive Board has discussed the staff report, a summary of the discussion is forwarded to the country's government. The summary of the Executive Board discussions for many Article IV consultations are published in Public Information Notices (PINs), which can be found in the IMF's website (see also Lastra). However, the Financial Sector Assessment Program (FSAP) provides the main instrument for detailed assessment of systemic risks and of the robustness of regulatory, supervisory, and crisis management systems at the bilateral level. At the multilateral level, financial sector surveillance is undertaken mainly through the Global Financial Stability Report (GFSR), in an integrated manner with the World Economic Outlook (WEO), the Fund's regional surveillance documents, and through various policy papers. Additionally, the Fund's vulnerability exercises are part of a broader commitment to better integrate its bilateral and multilateral surveillance.

avocado—without the pit.” (Mussa, 2). Mussa has argued that exchange rate surveillance was not vigorous enough to neither prevent the Mexican peso crisis of the 1990s nor the massive currency sterilization in China by the turn of the twenty-first century.

Part of the conundrum seems to rest on the fact that prior to 1977 there was no straightforward interpretation of Article IV. Consequently, the Fund’s Legal Department eventually prepared a paper for discussion by the Executive Board, which led to a comprehensive revision of surveillance over exchange rate policies in 1977. Central to the debate is the issue of unilateral sovereign right to determine the price of domestic currencies in international markets; what Mussa calls a “logical absurdity.”

Maintaining a balance between unilateral sovereign right and multilateral obligations should not be a very convoluted issue. The Fund provides advisory opinions (Mussa and Savastano) but the obligation to cooperate is implicit in the older version of Article IV. The issue is not whether or not nations have a right to set a specified value—because that was done under the par value system—it is whether or not members can arbitrarily (without the permission of the Fund) readjust the value of their currencies outside of a narrow band (more than 10 percent) after the price of currencies had been set. In effect, by voluntarily choosing to be members of the Fund, members are constrained and they do not have unfettered privileges or rights. Members are obligated “...to collaborate with other members and with the Fund to assure orderly exchange arrangements and to promote a stable system of exchange rates.” (Article IV§ 1). The Legal Department has concluded that the prevailing concept of collaboration before and during the time of the Second Amendment should be relied upon as a basis for the Fund to call on members to take specific actions or to refrain from taking specific actions (Mussa, 9).

Like Mussa, Lastra (2011) observes that a creative interpretation of Articles I and IV of the Articles of Agreement gives the Fund the legal basis to expand its surveillance role into issues of financial stability. In terms of the official interpretation of the Articles of Agreement, the Board of Governors at its first meeting in 1946 made a broad delegation of powers to the Executive Board, in accordance with the possibility foreseen in Article XII, Section 2(b). According to Section 15 of the IMF’s By-Laws: “The Executive Board is authorized by the Board of Governors to exercise all the powers of the Board of Governors, except for those conferred directly by the Articles of Agreement on the Board of Governors’. The Executive Board does indeed have the power of interpretation, though this power has to be exercised in a consistent manner with the general principles of interpretation, including those set forth in the Vienna Convention on the Law of Treaties.

Lastra’s translation suggests that the broad enumeration of goals in Article 1 has allowed the institution to survive over the years, adjusting and readjusting its role in response to diverse economic circumstances. The reference in Article I (i) to international monetary problems can be construed as a reference to international monetary and financial problems. Analogously, the same can be said about the reference in Article I (vi) to promote international monetary cooperation, which can be construed as a reference to international monetary and financial cooperation.

While some have been critical about the IMF’s role in the Greek crisis 2009/10—which was not a balance of payments problem but a budgetary one—and its role in Indonesia in 1998, Ciobanasu also sees a scope for a broader practical involvement of the Fund in issues of international instability even though the legality of some of the IMF’s operations might be questionable. The Fund’s seal of approval and its role as a provider of liquidity have been considered to be critical during periods of global systemic crises.

If involvement with capital flows and budgetary constraints are considered to be cryptic examples of excessive authority, more pointed criticisms of what has been considered to be overambitious policies could be found in the area of international trade; what the

Independent Evaluation Office (IEO) of the Fund has described as: measures that directly and primarily aim to influence the quantity and/or value of a country's imports and exports of goods and services, which also encompass traditional trade instruments—tariffs, quotas, and export and import subsidies—as well as customs administration and other domestic (“behind-the-border”) policies that distort trade. A narrower reading of the Articles of Agreement indicates that Fund oversteps its mandate when it engages in trade policy issues during surveillance or when it imposes trade (or other structural) conditionality in its lending arrangements (Saner and Guilherme, 2007)

The dichotomous characterization of the crises literature is interesting for a variety of reasons. In simple terms, it indicates the evolving challenges of the Fund in the face of changing global economic pressures. For the purpose of convenience, the crises literature will be classified into two broad categories; (a) those preceding the East Asian Crises and those that occurred in the aftermath of the East Asian Crises.

Lastra succinctly captures the evolution of surveillance policies from the 1970s through 2009. In the 1970s the emphasis of surveillance was on the traditional macro-economic policies such as exchange rate and monetary and fiscal policies. However, in the 1980s, structural policies became more relevant, particularly in the aftermath of the debt crisis in Latin America. At the beginning of the 1990s, the transition from centrally planned to market economies in countries in Eastern Europe and the former Soviet Union moved surveillance in the direction of further structural reforms, with emphasis on legal and institutional reform. In effect, until the early 1990s, the coverage of financial surveillance was rudimentary. The primary focus was on the impact of domestic credit creation on inflation or the exchange rate, basic monetary operations, and the development of market-based monetary policy tools. This narrow focus partly reflected the relatively modest size and simplicity of domestic financial systems and the superficial treatment of finance and credit flows in macroeconomic models of the day (Sahay et al.).

In the late 1990s the financial crises in South East Asia, Russia and other emerging economies, suggested that financial reform and financial law reform should be the object of IMF surveillance.

The East Asian crises of the 1990s revealed that external and domestic financial stability were closely linked. Consequently, Sahay and others note that the significant interactions between banking and balance of payments crises—especially in Asian and Latin American emerging economies—and contagion to neighboring countries, resulted in a greater focus on financial system stability. Lastra characterizes the shift in focus as a movement from macro-surveillance to micro-surveillance—a shift from the focus on the exchange arrangements of members and macro-economic policies to surveillance that takes into account other issues—often involving the workings of the private sector (‘micro’ issues), such as good governance involving both public and corporate sectors, legal and institutional reform, bank restructuring, and financial reform. However, as Lastra pointed out, it should also be noted that surveillance of national policies becomes more complex when countries embark on programs of trade and financial liberalization.

Just at about the time of the East Asian crises in the late 1990s, some emerging economies opted for inflation targeting as a monetary policy anchor, and the policy became part of the Fund's surveillance mechanism. The policy was first adopted by industrialized economies, but as emerging economies switched from the fixed exchange rate regime to the flexible regime, inflation targeting became much more attractive. For example, the IMF was confronted with this situation in Brazil in the middle of January 1999 (Blejer et al., 2002). Inflation targeting posed new challenges for the operational procedures of the Fund. More strikingly, the East Asian Crises and the 2008/9 global financial crises emphasized the urgency for financial surveillance.

The advent of financial surveillance shows that there is a real concern for the financial sector to support the real sector for global financial stability and economic growth. As such, Weiss (2013) notes that the IMF has transformed itself from an international monetary institution focused almost exclusively on issues of foreign exchange convertibility and stability to an international financial institution, assuming a broader array of responsibilities and engaging in a wide range of issues including financial and capital markets, financial regulation and reform, and sovereign debt resolution.

Accordingly, for a different set of reasons, the turn of the twenty-first century has rejuvenated much more interest in pre-emptive measures to avoid global crisis with catastrophic consequences. The old and new challenges for advanced and low income economies are by no means identical, especially because of divergent financial and structural differences. Nevertheless, the urgency of financial surveillance has also coincided with fundamental changes in the financial systems in low income countries (LICs). The financial sector of these countries has grown and become more inclusive over the past two decades though they remain relatively small and undiversified. Encouragingly, although they have much lower levels of financial depth than high- and middle-income countries, low-income countries are experiencing financial deepening at rates far faster than higher income countries. Notwithstanding the progress, the literature reflects that financial deepening will be of low quality if financial services are available to only a few firms or households.<sup>2</sup> In effect, access to finance is contingent on the depth of the financial system. Since the interaction of money supply, fiscal policy, inflation, national output, and surveillance is unavoidable, the next section discusses the interaction of the variables.

### 3. Money supply, fiscal policy, inflation, national output, and surveillance

A general presumption is that inflation is a monetary phenomenon. This presumption is misleading when growth or decline in the level of output is not granted adequate consideration. A concise definition of inflation requires the inclusion of the relationship between the expansion of money supply or credit and growth in national income or the lack thereof. Just how much money is chasing too few goods and services around? Consider the simple equation of exchange and its logarithmic transformation:

$$MV=PQ \quad (1)$$

$$\ln M + \ln V = \ln P + \ln Q; \quad (2)$$

where  $\ln P + \ln Q$  can be defined as nominal income ( $Q_N$ ) when velocity ( $V$ ) is presumed to be less volatile over a longer time horizon. Equation (2) can then be re-written as:

$$Q_N = VM^\beta \quad (3)$$

$$\ln Q_N = \ln V + \beta \ln M \quad (4)$$

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<sup>2</sup> See King and Levine, 1993, Rajan and Zingales, 1998, and Goyal et al., 2011. Conceptually, financial depth is often understood as: (i) access to financial markets for savings and investments over a longer period of time, (ii) the ability of financial intermediaries and markets to deploy larger volumes of capital and handle larger turnover, without necessitating large corresponding movements in asset prices (market liquidity), and (iii) the ability of the financial sector to create a broad menu of assets for risk-sharing purposes (hedging or diversification). Consequently, deep markets allow savers to invest in a broad range of quality investment and risk-sharing instruments, and allow they borrowers to access a broad range of financing and risk management instruments.

The responsiveness of national output to cash infusion or the elasticity of national income can be easily derived:

$$\frac{dLnQ_N}{dLnM} = \frac{1}{Q} dQ_N = \beta \frac{1}{M} dM; \quad \{\text{where } dLnV=0. \quad (5)$$

$$\beta = \left( \frac{dQ_N}{Q_N} \right) * \left( \frac{M}{dM} \right) = \left( \frac{dQ_N}{dM} \right) * \left( \frac{M}{Q_N} \right) \quad (6)$$

The seigniorage and inflation problem has been discussed more extensively in Warburton (2014). For ease of reference, the main arguments have been reproduced. Seigniorage becomes tenuous in inflationary and contractionary situations as demand for real transaction balances plummets. The direct link between deficits, seigniorage and inflation is well established. First, recall the Obstfeld and Rogoff (1996) representation of seigniorage in two component parts:

$$\frac{M_t - M_{t-1}}{P_t} = \left( \frac{M_t}{P_t} - \frac{M_{t-1}}{P_{t-1}} \right) + \left( \frac{M_{t-1}}{P_{t-1}} - \frac{M_{t-1}}{P_t} \right); \quad (7)$$

where  $P$  and  $M$  are for the general price level and the nominal stock of money respectively, with contemporary ( $t$ ) and lag ( $t-1$ ) indicators. The first expression on the right-hand side is the proceeds from inflation tax and the second is the change in the economy's real money holdings. Inflation tax has two distinct meanings: (a) the revenue that a government raises from printing money, and (b) the penalty for holding cash when inflation is high and when it becomes more desirable to hold assets. As a result, fiscal policy has a net effect on financial decisions. At interest rates above equilibrium rate where money balances supplied exceed the demand, individuals holding the excess supply of money try to convert some of their non-interest bearing money into interest bearing financial instruments. Interest-paying financial institutions lower the interest rates they are willing to offer. Conversely, at rates below the equilibrium level, rational agents will try to sell assets—interest rate is low and bond prices are higher—or make bank withdrawals (Mankiw, 318). Nevertheless, the feedback effects of financial markets on the real sector are not entirely straightforward (Warburton, 2013). Poorer people with less wealth to invest in financial markets tend to be impacted more adversely by the inflation tax.

Alternatively, the proceeds from the inflation tax reflect an intertemporal difference in real money balances. In the growing economy, seigniorage must be greater than the proceeds from the inflation tax:

$$\frac{\Delta M_t}{P_t} > \left( \frac{M_t}{P_t} - \frac{M_{t-1}}{P_{t-1}} \right). \quad (8)$$

The increase in the money supply accommodates increasing demand for real transaction balances without unnecessarily increasing inflation. The new conditionality on inflation requires a corresponding re-evaluation of surveillance. In reality, the old form of surveillance could not have been realistically isolated from the relatively new approach. This reality makes the broader interpretation of the IMF mandate more plausible.

Sachs and Larrain (1993, 333-334) have shown how fiscal deficits could be comprehensively linked to seigniorage and inflation. Recall the representation of the real value of government deficits ( $D_t$ ) as the real change in the money supply under the more practical floating exchange rate regime:

$$D_t = \frac{(M_t - M_{t-1})}{P_t} = \left[ \frac{(M_t - M_{t-1})}{M_t} \right] \left( \frac{M_t}{P_t} \right). \quad (9)$$

The equation of exchange and its regularity conditions of invariant nominal output and velocity can be used to clarify Equation (9) and show how a stock of deficit between periods and the change in the money supply attributable to budget deficits ( $D_t$ ) could trigger an increase in the inflation rate. Consider the money equation of exchange:

$$M_{t-1} = \left( \frac{P_{t-1} Q}{V} \right); \quad (10)$$

substituting prices for money in the first expression of Equation (9) and multiplying the right hand side by  $P_{t-1}/P_t$ , the deficit can be re-written as:

$$D_t = \left[ \frac{(P_t - P_{t-1})}{P_{t-1}} \right] \left( \frac{P_{t-1}}{P_t} \right) \left( \frac{M_t}{P_t} \right). \quad (11)$$

Defining inflation as  $\hat{P} = \frac{P_t - P_{t-1}}{P_{t-1}}$  and  $\frac{P_t}{P_{t-1}} = 1 + \hat{P}$ , government deficits can be written as

$$D_t = \left[ \frac{\hat{P}}{1 + \hat{P}} \right] \left( \frac{M_t}{P_t} \right). \quad (12)$$

As such, Equation 12 defines a deficit in terms of the product of a tax base or real money balances ( $M_t/P_t$ ) and a tax rate (the first expression on the right hand side), with  $\hat{P}$  as a representation of the inflation rate. In effect, with an invariant tax revenue base, deficits increase in tandem with the tax rate of inflation when deficits are financed through an inflation tax on real money balances; meaning that the printing of money by governments to raise revenue to finance purchases of goods and services is an inflation tax. The role of money is equally becoming more convoluted in terms of surveillance challenges.

With deficit problems, single-digit inflation, and intensified financial depth, developing countries are adopting more flexible and forward-looking monetary policy frameworks and ascribing a greater role to policy, interest rates, and inflation objectives. While some countries have adopted formal inflation targeting regimes, others have developed frameworks with greater target flexibility to accommodate changing demand for money, use of policy rates to signal the monetary policy stance, and implicit inflation targets (Lane et al.).

Many Fund-supported programs now assess monetary policy through central bank balance sheet targets of reserve money. But no correlation is observed between deviation in reserve targets and deviations in low inflation. As such, a review-based conditionality to assess monetary policy has been proposed. Fund-supported programs, it has been argued, should clearly articulate monetary policy objectives and set money or inflation target bands for each review. A monetary policy consultation clause would provide the necessary safeguards for the use of Fund resources in the event of deviations from the target band. The traditional framework for monetary conditionality would remain an option in countries where it has proven to be effective in achieving program objectives (Lane et al.).

The role of monetary and fiscal policies in the financial and real sectors is becoming highly probative. However, monetary conditionality for countries with evolving monetary policy regimes is problematic on all fronts. Some countries that are moving towards financial depth are forward looking and are using the short-term cost of borrowing money (interest rate) to



influence their monetary policy. As such, monetary aggregates are becoming imprecise indicators of effective monetary policy for conditionality purposes. Lane and others report that from 2003 to 2011, the number of countries implementing money targeting has declined by about 25 percent. About 40 percent of the emerging market countries and 20 percent of low-income countries have moved away from money targeting. Most of these countries (for example, Albania, Armenia, Ghana, Georgia, Moldova, Serbia, and Uruguay) adopted a formal inflation targeting framework, while a few have started to implement mixed regimes such as monetary targeting and an exchange rate anchor. In effect, monetary targets still provide financial intelligence.

From theoretical and practical perspectives, the relationship between inflation and money is generally presumed to be strongly related. As such, monetary aggregates are still considered to be an important tool for assessing inflationary conditions. Yet, because it is difficult to track the relationship between nominal monetary targets and monetary policy, the impact of monetary policy on output and inflation could be imprecise. Part of the empirical evidence suggests that the monetary policy transmission mechanism—the channels through which policy decisions influence real activity and inflation in the short-to-medium term—is weak or unreliable in developing countries (Mishra and Montiel, 2012). However, Berg and others (2013) find evidence that monetary policy has stronger effects in countries where policy is more clearly signaled to financial markets through a meaningful policy rate, such as Kenya and Uganda. Although there may be specific country circumstances where this is the case, the cause-effect relationship cannot be clearly established. The next section examines the exchange-rate-inflation conundrum in the context of IMF conditionality.

#### **4. Macroeconometric discussions and findings: From fixed-exchange rate to the inflation puzzle**

Conditionality is the quantitative device that the Fund uses to ensure that its funds are utilized temporarily, leading to performance criteria that are measured in quantitative targets on a number of variables that are jointly determined by the Fund and member countries. A floor is set at net international reserves (NIR) threshold and a ceiling is set at net domestic assets (NDA) of central banks. Although each country has the prerogative to adopt the monetary policy framework of its choice, quantitative targets minimize the ability of monetary authorities to successfully target inflation.

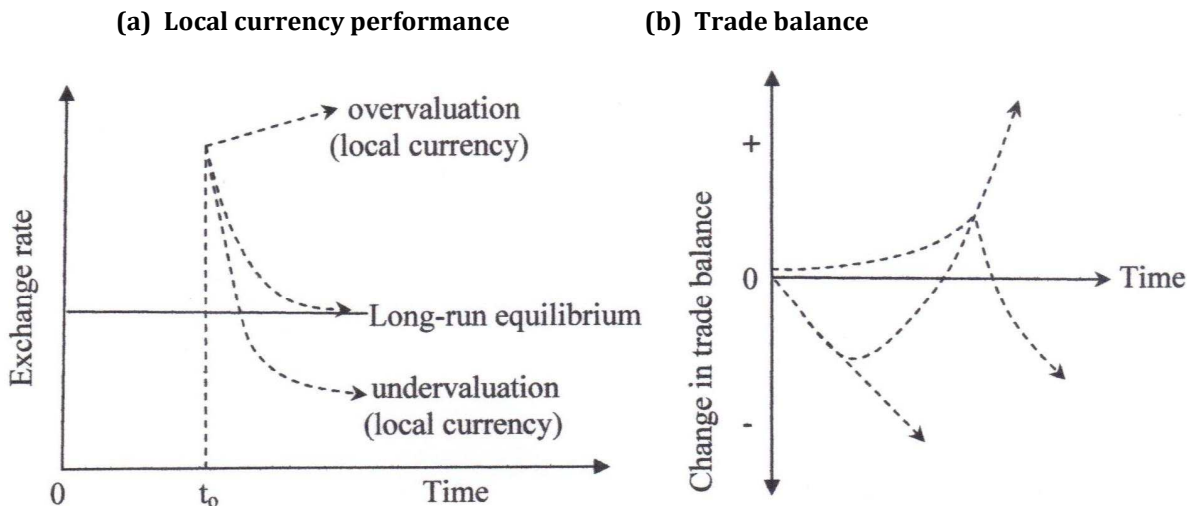
Monetary targets are intricately related to stability of balance of payments. The primary focus is presumed to be external sustainability rather than tight control over inflation. When NIR starts falling towards a targeted floor, say as a result of external shock, some amount of tightening may be required through open market operations. This would shift the LM curve inwards (see Figure 2b). It is hoped that increases in interest rate will provide a backstop to NIR losses. Even though the flexible regime requires less defense—thereby providing NIR savings—threats to inflation targets could require NIR losses.

Since monetary authorities cannot commit to exogenous variables over which they have no control, surveillance policies must also proactively analyze potential responses to shocks (deviations from inflation targets). Figures 1(a) and (b) are indicative of the uncertain trajectories of currency performance and the potential paths of the trade balance of a nation after devaluation. Theoretically, the devaluation of a currency increases the potential for the acquisition of foreign currency as foreign demand for domestic products increases from  $F_{D1}$  to  $F_{D2}$ , thereby increasing the supply of foreign currency to reduce trade deficits and improve trade balances (Figure 2a).

Given that the Fund has legal commitment to equality of treatment, standard policies are normally problematic. However, Blejer and others have suggested that the adoption of a

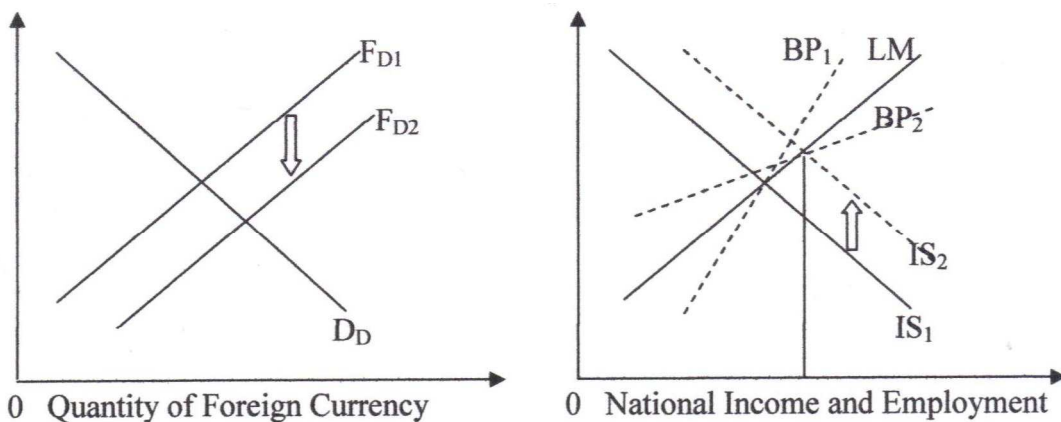
common rule, such as the Taylor Rule, could be a useful benchmark for strengthening monetary conditionality for short term interest rate, or the monetary base (bank reserves and currency in circulation).<sup>3</sup>

**Figure 1: Pegged Local Currency and Balance of Trade Trajectories after Devaluation**



**Figure 2. Currency Valuation and Internal and External (I&E) Imbalances**

$\varepsilon = F_C / D_C$  (a) Probable devaluation effect      i (b) I&E imbalances without devaluation



<sup>3</sup> The Taylor Rule sets the nominal interest rate as a function of a targeted real rate and two gaps: (a) the output gap, and (b) the inflation gap, with the sensitivity parameter for output usually ranging between 0 and 0.5, and the sensitivity parameter for inflation in the range of about 1.5 to 2 percent.

Questions about the theoretical underpinnings of exchange rate stability and macroeconomic stabilization are not new. In the 1960s, Mundell and Fleming advanced the view that fiscal and monetary policies can be utilized to achieve both internal and external balance without resort to exchange rate policy. Consider Figure 2(B) in which the trade accounts of national income are less sensitive to interest rate changes. The investment and savings (IS) curve shows the various combinations of real interest rates ( $i$ ) and national income for which the goods and services markets can be in equilibrium, and the liquidity and money (LM) curve shows the various combinations of interest rates ( $i$ ) and national income for which the financial markets are in equilibrium. On the other hand, the balance of payments curve (BP) shows the various combinations of interest rates ( $i$ ) and national income for which a nation's balance of payments can be in equilibrium for a given exchange rate.<sup>4</sup> For the balance of payments to be in equilibrium, trade deficits and surpluses must correspond to net capital inflows and outflows respectively.

The change in the current account, a component of the trade account, for a small open economy with residual capital flows can be posited algebraically and more directly. Krueger (1984) had shown that since the net current account (NCA) is a function of exports (X) and imports (M), which in turn are also contingent on national income (Y) and the prices of domestic currencies ( $\varepsilon$ ) (exchange rates), changes in national income and interest rate could also affect NCA:

$$\text{NCA} = X(Y, \varepsilon) - M(Y, \varepsilon); \quad (13)$$

$$\text{where } Y = Y(G, i, \varepsilon); \quad \frac{\partial Y}{\partial G} > 0; \quad \frac{\partial Y}{\partial i} < 0; \quad \frac{\partial Y}{\partial \varepsilon} > 0. \quad (14)$$

With very modest arguments, national income depends on government spending (G), the real interest rate ( $i$ ), and the price of domestic currencies.

$$\text{BP} = \text{NCA} + I; \quad (15)$$

where I is for the level of investment that depends on  $i$ .

Totally differentiating with respect to G and  $i$  (exogenous variables) and assuming that the exchange rate is insignificantly variant (constant), Equations (14) and (15) can be written as:

$$dY = \frac{\partial Y}{\partial G} dG + \frac{\partial Y}{\partial i} di \quad (16)$$

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<sup>4</sup> The goods and services markets are also in equilibrium when injections into the system (as a result of spending, exports, and investments), correspond to leakages, which are the result of savings, imports, and taxes, out of the system. For analytical reasons, money is demanded for transaction and speculative purposes. The speculative desire to hold money is to avoid the risk of falling asset prices, which also enables the risk-averse investor to take advantage of rising asset prices in the future; see also Salvatore, pp.647-668.

$$dBP = \left( \frac{\partial X^-}{\partial Y} - \frac{\partial M^+}{\partial Y} \right) \left( \frac{\partial Y^+}{\partial G} dG + \frac{\partial Y^-}{\partial i} di \right) + \frac{\partial I^+}{\partial i} di. \quad (17)$$

Evidently, any combination of income and balance of payments targets may be in agreement. For a given real income, BP can be improved by increasing the interest rate and government expenditure. Analogously, for a given level of BP, real income (Y) can be increased by increasing both interest rate and government expenditure. In effect, the Mundell-Fleming (IS-LM-BP) model suggests that any satisfactory analysis of exchange-rate determination and the balance of payments must take capital flows as well as the interaction of the current and capital accounts into consideration (see also Krueger, 83-86).

Figure 2(b) suggests that it is impractical to maintain internal and external balance by conducting both contractionary monetary and contractionary fiscal policies when the responsiveness of trade accounts to interest changes is not very significant in a relatively small open economy. With higher levels of unemployment, expansionary fiscal policy may be desirable, with the expectation that external balance could be achieved (the BP curve rotates from BP<sub>1</sub> to BP<sub>2</sub>) over time.

The new approaches to conditionality, involving internal and external balances, are somewhat grappling with the tenuous problem of exchange rate determination and macroeconomic price stabilization. Can a general theory be established that there is a long-run relationship between inflation and the money supply? While such a relationship can be established for some developing countries with a history of high inflation, advanced economies such as the UK and the US are not very good examples of such a relationship (see Table.1).

Cointegration tests reveal that a general theory of money supply and inflation over extended periods of time will vary from country to country. This monetary puzzle necessitates a more fluid approach to stabilization policies with long-term targets and consequences. For an evaluation of a longer time horizon, consider the inflation ( $\pi$ ) and money supply ( $M$ ) series (dynamics) of 52 years:

$$\pi_t = \pi_{t-1} + U_t, \quad U_t \sim iin(0, \sigma_U^2), \text{ and} \quad (18)$$

$$M_t = M_{t-1} + V_t, \quad V_t \sim iin(0, \sigma_V^2); \quad (19)$$

where  $U$  and  $V$  are serially and mutually uncorrelated errors. The series will be integrated iff a linear combination of the series produces a stationary process:

$$\pi_t - \alpha - \beta M_t = \varepsilon_t, \quad \varepsilon_t \sim iin(0, \sigma_\varepsilon^2); \quad (20)$$

The pace at which the gap between the growth of the money supply and inflation can be narrowed periodically, is known as the speed of adjustment. If the inflation-money ratio exceeds the long-run average value, the expectation is that the ratio should move towards the long-run equilibrium value defined by an error correction model<sup>5</sup>:

<sup>5</sup> Further, consider the random walk ( $\pi_t - \pi_{t-1} = U_t$  and  $M_t - M_{t-1} = V_t$ ) and drift ( $\alpha_1(\pi_{t-1} - M_{t-1}$  and  $+\alpha_2(\pi_t - 1 - M_{t-1}))$ ) representations of the two processes. A linear combination of the two processes gives:  $\Delta\pi_t = \phi_0 + \phi_1\Delta\pi_t + \phi_2\Delta M_t + \gamma(\pi_{t-1} - \beta M_{t-1}) + \eta_t$ ; where  $\alpha_1$  and  $\alpha_2 = \gamma$ —an indicator of the speed at which the deviation or distance of the two processes converges to correct past disequilibria,  $\beta$  is the cointegrating parameter that shows the effect of past money supply on inflation, and  $\eta_t$  is for the normally distributed errors (impulses).

$$\Delta\pi_t = \alpha_0 + \Delta\pi_{t-1} + \Delta M_{t-1} + \gamma(\pi_{t-1} - \beta M_{t-1} + \xi). \tag{21}$$

When series are cointegrated, deviations are corrected over time with gamma as an indicator of the speed of convergence. The role of money and inflation in the surveillance literature is of specific econometric interest.

Inflation is measured in terms of the annual growth rate of the GDP implicit deflator. The author prefers the implicit deflator as a measure of the general price level because it is not a disaggregated index like the consumer price index (CPI) or the producer price index (PPI). As such, the growth of the implicit deflator shows the rate at which the general price level changes in the aggregate economy (macroeconomy). The GDP implicit deflator is the ratio of GDP in current (nominal) local currency to GDP in constant (base) local currency. The data for this variable have been obtained from the World Bank’s World Development Indicators (WDI, 2014). Money and quasi money comprise the sum of currency outside banks, demand deposits other than those of the central government, and the time, savings, and foreign currency deposits of resident sectors other than the central government. This definition of money supply is frequently characterized as M2 to include money and quasi money. It is measured as a percentage of GDP and broad enough to accommodate money that is used as a store of value for future transactions. Data for the variable have also been collected from the WDI (2014). If the aggregate money supply and inflation are cointegrated, they are jointly determined and endogenous. An examination of the long-term relationship between the growth of money supply and the general price level for a selected group of countries is reported in Table 1.

**Table 1: The Long-run relationship between inflation and money supply (1960-2012) (Johansen unrestricted cointegration rank test)**

	Argentina	Brazil	Ghana	Mexico	UK	USA
Trace Statistic	38.90	34.38	33.55	39.16	9.54	3.99
p-value	(0.00)**	(0.00)**	(0.00)**	(0.00)**	(0.32)	(0.90)

Notes: The null hypothesis is that there is no cointegrating equation for one year lags, and the sample is adjusted (1963-2012). One star and two stars denote rejection at 0.10 and 0.05 levels respectively. The author has estimated the following trend assumption based on visual inspection of the data and theory:  $H_1(r) : \Pi y_{t-1} + Bx_t = \alpha(\beta' y_{t-1} + \rho_0) + \alpha \perp \gamma_0$ ; where  $r$  is the number of cointegrating relations (cointegrating rank or number of linearly independent rows and columns),  $\pi$  is the coefficient matrix,  $\beta$  is for each column of cointegrating vector,  $\rho$  captures the presence of an intercept expression for the cointegrating equation,  $\alpha$  and  $\beta$  are matrices with rank that ensure stationarity such that  $\Pi = \alpha\beta$  and  $\beta' y_t$  is  $I(0)$ , and  $\alpha \perp \gamma_0$  are the deterministic terms outside of the cointegrating relations. The trend assumption is stochastic since there is no trend in the cointegrating equations. Refer to Figures 4a and b in Warburton (2014) for further discussion of broad money growth and inflation in Argentina.

The trace statistic tests the null hypothesis of  $r$  cointegrating relations against the alternative of  $k$  cointegrating relations, where  $k$  is the number of endogenous variables, for  $r = 0, 1, \dots, k-1$ . The alternative of  $k$  cointegrating relations corresponds to the case where none of the series has a unit root and a stationary VAR may be specified in terms of the levels of all of the series. The trace statistic for the null hypothesis of  $r$  cointegrating relations is computed as:

$$LR_r = (r | k) = -T \sum_{i=r+1}^k \log(1 - \lambda_i); \tag{22}$$

where  $\lambda_i$  is the  $i$ -th largest eigenvalue of the matrix (Eviews 7). All specifications and estimations are derived from Eviews 7. While a long-term relationship between inflation and the money supply can be established for Argentina, Mexico, and Ghana, establishing a direct

long-term relationship between inflation and the money supply in the UK and the US can be spurious.

Of course, the US dollar and the British pound have substantial network externalities. They are very useful convertible currencies because others are willing to hold them to conduct international transactions with them.<sup>6</sup> The findings that are reported in Table 1 corroborate Lane et al. They found that the short-term relationship between money and inflation was stronger for countries with high inflation and low financial development in the earlier period, but it declined across the board over the last decade. (Lane et al.). Their finding could be extended to include a longer time horizon.

In effect, a fundamental problem with the conditionality mandate is its short-term criterion. Over extended periods of time, it is reasonable to envision why some members may have problems with quantitative targets, fiscal consolidation, the targeting of inflation, and declining economic growth. The interaction of variables is far from uniform over longer periods of time.

The inflation triggers are imprecise and they might only have some limited short-term relevance. For example, Figure 2b shows that tighter monetary policy to correct trade imbalances without exchange rate adjustments could ultimately result in increased unemployment with potential long-term consequences. Alternatively, there must be a propensity to engage in expansionary fiscal policy during monetary contraction when national output is not very sensitive to interest rate changes, assuming that the required level of full employment coincides with equilibrium in all markets. As the economy adjusts gradually, trade accounts can be improved (the rotation of  $BP_1$  to  $BP_2$ ) to also attain external balance. The bivariate analysis also suggests that exogenous variables may be critically important.

The empirical results of this paper have been presented in Table 2. The adjustment periods (the time periods for which the growth in money supply have not deviated too far from the rate of inflation) have been relatively longer in Ghana and Argentina. The cointegrating parameter that shows the effect of changes in M2 as a percentage of GDP on the general price level for Argentina has been fairly large and positive. Since the money supply is positive and fairly large, this suggests that the general price level must fall to get back to equilibrium. Without any stable exchange rate mechanism, the adjustment to equilibrium could be accomplished by increasing real output through the fiscal policy mechanism (see Figure 2b).

The cointegrating parameter for the growth in the money supply as a percentage of GDP on the general price level in Mexico and Ghana have not been discovered to be significantly large and consequential. The cointegrating parameter for the growth in Brazil's money supply is also large but the speed of adjustment is elusive and indeterminate.

If exchange rate cannot be significantly adjusted to alter output levels (see Figure 2b), then either real output must be increased or expansionary fiscal policy should be utilized to

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<sup>6</sup> This privilege is often times associated with the so-called "exporting-inflation" syndrome, whereby increases in the money supply does not necessarily cause the domestic general price level to rise to any significant extent because access to US credit fosters consumption of US products. Without any sterilization, the relative value of other currencies is expected to appreciate, *ceteris paribus*. A close corollary of this analysis is original sin, the inability of countries to borrow funds that are denominated in their currencies (Eichengreen et al.). Of course, such currencies generally have insignificant market share and are usually inconvertible.

facilitate an increase in real production or long-term productivity. It should be recalled that implicit deflator (the measure of inflation) is the ratio of nominal to real GDP.

**Table 2: Adjusting variations in money supply and inflation (1960-2012) (t-stat in parenthesis)**

Country	Adjustment Parameter	Estimated Time periods for Adjustment (years)	Effect of Past Money Supply on Inflation
Argentina	-0.48 (-2.83)**	4	47.27(2.0)**
Brazil	-0.07(-1.72)	NA	26.27 (13.79)**
Mexico	-0.15(-3.21)**	2	0.74(0.77)
Ghana	-0.38(-2.11)**	3	1.75(1.28)

Notes: Adjustment parameter is for cointegration Equation 1 (cointEq1) with inflation as the dependent variable. The adjustment parameter for Mexico is estimated over a two-year period. The adjustment parameter for Brazil is uncertain even when the money supply is considered over a period of one to two years. The time periods for adjustment has been calculated as  $(\ln 1 - \tau) / (\ln(1 - \gamma))$  and as a percent of available information (52 years); where tau is a dissipation rate of 95 percent and gamma is the estimated speed of adjustment.

## 5. Conclusion

Though adjustments of the growth in money supply as a percentage of GDP to inflation in the long-run seem to occur over a shorter period of time for the countries considered, conditionality and the surveillance infrastructure will be constraining when there is a propensity to foster fiscal and monetary contractions concurrently in the presence of significant unemployment (refer to Figure 2b). For countries with underdeveloped financial markets and bad governance, trade accounts are not very sensitive to interest rate changes. This makes it unlikely that they will attain external balance within a short period of time. It also raises the specter of higher levels of unemployment when fiscal contraction reinforces monetary contraction. As a policy measure, Article IV obligations to reduce inflation when exchange rate mechanisms are ineffective must also consider the levels of unemployment and long-term productivity that should be generated through the fiscal channel. Of course, the efficacy of less restrictive conditionalities under the Article IV mandate will ultimately be contingent on the quality of governance, as well as foreign absorptive capacity and exogenous conditions, if long-term external and internal balances are to be achieved.

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