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**Money Still Makes the World Go Round: The Zonal View**

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Abstract

Many leading monetary economists have come to regard the monetary aggregates as obsolete measures of the monetary policy stance. This critique has led some to view money as having lost its central role in the conduct of monetary policy. We say to those advocating excising money from monetary policy, “not so fast”. To better understand the potential role for money, we develop a zonal view of monetary policy which reflects the historical regularity for the relative informativeness of the quantitative measures of monetary policy, such as the monetary aggregates, and real interest rates to depend on the inflation zone in which a central bank finds itself. The zones range from high inflation (zone 1) to deep deflation (zone 5), with intermediate zones of moderate inflation (zone 2), low inflation (zone 3) and low deflation (zone 4). We find considerable support for this view in the historical data which stretches back to the 19<sup>th</sup> century. Seen from this perspective, the past experience of central banks casts doubt on the singular importance often attributed to the short-term real interest rate as an indicator of the stance of monetary policy. This applies especially in the current low inflation environment in which many central banks find themselves. The zonal view has far-reaching implications for monetary policy frameworks, for the analytical efforts to understand the monetary policy transmission mechanism and for central bank communication strategies.

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## I. Introduction

Many leading monetary economists have come to regard the monetary aggregates as obsolete measures of monetary policy stance, especially in reference to the ECB's twin pillars. This critique has led some to view money as having lost its central role in the conduct of monetary policy.<sup>1</sup> This general sentiment has also found its way into newly adopted monetary policy frameworks in a wide range of countries. Indeed, most inflation targeting regimes have put limited, if any, emphasis on the monetary aggregates in their adopted frameworks. And even those central banks which have seen their frameworks evolve in a more organic manner over the years have been affected by the diminished regard in which the monetary aggregates have come to be held both inside and outside central banks; the recent decision of the Federal Reserve Board to discontinue its collection and publication of M3 is a case in point. To be sure, central banks still operate in short-term money markets with the objective of altering the supply of reserves as a means to influence liquidity. But these central bank operations are usually treated as behind-the-scenes activities associated with open market operations.

Nonetheless, to those advocating the removal of money from monetary policy, we say "not so fast". The role of the monetary aggregates is still fundamental in the conduct of monetary policy even if it may have been overshadowed during recent decades. In part, the more diminutive role of the monetary aggregates, in many respects, is a natural by-product of the favorable low and stable inflation environment that has been achieved. It is not, as some have suggested, that the monetary aggregates have simply become obsolete. In fact, in the low inflation environment, a wide range of traditional guideposts for policy appear to have become less reliable.<sup>2</sup> It is important in interpreting these changes to place them in a broader historical context. By doing so, one can see that the mistake is not putting too much weight on the monetary aggregates as a measure of the stance of monetary policy; rather the mistake is to infer from recent changes in the empirical behavior of interest rates and money that the monetary aggregates have become obsolete.

This broader perspective also highlights the importance of a nuanced understanding of the practical role of money in central banking. First, as Lucas (1976) emphasized, a fundamental change in the policy environment should alter empirical regularities amongst key macroeconomic variables. Greater attention to uncovering the evolving and possibly subtle relationships, rather than being dismissive of them, would seem to be a more productive approach at this juncture. Second, the success of central banks in achieving and maintaining low, stable inflation regimes has undoubtedly been beneficial. But economic history is replete with examples of victory over various scourges only to be replaced by others. Hoping for the best, but preparing for the various contingencies, would seem to be the policy dictated by prudence. In this sense, research on the monetary aggregates remains essential, owing to our view that the monetary aggregates give central banks a wider array of options than simply considering real interest rates as the only relevant guide in accounting for variation in inflation and nominal income. In this sense, McCallum's model (1999) of the money market in a modern monetary policy framework is consistent with our view of the macroeconomy and aggregate price determination. The monetary aggregates are useful measures of the policy stance even controlling for interest rates, and especially so under various circumstances characterized by high inflation, deep deflation and the situation in which policy interest rates

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<sup>1</sup> See, eg, Begg et al (2002), Gali et al (2004), Walsh (1998) and Woodford (2003).

<sup>2</sup> See, eg, BIS (2005, 2006)

are near the zero lower bound. Ultimately, of course, the degree to which this is relevant is an empirical issue.

In this paper, we describe a hypothesis we call the zonal view of monetary policy and offer empirical evidence in support of it.<sup>3</sup> Broadly speaking, the zones of interest span a range from high inflation (zone 1) to deep deflation (zone 5), with intermediate zones of moderate inflation (zone 2), low inflation (zone 3) and low deflation (zone 4). The implications of the zonal view go straight to the heart of the current monetary policy debate. Under the zonal view, the information content of quantitative measures of monetary policy such as the monetary aggregates (and credit aggregates in more financially advanced economies) versus, say, short-term real interest rates, depends on the inflation zone in which a central bank finds itself. Naturally, the inflation dependence of the zones should not be construed to represent a structural relationship, owing to the endogenous nature of inflation. But these zones might be best thought of as shorthand used to broadly characterize the policy environment, not least being the conservatism of the central bankers and the way in which economic agents update their inflation expectations. We will argue that these zones provide a simple but useful taxonomy to reflect historical regularities between the level (and variability) of inflation and the relative usefulness of the monetary aggregates and real interest rates as measures of the stance of policy.

From the outset it is important to note that we are not advocating 1970s-style intermediate monetary aggregate targeting. Rather we see various uses of the monetary aggregates in light of their special role in monetary theory. We maintain that inflation is fundamentally a monetary phenomenon. This suggests various ways in which the monetary aggregates could be used by central banks, depending on our knowledge of the monetary policy transmission mechanism. On the one hand, if the exact linkages between the monetary aggregates and macroeconomic outcomes are well understood, the monetary aggregates could be used profitably as intermediate targets. On the other hand, under much less rigorous conditions, the monetary aggregates could be used for monitoring purposes, possibly as a monitoring range. Between these two extremes, central banks have the option to use them, say, as long-range targets, assuming either a reliable conditional or unconditional path for velocity and real output growth is available. In addition, central banks could rely on the aggregates as guideposts for cross-checking purposes with respect to medium- and longer-term price stability objectives, as the ECB has formally adopted in its policy framework.

The rest of the paper develops these points in greater detail. Section II briefly delineates the broad contours of the long-standing debate over interest rates versus quantitative measures such as the monetary aggregates in the conduct of monetary policy. Section III describes the zonal view with special attention to the historical policy milieu that central banks have faced. Section IV presents an empirical methodology to test the main implications of the zonal view and reports our empirical findings. Section V concludes with implications for monetary policy.

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<sup>3</sup> Bordo and Filardo (2005) discuss the potential importance of thinking about the monetary policy challenges in a zonal view but focus more narrowly on the tradeoffs faced by central banks in deflationary environments.

## **II. Changing views on the monetary aggregates and interest rates as measures of the policy stance**

Traditionally central banks have used short-term interest rates as both their policy instrument and as a policy indicator because of the close connection between central banks and financial markets. This debate has deep roots in the Banking School views of the early 19<sup>th</sup> century (White, 1984). The Great Inflation of the 1960s and 1970s convinced most economists and policy makers of the validity of Milton Friedman's (1963, 1968, 1982) reading of the monetary history and the argument that inflation is "everywhere and always a monetary phenomenon". This led to greater emphasis on the monetary aggregates in the conduct of monetary policy and, throughout the industrialized world, the explicit adoption of monetary aggregate targets in the mid-1970s. The modus operandi was similar in many respects. The Federal Reserve, the Bank of England and the Bundesbank, amongst others, would announce a target range for the path of the monetary aggregates and then manipulate their policy tools to hit the target. In theory, the resultant paths would, in turn, produce desired paths for nominal income growth and inflation. Monetary aggregate targeting of this variety required a detailed analysis and forecasting of short-run money demand and money supply (Poole (1970)), which in practice entailed setting a short-term interest rate to achieve its desired monetary target, given the determinants of money demand (Meulendyke (1998)).<sup>4</sup>

The policy strategy was heavily criticized in the 1970s and 80s by many but most persuasively by Charles Goodhart (1984), who invoked "Goodhart's Law", stating that financial innovation would lead the public to substitute away from the central bank's chosen monetary aggregate. The historical evidence of instability in the demand for money in every country during the 1970s and 1980s appears to have reflected financial innovation in the face of inflation and disinflation and a common lack of understanding of how the innovations were blurring the relationships between the monetary aggregates and other macroeconomic developments. As a result, major divergences between actual money growth and the targets arose (Bank of England (1986), Freedman (1983), Goldfeld (1976), Johnston (1985)).

Ultimately, very limited success in stemming inflation led most central banks to abandon explicit monetary targeting beginning by the late 1970s and early 1980s. There were some well-known attempts to raise the primacy of the monetary aggregates in central banks to end high inflation, but results were mixed. To be sure inflation came down. But the process was not seen in a wholly positive light. (Here we are alluding to the specific efforts of Volcker in the United States and Thatcher in the United Kingdom.) The resulting recessions discredited the efforts in the eyes of many, especially those who expected small sacrifice ratios owing to the putatively well-broadcasted program of disinflation. Others soured on the "monetarist prescription" owing to the resulting whipsaw volatility of interest rates and the associated financial stress. These and other negative post-mortems that were put forward at the time led to a critical mass of discontent with respect to the use of the monetary aggregates in the policy process, despite the pleas of many who argued that the central banks never truly implemented a authentic monetarist program.

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<sup>4</sup> The earlier literature circa 1960s focused on short-term interest rates versus monetary aggregates as intermediate targets Laidler (2004b). Some of the later literature focused on base control (eg McCallum (1989)). We abstract from this distinction and instead view the issue as focusing on the choice of reliable measures of monetary policy's future impact on the economy, ie as a reflection of the stance of monetary policy.

By the mid-1980s, the international experiences with high and variable inflation and the instability of money demand led central banks to return to their traditional emphasis on short-term interest rates as the principal indicator of the stance of policy and to increasingly downplay the role of monetary aggregates in the policy process. Exceptions in the industrialized countries were arguably the Bundesbank and Swiss National Bank. By end of the 1990s, countries began adopting explicit inflation targeting, such as the Bank of England, Bank of Canada, Reserve Bank of New Zealand, etc (IMF (2006)). At the same time, interpretations of the policy implications of rational expectation models and a number of empirical studies (notably Sims (1980)) also undercut support for the monetarist approach.

By end of the twentieth century the traditional use of the monetary aggregates largely disappeared from central bank radar screens. However, there were some key exceptions to the wholesale abandonment of the aggregates. The traditional emphasis on the aggregates, if not the practice of the Bundesbank, became a centerpiece of the ECB's policy framework in its twin pillars approach.<sup>5</sup> The monetary aggregates played a central role in the monetary analysis pillar, owing to the fact that the monetary aggregates, especially long swings in them, were viewed as providing valuable information on medium- and long-run inflation trends. To a lesser degree, the two perspectives approach of the Bank of Japan recognized a role for the quantitative measures of monetary policy, as did its former quantitative easing policy (Ugai (2006)). The Swiss National Bank also retained some of its traditional emphasis on the monetary aggregates as an information variable (Kugler and Rich (2002), Rich (2003)). Interest in the broad money and credit aggregates as measures of the stance of policy has also grown at central banks in recent years as have concerns about excess liquidity, asset prices and monetary policy.<sup>6</sup>

### **III. Monetary policy and the zonal view**

The historical record has provided a wide range of experiences from which to draw some conclusions about the usefulness of monetary policy. In this section we offer a holistic approach to determining the appropriate monetary policy framework.<sup>7</sup> In general, history shows that the appropriate framework depends on the inflation circumstances or, more precisely, the inflation zone in which a central bank finds itself. The zones span the spectrum from high inflation to deep deflation; for a visual summary of this view, see Figure 1. We discuss each zone and its implications for monetary policy tradeoffs, in turn, emphasizing what we have learned from the historical record.

In the end, we find that the predictability (not necessarily stability) of velocity over various time horizons is an important determinate of the attractiveness of the monetary aggregates as a guide for policy. But, it is also important to note that the ability of interest rates to reflect the stance of monetary policy is far from perfect. We question the infallibility of using rates, especially short-term interest rates, as a reliable indicator of the stance of monetary policy in all situations. Such drawbacks are magnified when considering the term

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<sup>5</sup> For an alternative view of the Bundesbank's stated framework and actual conduct, see Clarida and Gertler (1997).

<sup>6</sup> For a recent review of the policy implications and the reactions of central banks, see White (2006) and Borio (2006).

<sup>7</sup> By holistic, we chiefly mean that the whole perspective is greater than the sum of the parts.

structure of interest rates, especially, on the one hand, in economies with financial markets that are not particularly well developed and, on the other hand, in small open economies with fully-integrated and well-arbitrated financial markets. Having to infer the real interest rate and the natural rate also complicates the practical use of interest rates as policy guides.

### **Zone 1: high inflation**

Zone 1 is characterized by high and volatile inflation, as experienced in Latin America during much of the twentieth century, as well as in infamous European cases of hyperinflation during the interwar period. These episodes provide the clearest example of Friedman's dictum (see , eg, McCandless and Weber (1995)).

The prescription to avoid or escape such circumstances seems simple enough – reduce and stabilize the growth rate of money. Such a simple policy has often been complicated by political pressures to raise revenues by monetary creation (the seigniorage motive). Hence, to keep high and volatile inflation from reappearing, successful monetary reforms have generally gone hand in hand with fiscal reforms (Sargent (1986a)). Such monetary reforms historically have included provisions to slow the rate of money growth and to ensure more central bank operational independence.<sup>8</sup>

Moreover, a package of tight money and fiscal balance can be further enhanced if anchored by a credible commitment mechanism to stabilize inflationary expectations with the concomitant effect of stabilizing velocity. Words alone are not sufficient in such a zone. Words must be backed up with actions. History provides several examples of successful private and public action. In the nineteenth century and the early twentieth century, arrangements included adhering to the gold standard (as was the case with the stabilizations in Europe in the 1920s), establishing a provision (by the means of international loans) of gold or other hard currency reserves by a credible authority such as the Bank of England or the Federal Reserve, and, in the interwar period, the Bank for International Settlements. In addition, private sector solutions are possible and, in fact, have been used in the past. Private sector guarantees of international loans, for example, were offered by Rothschilds or JP Morgan both before and after World War I (Bordo and Schwartz (1999)). In the more recent period, IMF-backed reform programs have often played an important role in successful programmatic reforms leading to the elimination of high inflation.

Hence the monetary aggregates provide unambiguous information during very high inflations. During these periods of excessively high inflation, financial markets often seize up and fail to work efficiently. In most cases, rationing and administrative credit controls are in place, all blurring the information content associated with the level and changes in interest rates. While true for hyperinflations, moderate-to-high double-digit inflation rates can coexist

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<sup>8</sup> The costs of large credible disinflations are estimated to be rather small (Sargent (1986a&b)). Andersen (1992) and Ball (1994) provide additional cross-country evidence that the costs of disinflation (in terms of the sacrifice ratio) differ systematically with the size and speed of the disinflation and the extent of wage flexibility. Also see Siklos (1995) for a review of twentieth-century inflations and disinflations. Recently, Erceg and Levin (2003) argue that a policy of monetary contraction inevitably would lead to a (temporary) real contraction in the face of inelastic price expectations and nominal rigidities but, the more credibly perceived the commitment to restore price stability, the lower the sacrifice ratio. Credibility and the cost of disinflation would also depend on future political outcomes and economic shocks – developments which would be difficult to predict with precision. Such developments could also make it difficult to rule out a return to an unfavorable regime of the type seen in the past (Gagnon (1997)).

with functioning and stabilized financial markets, leading to the possibility that even in this zone a mix of interest rates and monetary aggregates may be useful measures of the stance of policy.

## **Zone 2: moderate inflation**

In the case of moderate inflation, such as that which characterized the experiences of the advanced countries in the 1970s and early 1980s, the prescription to improve outcomes is similar in spirit: tight, credible monetary policy. Two different strategies to achieve low inflation generally have been followed: monetary aggregate targeting and an interest rate approach, which, in recent years, has been tied to an inflation targeting framework.

In the former strategy, the central bank uses its policy tool (eg open market operations) to achieve a desired growth rate of some monetary aggregate consistent with achieving its inflation goal on quantity theoretic lines (eg Sargent (1986b)).

In the latter strategy, the monetary authority targets a short-term interest rate to achieve the desired inflation target, accounting for the influence of the real economy via the output gap as well as other variables. To achieve a successful strategy, the monetary authority must ultimately focus on the real interest rate, or else the policy could create unstable nominal conditions; one such necessary condition for stability is that the nominal interest rate moves by more than the change in the inflation rate, which is sometimes referred to as the Taylor principle (Taylor (1999)). In a sense the modern approach is more akin to the Wicksellian approach in which the monetary authority targets the natural rate of interest (Woodford (2003)).<sup>9</sup>

Higher levels of inflation have historically been associated with higher inflation uncertainty. Such volatility would naturally mean that ex ante and ex post short-term real interest rates would be quite volatile. This behavior would generally diminish the usefulness of interest rates as instruments and guides of monetary policy and would lead to a preference for monetary aggregate targeting. As inflation declined and credibility for low inflation increased, interest rate uncertainty would likely decrease and variation in the nominal short-term interest rate would largely reflect variation in real rates. This improvement bolsters the case for using a Wicksellian real interest targeting strategy at the lower end of the inflation range in this zone.

Also with disinflation, velocity would likely become less predictable in large part because financial innovation could play a more dominant role in its fluctuations, further strengthening the case for interest rate guides for policy. Looking forward, if the pace and nature of financial innovation were to have more muted effects on velocity, it is conceivable that central banks would raise the weight of monetary aggregates in their conduct of monetary policy.

In this zone, a mixed monetary policy strategy makes good sense. The monetary aggregates arguably have provided a tried and historically true guide for monetary policy, if

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<sup>9</sup> It took about a decade (1979-1992) for the United States, United Kingdom and other advanced countries to achieve this outcome. Doing so required following a preemptive policy on several occasions (eg 1994) to raise real rates above the prevailing nominal rate and in effect respond to an “inflation scare” (Goodfriend (1993), Orphanides and Williams (2003)). Reynard (2006) emphasizes the role of money during the Great Disinflation.

only to provide a broad mooring of the price level over time; arguably, the relationship between the monetary aggregates and inflation has been imprecise in the short-run but has been fairly close over the medium-run in many economies (Haug and Dewald (2004)). As history has shown, however, financial innovations have at times adversely affected the stability and predictability of velocity; even some of the recent instability has reflected the lingering vestiges of inefficient Great Depression-era regulatory constraints being lifted. To be sure, interest rate “rules” based on output gaps have had success as guides for policy, especially as inflation has become moderate or low. But this does not suggest that the monetary aggregates should be completely ignored. Rather it suggests that relying both on the monetary aggregates and interest rate rules based on economic measures related to short-term price pressures as guides for policy has considerable appeal. The ECB’s two-pillar approach is an example of such an approach (Issing (2001), Issing et al (2001), Masuch et al (2002)).<sup>10</sup>

### **Zone 3: low inflation/price stability**

In this zone, with a credible nominal anchor in place, consumers, workers and investors would incorporate expectations of price stability, or low inflation, into their decision-making. They would also anticipate that departures of the price level from some reference value, or of inflation from the low desired inflation rate, would be transitory and hence would be expected to be offset by corrective monetary actions. In the historical case of the gold standard, the credible commitment to maintain the gold parity, except in cases of wartime emergency, firmly anchored expectations. In credible fiat currency regimes, an anchor could be established as an implicit policy rule to achieve the monetary authority’s inflation, or price level, goal.

In the current policy context, two important issues are raised about how a central bank might best enter this zone and how the central bank might maintain it once it is achieved. For most advanced countries, the success in achieving low inflation environments over the past decade or so through, in many cases, a deliberate and gradual disinflation into this zone from zone 2 has meant that most of the discussion has revolved around its maintenance. The disinflation was achieved via tight monetary policies. Such policies led naturally to subpar growth at times, as the literature on empirical sacrifice ratios has emphasized. There is some evidence to suggest that the more credible and transparent the resolve of the monetary authority, the lower the transition costs (Erceg and Levin (2003)). An alternative, the opportunistic approach may represent a lower-cost strategy (Bomfim and Rudebusch (1998), Orphanides et al (1997)). Under such a strategy, the monetary authority would wait patiently for a favorable price shock to materialize and produce a lower inflation rate. Once achieved, the maintenance of the low inflation/price stability zone is thought to require low-inflation vigilance where the monetary authority adopts a more symmetric approach to fighting both rising inflation pressures and declining inflation pressures. The usefulness of the monetary aggregates and the real interest rate as a guide during a disinflation

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<sup>10</sup> The 2003 restatement of the ECB’s policy strategy emphasized its two pillar approach. The pillars do not represent two approaches, per se, but rather complementary ways to assess the overall assessment of the risks to its price objectives. In particular, economic indicators of short-run price pressures are first analyzed and then cross-checked with the medium-term and long-term implication from the monetary aggregates. Issing (2002) offers an analysis of the deflation risk in the euro area which illustrates how a central bank may use the monetary aggregates to assess the monetary environment. For a dissenting viewpoint, see Galí et al (2004).



is still unresolved. Reynaud (2006) argues that the monetary aggregates remain valuable; this is somewhat at odds with the analysis of Friedman (1984).

Trying to maintain low, stable inflation also raises some difficult questions. Conventional central bank conduct in a low inflation environment clearly suggests that the majority of central banks rely predominately on short-term interest rates to characterize the stance of policy. White (2006) raises some important concerns about whether short-term interest rates alone are sufficiently informative. Asset prices and the quantitative measures of monetary policy are suggested as additional types of information that are crucial to understanding the underlying macroeconomic dynamics, even if the dynamics may be exhibiting lower frequency dynamics than would be conventional. We do not take a stand on the exact transmission mechanism through which money ultimately impacts nominal variables. We leave open the possibility that it could be through asset markets or through traditional channels; this would require additional historical data to be collected and refinements to econometric analysis. Regardless of the exact nature of the dynamics, recent findings by Neumann and Greiber (2004) and Assenmacher-Wesche and Gerlach (2006) suggest that correlations between movements in the monetary aggregates and macroeconomic variables are considerable and robust.

Another important potential policy concern that arises in this zone is the proximity of the zero lower bound for nominal short-term interest rates. If inflation were to fall low enough, possibly into deflation, a monetary authority would generally find it increasingly difficult to use short-term interest rates as an accurate measure of the stance of policy or as a reliable policy guide. Moreover, short-term policy rates could prove to be a poor means to communicate the policy intentions of the monetary authority. Again, the historical evidence from Meltzer (1999) underscores this point.

The problems with short-term nominal interest rates, however, should not be construed to mean that the monetary authority necessarily loses its room for maneuver. In fact, the historical record makes clear that the monetary authority may have ample room, especially if the financial sector is healthy. Moreover, the recent debate over the implications of the zero lower bound has emphasized the various options available for policy makers (Bernanke and Reinhart (2004), Yates (2003)).<sup>11</sup> The monetary authority could adopt non-conventional measures to conduct policy such as targeting long-term interest rates, pursuing unsterilized foreign exchange intervention, adopting quantitative easing (by focusing on monetary targets) and purchasing goods and commodities outright. History suggests that the most time-tested means at the central bank's disposal is the expansion of the money supply via the monetary aggregates – both narrow and broad measures. By using open market operations to increase the reserves of the commercial banks, the central bank could boost aggregate demand and achieve its desired inflation rate (Lucas (2004)).<sup>12</sup>

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<sup>11</sup> They also highlight the use of communication strategies to shape interest expectations, central bank asset rebalancing to influence the relative market supplies of different types of debt securities, foreign exchange rates and the expansion of the monetary base. Andrés et al (2004) illustrates that imperfect asset substitution in a general equilibrium setting can provide an additional channel for monetary policy by operating on the long-term interest rate; the simulation results suggest at least a modest influence is available. McCallum (2000) describes how monetary authorities can use the exchange rate even when the zero lower bound is binding.

<sup>12</sup> The recent academic debate about the monetary aggregates suggests that even at low levels of inflation the monetary aggregates are sufficiently correlated with inflation to be of importance in the conduct of monetary

#### **Zone 4: low-to-moderate deflation**

As discussed in Bordo and Filardo (2005), the low-to-moderate deflation zone (roughly 0% to 3% deflation) might be viewed by some as the next logical step towards truly realizing the benefits of low inflation. In a nutshell, the logic of this approach goes back to insights into the optimum quantity of money by Friedman (1969). He argued that a modest steady-state deflation would lead to greater economic efficiency as the distortions arising from holding non-interest bearing money were eliminated.

Such a deflationary outcome would naturally build on the recent trend toward reducing inflation. Of course, achieving this would technically require tighter monetary policy. But, more important, it would require the resolve to do so. Recent history raises doubts about the eagerness of central banks to pursue such a goal. In contrast to the distant past, policy makers recently have shown a reluctance to target deflation; if anything, monetary policy makers around the globe have generally perceived deflation as being undesirable. To be sure, some central banks have included zero inflation as the lower end of their preferred inflation ranges, the latest being the Bank of Japan. But none have embraced the Friedman proposal of -3% or variants with slightly higher numbers (eg Kahn et al (2003)). In the end, the attractiveness of the moderate deflation policy is an empirical issue that would depend on the relevance of several important assumptions in the theories, not least being the nature of downward nominal rigidities, the size of the expected benefits of steady-state deflation and the level of the real interest rate.

This zone could present some additional complications from the zero lower bound for nominal interest rates. Naturally, the closer the economy initially is to zero lower bound, the more likely the bound would be reached. The likelihood of reaching a zero nominal rate would depend on the steady-state deflation rate and on the type of shocks affecting the real interest rate. Negative demand shocks, for example, would likely generate both transitory declines in the real interest rate and disinflation. In this case, the zero lower bound for short-term nominal interest rates would more likely be hit than if the steady-state inflation rate were higher. A similarly-sized supply shock would present less of a problem because of the tendency for the real rate to increase, and therefore offset the disinflationary effect on the probability of hitting the zero lower bound.

This suggests several possible policy options. One obvious option is for central banks to steer clear of the zero lower bound by choosing a comfortably high steady-state inflation rate – something in zone 3 or possibly zone 2. The cost of this choice would be the foregone stream of benefits from the lower inflation rate. Another option is for the central bank to rely more heavily on quantitative measures of monetary policy rather than on short-term interest rates to guide monetary policy. One interesting idea comes from the theoretical findings of Benhabib, Schmitt-Grohé and Uribe (2002). They argue that a central bank could eliminate some of the problems associated with the zero lower bound for nominal interest rates by switching from an interest rate rule to a monetary aggregate rule when nominal interest rates become sufficiently low.<sup>13</sup> Along these same lines, a monetary authority might use several

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policy. This line of argument using new Keynesian models is most forcefully argued by Nelson (2003). Gerlach and Svensson (2003) also provide some evidence to suggest the P\* model might be useful in European monetary policy. For a more skeptical view about the marginal usefulness of the monetary aggregates, see Svensson (1999a) and Rudebusch and Svensson (2002).

<sup>13</sup> Arguably, the Bank of Japan switch from interest rate targeting to quantitative easing reflects the difficulty of formulating monetary policy in terms of short-term interest rates when the zero lower bound for nominal

different types of contingent rules for various policy instruments, not least of which include targeting exchange market rates, possibly through greater emphasis on exchange rate interventions; this particular option, however, may be more feasible for small economies than for large ones.

Central banks might also find it useful to take actions that more effectively shape private sector expectations, as has been emphasized in the recent literature on the liquidity trap. One possibility is the adoption of a new policy regime with a stronger nominal anchor. As the gold standard period illustrates, a price level anchor appears to have been effective in preventing the zero lower bound for nominal interest rates from being reached. Another means to shape expectations is through words, rather than actions. Central banks that provide a more transparent and credible policy regime are more likely to achieve their goals (Fracasso et al (2003)). Hence, zone 4 would put a premium on central bank credibility and transparency in order to prevent adverse outcomes. This suggests that a central bank interested in entering and maintaining zone 4 would likely want to place particular emphasis on clear, credible communication. Indeed, the stronger the perceived commitment of the monetary authority to maintain the inflation rate in a particular narrow range, or the price level on a particular path, the less likely a pathological expectational channel would be realized. Other possible policies to minimize the macroeconomic risks include well designed fiscal and prudential policies responses.

What we have discussed so far assumes that policy makers fully understand the economic and policy environment. This assumption could be at odds with reality during the transition from a low inflation environment to a low-to-moderate deflation environment. This uncertainty would represent a potential cost policy makers would have to factor into their decision to enter zone 4. The new economic environment could present challenges owing to the possibility that policy makers might need to recalibrate their monetary policy strategies and might find the private sector responding differently than in zone 3. As propounded by Lucas (1976), when a monetary policy regime changes, the economy might respond quite differently – especially if we do not have good theories to model the change. Recent experiences illustrate that this channel is still empirically relevant in the case of deflationary dynamics.

Finally, a key concern arising from being in zone 4 is the possibility that a modest shock could initiate a sequence of events that could cause the economy to careen uncontrollably into an ugly deflation. The distinction between good, bad and ugly deflations is developed in Bordo and Filardo (2005) and Borio and Filardo (2004). While it is impossible to rule out such possibilities in any of the zones, history has shown that deflationary spirals are extreme outcomes that rarely occur in isolation but rather are products of the confluence of bad economic shocks, bad policies and bad luck. We consider this unlikely outcome in zone 5.

### **Zone 5: deep deflation**

In a situation like the Great Contraction of 1929-1933, many have argued - persuasively in our view - that expansionary monetary policy could have softened the blow to the economy. But, as contractionary forces became sufficiently strong and the monetary transmission

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interest rates binds. The policy of quantitative easing (ie targeting commercial bank reserves) had parallels to the monetary targeting strategy followed by the United States in the 1930s.

mechanism sufficiently impaired, expansionary open market purchases could have driven down short-term interest rates to the zero lower bound without the expected stimulus permeating the economy. Clearly, if such an extreme were to occur, a monetary aggregate targeting strategy would be superior in such a situation. Indeed in the 1930s US experience, short-term interest rates did approach zero by the end of 1932. When the Federal Reserve expanded open market purchases by \$1 billion in the spring of 1932, it succeeded in temporarily stimulating the economy. This policy was abandoned after several months, some argue, because of concern over the Federal Reserve holdings of free gold (gold reserves in excess of statutory requirements) (Eichengreen (1992)); the evidence, however, is not thoroughly convincing on this point (Bordo, Choudhri and Schwartz (2002)). Others argue that it was abandoned because Congress, which had pressured the Federal Reserve to stimulate the economy, went on recess in July 1932 and the Federal Reserve reverted back to its original “liquidationist stance” (Friedman and Schwartz (1963)).<sup>14</sup> Although the zero lower bound was reached in late 1932, a successful reflationary monetary policy was initiated in March 1933 by the US Treasury actively purchasing gold (and silver) in a deliberate attempt to devalue the dollar.<sup>15</sup> This evidence supports the cases both for conducting open market operations in assets other than short-term paper and for the use of monetary aggregate targeting in the case of severe deflation.

In the case of the US Great Contraction, although monetary policy did eventually end the “ugly” deflation, the recovery was attenuated by other policies followed by the Roosevelt administration. The NIRA, established to artificially raise wages and prices by restricting the supplies of labor and commodities reduced aggregate supply in 1934-35 below what it would otherwise have been (Weinstein (1981), Bordo, Erceg and Evans (2000), Cole and Ohanian (1999)).

In light of the recent deflation in Japan, it is useful to highlight the financial developments during the Great Contraction. The United States effectively resolved its banking crisis by not allowing forbearance (ie all insolvent banks were closed) and the Banking Holiday of March 1933 in which all of the commercial banks were closed for a week to determine which banks were solvent. At the end of the week one-sixth of the nation’s banks were closed. Another policy which aided in resolution was injection of capital into the banking sector by the Reconstruction Finance Corporation (Calomiris and Mason (2004)). Under this view, the moderate deflation in Japan is more symptomatic of deeper supply-side problems than the inability of the Bank of Japan to boost aggregate demand via the expansion of the monetary base. Japan’s current quantitative easing program, with its huge increase in the money stock, illustrates that inflating the economy via monetary policy alone can only go

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<sup>14</sup> Most Federal Reserve officials believed in the “real bills doctrine” which, in its simplest terms, argued that the central bank should only accommodate member bank lending based on self-liquidating real bills issued to finance commercial activity. They should not accommodate bills financing speculative activity. In this view the Great Contraction was said to have resulted from “over-speculation” and it was further believed that open market purchases would only rekindle further speculative lending.

<sup>15</sup> Bordo et al (2002) demonstrate that had the Federal Reserve followed a stable monetary policy throughout the Great Contraction by offsetting the shocks to money demand and supply that occurred, a severe recession could have been avoided. In a similar vein, Christiano et al (2004) conduct a counterfactual exercise in which expansionary monetary policy actions are taken after the shocks are revealed. They are able to avoid the zero lower bound constraint and offset the Great Contraction. Bordo et al (2002) provide simulations which demonstrate that had such policies been followed the Federal Reserve would not have been constrained by its gold reserves.

so far in returning an economy to more normal operating conditions. In particular, monetary policy can certainly boost aggregate demand, as has been clear throughout the historical record and the present in Japan, but its impact on supply-side developments is rather tenuous and the interaction of the supply-side and the monetary transmission mechanism can be seriously distorted in a way that can complicate the calibration of the monetary policy response.

Finally, but not least, it is important to note that, despite the extremes of conditions, it is not clear that a liquidity trap was truly realized in the Great Contraction. If it had been, the monetary aggregates, as well as other instruments of monetary policy, would have been impotent. In such a situation, the monetary authority would have had few concrete options but to wait for fiscal and prudential policies to return the economy to a greater sense of normalcy. A set of intriguing alternative proposals for escaping liquidity traps has been advocated in recent years. Svensson (2003b), Krugman (1998), Eggertsson (2004) and Eggertsson and Woodford (2003) have argued that central banks could manipulate private sector expectations about future price levels, which in turn would boost inflation expectations once the policy was adopted. Svensson (2001, 2003b) offers what he calls the “foolproof” way of escaping a liquidity trap by simultaneously announcing a depreciation of the exchange rate and an elevated price level target. Once the price level target was realized, the monetary authority would then initiate a preannounced exit strategy of a floating rate regime with an inflation (or price level) targeting regime. While sensible in theory, the ability of the monetary authority to precisely and credibly manipulate private sector expectations in a well orchestrated manner is still an open question.<sup>16</sup> Unfortunately, with little evidence of liquidity traps in the historical record, it is difficult to know the likely success or the risks of unintended side effects.

### **The zonal approach: summary**

In sum, monetary policy can eliminate deflation of any magnitude just as it can eliminate inflation. However, the appropriate monetary policy strategy depends on the inflation/deflation zone in which a central bank finds itself. Emphasizing the monetary aggregates appears, from a historical perspective, to be rather important during periods of high inflation and deep deflation. During periods of low inflation, velocity over short periods of time has shown a tendency to be more volatile and unpredictable than variation in the natural interest rate, thereby tilting the balance of the arguments toward the reliance on interest rate instruments in the conduct of monetary policy.<sup>17</sup> However, in the zone of low inflation/price stability and low-to-moderate deflation, the influence of the zero lower bound for short-term nominal interest rates makes reliance on short-term interest rates more problematic; hence, the balance tilts toward the monetary aggregates playing a dominant role as the guide of choice. Finally, even though monetary policy has the ability to generate inflation, it cannot necessarily eliminate stagnation arising from deep-seated structural problems, especially a dysfunctional financial intermediation system. All of this points to a U-shaped pattern in the relationship between the zones and the usefulness of the monetary aggregates relative to real short-term interest rates as measures on the stance of monetary policy.

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<sup>16</sup> Kugler and Rich (2002) have raised some doubts about whether the foolproof way would have worked well in the case of Switzerland in the 1970s.

<sup>17</sup> Laidler (2003, 2004a) makes arguments along related lines.

#### IV. Empirical methodology and results

We now turn to formal econometric methods to assess the empirical significance of the zonal view in G7 and G10 countries. With annual data going back to the 19<sup>th</sup> century, we can sift through the historical record to draw inferences about the wide range of policy experiences faced by central banks. In particular, the zonal view implies threshold values associated with inflation that, in principle, can be inferred from the statistical relationship between the inflation zones in which a central bank finds itself and value of traditional indicators of the stance of monetary policy to account for subsequent macroeconomic performance. This empirical exercise should be thought of as being largely complementary to, rather than substituting for, the historical narratives detailed earlier in the paper. In many respects the narratives provide a richer characterization of the policy environment, especially with respect to the contextual setting, than the application of statistical methods. But the econometric approach offers a different perspective of the same phenomenon, albeit with much more numerical precision. This precision, of course, may be dulled by the inherent limitations associated collecting historical data, especially when stretching far back in time. Nonetheless, as in our previous research, these data are sufficiently informative to shed considerable light on the broad contours of the policy environment.

##### *Two-step estimation approach*

In particular, we take a two-step approach. In the first step, we identify the boundaries of the inflation zones. We use a nonparametric econometric method that is robust to outliers and to particular functional forms. These robustness properties are particularly advantageous when exploring the “forest” rather than the “trees” of a long historical, cross-country dataset. At the same time, the method is flexible enough to allow the possibility of non-linear interactions amongst the variables and the inflation zones. The main criterion in assessing the boundary points is evidence of a changing empirical relationship between the monetary aggregates and real interest rates in accounting for subsequent output performance.

Formally, the zones are estimated with a flexible nonparametric modelling method, known as an adaptive spline threshold autoregression (ASTAR). In this ASTAR model, we assume that our target variable, the change in either inflation or output growth, is a function of the observables,  $X$ , such that

$$\Delta\pi_t = f(X_{t-1}) + \varepsilon_t \quad (1)$$

where  $f$  is an unknown function,  $X_{t-1}$  is a vector of lagged changes in the growth rate of real money aggregates ( $\Delta(\dot{m} - \dot{p})_{t-j}$ ), changes in real interest rates ( $\Delta r_{t-j}$ ) and the level of the inflation ( $\pi_{t-1}$ ). The  $\varepsilon$  is an additive regression error with a mean of zero and a variance  $\sigma_\varepsilon^2$ . This function is approximated with a sequence of product basis functions

$$\hat{f}(X_{t-1}) = \sum_{k=1}^K c_k \mathbf{B}_k(X_{t-1}) \quad (2)$$

where  $\mathbf{B}_k(X_{t-1})$  is the product of  $N$  truncated linear spline functions of the form  $\mathbf{B}_k(X_{t-1}) = \max(0, X_{t-1} - z_1) \times \dots \times \max(0, X_{t-1} - z_N)$ . A by-product of this is a set of thresholds  $\{z_1, \dots, z_N\}$  which are jointly estimated with the linear weights  $c_k$  using MARS (Salford Systems (2001)). Various studies have shown the flexibility and benefits of using this approach over parametric nonlinear threshold models (eg Lewis and Stevens (1991)).

In the second step, we use the estimated zone boundaries to estimate piecewise pooled regressions in order to examine the relative contribution of the monetary aggregates and real interest rates to explaining macroeconomic performance – that is, subsequent inflation and output behaviour. The equations of interest are of the following form:

$$\Delta\pi_t = \alpha + \beta_\pi \Delta\pi_{t-1} + \sum \beta_{mp,j} \Delta(\dot{m} - \dot{p})_{t-j} + \beta_{r,j} \Delta r_{t-j} + \beta_c c_{t-1} + e_t \quad (3)$$

for each inflation zone  $\{z_1, \dots, z_N\}$  and where  $c$  is a crisis indicator (either banking or currency or both). Basic theory would suggest that the coefficients on the monetary aggregates should be positive and on interest rates negative.

In general, the regressions are estimated with standard panel methods, employing fixed effects and robust cross-sectional heteroskedasticity variance-covariance matrices when appropriate. Outliers in the dataset are handled in a nonparametric manner by restricting the range of the variability in the right-hand-side and left-hand-side variables. We deal with outliers by simply truncating the extremes in the data associated with very large outliers. In the case of the change in output growth we generally limited the annual swings to be less than a 5-15 percentage points range in absolute value depending on the zone; for real money growth, less than a 15-20 percentage points range.<sup>18</sup>

Finally, we calculate the goodness of fit of these regressions, zone by zone. In particular, the goodness-of-fit for the restricted regressions are, for example,

$$\Delta\pi_t = \alpha + \beta_\pi \Delta\pi_{t-1} + \beta_{mp} \Delta(\dot{m} - \dot{p})_{t-1} + \beta_c c_{t-1} + e_t, R_{mp}^2 = x_\pi \quad (4)$$

$$\Delta\pi_t = \alpha + \beta_\pi \Delta\pi_{t-1} + \beta_r \Delta r_{t-1} + \beta_c c_{t-1} + e_t, R_r^2 = w_\pi \quad (5)$$

for each zone. The analogous regressions for output are also estimated.

The  $R^2$  metric is used to calculate the relative goodness of fit, zone by zone, on the monetary aggregates and real interest rates in predicting economic activity. One complicating feature of the  $R^2$  is that it is bounded by zero and one. Hence, proportional gains and absolute gains in  $R^2$  may yield give two different impressions about the marginal gain. We therefore report both measures of the relative fit. This relative fit criterion provides an empirical analogue to Figure 1.

The data are annual observations on real GDP, monetary aggregates, CPI inflation, real short-term interest rates and an index of banking and currency crises for G10 economies from the 19<sup>th</sup> century to 2003. Details of the dataset are found in the data appendix.

## Results

Table 1 presents the statistical evidence from the ASTAR specification confirming the inflation thresholds arising from the nonlinear interactions amongst the monetary aggregates, interest rates and output growth for the G7 economies. The main thrust of the results corroborates the analysis based on the historical narratives with five inflation zones

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<sup>18</sup> For the inflation equations, we exclude changes in growth for output and real money greater than (in percentage points in absolute value) 10 and 15 for zone 1 and zone 2, 5 and 15 for zone 3, 15 and 15 for zone 4 and 15 and 20 for zone 5, respectively; for the output equations, 15 and 15 for zone 1, 10 and 15 for zone 2, 10 and 15 for zone 3, 10 and 15 for zone 4 and 15 and 15 for zone 5, respectively.

characterized by high inflation, moderate inflation, low inflation, modest deflation and deep deflation. The statistical thresholds are estimated to be approximately {15, 5, 0-1, -6}. These approximate thresholds were also consistent with those found in the larger sample of G10 economies.

The details indicate that the best fit of this adaptive spline method involves 14 basis functions with nine two-way interactions. All four regressors score highly with respect to the variable relative importance metric. Overall, the  $R^2$  is 0.37 and the estimated coefficients are generally statistically significant at high levels of statistical significance, as indicated by the size of the t-ratios. The basis functions associated with the level of inflation are highlighted in bold; the two thresholds of 0 and 1.27 are fairly close and hence considered a single threshold for the low inflation/modest deflation threshold.

Equations 3-5 are estimated for each of the inflation zones as a means to further explore the nature of the interactions amongst changes in the growth rate of output, the change in the growth rate of real money growth and changes in real interest rates. Tables 2-5 show that the relatively simple specifications for the relationships yield economically reasonable coefficient values, with a generally positive relationship between an increase in real money growth and the change in output growth rate and a negative relationship between an increase in real interest rates and the change in the output growth rate. The intuitively plausible coefficient signs carry over to the change in the inflation rate specifications. The lagging relationship also is consistent with the conventional wisdom that the lags between movements in policy instruments and inflation tend to be longer than for output; the lags for inflation tend to be at least two years and those for output at least one year. Moreover, the best fit also tends to include multi-year moving averages of the money growth variable. This suggests that year-to-year fluctuations in the growth rate of money may not be particularly informative but accumulated changes in liquidity conditions are often rather important. All these results are sufficiently consistent with the general body of past research on the behaviour of the money and interest rates to imply that these are reasonable specifications from both a statistical and economic points of view.

Several zone specific results stand out. The low inflation zone tends to have the lowest fit which might seem odd because it is likely to be the most stable of regimes. However, as is clear from control theory, the greater is the control over the target variable, the weaker the resulting time-series correlation between the policy instruments and the target variable. The evidence in this pooled cross-section sample supports this implication. Naturally, this suggests that there might be gains from further statistical investigation using system methods for zone 3 that might exploit the structural relationships to explore the relative importance of the monetary aggregates and real interest rates as measures of the stance of policy, but this goes well beyond the scope of this paper in terms of modelling (likely requiring careful modelling of expectation formation) and the data requirements (higher frequency and real-time).

The multi-year averages of changes in money growth also appear to be zone dependent. For the inflation regressions, two-year averages for lags 3 and 4 contribute to the statistical fit in zones 1 and 2. In conjunction with the second lag, which is statistically significant for all the inflation specifications, inflation dynamics exhibit a clear statistical relationship with medium-term swings in the monetary growth rates in this historical data, even when controlling for interest rate variation. This finding alone suggests a pre-eminence of the monetary aggregates in monetary policy frameworks. For the output regressions, the importance of medium-term swings in money are much more concentrated in zones 4 and 5. Indeed, the output results also underscore the importance of distinguishing between deflations



associated with declining output and with general output expansion. In Bordo and Filardo (2005), this distinction amongst good, bad and ugly deflations is statistically and economically important when considering the monetary policy implications of deflation. The distinction appears to carry over to the study of periods of accelerating and decelerating output. Of particular note is reduced statistical significance of the real interest rate variation on output dynamics in zones 4 and 5. Most alternative specifications (not shown) tended to either confirm the statistical insignificance or indicate a positive partial correlation. The tendency of the positive correlation is consistent with the finding of Meltzer (1999) that real interest rate variation in deflation episodes may be misleading while monetary aggregate variation exhibits behaviour consistent with standard theory.

The main point of this exercise is to highlight the variation in the explanatory power of money and interest rates across the zones. Two related measures are presented in the tables. First, there is the percentage point difference in  $R^2$  between the specification with the monetary aggregates ( $R_{\Delta M/P}^2$ ) and the specification with the real interest rate ( $R_{\Delta(R-\pi)}^2$ ). A positive value indicates that  $R_{\Delta M/P}^2$  exceeds  $R_{\Delta(R-\pi)}^2$ , and vice versa. Across the tables, the tendency for a U-shaped relationship stands out – it might be characterised as a left-sided smirk rather than a symmetrical smile. But, there is nothing in the theory described above that would be inconsistent with this general shape of a trough in the middle zone with the left and right branches rising. It is also noteworthy that even in zone 3, the explanatory power of the monetary aggregates remains fairly consistent with that of the real interest rate. In the other zones, the explanatory power tends to rise in a relative sense. This general pattern is confirmed by looking at the ratio of  $R_{\Delta M/P}^2$  to  $R_{\Delta(R-\pi)}^2$ . Figure 2 illustrates graphically the estimated pattern for G7 output and inflation behaviour, respectively.

## V. Policy implications and conclusions.

The zonal view has implications for monetary policy frameworks, analytical efforts and communication strategies.

With regard to monetary policy frameworks, the zonal view makes a strong case for central bank flexibility. Central banks have clearly made great advances in economic welfare by bringing inflation down and keeping it stable. In the low inflation environment, the evidence to date suggests that short-term interest rates have been fairly reliable guides. However, past success does not guarantee future returns. While the possibility of a break-out of double-digit inflation seems negligible at this juncture, the risk of deflation remains a constant threat. In a low inflation environment, unless macroeconomic control becomes remarkably better, (bad) deflation might always be one recession away. This aspect of the policy environment cautions against complacency, especially with respect to the temptation to assume that reliable policy guideposts in one zone means that the monetary policy Holy Grail has been found. This suggests that central bankers need to be conservative not only about price stability but also about the current policy paradigm. As argued above, the early inflation targeting regimes were too narrowly focused. An indication of progress has been the movement of inflation targeting central banks to make inflation horizons more flexible. Our analysis would suggest that these central banks could go farther by adopting a more robust policy framework. Most central banks need only look to the ECB and Bank of Japan.

The zonal view points to additional risks that may arise from complacency. The premise of the zonal view is that the monetary policy transmission mechanism is subject to change. Instead of being dismissive, central banks and the research community need to

reinvigorate efforts to examine the subtle linkages between the monetary (and credit) aggregates and the macroeconomy to ensure that our knowledge does not atrophy. If this uninformed state were to materialize, central banks could find themselves ill-prepared for some circumstances that may prove costly and, regrettably, avoidable. The historical record is replete with examples of when policymakers thought they had mastered the art of central banking only to find the opposite to be so. The Great Inflation and the Great Depression were ultimately caused by major policy mistakes. In both cases, more prudent (in retrospect) use of the monetary aggregates might have generated very different outcomes.

All these considerations call for greater analytical efforts to improve both our diagnostic tools as well as our understanding of the appropriate prophylactic measures to deal with the full spectrum of plausible policy environments. At a minimum, central banks should not abandon the monetary (and credit) aggregates in their monetary policy toolkit. Our analysis underscores the fact that monetary policy environments are complex. Yet a constant in the evolving environments is the potential usefulness of the monetary aggregates. They can play an important role in a wide range of circumstances even though the relationships may often be subtle, nonlinear and time-varying. We doubt that such tools can simply be put in a closet and pulled out when needed, especially with financial innovations continuing apace. Likewise, the use of short-term interest rates as guides for policy will only be as good as the assumptions about movements in the natural rate of interest. More research on zone-dependent variation in the natural rate is called for.

An additional consideration in interpreting the recent past is the use of the monetary aggregates and real interest rates as communication devices. With growing interest in transparency, central banks have been seeking the best ways to explain their policy frameworks and decisions to the public. The past complications associated with money multipliers, velocity shifts and the choice of the appropriate monetary aggregate have given interest rates an advantage. And, in the current low inflation environment, velocity developments still appear fairly volatile and difficult to predict over the short run. Over the medium-term and long-term, however, the more predictable relationships suggest that the monetary aggregates can play a role not only in the policy briefing process but also in informing the public about the intentions of policy makers and in assessing their performance.

In sum, we find the zonal view to have far-reaching implications for central banking. The empirical evidence clearly shows a robust correlation between the monetary aggregates and macroeconomic developments, even when controlling for real interest rates. This does not suggest that central banks should revert to monetary targeting. But it does underscore, at a minimum, the risks of dismissing the usefulness of the monetary aggregates for medium-term and long-term price stability and communication strategies. The implication of the zonal view for the design of policy frameworks is more novel. It calls for monetary policy frameworks that are implicitly, if not explicitly, broad enough to cover the feasible policy environments in which central bankers might reasonably find themselves. Some recent changes in the central banking world and in academic quarters indicate that things are starting to move in the right direction, but further progress is warranted.

**Table 1: Inflation zones**

$\Delta\Delta GDP_{t-1} = c_0 + \sum \alpha_j BF_j + e_t, \text{ for } j = 2,3,4,11,13,18,19,20,21,23,26,28$			
Variable	Estimate	t-ratio	Basis function
$c_0$	8.61	5.25	
$BF_1$			$\max(0, \Delta\Delta GDP_{t-1} - 3.85)$
$BF_2$	0.51	11.94	$\max(0, 3.85 - \Delta\Delta GDP_{t-1})$
$BF_3$	-0.34	-6.94	$\max(0, \Delta r_{t-1} + 34.44)$
$BF_4$	-0.34	-3.83	$\max(0, \Delta(\dot{m} - \dot{p})_{t-1} - 5.38)$
$BF_{11}$	0.01	4.91	$\max(0, \Delta(\dot{m} - \dot{p})_{t-1} + 3.71) * BF_3$
$BF_{13}$	-0.03	-4.20	<b><math>\max(0, \Delta\pi_{t-1} - 12.21) * BF_2</math></b>
$BF_{16}$			$\max(0, 5.96 - \Delta r_{t-1})$
$BF_{18}$	0.08	6.38	<b><math>\max(0, 0.00 - \Delta\pi_{t-1}) * BF_{16}</math></b>
$BF_{19}$	-0.146	-3.44	<b><math>\max(0, \Delta\pi_{t-1} - 1.27) * BF_1</math></b>
$BF_{20}$	-0.073	-3.92	<b><math>\max(0, 1.27 - \Delta\pi_{t-1}) * BF_1</math></b>
$BF_{21}$	-0.168	-7.29	$\max(0, \Delta r_{t-1} - 0.448) * BF_1$
$BF_{23}$	0.32	5.67	<b><math>\max(0, \Delta\pi_{t-1} - 5.12) * BF_1</math></b>
$BF_{26}$	-0.02	-6.92	$\max(0, -0.32 - \Delta(\dot{m} - \dot{p})_{t-1}) * BF_{16}$
$BF_{28}$	0.01	2.91	<b><math>\max(0, -6.59 - \Delta\pi_{t-1}) * BF_3</math></b>
<b>Num of obs.</b>	660		
$R^2$	0.37		
<b>Relative variable importance</b>			
$\Delta\Delta GDP_{t-1}$	100		
$\Delta r_{t-1}$	75		
$\Delta\pi_{t-1}$	62		
$\Delta(\dot{m} - \dot{p})_{t-1}$	48		

Note: For G7 countries, 1880-2003 using 30 basis functions with 2-way interactions amongst the variables and with the restriction of at least 15 observations between knot-points.

**Table 2: The Zonal View and G7 Inflation**

	$\Delta\pi_t = c + \sum \beta_j \Delta\Delta(M/P)_{t-j} + \sum \gamma_j \Delta(R - \pi)_{t-j} + \sum \theta_{t-j} \Delta\pi_{t-j} + \alpha X_{t-1} + \varepsilon_t$				
	<u>Zone 1</u>	<u>Zone 2</u>	<u>Zone 3</u>	<u>Zone 4</u>	<u>Zone 5</u>
	$10 < \pi_t$	$5 < \pi_t < 15$	$0 < \pi_t < 5$	$-6 < \pi_t < 0$	$\pi_t < -6$
Constant	1.977 ( 3.04)	0.292 ( 2.74)	0.048 ( 0.83)	-0.567 (-5.44)	-6.322 (-7.17)
$\Delta\Delta(M/P)_{t-2}$	0.325 ( 3.54)	0.141 ( 2.95)	0.010 ( 0.56)	0.152 ( 3.34)	0.368 ( 2.79)
$\Delta\Delta(M/P)_{t-3}$	0.189 <sup>††</sup> ( 1.36)	0.183 <sup>††</sup> ( 3.06)	0.021 ( 1.50)	0.055 ( 1.55)	0.199 ( 1.73)
$\Delta(R - \pi)_{t-1}$				-0.522 (-1.81)	
$\Delta(R - \pi)_{t-2}$	-0.433 (-2.41)	-0.131 (-1.85)	-0.074 (-1.30)		-0.596 (-1.09)
$\Delta\pi_{t-1}$	-0.101 (-1.13)	-0.149 (-1.63)	-0.131 (-4.09)	-0.958 (-3.21)	-0.437 (-5.82)
$\Delta\pi_{t-2}$			-0.131 (-2.08)		
<i>Banking crisis<sub>t</sub></i>				1.591 ( 2.08)	
$R^2_{benchmark}$	0.31	0.16	0.06	0.37	0.66
(1) $R^2_{\Delta\Delta M/P}$	0.20	0.13	0.06	0.35	0.64
(2) $R^2_{\Delta(R-\pi)}$	0.07	0.05	0.06	0.31	0.52
(1) – (2)	0.13	0.07	0.00	0.04	0.12
% gain: (1)/(2)	<b>2.90</b>	<b>2.37</b>	<b>1.03</b>	<b>1.15</b>	<b>1.23</b>
Nobs	41	114	322	119	24

Notes: <sup>††</sup> denotes a two-year average ( $t-j$  and  $t-j-1$ ) of the variable. The  $t$ -statistics are in parenthesis. The results are generally robust to fixed effects. The panel regression was estimated using GLS with cross-section diagonal weights, except for zones (1 and 5) with small sample sizes. The weighting matrix from the unconstrained regression is used in the constrained regressions. The standard errors of the coefficients are estimated using the diagonal form of the panel corrected standard error methodology. The outlier method is described in the text. The sample period excludes the two World War periods, ie 1880-1913, 1922-38, 1948-2003.

**Table 3: The Zonal View and G10 Inflation**

	$\Delta\pi_t = c + \sum \beta_j \Delta\Delta(M/P)_{t-j} + \sum \gamma_j \Delta(R-\pi)_{t-j} + \sum \theta_{t-j} \Delta\pi_{t-j} + \alpha X_{t-1} + \varepsilon_t$				
	<u>Zone 1</u>	<u>Zone 2</u>	<u>Zone 3</u>	<u>Zone 4</u>	<u>Zone 5</u>
	$10 < \pi_t$	$5 < \pi_t < 15$	$0 < \pi_t < 5$	$-6 < \pi_t < 0$	$\pi_t < -6$
Constant	2.268 ( 4.05)	0.415 ( 4.88)	0.021 ( 0.45)	-0.558 (-7.07)	-6.633 (-8.62)
$\Delta\Delta(M/P)_{t-2}$	0.308 ( 3.76)	0.150 ( 3.89)	0.011 ( 0.69)	0.138 ( 4.31)	0.368 ( 3.19)
$\Delta\Delta(M/P)_{t-3}$	0.091 <sup>††</sup> ( 0.75)	0.173 <sup>††</sup> ( 4.15)	0.019 ( 1.53)	0.072 ( 2.58)	0.169 ( 1.51)
$\Delta(R-\pi)_{t-1}$				-0.655 (-2.90)	
$\Delta(R-\pi)_{t-2}$	-0.408 (-2.52)	-0.060 (-0.97)	-0.126 (-2.58)		-0.803 (-1.36)
$\Delta\pi_{t-1}$	-0.093 (-1.10)	-0.233 (-3.17)	-0.128 (-4.68)	-1.032 (-4.41)	-0.454 (-5.98)
$\Delta\pi_{t-2}$			-0.149 (-2.72)		
<i>Banking crisis<sub>t</sub></i>				1.990 (3.03)	
$R_{benchmark}^2$	0.29	0.17	0.06	0.30	0.60
(1) $R_{\Delta\Delta M/P}^2$	0.19	0.17	0.05	0.27	0.58
(2) $R_{\Delta(R-\pi)}^2$	0.05	0.05	0.05	0.23	0.46
(1) – (2)	0.14	0.12	-0.01	0.04	0.11
% gain: (1)/(2)	<b>3.92</b>	<b>3.30</b>	<b>0.85</b>	<b>1.19</b>	<b>1.24</b>
Nobs	50	179	491	196	36

Notes: See notes from Table 2.

**Table 4: The Zonal View and G7 Output**

	$\Delta\Delta y_t = c + \sum \beta_j \Delta\Delta(M/P)_{t-j} + \sum \gamma_j \Delta(R-\pi)_{t-j} + \sum \theta_{t-j} \Delta\Delta y_{t-j} + \alpha X_{t-1} + \varepsilon_t$						
	<u>Zone 1</u> $10 < \pi_t$	<u>Zone 2</u> $5 < \pi_t < 12$	<u>Zone 3</u> $0 < \pi_t < 5$	<u>Zone 4</u> $-6 < \pi_t < 0$		<u>Zone 5</u> $\pi_t < -6$	
				("good")	("bad")	("good")	("bad")
Constant	-0.216 (-0.89)	-0.149 (-0.99)	-0.078 (-1.20)	-0.175 (-1.71)	-1.404 (-6.59)	-0.828 (-0.49)	-1.806 (-1.09)
$\Delta\Delta(M/P)_{t-1}$	0.301 (2.77)	0.122 (1.67)	0.168 (4.67)	0.189 (2.92)	0.591 <sup>††</sup> (3.61)	0.976 <sup>††††</sup> (1.15)	0.403 <sup>††</sup> (1.50)
$\Delta\Delta(M/P)_{t-2}$		0.119 (2.27)		0.035 (0.67)		0.225 (0.59)	
$\Delta(R-\pi)_{t-1}$		-0.161 (-1.41)	-0.324 (-4.30)	-0.168 (-2.15)	-0.169 (-2.16)		-0.077 (-0.33)
$\Delta(R-\pi)_{t-2}$	-0.110 (-1.19)	-0.133 (-0.88)				-0.092 (-0.30)	
$\Delta\Delta y_{t-1}$	-0.241 (-1.19)	-0.135 (-1.09)	-0.331 (-7.68)	-0.323 (-5.52)	-0.317 (-4.11)		
<i>Banking crisis<sub>t</sub></i>		2.588 (1.82)				-5.943 (-0.75)	
<i>Currency crises<sub>t</sub></i>		-4.482 (-2.50)					-6.152 (-1.68)
$R^2_{benchmark}$	0.37	0.29	0.24	0.28	0.57	0.27	0.34
(1) $R^2_{\Delta\Delta M/P}$	0.33	0.26	0.19	0.25	0.50	0.27	0.34
(2) $R^2_{\Delta(R-\pi)}$	0.17	0.19	0.18	0.22	0.36	0.16	0.21
(1) – (2)	0.16	0.07	0.01	0.03	0.14	0.11	0.13
% gain: (1)/(2)	<b>1.92</b>	<b>1.35</b>	<b>1.06</b>	<b>1.13</b>	<b>1.38</b>	<b>1.71</b>	<b>1.61</b>
Nobs	29	59	248	105	30	14	15

Notes: <sup>††</sup> denotes a two-year average ( $t-j$  and  $t-j-1$ ) of the variable; <sup>††††</sup> denotes a four-year average. The  $t$ -statistics are in parenthesis. The results are generally robust to fixed effects. The panel regression was estimated using GLS with cross-section diagonal weights, except for zone 5 owing to the small sample sizes. The weighting matrix from the benchmark regression is used in the constrained alternatives. The standard errors of the coefficients are estimated using the diagonal form of the panel corrected standard error methodology. The outlier method is described in the text.

**Table 5: The Zonal View and G10 Output**

	$\Delta\Delta y_t = c + \sum \beta_j \Delta\Delta(M/P)_{t-j} + \sum \gamma_j \Delta(R-\pi)_{t-j} + \sum \theta_{t-j} \Delta\Delta y_{t-j} + \alpha X_{t-1} + \varepsilon_t$						
	<u>Zone 1</u> $10 < \pi_t$	<u>Zone 2</u> $5 < \pi_t < 12$	<u>Zone 3</u> $0 < \pi_t < 5$	<u>Zone 4</u> $-6 < \pi_t < 0$		<u>Zone 5</u> $\pi_t < -6$	
				("good")	("bad")	("good")	("bad")
Constant	-0.202 (-0.94)	-0.276 (-2.36)	-0.037 (-0.71)	-0.105 (-1.37)	-1.480 (-6.51)	-0.386 (-0.32)	-2.712 (-2.26)
$\Delta\Delta(M/P)_{t-1}$	0.343 ( 3.87)	0.213 ( 4.49)	0.155 ( 5.51)	0.110 ( 2.26)	0.325 <sup>††</sup> ( 2.53)	0.429 <sup>†††</sup> ( 0.97)	0.357 <sup>††</sup> ( 1.60)
$\Delta\Delta(M/P)_{t-2}$		0.064 ( 2.16)					
$\Delta(R-\pi)_{t-1}$		-0.171 (-2.07)	-0.260 (-4.81)	-0.039 (-0.67)	-0.002 (-0.03)	0.041 ( 0.36)	-0.096 (-0.47)
$\Delta(R-\pi)_{t-2}$	-0.069 (-0.94)	-0.102 (-1.15)					
$\Delta\Delta y_{t-1}$	-0.150 (-0.85)	-0.211 (-2.47)	-0.298 (-7.81)	-0.330 (-6.52)	-0.043 (-0.59)		
$R_{benchmark}^2$	0.39	0.30	0.20	0.22	0.20	0.07	0.14
(1) $R_{\Delta\Delta M/P}^2$	0.37	0.26	0.15	0.22	0.20	0.07	0.13
(2) $R_{\Delta(R-\pi)}^2$	0.07	0.11	0.14	0.20	0.07	0.03	0.02
(1) – (2)	0.30	0.16	0.02	0.02	0.13	0.04	0.11
% gain: (1)/(2)	<b>5.38</b>	<b>2.45</b>	<b>1.11</b>	<b>1.10</b>	<b>2.75</b>	<b>2.29</b>	<b>6.27</b>
Nobs	33	99	383	180	44	23	21

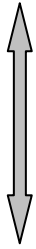
Notes: see note from previous table. <sup>†††</sup> denotes a three-year average.

**Figure 1: The zonal view**

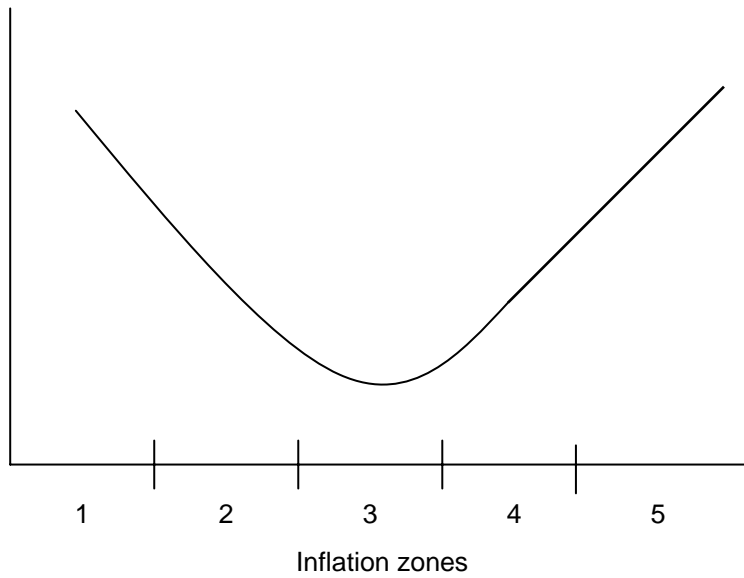
**Monetary policy and deflation: the zonal view**

**Relative policy value**

Monetary  
aggregates



Short-term  
interest rates



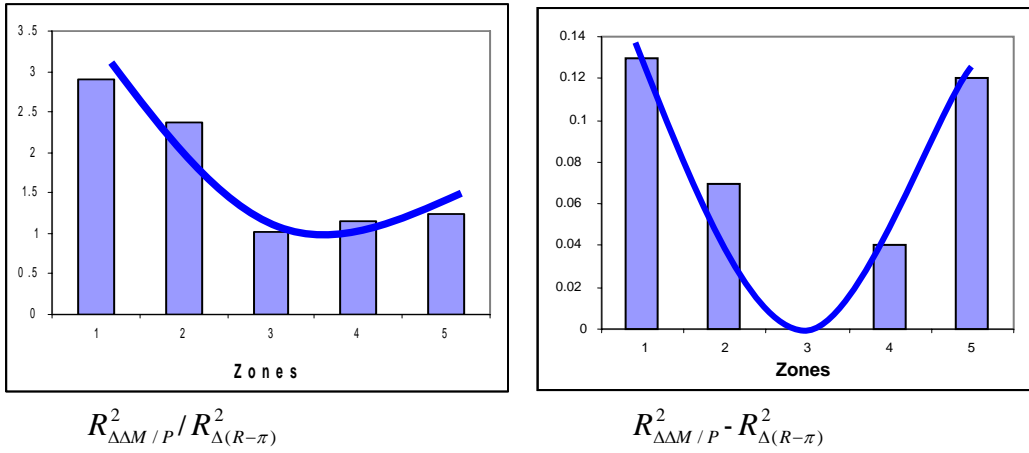
Zones

- Zone 1: high inflation
- Zone 2: moderate inflation
- Zone 3: low inflation
- Zone 4: low/moderate deflation
- Zone 5: deep deflation



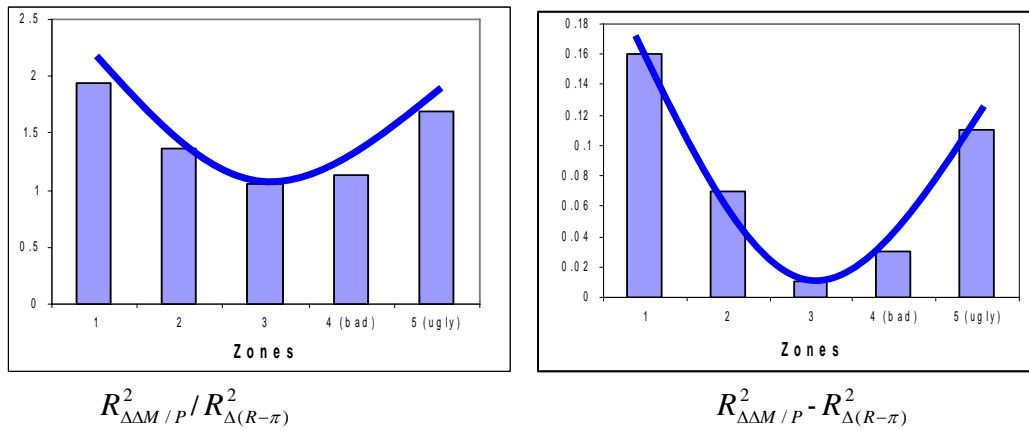
Figure 2: G7 inflation and output regressions  $R^2_{\Delta\Delta M/P}$  versus  $R^2_{\Delta(R-\pi)}$

G7 inflation results

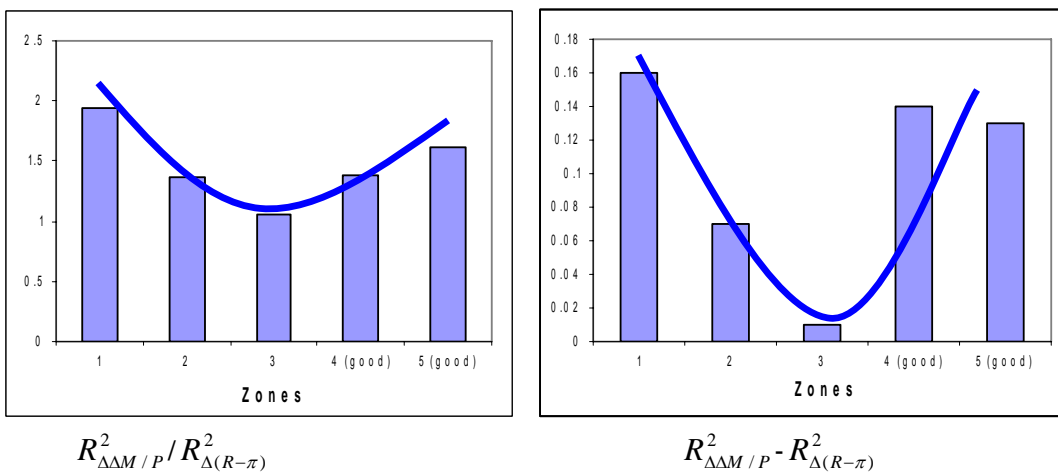


G7 output regressions

Case I: Output is falling in zones 4 and 5



Case II: Output is rising in zones 4 and 5



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