Federal Reserve Bank of Dallas
Globalization and Monetary Policy Institute
Working Paper No. 155
http://www.dallasfed.org/assets/documents/institute/wpapers/2013/0155.pdf

Is Monetary Policy a Science? The Interaction of Theory and Practice Over the Last 50 Years*

William R. White

September 2013

Abstract

In recent decades, the declarations of "independent" central banks and the conduct of monetary policy have been assigned an ever increasing role in the pursuit of economic and financial stability. This is curious since there is, in practice, no body of scientific knowledge (evidence based beliefs) solid enough to have ensured agreement among central banks on the best way to conduct monetary policy. Moreover, beliefs pertaining to every aspect of monetary policy have also changed markedly and repeatedly. This paper documents how the objectives of monetary policy, the optimal exchange rate framework, beliefs about the transmission mechanism, the mechanism of political oversight, and many other aspects of domestic monetary frameworks have all been subject to great flux over the last fifty years. The paper also suggests ways in which the current economic and financial crisis seems likely to affect the conduct of monetary policy in the future. One possibility is that it might lead to yet another fundamental reexamination of our beliefs about how best to conduct monetary policy in an increasingly globalized world. The role played by money and credit, the interactions between price stability and financial stability, the possible medium term risks generated by "ultra easy" monetary policies, and the facilitating role played by the international monetary (non) system all need urgent attention. The paper concludes that, absent the degree of knowledge required about its effects, monetary policy is currently being relied on too heavily in the pursuit of "strong, balanced and sustainable growth."

JEL codes: E52

* William R. White is currently the chairman of the Economic Development and Review Committee at the OECD in Paris. He was previously Economic Advisor and Head of the Monetary and Economic Department at the Bank for International Settlements in Basel, Switzerland. +41-(0)-79-834-90-66. white.william@sunrise.ch. This paper will be published as a Chapter in a book prepared to celebrate the 50th anniversary of SUERF (The European Money and Finance Forum).

"In theory, there is no difference

between theory and practice.

In practice, there is."

Yogi Berra

1. Introduction

It has become fashionable to talk about the "science" of monetary policy[1]. This assertion must imply that there is a well accepted theory about how monetary policy should be conducted. Moreover, it must also assume that this theory has been confronted with the facts and has been found universally useful by policy makers. Indeed, the joint use of inductive and deductive logic is at the core of the scientific method and the very definition of science[2].

In this paper, it is rather contended that the practice of monetary policy is far from a science. It has evolved continuously for the last fifty years, and is still in the process of change. At least five phases[3] can be roughly distinguished: Bretton Woods (1946 to 1972), Monetarism (1972 to 1982), Inflation Control (1982 to 1992), Inflation Targeting (1992 to 2007), and finally, The Response to the Crisis (2007 to 2013). Moreover, unlike science, where knowledge accumulates incrementally about eternal realities, these phase changes in monetary policy have occurred in response to both changed circumstances (economic structure) and sometimes the mere fashion of beliefs (economic theory).

An important factor conditioning the changing conduct of monetary policy has been continuous change in the **structure** of the economy itself. Both the real and financial sectors have evolved under the influence of new technology and the general trend (since the 1960's) towards deregulation and liberalization. While international trade had been rising steadily since the end of World War ll, the entry of previously planned economies into global markets (dating from the late 1980's) was a particularly important event. More generally, the importance of the Advanced Market Economies (AMEs) in the global economy has been increasingly complemented by the growth of the Emerging Market Economies (EMEs). Financial markets have also evolved. Initially, financial systems were largely limited by national borders, were bank dominated, and characterized by a high degree of cartelization and associated stability.

[1] See Clarida et al (1999), Mishkin (2009) and Mishkin (2011) for examples

[2] Hayek (1979) and Popper (1972)

[3] These distinctions are more or less consistent with those drawn in earlier surveys of the conduct of monetary policy by Bordo(2008), Goodhart (2010) and Laidler (2007)

Over the years, however, this financial structure changed into one much more characterized by globalization, securitization ("shadow banking" and market based intermediation) and a highly significant degree of consolidation[4].

Significant changes in "accepted" economic **theory** have also occurred over the last fifty years. Academic theorists played a significant role in this evolution, with the contributions of Milton Friedman being of seminal importance. Two general trends characterized the theoretical literature over the pre crisis period. First, it became increasingly accepted that the economy was inherently self stabilizing, and that discretionary policies were either useless or harmful. In this regard, the academics drew more from Hayek than from Keynes. Second, the role played by expectations, and particularly inflationary expectations, took on increasing importance. Indeed, the idea advanced by Friedman and Phelps[5], that changing inflationary expectations meant there was no long run tradeoff between inflation and output, was arguably the most influential theoretical insight of the post war period. Arguments put forward by Friedman also played a big role in legitimizing the shift towards floating exchange rates after the breakdown of the Bretton Woods regime.

To some degree, theoreticians were responding to the changing structure of the economy. In effect, there was a positive feedback loop between theory and practice. As the economic benefits of liberalization became increasingly evident, they demanded rationalization in terms of theory. As well, however, there was a certain influence of political ideology, not least the merits of free markets and the related belief that government interference in markets would eventually prove a threat to democracy itself[6]. Finally, theoreticians also responded to the changing nature of the problem being faced by policymakers; focusing in earlier decades on unemployment, but from the 1970's onwards on how to control inflation.[7]

Against this backdrop of change in economic structure and theory, the **practice** of monetary policy also changed enormously. Not surprisingly, there was also a general trend over the last 50 years for central banks to rely more on the operations of free markets (increasingly assumed to be self stabilizing and "efficient") and to focus more on the management of inflationary expectations and less on trying to fine tune the economy. However, while central bank practices prior to the crisis were strongly influenced by trends in theory, they responded pragmatically to other influences as well. Not least, central banks changed their practices when

[4] See Adrian and Shinl (2010),Gorton and Metrick (2010) and Bank for International Settlements (2010)

[5] Friedman (1968) and Phelps (1968)

[6] Again the influence of Hayek can be identified. In particular, see Hayek (1944)

[7] See the references in Laidler (2009).

evidence emerged that previously held theories were simply inconsistent with the facts or that previous practices had unforeseen and unwelcome consequences. [8]

Central banking practice and monetary theory have also diverged over the last fifty years because the real world is infinitely more complex and constraining than any theoretical model can be. First, central banks must choose a strategy for conducting policy which shows a certain consistency over time. In this context, regime choices, particularly with respect to exchange rates, take on great importance. Second, central bankers operate within an empirical, political and philosophical framework, with many practical aspects of these frameworks not subject to any guidance from monetary theory. Third, conditional on the exchange rate regime and the chosen monetary framework, policy makers must also make certain operational decisions which allow them to exploit whatever room for maneuver remains in pursuing their objectives. However, theory provides no unambiguous guidance about how best to deal with such issues as errors in estimating output "gaps" or how best to choose among alternative operating instruments.

The principal objective of this paper is to show how these exchange rate choices, monetary policy frame works, and operational procedures have evolved over the last fifty years - and why. A further point of interest will be to evaluate how the current crisis might also lead to changes in each of these aspects of monetary policy going forward. In the process, we might also get some insights as to why thoughtful people might reasonably disagree on how best to conduct monetary policy. And, as a corollary, we might also understand better why an approach to monetary policy that might seem good for one country might not be seen as equally good for another.

2. The Choice of an Exchange Rate Regime

It seems generally agreed that a monetary authority needs some kind of a strategy to ensure the consistent conduct of policy over time. When considering such a strategy, the choice of an exchange rate regime figures very highly. The underlying reality is that of the "Impossible Trinity". A country cannot simultaneously have free capital flows, a fixed exchange rate and an "autonomous" monetary policy[9]. While this phrase was made famous by Mundell (1963) and

[8] This conclusion is also reached by Laidler (2007), Goodhart (2010) and Cagliarini et al. (2010) In particular, they all agree that both theorists and practitioners refocused their attention on inflation, after the beginning of the Great Inflation of the 1970's.

[9] The word "autonomous" is used here to convey the idea that a state or currency area can have a monetary policy stance that differs from other states or currency areas. This is a different concept from the "independence" of central banks, which relates to the capacity to conduct domestic monetary policy free from the day to day influence of other domestic bodies.

Fleming (1962) in the 1960's, it formed the backdrop for the Bullionist – Currency Debate in the UK going as far back as the 19th century[10]. What has changed over time, however, has been the weight given to the arguments for retaining (or omitting) each of the three elements. Moreover, at various times, countries have run into serious difficulties through trying to achieve simultaneously more of the three objectives than was practically possible.

The most enduring of fixed exchange rate regimes was the **gold standard**, which dominated the scene prior to World War 1 and was temporarily reimposed in many countries afterwards. During that period, the desirability of internationally mobile capital and a fixed exchange rate against gold went essentially unchallenged. The advantages were said to include the long run stability of domestic prices, an efficient international allocation of capital, transparency and simplicity. The loss of monetary autonomy (discretion was largely replaced by a rule) was actually welcomed, as domestic authorities were generally not trusted to pursue price stability. The legacy of this heritage can be seen in modern currency boards[11] and above all in the establishment of the euro zone[12].

The **Bretton Woods system** gave priority to fixed (but adjustable) exchange rates and to the autonomous conduct of domestic monetary policy. The desire for fixed exchange rates reflected the belief that fixed rates were necessary for the continued expansion of world trade, while monetary policy was thought to have considerable countercyclical potential. The price to be paid involved acceptance of the many impediments to free capital flows that had built up over the years. However, the Bretton Woods system eventually broke down as capital flows increased in volume and the problems associated with the Impossible Trinity became more pressing. The fact that the United States (at the centre of the system) was pursuing an aggressively expansionary monetary policy, in spite of rising domestic inflation[13], also proved

[10] See Bordo (2008) p718

[11] For a discussion of the workings and successes of some modern currency boards, see Ghosh et al (2000) as well as Hanke and Schuler (1994)

[12] For some years there have also been ongoing discussions of possible currency unions in the Gulf and in Southern Africa. These discussions have not yet lead to concrete actions, not least because of concerns about some of the economic disadvantages of such relationships. A further political factor has been concern about the dominant influence of single countries at the centre of each of these proposed currency unions.

[13] There were arguably two reasons for the failure of monetary policy to resist rising US inflation. First, it was widely believed at the time that inflation was a cost – push phenomenon against which monetary policy could do nothing. Second, the Chairman of the Federal Reserve (Arthur Burns) was under strong pressure from the Nixon Administration (which had appointed him from among their own ranks) to contribute to Nixon's reelection by keeping policy rates down. For different interpretations of these events, see Meltzer (2009a) and 2009b)) and Nelson (2012)

increasingly uncomfortable for those pegged to the dollar. As inflation began to rise almost everywhere, the pressure to cut the link with the dollar eventually proved insurmountable[14].

Prior to the breakdown of the Bretton Woods system, a growing theoretical literature[15] had supported the view that this was actually a good thing. Not only did a **floating exchange rate regime** allow a nationally determined monetary policy, but it was in theory a desirable response to asymmetric shocks between countries. The danger that the float might be unstable, leading to costly resource misallocations, was refuted by the generally accepted doctrine of Uncovered Interest Parity (UIC). Moreover, after the breakdown of the Bretton Wood system, trade continued to expand rapidly and trade barriers continued to decline, indicating that fixed rates were not necessary to promote these ends. The positive aspects of international capital flows were also stressed, along with the merits of an autonomous monetary policy. Indeed, in the late 1990's the IMF began lobbying strongly in favor of changes to Article 8 of the IMF Articles to make capital account liberalization compulsory[16].

However, as practical experience with floating grew, the conflicts inherent in the Impossible Trinity also became still more evident. The weakness of the dollar in the late 1970's compounded inflationary problems in the US. The subsequent appreciation of the dollar in the mid 1980's was so strong that it was deemed by the G5 (later the G7) to be unacceptable, and led to the Plaza Accord. The subsequent depreciation was then so strong that it led to the Louvre Accord to stabilize exchange rates once more[17]. These international Accords were given priority over domestic objectives, much like Bretton Woods had done earlier, but led in turn to some highly undesirable consequences. In particular, as efforts were made to lower the value of the Yen and support the dollar, as agreed in the Louvre Accord, Japanese monetary policy was kept very accommodative. While this did not lead to a sharp increase in inflation, as many expected, it did contribute materially to the Japanese credit, asset price and investment "boom" which turned to "bust" in the early 1990's.

Other crises in the 1990's also attest to some of the problems posed for policymakers by highly volatile capital flows, both inflows and outflows. As capital inflows increased around the middle of the 1990's, a number of Asian countries also used easy monetary policy to resist the upward pressure on their exchange rates. As in the earlier Japanese case, this led to many internal (credit driven) imbalances which again culminated in a deep crisis and recession. In

[14] For a gripping account of this period see Silber (2012)

[15] See in particular Friedman (1953)

[16] In addition to noting the advantages for the international allocation of capital, the Fund also stressed the disadvantages of capital controls. They noted that controls became more porous with time, that they were subject to abuse and invited corruption, and could have perverse effects of various sorts.

[17] See Funibashi (1988)

contrast, buoyed by positive structural developments in the early 1990's, a tightening monetary policy in Mexico led to capital inflows which sharply increased the value of the peso. Then, as the country's external balance began to deteriorate, the peso fell even more rapidly than it had risen and a deep recession followed. Taken together, these experiences indicated that both floating and fixing have their associated dangers.

The European Monetary System (EMS) established by the European Council in November 1978, and launched in March 1979, was another attempt to fix exchange rates which was eventually undermined by free capital flows. It too ended in crisis in the early 1990's, with a number of countries (UK, Italy, the Nordics) being forced out of the exchange rate mechanism. In this case, the problem was not one of major inflows, followed by subsequent outflows. Rather, doubts grew as to the sustainability of the chosen exchange rates and speculation followed. In the UK, monetary policy resistance was muted given the fear (both political and economic) of the effects of a sharp increase in predominantly variable rate mortgages. In Sweden, the policy rate was raised to over 500 percent (annualized), but this was thought "unsustainable" and failed to restore confidence. Not least, such high interest rates threatened to raise government debt service requirements at a time when the government deficit was already uncomfortably high.

These recurring exchange rate crises led to a **fundamental rethink** of how to deal with the Impossible Trinity problem. The need for a rethink was further indicated by a number of studies indicating that Uncovered Interest Parity did not hold in practice, except over very long time periods[18]. This implied that free capital flows could cause floating exchange rates to move a very long way from "equilibrium" levels with significant implications for resource misallocations. The rethink, however, led different countries to come to sharply different conclusions.

In the AME's, with their much longer history of liberalized financial markets, there was a widely held belief that only corner solutions (more fixed or more floating) would prove a viable response to the problem of capital flows[19]. As a result, it was concluded that floating among the larger AME's had to be much more vigorously embraced. In effect, "fixing" was given up, and there have in fact been very few attempts to interfere with (much less to target) exchange rate movements in recent years[20].

[18] See Berk et al (2001). Also Murray and Khemani (1989)

[19] Fischer (2001) was a vocal critic of this view.

[20] However, statements made early in 2013 by the incoming Japanese Prime Minister on the need to weaken the yen, and subsequent statements by the President of France on the need to weaken the euro, could indicate this phase of "benign neglect" might be coming to an end.

In contrast, but still in keeping with the belief in corner solutions, the decision was taken within Europe to introduce the euro and to establish the euro zone. This was given legal substance by the Maastricht Treaty of 1992. In effect, "national monetary policy" was given up by the member countries in the hope of achieving other economic and political[21] benefits. Not least, the single currency was expected to give impetus to the establishment of a single European market. Moreover, there would be a flow of capital from high saving countries (with low rates of return on capital) to countries with low saving rates (and high rates of return on capital). Price stability would be assured through the establishment of an "independent" European Central Bank with price stability as its core mandate. Fiscal discipline was thought to be ensured by provisions of the Maastricht Treaty which set limits for the size of deficits and the stock of sovereign debt.

While many of the institutional changes promoted in the Maastricht Treaty of 1992 were recognized as being inadequate, there was a strong sentiment from the beginning that any shortcomings would be more than matched by future institutional change. James (2012) notes that many of the participants in the discussions leading up to the establishment of the euro zone saw clearly that, if the Eurozone were to survive, it would eventually require fiscal, banking, economic and, above all, political union.

Whereas the AMEs satisfied the Impossible Trinity by dropping one of the three elements, the recent trend in EMEs has been to accept **"**constrained" versions of all three to cope with persistent upward trends in their exchange rates. This choice might reflect the fact that their financial sectors have continued to be highly regulated by AME standards. Thus, many countries have combined a managed float (with heavy foreign exchange intervention and reserve accumulation) with managed capital flows (encouraging FDI and discouraging "hot money")[22] and with a form of constrained monetary policy (relying less on policy rate increases and more on higher reserve requirements)[23].

Concerns about higher policy rates attracting harmful capital inflows, and an unwelcome appreciation of the exchange rate, have also contributed to EME's showing a greater interest in

[21] James (2012) casts doubt on the hypothesis that the motivation for the euro zone was primarily political, designed to link France and Germany so tightly that war would be inconceivable. That is not to deny that many saw this as a welcome side effect.

[22] Along with administrative measures to manage capital inflows, many EME's have taken measures to reduce the harm caused by volatile inflows and outflows. For example, regulatory measures can be taken to limit currency mismatch problems on the balance sheets of financial institutions.

[23] Turkey is an extreme example of this. In 2011, as administrative controls were tightened over domestic credit, policy rates were lowered to reduce the inflow of foreign capital. Innovative measures were also taken to drive a wedge between deposit rates (lower) and loan rates (higher).

recent years in the use of macro prudential instruments[24]. Such interest was already increasing in both AME's and EME's[25] given the presumed usefulness of macro prudential instruments in the pursuit of financial stability.

Looking forward in light of the global crisis, it would not be surprising if all countries (but particularly EMEs) were to start putting increased reliance on capital controls to help resolve the problems posed by the Impossible Trinity. The failure of UIP to hold, except in the long run, constitutes a market failure that might seem positively to invite an administrative response. Further, the ultra easy monetary policies pursued by the largest currency blocks, since the onset of the crisis, have already elicited fears of "currency wars" between the AME's and EME's. This could provide moral cover for recourse to the use of instruments previously thought inappropriate. Further, recent concerns about "competitive devaluations" within the AME group imply that this danger is growing[26]. Finally, Reinhart and Sbrancia (2011) have noted that the growing incapacity of AME governments to service their sovereign debts could easily lead to financial repression; some combination of continued low interest rates, inflation and forced holdings of government debt through administrative means. In effect, it might eventually prove expedient for AME's to prevent capital outflows and for EME's to prevent capital inflows[27].

Future policies within the Eurozone will reflect not only the global crisis, but the crisis which emerged in its wake in the Eurozone itself. Both crises had their roots in the same phenomenon, a buildup of debt by borrowers that eventually proved unsustainable and threatened as well the survival of those (especially financial institutions) that had made the imprudent loans in the first place. Within the Eurozone, this manifested itself as a "sudden stop" of private capital flows to the peripheral Eurozone countries, later reinforced by regulatory influence in creditor countries. The shorter term Eurozone challenge is to ensure adequate financing for debtor countries, preferably (but not necessarily) by renewed inflows of private funds. In this regard, it is crucial that the longer run integrity of the Eurozone itself becomes unquestionable. This will require steady progress towards the fiscal, banking, economic and political union referred to above. A longer term Eurozone challenge will be to

[24] See Galati and Moesner (2011) and CGFS (2012) for a list of such measures, an assessment of their effectiveness, and how they might be best used in practice.

[25] See Borio and Shim (2007) and International Monetary Fund (2013)

[26] The Swiss National Bank took extreme measures to prevent the Swiss franc from rising above a level of 1.20 Swiss francs to the Euro. The new Abe government in Japan has also taken some extreme measures to reflate the economy which has had the effect of sharply lowering the value of the yen against the dollar.

[27] At the global level, the IMF (2012) has recently agreed that capital controls can be useful (albeit, in extremis) and that countries that are the source of capital flows have some responsibility for the macroeconomic implications for host countries. Both these rulings would lend support to a wider use of capital controls in both EMEs (inflows) and AMEs (outflows)

restore the relative competitiveness of the peripheral countries. Not least, this will require that future capital inflows are used for more productive purposes than they were in the past. If these challenges are not met, the Eurozone could disintegrate as have many monetary unions before.

A greater use of capital controls at the global level might also trigger a broader reevaluation of **global exchange rate arrangements**. The fact that the current crisis has had implications for virtually all major countries intuitively supports the search for a common global source for these problems. As described above, we currently have a "non system" in which AME's and EME's can react in markedly different ways to movements in their exchange rates[28]. Moreover, the growing importance of EME's in the global economy implies that their exchange rate choices now have serious implications for others. Whether EMEs hold down their exchange rates through easy money or through intervention, their actions contribute to higher inflation and other imbalances, both domestically and in the AME's as well[29]. Note too that there are no technical limits on the capacity of countries to print money to hold down their exchange rate. This implies that the potential for damaging side effects could be very large indeed.

To be even more speculative, if the end result of the current exchange rate "non system" is continuing crisis, even the merits of **autonomous national monetary policies** could be questioned. A recent study group, composed of both academics and central bank practitioners[30] has explicitly stated the need for a global monetary authority. Moreover, the recent statement by the IMF (2012),that policymakers in countries where capital flows originate must think about the implications for others, goes in the same direction. Evidently, relying on the US to set global monetary policy will not work if the US continues to focus only on US outcomes. This was one of, if not the, principal lesson from the failure of Bretton Woods.

3. The frameworks within which a national monetary policy must be conducted

Without prejudice to the different answers that might be given to the "Impossible Trinity" problem, assume that a country (or currency area) chooses to follow an autonomous monetary policy within a floating exchange rate regime. This suggestion was first made by Keynes (1923),

[28] See Pringle (2012)

[29] Evidently, a decision by an EME to peg (more or less) its exchange rate to that of an AME eventually leads to an importation of any problems that the AME country might have. However, the links run the other way as well. For example, easy money in the EME can lead to higher inflation and higher priced exports to the AME. Intervention in the foreign exchange markets leads to a buildup of foreign exchange reserves, which will lower longer term interest rates in the AME where these reserves are invested in such assets as US Treasuries.

[30] Committee on International Economic Policy and Reform (2011).. Robert Mundell and Ronald McKinnon have been long time advocates as well.

and briefly implemented by Sweden in the middle 1920's. Broadly speaking, this assumption is correct for most large countries (or currency areas) today.

In conducting monetary policy in this way, policymakers are subject to constraints imposed by three separate frameworks. First, the analytical framework constitutes the policymakers' views about how instruments directly under his control are linked to the objectives sought by the policymaker. Second, policy must be consistent with an agreed political framework. In this regard, issues pertaining to mandates, powers and accountability are crucial. Third, policymakers are constrained by their philosophical framework. That is, before passing on to operational issues (as discussed in Section 4), higher level decisions are first required on the robustness of the policy makers belief system, the relative importance of rules and discretion, and on the optimizing procedures that policymakers intend to follow. Each of these frameworks has changed materially over the last fifty years, and each seems likely to change further in light of the current crisis.

a) The analytical framework for conducting monetary policy.

Policymaking demands some knowledge (or at least a belief) of the relationship between what the policy maker is trying to control (the objective of monetary policy) and his control instruments (policy rates and the central bank balance sheet). Prior to World War ll, European economic thought about how the economy worked, and the particular role of money, was essentially deductive. In contrast, American economists were more likely to formulate theories on the basis of close observation of economic developments[31]. It was perhaps inevitable that these two traditions would merge, since theory without testing (pure deduction) and testing without theory (pure induction) would seem to fall well short of the requirements of the "scientific method". Tinbergen likely deserves credit for this fusion in having created and tested econometrically the first macroeconomic models[32].

By the 1960's, most central banks (especially in the English speaking world) and most academics had accepted that the IS/LM model suggested by Hicks (1937) was a good representation of the views expressed in Keynes' General Theory (1936) [33]. This model could explain how fluctuations in the flow components of the National Income Accounts came about,

[31] See Haberler (1939) and Laidler (1999)

[32] Backhouse and Bateman (2011). Apparently, Keynes was very skeptical about Tinbergen's work. This reflected his feeling that "animal spirits" would ensure that the functions in the model would be unstable over time. Ibid, page 14, footnote 9

[33] This view was certainly not universally accepted. See Backhouse and Bateman (2011). Robinson (1962) famously described this model as a form of "bastard Keynesianism" Leijonhufvud (1968) also expressed the view that many of the most important of Keynes' insights in the General Theory were omitted from the IS/LM framework.

and, better yet, also led easily onwards to policy conclusions. Subsequently, many central banks (along with many others) began to build econometric models[34] along such lines, with an early and powerful finding being the existence of a tradeoff between the rate of inflation and the level of unemployment[35]. Over the years, models of this sort were altered almost continuously on the basis of both empirical shortcomings and changing beliefs about how the economy worked.

The consensus supporting the use of such models began to break down in the late 1960's. Two factors played key roles; facts and theory. First, the simultaneous rise of both unemployment and inflation in the late 1960's and early 1970's was simply not explainable using traditional empirical models. Second, as noted above, Friedman (1968) and Phelps (1968) had already introduced the concept of the NAIRU (the Non Accelerating Inflation Rate of Unemployment) or the Natural Rate of Unemployment. The important implication was that there was no long run tradeoff between unemployment and inflation since inflationary expectations were endogenous. Even assuming adaptive expectations, inflation would rise at an accelerating pace given any given degree of excess demand. The turbulent decade of the 1970's, which included two major shocks to oil prices as well, also led to a much greater emphasis on modeling supply side shocks and other factors explaining inflationary expectations.

The poor forecasting performance of Keynesian structural models during the 1970's also fostered, for a time, increased acceptance of much simpler (reduced form) models based on the "monetarist" theories of Milton Friedman. These models suggested that nominal GDP could be reasonably well forecast on the basis of the previous rates of growth of monetary aggregates. In effect, money growth would drive inflation and inflationary expectations, while Friedman expected that real growth would quickly return to trend once shocked away from it. Evidently, this last assumption deviated fundamentally from the Keynesian assumption that capitalist economies in "Deep Slumps" might stay there forever without activist government policies[36].

Unfortunately, those accepting this "monetarist" logic, including those central banks that had adopted monetary targeting, were quickly disappointed. The stable demand for money function, on which the whole monetarist framework was based, proved to be an illusion. In particular, technological developments (for example, "sweep" accounts in the US) led to a

[34] Early examples were RDX1 and RDX2 at the Bank of Canada, and the MPS model at the Board of Governors of the Federal Reserve. DRI was a private sector firm that also estimated an early structural model.

[35] The earliest empirical evidence on this was provided by Phillips (1958). Such "Phillips curves" were then added to models based on the IS/LM framework to provide a link between real variables and inflation.

[36] As noted briefly above, Friedman's assumption was similar to that of Hayek. The latter also assumed that the economy would mend itself. In contrast, government interference would only perpetuate the factors that had led to the slump in the first place.

sharply lower need for narrowly defined money in many countries. The demand for money that was more broadly defined was also increasingly affected by the invention of new money "substitutes".[37] Monetary targets subsequently became much less fashionable, though monetary indicators remained an important guide for policy at some central banks, the Bundesbank in particular. These policy issues are returned to below.

Friedman's assumption that unemployment could be only a temporary phenomenon, combined with two other theoretical advances concerning expectations, then powered a massive shift in orientation. This affected academic economists in particular. First, Sargent and Wallace (1970) replaced the assumption of adaptive inflationary expectations with that of rational expectations (RE); that is, people's expectations had to be consistent with the outcomes generated by the model itself. While the logic of this seemed compelling[38], it did require the assumption of a single "representative agent" and a relatively small model to be computationally tractable at that time. Given these assumptions, Sargent and Wallace were able to demonstrate that changes in monetary policy would have only the briefest of impacts on real variables in the economy. Second, Lucas (1980) noted that virtually all structural equations have imbedded in them some process of forming expectations, and that any change in the monetary policy "regime"[39] would therefore render "unstable" any structural equations estimated on past data.

The combination of these insights led to two different strands of modeling. Both emphasized relatively small and internally consistent models, based on maximizing behavior on the part of representative economic agents. Thus, both contrasted sharply with the large structural models that had come before. Moreover, both focused on the problem of controlling inflation. On the one hand, Real Business Cycle models were based on the further assumptions of rational expectations and essentially instantaneous market clearing at full employment. Deviations from full employment then became solely due to technology shocks or changes in the preferred tradeoff between work and leisure. On the other hand, New Keynesian models

[37] With the growth of "shadow banking" over the last decade or so, this last complication has become ever more important.

[38] Mankiw (1988) p440 states that economists normally expect economic agents to demonstrate rationally maximizing behavior. Against this background, "It would be an act of schizophrenia not to assume that economic agents act rationally when they form their expectations of the future. "

[39] Note that the Lucas critique applies to only changes in the policy "regime" (say a change in the parameters of the Taylor rule), not to changes in policy itself(say the policy rate). Since policy regime changes are likely to occur only infrequently, this must then lessen the practical relevance of the Lucas critique of large structural models. For a convincing discussion of the theoretical shortcomings of both the Rational Expectations hypothesis and the Lucas critique see Frydman and Goldberg (2011).

made essentially the same assumptions, but assumed various kinds of "frictions" that slowed down the reestablishment of full employment[40].

It was perhaps inevitable that these two strands of thought (sometimes referred to as Modern Macroeconomics) would eventually merge into what came to be called Dynamic Stochastic General Equilibrium models. An important practical aspect of these models is that they make no reference to money or credit, and they have no financial sector. Further, particularly among academics, certain beliefs hardened into paradigms with the upshot being that eventually only certain approaches to theory were deemed legitimate.[41] Indeed, Morley (2010) pp 13-14 suggests that Modern Macroeconomics eventually came to define a "method" rather than a "subject matter". As a result, little effort was made to evaluate the forecasting capacity of these models, either in or out of sample.

While DSGE models were the mainstay of macroeconomic modeling at academic institutions, central banks followed a more eclectic path[42]. Many central banks estimated DSGE models, but their relevance to actual policy decisions seems to have been quite limited[43]. Most also continued to forecast and do simulations with their large structural models, albeit sometimes adapted to support the natural rate hypothesis and to allow experiments with various forms of expectations formation. However, perhaps as a corollary of the earlier disappointment with the monetarist experiment, monetary aggregates and credit essentially disappeared from the empirically estimated structural models as well. As with the competing DSGE models, monetary policy came to be represented by a Taylor rule which set policy rates so as to hit inflation objectives over a period of time.

Looking forward in light of the crisis, there seems to be a significant likelihood of another phase shift in how central banks see their actions affecting the real economy. Similar to their questioning of prior beliefs in the late 1960's, some central bankers have become increasingly skeptical about the usefulness of the analytical frameworks they had previously relied upon[44]to help guide policy decisions. Perhaps the main reason for this sense of unease is that none of the

[40] Fashions changed here as well. Earlier research assumed sticky wages, whereas the later literature relied more on sticky prices. See Mankiw (1988) p 446

[41] See Leeson (2000) and Laidler (2009) pp17-18. For a discussion of why economic beliefs can take on "theological" qualities, see Häring and Douglas (2012).

[42] For the relative contributions of central bankers and academics to the conduct of monetary policy, see Blinder (1995)

[43] Roger and Vlcek (2012) note (p18) "Most central banks still use semi structural models as their core model in forecasting and policy analysis".

[44] Prior to the crisis, and particularly close to the end of the "Great Moderation"the prevailing sentiment was that our knowledge had advanced significantly. See Romer and Romer (2002) and Blinder (2005).

macroeconomic models in wide spread use before the crisis (neither DSGE models nor larger structural models) predicted it. Indeed, such crises were literally ruled out in DSGE models by the assumption[45] of self stabilisation. Not surprisingly, the first issue raised by the crisis is whether this assumption ought not to be dropped, not least because of the significant economic damage likely to result from financial instability[46]. Leijonhufvud (2009) has linked the pre and post crisis literature by noting that economies may have only a "corridor of stability", outside of which instability reigns. Economies can then be pushed "too far", not least by overly expansionary monetary policies.

In fact, alternative lines of macroeconomic and monetary research are now being pursued much more actively than before the crisis[47]. Perhaps the best candidate to replace extant theories would be models that recognize the importance of fiat credit in influencing economic decisions (to both spend and to produce), the importance of stocks (in particular stocks of debt) and the endogeneity of risk in the financial system[48]. These models can produce highly non linear results similar to those observed in real life crises. This approach has similarities with some pre War business cycle models.[49] As well, insights can also be gained from the new, and rapidly developing, study of complexity economics[50]. This approach is at the other end of the stability spectrum from DSGE models in that complexity economics assumes many agents (no

[45] White (2010)

[46] There is now a huge literature documenting the history of financial crises, and the particular role played by dysfunctional financial systems. See Reinhart and Rogoff (2009), Schularik and Taylor (2009) and Reinhart and Reinhart (2010)

[47] For example, INET (the Institute for New Economic Thinking) was set up in 2010 and has attracted some of the world's most prestigious scholars. In 2012, the OECD began the NAEC project (New Approaches to Economic Challenges)which also aims to challenge conventional thinking. The work of the Santa Fe Institute, and others engaged in "agent based" modeling is receiving increased attention, as is the work of scholars working in the tradition of Minsky (2008). See in particular, Keen (1995) and a long list of his later publications.

[48] An early modern sponsor of such research work was the Bank for International Settlements (BIS). In addition to its Annual Reports from the mid 1990's onwards, see the many BIS Working Papers by Claudio Borio and coauthors. Not surprisingly, this coauthor also recommends Borio and White (2003) and White (2006).

[49] Not least, the Austrian school led by Hayek and von Mises, and the work of Dennis Robertson. See Laidler (2009) p40. Issing (2013) suggests that, rather than a new paradigm, we simply need to remember some of the principles that served the Bundesbank so well for most of the post War period. In particular, he asks "How long will we have to wait until the neglect of money and credit in monetary theory and policy will be understood as the major source of macro policy mistakes?" Of course, the principles to which Issing alludes were themselves developed on the basis of theories and practical experiences drawn from the pre War period.

[50] See the many references in Ball (2012) p37. In their basic assumptions about how the economy functions, complexity theorists and the Austrian school of thought seem to have a lot in common.

representative agent), each acting according to local rules (no concept of rational expectations), and it eschews all concepts of equilibrium. There are many parallels in this regard with evolutionary biology.

b) The political framework for conducting monetary policy

It is important to note that monetary policy must be conducted within a political framework, which also constrains the capacity to match theory with practice. Here too there have been important developments over time. In the immediate post war period, central banks were generally firmly under the control of their Treasuries. In the US, the Treasury- Federal Reserve "Accord" was a good example of this. Over time however, central banks were increasingly given some form of "independence". Note that this word is highly misleading, in that no government institution can be wholly independent in a democratic society. Indeed, it is likely the case that a central bank cannot sustainably follow policies that do not have public and popular support[51]. A more nuanced approach[52] to the independence issue would distinguish between a central bank's mandate, its powers and its democratic accountability.

Many central banks began the post war period with a mandate that was extraordinarily broad. They were expected to meet many objectives simultaneously[53], and often conflicting objectives at that[54]. However, as these conflicts became more apparent in the course of implementing monetary policy in practice, central bankers came to focus on a significantly narrower set of objectives (discussed below). In a number of countries, the objective of monetary policy was clarified further by ranking the priority of objectives[55]. For example, this has been explicitly the case in specifying the mandate for the European Central Bank.

---

[51] See Silber (2012) who records Volcker's belief that he both needed and obtained public support to pursue the fight against inflation in the early 1980's.

[52] Crow (1993)

[53] Consider for example, the mandate given to the Bank of Canada in 1934 "WHEREAS it is desirable to establish a central bank in Canada to regulate credit and currency in the best interests of the economic life of the nation, to control and protect the external value of the national monetary unit and to mitigate by its influence fluctuations in the general level of production, trade, prices and employment, so far as may be possible within the scope of monetary action, and generally to promote the economic and financial welfare of Canada."

[54] In addition to problems posed by the Impossible Trinity, there was the recognition that the pursuit of lower unemployment, beyond some limit, would lead to higher inflation.

[55] For example, the ECB has been given the mandate of pursuing price stability, but also of maximizing growth, providing it is consistent with the first objective. In contrast, the Federal Reserve Board has been given a dual mandate with no preference given to either.

As to where the mandate comes from, there is a wide spectrum of possibilities reflecting the chosen tradeoff between flexibility and immutability. At one end of the spectrum, the central bank sets the mandate for itself. In other cases, the central bank has announced its mandate jointly with the government. In still other cases, legislation (or in the case of the ECB, an international treaty) determines the mandate and, in extremis, the mandate becomes part of the country's constitution. While some have seen the involvement of governments as a threat to central bank "independence", others have welcomed this involvement. It effectively ensures that government cannot subsequently try to impede the central bank in the pursuit of a mandate given by the government itself. Further, such government involvement in central bank affairs might implicitly put welcome constraints on the pursuit of active fiscal policies by the government itself.

As to powers, the use of policy instruments under the central banks control, free of political interference, is what most people would consider to be the essence of "independence"[56]. In effect, one cannot "will the ends" without "willing the means". This trend too has evolved over time, and for various reasons. In the early 1960's, the Coyne affair in Canada highlighted that, if there were to be subsequent accountability, a clear assignment of responsibilities between the government and the central bank was needed[57]. The growing recognition that political pressures would always give primacy to shorter term objectives, regardless of longer term costs, was a further argument for putting "technical issues" more firmly in the hands of officials that did not need to be reelected. Further, as the pursuit of price stability moved closer to the core of the central bank mandate, the perception that inflationary expectations might be sticky, and that the short run Philips curve might be flat, implied that the costs of political interference might also prove very high. Thus, such influence should be avoided.

Some means of holding central banks democratically accountable constitutes the third part of the political framework. In principle this has both an ex ante and an ex post aspect to it. The ex ante aspect has to do with transparency, and the capacity of a central bank to explain its actions clearly. This aspect has also changed greatly over the years. For much of the post war period, central banks cultivated a mystique of knowledge based essentially on the principle of "never apologize, never explain". However, this began to change in the 1980s, and by the late 1990's central banks almost everywhere were publishing specifications of internal economic models, inflation reports, minutes of meetings, etc. Theory also contributed to this change, in that it became increasingly believed that expectations (both on the part of Wall Street and Main Street) could be directly affected by the stated beliefs and intentions of central banks. This is pursued further below.

[56] Debelle and Fischer (1994) labeled this "instrument independence"

[57] See Siklos (2007)

Ex post accountability has to do with central bankers failing to fulfill their mandate. Again there have been significant changes. A variety of mechanisms have been put in place to ensure that an explanation is given whenever mandates are not met. For example, some inflation targeting central banks must now write a letter to the appropriate government official explaining their failure to hit agreed targets. Hearings before committees of elected representatives are an increasingly common approach. Beyond this, however, few central bank governors have been dismissed or otherwise sanctioned for a failure to achieve the central bank's mandate[58]. Similarly, in those countries where the government has the explicit right to send a "directive" to the governor of a central bank, to force a change in policy[59], this right has never been exercised. Presumably, such ex post action has been eschewed for fears of causing turmoil in financial markets.

Looking forward in light of the crisis, there are grounds to believe that the political framework constraining the conduct of monetary policy will change. The very capacity to classify the governance process into mandate, independent powers and accountability depends fundamentally on the mandate being rather simple. However, as will be discussed below, a debate is already under way as to whether other objectives than price stability ought not to be given higher priority[60]. If these other priorities are also likely to be pursued by other arms of government (say preventing financial instability with potentially high costs for taxpayers), then closer links between central banks and governments would seem almost inevitable.

Moreover, in the course of trying to manage the crisis, many central banks have done things that have already brought them much closer to governments. In Europe, for example, the ECB has purchased (or accepted as collateral) assets of lower quality and longer maturity than has been traditional. In consequence, it has exposed itself to the risk of losses and even the potential need for recapitalisation. Similar, perhaps even greater, potential losses might affect other major central banks as well. Even if it can be argued that central banks do not need capital to carry out their functions[61], such financial losses would likely involve a huge reputational loss as well. Further, by offering to purchase sovereign assets on a significant scale

[58] The Bank of England provides a good example of such forbearance. Between 2011 and 2013, as inflation repeatedly exceeded target levels, the Governor of the Bank had to send repeated letters of explanation to the Chancellor of the Exchequer..

[59] This right exists in both Canada and the Netherlands. The unstated assumption is that the head of the central bank would resign if such a directive were sent.

[60] In White (2006), I asked specifically "Is Price Stability Enough?" I concluded, as had many pre War scholars, that the single minded pursuit of such a mandate by a central bank was no guarantee of macroeconomic stability.

[61] As long as central bank liabilities remain acceptable as means of payment, capital is not required to maintain confidence. The counterargument has to do with the qualification "as long as". There is no telling what might be the trigger for a run on central bank liabilities and the currency.

(the OMT initiative), the ECB has opened itself to the charge that it is cooperating in the reestablishment of "fiscal dominance" in Europe[62]. Finally, there can be no doubt that many central banks have carried out operations with significant distributional implications[63]. Given that distributional issues are essentially political and not technical[64], this also implies closer links between central banks and governments. While it is true that these links might be reversed once the crisis ends, history would suggest this will not be done without significant effort and strong popular support for renewed "independence".[65] Such support might or might not be forthcoming, depending on how views developed about the culpability of central banks in contributing to the crisis in the first place.

c) The philosophical framework for conducting monetary policy

The third structural aspect conditioning the conduct of monetary policy could be described as the philosophical framework[66]. How do central banks approach decision making? Three important issues can be identified. The first has to do with the "rhetoric of economics"[67]. The second has to do with the relative merits of rules and discretion, and the third is the choice of a central banks optimizing principle. All of these issues have been widely debated over many decades and fashions have ebbed and flowed.

The **"rhetoric of economics"** has to do with the belief system of central bankers, the kinds of evidence they use in justifying those beliefs, and their willingness to change those beliefs. Across central banks, there are wide differences in what is believed, with the particular history

[62] Two senior German officials resigned from the ECB in protest against similar ECB actions. The current President of the Bundesbank has repeatedly declared his opposition to the OMT program.

[63] One example would be selective access to central bank lending facilities. Of much greater significance has been the decision of virtually all central banks to keep interest rates very low for a long period. This clearly redistributes income on a grand scale from creditors (savers) to debtors. Moreover, while such policies might help for a period of time to improve the solvency of banks, low interest rates on longer term securities will over time threaten the solvency of insurance companies and pension funds. See White (2012).

[64] On this, see Leijonhufvud (2009)

[65] See Capie (2013)

[66] Mervyn King, then Governor of the Bank of England, may have been alluding to such issues when he wrote "Economics is not a set of doctrines but a way of thinking".

[67] This phrase was introduced by McCloskey (1985) in a book of the same name. Rhetoric was defined by Aristotle as the need to use "all available means of persuasion".

of individual countries often playing a central role[68]. For example, central European central bankers believe inflation is the predominant threat to macroeconomic stability. This reflects the hyperinflation of the 1920s. In contrast, for those in English speaking countries, unemployment is seen as the biggest threat. This reflects their experience of the Great Depression. It is notable that, when the financial crisis worsened in 2008 but with inflation still rising, the ECB raised policy rates while the Federal Reserve continued to loosen.

As to other kinds of evidence referred to by individual central banks, the historical experience of other countries seems to have had virtually no role to play. For example, in the run up to the current crisis, the similarities with Japanese developments in the 1980s and pre War crises were totally discounted. In contrast, over time, the role of econometric and mathematical evidence was given greater weight virtually everywhere. There is, however, no reason to doubt that, in interpreting such evidence, central bankers also shared in that trait of human nature that selectively chooses evidence to support beliefs already established[69]. Finally, for most central banks, their willingness to reject old beliefs and embrace new ones was greater in the 1960s and 1970's than more recently. The Great Moderation in the AMEs convinced most central bankers (from the countries affected) that the policies they had been following were fundamentally sound. The fact that the monetary policies followed since the beginning of the crisis have essentially been "more of the same"[70] further attests to the tenacity of the earlier belief system.

The **rules versus discretion** debate was popularized by Friedman in the 1960's. He believed that a rule providing stable growth for the money supply would lead to stable prices, which he believed ought to be the principal objective of central bank policy. [71]. A number of central banks subsequently established "monetary targeting regimes", although the rules were often

[68] White (2011)

[69] Psychologists refer to the phenomenon of "cognitive dissonance". Human beings give little attention to evidence that conflicts with the prevailing paradigm, until the evidence becomes so overwhelming (and the cognitive dissonance so great) that a paradigm shift is required. See Kuhn (1962). From personal observation over many years, I have yet to see a serious piece of economic research from a central bank that failed to uphold the belief system of the central bank in question. See also Grim (2009) and Haring and Douglas (2012).

[70] By "more of the same" is meant the pursuit of policies designed to stimulate short term aggregate demand, without any serious consideration of possible medium term unexpected consequences. See BIS (2010) and White (2012)

[71] Although Friedman (1959) did not mention it, this idea goes back at least to Henry Simon of the University of Chicago in the 1930's. Leeson (2000) documents the process through which Friedman's ideas became so widely accepted in the 1970's.

interpreted quite flexibly[72]. Even the Bundesbank, which was an early advocate of such regimes, was prepared to set aside its intermediate monetary targets if they seemed to conflict with its ultimate inflationary goals[73]. As noted above, the perceived instability of the demand for money eventually led to the end of these targeting regimes. Nevertheless, the Bundesbank and the European Central Bank continue to monitor monetary ("second pillar") developments quite closely, recognizing the presumed longer run association between monetary developments and inflation.

Despite this particular setback, the rules versus discretion debate has continued in other ways. In the 1960's, as central bankers were given a freer hand to set monetary policy, changes in policy instruments tended to be made in a highly discretionary way. Policymakers looked at a host of "indicators" to help them decide what to do[74]. While the pursuit of a monetary rule proved a dead end, it nevertheless gave a taste for what rules could provide. In particular, rules aid transparency (of which more below) and greatly simplify the policy making process. In any event, one simply cannot look at every relevant indicator (de novo) all the time.

Perhaps reflecting such considerations, central banks have tried to simplify the basic framework they use to guide their policy actions. However, major central banks seem to have drifted apart in their views about what constitutes best practice in this regard.[75]. Contrast, for example, the Federal Reserve with its "one pillar" (the output gap), the ECB with its "two pillars" (output gap and monetary pillar) and the Bank of Japan with its "two perspectives" (output gap and the need to avoid another credit bubble). However, what unites these central banks is their common reliance on the use of a Taylor rule which links deviations of the policy rate (from the natural rate) to indicators of projected inflation[76], in particular the output gap. Some central banks have gone even further (Norway, New Zealand), giving forecasts of future policy rates conditional on forecasts of the variables entering the Taylor rule.

Another aspect of the debate has centered around the "time inconsistency problem" identified by Kydland and Prescott (1977). They pointed out that policymakers, bound only by discretion, would promise to deliver a low inflation rate but would then provide greater than

[72] For example, central banks sometimes shifted focus from one monetary aggregate to another. The fact that different monetary aggregates had different income and interest rate elasticities meant that targeting different aggregates had different implications for the setting of policy rates.

[73] See Cagliarini (2010).

[74] For an early introduction to this literature see Brunner and Meltzer (1969).

[75] For a discussion of such differences, see White (2011).

[76] Monetary rules were a precursor of the Taylor rule, in that the operating procedure followed was to invert the estimated demand for money function and determine (conditional on a forecast for real demand and prices) what path the policy rate had to follow to hit the money supply target by a certain date.

expected stimulus to artificially raise output. Rational agents, however, would see this coming and the ouput benefits would not materialize. The end result would be a "too high" inflation rate. Kydland and Prescott then went on to suggest that this outcome might be prevented by the imposition of a fixed rule concerning inflation. Needless to say, Blinder (1995) and likely most central bankers, have questioned the practical relevance of this advice reflecting their belief that central bankers would never behave in the underhanded way that Kydland and Prescott assume.

The choice of an **optimizing framework** for the conduct of policy is a third philosophical issue. Should policy makers focus on maximizing output growth over time, or rather conduct their policy so as to avoid truly bad outcomes, a kind of minimaxing strategy? Looking backwards, a common thread has been maximization, perhaps in large part because the extant models did not allow for truly bad things to happen. The worst that could be expected was an upward shift to inflationary expectations, but even this was generally ruled out in the models by the assumed "credibility" of central banks and their commitment to keep inflation low.

It would be tempting to think of the Federal Reserve's pioneering introduction of a "risk approach to monetary policy", in the early years of this century, as a deviation from the single minded focus on maximizing output. However, the particular risk of concern to them was the risk of a Fisher type debt-deflation arising from the debt "headwinds" generated by earlier credit expansions. Accordingly, their "risk approach" actually implied that the Federal Reserve should be inclined towards an easier monetary policy than traditional indicators would have implied[77]. Thus, in practice, central banks continued to be encouraged by their belief system to push the limits of growth as far as possible.

Looking forward in light of the crisis, changes seem likely with respect to all three elements of this philosophical framework. The "rhetoric" of central bankers looks set to change in many ways. Since the crisis was so unexpected, and so impervious to stimulatory policies that worked in previous crises, it might well encourage central bankers to rethink previous beliefs. Moreover, they might also be expected to revisit the evidence on which those beliefs were based. If this happens, formal macroeconomic models seem likely to have less influence over policy decisions in the future and the analysis of historical events rather more. Fortunately, as noted above, there has already been an explosion of historical studies of earlier crises across a wide range of countries to help guide future policy.

Whether this possible questioning of previous beliefs will culminate in a "paradigm shift" still remains to be seen. First, as Kuhn (1962) has stressed, paradigm shifts are always very hard to achieve. Second, Steven Cechetti, Economic Adviser at the BIS, has made the valid point that "It takes a model to replace a model", and we are very far from having a viable alternative

[77] See Hanoun (2012) and also Taylor (2010) for evidence that, in recent downturns, the Fed has lowered policy rates much more than was suggested by the Taylor rule.

model. Third, to shift one's beliefs is an admission of previous error, and central bankers will have a strong aversion to doing this. Indeed, there are still many in academia, some with long associations with central banks, who contend that the crisis need elicit no significant change in the way monetary policy has been conducted[78]. Fourth, and closely related, many now point to shortcomings in the regulatory framework as being primarily responsible for what happened. The fact that, in the wake of the crisis, a number of central banks have been given significantly stronger regulatory responsibilities could well support that viewpoint.[79]

As for the rules versus discretion debate, the crisis could well swing the balance back towards discretion. To the degree that central bankers become inclined to question how much they really know about how the economy operates, they will be wary of rules that might be "wrong" rules. Finally, given such recent evidence of massive tail events, the need to formulate policies to avoid truly bad outcomes should receive more attention. Central bank optimizing frameworks could then swing from maximizing to minimaxing. In this context, there should be greater interest in procedures that are "robust" in the face of large shocks.[80] Nevertheless, the fact that monetary policy since the crisis has continued to focus almost exclusively on output gaps and price developments suggests that this change in orientation, while possible, has not yet happened.

4. Practical Issues in Conducting Monetary Policy

Alongside the constraints imposed on central bankers by the Impossible Trinity and the three frameworks just discussed, the conduct of monetary policy has been complicated by three other practical issues. First, there must be agreement on the objective being sought in the conduct of monetary policy. Second, even if policymakers claim (at any moment in time) to be reasonably certain about what model best describes the workings of the economy, there remains considerable uncertainty about parameter values, and the nature of exogenous shocks. Third, processes are required to actually formulate and then implement the monetary policy decided upon. Over the last fifty years, there have been major changes with respect to each issue. Moreover, looking forward in light of the crisis, further changes seem likely.

[78] For an example, see Mishkin (2011)

[79] The greater involvement of central banks has primarily reflected the view that traditional financial regulators lack a sufficiently "systemic" orientation. Central bankers were thought more likely to have such a systemic perspective, on the workings of the financial system in particular, even though there was little practical evidence of such an orientation in the run up to the crisis.

[80] A seminal reference is Brainard (1967). For some practical work in this vein, see some of the recent publications of the Norges Bank. In particular, Vikoren (2013)

a) Choosing the objective of monetary policy

Choosing an objective for monetary policy is logically distinct from having a model of how the economy works. That said, changing views about how the economy works, and the limitations of monetary policy, can certainly influence the objectives sought. What is a fact is that, over the last fifty years, the objective of monetary policy has changed markedly and repeatedly. Indeed, against the backdrop of history, the speed of regime changes has been unprecedented.[81]

In the decade or so following the end of the war, there appears to have been an intuitive understanding that there was no tradeoff between inflation and unemployment[82]. The one could not then be manipulated to affect the other[83]. However, with time, the belief gradually emerged that such a tradeoff did exist. As noted above, empirical work supported this hypothesis and it also played into the growing bias towards activist "Keynesian" policies. The existence of the tradeoff led to the important conclusion that policy could lower the level of unemployment permanently if policy makers were prepared to accept a "moderately" higher level of inflation[84]. The primary objective of policy in the 1960's therefore became reducing unemployment until the costs of higher inflation seemed unacceptable

However, the hypothesis of the Natural Rate of Unemployment, introduced in the late 1960's, led to the conclusion that inflation would continuously accelerate if unemployment were to go below the Natural Rate. Rising inflation in many countries in the late 1960's, even before the oil price shocks of the 1970's, reinforced this view. Policy then became directed at keeping unemployment at or near this natural rate so that inflation could be stabilized. The different reactions to the first and second oil price shocks were manifestations of this transition. Both shocks had stagflationary implications, pushing up inflation and reducing employment as real incomes fell and spending fell as well. In response to the first shock, central bankers tried to stabilize employment. However, by the time of the second shock, the priority had shifted to inflation control. As discussed above, this changed preoccupation had already

[81] See Davies (2002) for a very long historical overview.

[82] See Romer and Romer (2003)

[83] There was at the time a significant body of thought that inflation was essentially a cost push phenomenon. This contributed in various countries (and at various times) to the introduction of wage and price controls.

[84] An early and influential paper supporting this conclusion was provided by Samuelson and Solow (1960). However, Hall and Hart (2010) contend that the "hand drawn" curve suggested by the authors actually bore no relationship to the curve that would have emerged had they used the regression techniques available at the time. A more positive aspect of the paper was that the authors noted that the presumed relationship could shift over time. In this regard, they predated the later observations of Friedman and Phelps.

been signaled by the adoption of monetary targets in a number of countries in the latter half of the 1970's.

The Natural Rate hypothesis had led policymakers to question the benefits to the real economy of a lower unemployment rate that could only be maintained temporarily. In addition, growing attention also began to be paid to the associated costs of higher inflation[85]. These costs were becoming ever more evident as the period of high inflation lengthened.[86] Further, it came to be better appreciated that the costs of "living with" high inflation were permanent, whereas the costs of reducing it would be only temporary. Together with a growing concern that high inflation rates would naturally ratchet up, and could not be credibly stabilized[87], these arguments led to the conclusion that the high inflation rates of the late 1980's had to be reduced to much lower levels.

A related issue had to do with the speed of that reduction. On the one hand, the existence of a non-linear short-run Phillips curve[88] and a weak financial system argued for "going slow". On the other hand, a high initial level of inflation and a belief that inflationary expectations could be easily shocked downwards argued for "going fast". Broadly speaking, the pendulum swung from "gradualism" in the late 1970's to "cold turkey" in the early 1980s. The bold action of Paul Volker in the US, and the increasing importance given to inflationary expectations in the inflation process, likely both contributed to this change.

By the late 1980s, with inflation much reduced, there was almost a universal acceptance by central banks that price stability should be the primary objective of monetary policy. In effect, central bakers had shown empirically that they could do this, and accepted theory said they could not sustainably do anything else. Further, it was widely realized that, in leaning

[85] There is in fact much controversy about why policymakers in the US shifted their focus. . Meltzer (2009a and b) contends that this conclusion reflects a shift towards policymakers being less willing to tolerate the costs of inflation. Nelson (2012) asserts that it reflected the acceptance of the Natural Rate hypothesis. In fact, it was probably a combination of the two.

[86] See Selody (1990). Among the costs commonly referred to at the time were those caused by distortions to relative prices and the efficiency of the price system, excessively rapid repayment of principle on nominal contracts, higher risk premia and lower fixed investment, the discouragement of longer term capital markets and interaction with the tax system. In the limit, many feared an erosion of trust in government and associated political instability. Volcker explicitly notes this latter concern in explaining the Feds determination to reduce inflation in the early 1980's. Of course, these broader political concerns were by no means new. See Keynes (1923) and Hayek (1944).

[87] See Silber (2012) in which Chairman Volcker repeatedly refers to the possibility (and the dangers) of inflationary expectations coming unstuck in the early 1980's

[88] A convex Philips curve implies that holding up unemployment "less but for longer" has a bigger effect on inflation for a given cumulative loss of employment.

against demand side shocks[89], there was no conflict between the pursuit of unemployment and inflation objectives. This helped significantly in the political battle to "sell" price stability as the principal objective of monetary policy. Closely related, the objective of price stability also implied an equal (or perhaps even greater) willingness to lean against deflation as to lean against inflation.

In the early 1990's, a number of central banks went even further by adopting explicit Inflation Targetting (IT) regimes. This trend began in New Zealand and Canada and then spread widely to both other AME's and EME's. Interestingly, however, such regimes were not explicitly adopted by the European Central Bank, the Federal Reserve or the Bank of Japan[90]. In effect, IT central banks pledged to set their policy instruments in such a way as to ensure that their forecast of inflation two years hence would be consistent with the target. With time, there was a convergence of views that this target should be of the order of two percent or less, though there was little empirical evidence to suggest that the economic costs of somewhat higher inflation were indeed significant[91]. A small positive rate of inflation was said to accommodate measurement bias, to facilitate relative wage adjustments and to allow real interest rates to be negative even if interest rates should fall to the Zero Lower Bound (ZLB) in nominal terms[92].

The pursuit of price stability, whether implicitly or explicitly, seemed increasingly validated in the Advanced Market Economies by much better macroeconomic performance. The so called "Great Moderation", which began in the early 1980's and persisted until the current crisis began, was characterized by low and stable inflation but high and stable growth. The conventional wisdom among central bankers at the time was that the benefits promised by stable prices had in fact materialized. Unfortunately, this led to a still more extreme shift in views. Whereas price stability was originally viewed as necessary for sustainable real growth, price stability became increasingly seen as sufficient to ensure sustained growth. Thus, evidence that macroeconomic problems were building up under the surface tranquility,

[89] The issue of supply side shocks is returned to below.

[90] The reasons differed across the institutions. The Bank of Japan, already facing mild deflation and at the zero lower bound for the policy rate, felt they did not have the technical capacity to hit a positive inflation target. See Yamaguchi (1999). The Fed was fearful of a negative reaction in Congress to downgrading the importance of reducing unemployment. The European Central Bank was closer to the IT model, but gave significant emphasis as well to the second (monetary) pillar when deciding how to set the policy rate.

[91] Central banks also differed in the particular index they chose to stabilize, with food, energy and housing costs being the most controversial. The Federal Reserve chose to focus on "core inflation" which included a proxy (rental equivalent) for measuring the costs of housing services. In contrast, the ECB focused on headline inflation, but without any house cost component at all.

[92] A more recent suggestion that the inflation target might be raised to enhance this latter effect was generally rejected by central banks. See Blanchard (2010)

threatening the very foundations of the "Great Moderation", was systematically ignored. Even the spread of financial crises to the AME's in the late 1990's[93] was dismissed. These crises were said to reflect only "teething problems", arising from inexperience with new financial instruments and changing technology, rather than manifestations of underlying and perhaps more serious issues.

This complacency can only be explained by recourse to the philosophical framework discussed above. Both fact and theory seemed to support the accepted paradigm of central banks, and a growing hubris invited an extension of its reach. In contrast, had more attention been paid to historical evidence, it would have been noted that financial and economic crises had occurred repeatedly over many centuries[94] and there was no good reason to assume this would not continue. Moreover, most of these historical episodes looked remarkably alike in their dynamics, and also remarkably similar to developments observable in the latter years of the Great Moderation. Further, and essentially, none of the big crises in history had been preceded by any significant degree of inflation. Thus, price stability had not historically been sufficient to ensure macroeconomic stability. Indeed, it could be argued that, if low inflation was in large part due to positive productivity shocks, this should actually have been a signal to raise policy rates rather than to lower them[95].

In addition to the witness of economic history, recourse could also have been made to the history of economic thought. There was a huge pre War literature on business cycles, including the role of money and credit, which was well summarized by Haberler (1937). As well, a later literature emerged based on the work of Koo (2003), Minsky (2008) and researchers at the BIS among others. Broadly speaking, this literature emphasized credit driven "imbalances" in the economic system (speculation and leverage) leading to "booms" and sudden "busts". All of this publically available literature was essentially ignored by major central banks. So too were any warnings implicit in the papers prepared for the private meetings of central bankers at the BIS

[93] Two important events were the failure of LTCM in 1998 and the stock market "bust" of 2001

[94] To support these assertions, see the historical studies referred to above.

[95] For an analytical treatment of positive productivity shocks see Selgin (1997) and Beckworth (2008). In the 1920's Hayek felt that the absence of inflation in the US, in spite of sharp increases in productivity, was a sure sign of trouble ahead. See Haberler (1984). In effect, monetary stimulus was required to prevent prices from declining (in a "good deflation") and it was this stimulus that would lead to "malinvestments" and eventual crisis. An argument more pertinent to the present crisis would be that EME's (not least previously centrally planned economies like China and the countries of Central and Eastern Europe) exported a significant degree of disinflationary pressure to the AME's with the same results foreseen by Hayek.

itself[96]. Thus, when the crisis broke in 2007, it came as a complete shock to many central bankers and elicited the usual human response to such events - denial[97].

Even in those cases where the possibility was entertained of trouble building up under the surface, it was argued that it was not possible for monetary policy to do anything about it. Interestingly, this argument was generally couched in terms of the difficulties of "pricking asset price bubbles" rather than leaning against the broader range of credit driven imbalances characteristic of a boom. Presumably, this criticism reflected the fact that it was easier to discredit the idea of "pricking asset price bubbles" than discrediting a broader based approach which recommended credit restraint. Moreover, to ensure the perception that monetary policy would nevertheless retain its potency, it was also asserted that cleaning up after the bust would be relatively painless[98]. Even after interest rates had been reduced to the ZLB, this assertion that monetary policies would continue to be effective was implicitly maintained through the repeated application of non traditional monetary policy measures. Unfortunately, maintenance of this belief also mitigated against the search for alternative policies that might have been much more successful in helping the economy recover from the crisis in a sustainable way.

Looking forward in light of the crisis, the objective of monetary policy might or might not change again. It is certainly notable that the FOMC of the Federal Reserve Board announced in 2012 that it would not tighten policy until the unemployment rate fell to 6 ½ percent , a real rather than a nominal objective. It is not clear, however, whether a similar objective would be chosen once the economy was once again growing normally. Another source of uncertainty has been the recurrent call by the leaders of the G20 for the achievement of "strong, sustained and balanced growth". What is not clear is whether the reference to "balanced" reflects the desire that credit driven "imbalances" in the future be monitored and resisted before they eventually culminate in crisis. While this might be hoped, such an interpretation would seem inconsistent

[96] Poole (2012) notes that he had attended FOMC meetings for fifteen years and had never heard a discussion of these issues. This implies that those people attending both the BIS meetings and the FOMC meetings never brought back any of the discussions at the former to the attention of the latter.

[97] For example, when the crisis began it was said to be confined to the US subprime market. Then, it was seen to have much wider financial implications, but these were said to constitute a liquidity problem only. Only much later was it admitted that bank insolvency might also be an issue. Moreover, the idea that these financial problems could affect the real side of the economy was denied for almost two years until the global recession struck in 2009.

[98] For a fuller discussion of the "Lean versus Clean" debate, see White (2009). While easy monetary policies are often referred to as Keynesian, such monetary policies were recommended in Keynes's Treatise of 1933 and not the General Theory of 1936. By the time of the latter publication, Keynes had developed the notion of the "liquidity trap" and had concluded that monetary stimulus would not suffice to restore full employment. See Kregel (2011).

with the "ultra easy monetary policy" actually followed during the crisis which has had the side effect of aggravating the imbalances which already existed.

Looking forward, another uncertainty has to do with the broader role that central banks might play in the pursuit of systemic stability, not least with respect to the financial sector. Perhaps the only thing that is clear is that a greater focus on systemic issues will generally call for more central bank involvement. Nevertheless, as noted above, there is still an ongoing debate about the respective roles played by easy monetary policies and inadequate regulation in the run up to the current crisis. As a result, there is not yet any agreement as to what role, if any, monetary policy should play in "leaning" against future credit crises. As for the assignment to date of responsibility for macroprudential policies, it has in fact varied widely across countries. This indicates a clear lack of consensus, both as to what needs to be done and who should do it.

On the one hand, some say that the fundamental issue is the pursuit of macreconomic stability and central banks must take overall responsibility. They should accept that they have a variety of objectives, commonly referred to as price stability and financial stability, and should oversee the use of a variety of instruments to achieve them. Evidently, this would sometimes demand more complicated tradeoffs than under previous regimes[99] . One implication might be a simple lengthening of the policy horizon (currently about two years) over which the objective of price stability is pursued. A longer horizon would allow for monetary policy to preempt prospective boom-bust processes that might eventually threaten deflation and financial instability. Put otherwise, a longer horizon would allow inflation to dip temporarily below desired levels in response to tighter policies directed to slowing excessive credit growth.

On the other hand, some have recourse to the Tinbergen assignment principle and suggest that central banks should continue to focus on price stability alone. This would imply the assignment of macroprudential instruments to some other institution. An ancillary advantage would be political. Vesting too much power in one institution could invite a degree of political oversight and accountability that might in the end subvert the central banks capacity to make "independent" and essentially technical judgements about what policies to pursue. This line of reasoning would also argue for giving responsibilities for microprudential and Conduct of Business oversight to institutions other than central banks.

Were central banks to begin leaning against incipient credit bubbles, two sets of indicators would have to be monitored by someone. First, there is the possibility of problems on the real side of the economy feeding back on to the health of the financial system. A considerable

[99] Potential conflicts among competing objectives should not, however, be overemphasized. In talking about past policy regimes that were the predecessors of today's inflation targeting regimes, Laidler (2007, p8) states "These regimes in short have a long intellectual pre-history during which the stabilization of inflation was by and large not treated as a policy goal separate and distinct from mitigating the (credit) cycle and maintaining financial sector stability, but as a key means of promoting precisely these ends"

amount of quite parsimonious work on such indicators has already been carried out, but much more work is needed[100]. Second, there is the possibility of strains emerging within the financial sector and feeding back on the real side of the economy. The data requirements for assessing this are great, and have been a particular focus of G20 work[101]. The work of Reinhart and Rogoff (2009) reminds us that both chains of causation have been seen repeatedly in history. The work of Reinhart and Reinhart (2010) and Jorda et al (2012) further indicates that, when both channels are operative, the crisis is likely to be particularly deep and long lasting. The implication of these insights is that both strands of empirical work are of significant importance.

b) Dealing with uncertainty about the monetary transmission mechanism.

Models that assume instantaneous (or almost) market clearing and rational expectations imply few uncertainties in the conduct of monetary policy. Changes in monetary policy are quickly reflected in changes in prices with few (if any) real side effects. In contrast, as noted above, most central banks rely in practice on models of the IS/LM variety which relate monetary policy instruments to the flows measured in the system of National Income Accounts. Moreover, practitioners continue to believe that monetary policy affects prices only with long and variable lags. The "long" arises from regulated prices, multi-year contracts and overlapping wage settlements. The "variable" arises from the crucial role of expectations at each stage of the transmission mechanism.

Aside from some of the fundamental shortcomings revealed by the crisis, central bankers have always had to cope with other deficiencies in their knowledge about how the economy functions. For example, consider the current debate about the size of fiscal multipliers in Europe. Fiscal restraint was initially pursued on the basis of a belief that the multipliers were small[102]. More recent evidence, however, indicates that the multipliers might actually be quite large. Moreover, the data required to monitor the economy is often inadequate in scope and frequently revised. For this latter reason, measuring the "output gap" in real time is essentially

[100] See Borio and Lowe (2002), Borio and Dhremann (2009) and Barrell et al (2010),

[101] The status of this G 20 work is regularly assessed. See Financial Stability Board (2012) This G 20 work is closely related to suggestions made by Cecchetti et al (2010) and the Issing Committee (2009) on the need for "risk maps" to identify vulnerabilities in the financial sector.

[102] Arguments evoking Ricardian Equivalence said the multipliers would be zero. Some European central bankers even said that fiscal restraint would, via increased confidence effects, raise total spending. More recently, the focus has been on the dangers associated with many countries pursuing fiscal restraint together, especially if interest rates were already at the ZLB (therefore no "crowding in" from easier monetary policy). Also see Blanchard and Leigh (2013)

impossible[103], even in normal times. Borio et al (2013) notes the even greater problems faced in the aftermath of a credit bubble, when output levels can be raised to unsustainable levels without a simultaneous increase in inflation. Finally, all systems are subject to unexpected shocks of various sorts.

As for the transmission mechanism of monetary policy, it is generally accepted that changes in policy rates affect other asset prices and the exchange rate, and that these in turn affect aggregate demand, the output "gap" and finally inflation. Unfortunately each of these links is complicated and inadequately understood. For example, interest rates affect spending through substitution effects, distribution effects, wealth effects, risk seeking effects, and sometimes "credit rationing" effects. Exchange rate changes have substitution effects, terms of trade effects, foreign debt effects and can also affect the cost of capital (via imported capital goods). In addition to the sheer complexity of these links, each could easily be influenced by the state of expectations at the time.

To add to the parametric instability implied by changing expectations, we also know that many structural changes have occurred on both the real and financial sides of the global economy over the last fifty years. These might also have affected the transmission mechanism over time. On the one hand, efforts have been made to reduce rigidities in labor and product markets in many countries. Moreover, central bankers have been making ever clearer statements about their objectives and intentions. Both sets of developments bring us closer to a DSGE kind of world where objectives might be expected to be met more reliably than previously. On the other hand, both practice and theory have revealed that the modern economy is much more complicated and rapidly changing than people used to believe. The massive expansion of the "shadow banking" system in recent years, with all its associated vulnerabilities, is a case in point[104]. Perhaps even more important, globalization (both financial and real) is only just beginning to be understood. Nevertheless, early indications are that it might have profoundly changed the transmission of shocks from country to country[105], the inflationary process in some countries[106] and the fundamental nature of "value added" production chains[107].

Looking forward in light of the crisis, a first lesson was discussed above in the context of the "empirical framework" for conducting monetary policy. Models will have to be developed

[103] See Orphanides (2001)

[104] Adrian and Shin (2010) and Claessens et al (2012)

[105] See IMF (2012) and Fratzscher et al (2012).

[106] White (2008)

[107] OECD (2013)

to better reflect the transmission mechanism from monetary policy to credit growth, imbalances and potential crisis. However, a second lesson is also worth drawing. Namely, the transmission mechanism of monetary policy might also change significantly in the aftermath of a burst credit bubble[108]. Risk premia can rise, and debt overhang can pose a long lasting problem[109]. Currencies considered as "safe havens" might rise when they would normally fall as domestic policy rates were lowered. Policy rates can hit the ZLB, which implies they can fall only marginally further[110]. Financial systems, not least the interbank market, can cease to function impeding the normal transfers from lenders to borrowers. All of these developments might reduce the effectiveness of expansionary monetary policy[111].

This raises the broader question of what else might be done by monetary policy to restore growth and confidence in such circumstances. Again, there is great uncertainty. One possibility is Quantitative and Credit Easing, in effect expanding the balance sheet of central banks in one way or another. It is notable that the policy of the ECB in this regard varies in numerous ways from the policy followed by the Federal Reserve[112]. Not least, the ECB treats its actions as attempts to improve the transmission mechanism of monetary policy, whereas the Fed has increasingly suggested that its policies are a complement to traditional policies at the ZLB. Indeed, the policies followed by the Fed have themselves changed and been given different motivations over time. For its part, and based on its much longer experience with these kinds of policies, the Bank of Japan remained very skeptical about their effectiveness all through the period when Shirakawa was Governor. Since there is no broad consensus on which variant of Quantitative and Credit Easing is most effective, the topic continues to be widely debated.

Another possibility in such circumstances is Forward Guidance about the future stance of monetary policy. Suggestions of this nature seem to assume that central bank statements will have direct effects on private sector behavior. Fundamentally, this is a variant on the rational

[108] In effect, central bankers will have to have two macroeconomic models, one for before the crisis and one for afterwards. This is consistent with Leijonhufvud (2009) and his concept of the "corridor of stability". The world may work very differently when the corridor has been exceeded.

[109] See Reinhart and Reinhart (2010)

[110] Some countries, like Denmark, have announced negative rates on cash balances held by banks at central banks. There are limits to this however. If banks then recoup costs by offering negative rates on deposits, clients may withdraw cash. If banks recoup costs by raising loan rates, this will reduce loan growth and spending in turn. This would, of course, be the very opposite of the results intended.

[111] For a broader assessment, see White (2012)

[112] For a list of those differences, see Fahr et al (2011). Issing (2013) provides a robust, if implicit, defence of the ECB's practices in criticizing some of the policies pursued by the Federal Reserve after policy rates hit the Zero Lower Bound.

expectations hypothesis discussed earlier. This belief has been more firmly held in some countries (say the US) than in others (say Japan). The Fed has gone the furthest with its reliance on communications policy. Consider its repeated references to "measured" policy rate increases between 2003 and 2007, and its more recent promises to keep policy rates at current low levels for some years to come. In contrast, the ECB had resolutely refused to give Forward Guidance until it did so in a very limited way in the summer of 2013. Given the importance of this issue, significantly more empirical work is required on whether inflationary expectations are in practice "forward looking" and "rationally" based on stated central bank intentions - or not.

Another set of suggestions is closely related but goes even further. Some have suggested that the objective of monetary policy should be changed to give more credibility to the promise that policy rates will be maintained at very low levels for a long time. By suggesting that policy rates will not be raised until US unemployment falls to 6 1/ 2 percent[113], the Federal Reserve Board has made a move in this direction. Woodford (2012) has gone even further by suggesting that the Fed should pursue a target for the level of nominal GDP. Assuming the target was simply an extrapolation of pre crisis income level trends, this would imply that a very large nominal output "gap" would have to be filled before policy rates could rise. Finally, in a recent speech, Lord Adair Turner (2013) has suggested that policy makers should consider expanding fiscal deficits even further, with the deficit being financed by a "permanent" expansion in base money issued by the central bank.

Subsequently, numerous practical difficulties have been raised with respect to all these suggestions. However, of greatest concern has been the downplaying of the price stability objective of monetary policy. Coupled with concerns about "fiscal dominance" in many countries, and recent huge expansions in central bank balance sheets, critics of these suggestions worry about a sharp upward shift in inflationary expectations. The suggestion of a "permanent" increase in base money is even more worrisome since, given our lack of understanding of the factors determining the velocity of money, it would seem to leave the price level essentially indeterminate.

By way of a final criticism of these suggestions, a literature is now developing which concludes that a high degree of transparency about the future use of policy instruments might actually contribute more to financial instability than to stabilization of the real economy. Adrian and Shin (2008) write

> "If central bank communication compresses the uncertainty around future short rates, the risk of taking on longer term assets financed by shorter term debts is compressed……..In this sense, there is the possibility that forward looking communication can be counterproductive"

[113] A side constraint was that inflation had to remain below 2 ½ percent.

The BIS also made a similar point at various times between 2003 and 2007, when policy rates in the US were being raised month after month in a "measured" way. The word "measured" then became market code for the Fed's intention to raise the Fed funds rate by 25 basis points at each subsequent meeting of the FOMC. Thus, while maturity spreads were falling, the variance term in the Sharpe ratio was falling even faster. Many market participants have subsequently suggested that high transparency was actually an open invitation to the speculation and leverage which culminated in the crisis of 2007.

In the aftermath of the use of non traditional monetary instruments to fight the current crisis (including forward guidance), interest rate spreads and other measures of risk eventually fell to near record lows. Long bond rates in many countries actually did set record lows. This led many market commentators to suggest that "transparency" might again be having unexpected and unwelcome consequences by encouraging financial asset prices to rise to unsustainable levels. However, others continued to feel that clear indications from the monetary authority (especially the Fed) about the timing and pace of the "exit" from previous policies was appropriate and would contribute materially to the unwinding of speculative positions in an orderly way.

c) Processes to formulate and implement monetary policy

The third practical requirement, if monetary policy is to be applied effectively, is a set of processes for changing the setting of policy instruments. Again there have been major changes over the course of the years. Broadly put, the change has been from more informal (and irregular) processes to more formal processes (regular meetings at defined intervals) leading up to more regular changes in policy instruments. As well, there has been a trend away from unilateral decisions on the part of the head of the monetary authority towards the use of committees. However, there continues to be wide variations in the practices followed by different central banks[114].

Over the years, an economic forecast generated by the staff of the central bank moved increasingly to the heart of the process, with particular attention being paid to the forecast for the main objective(s) sought by policy. In recent years, this has implied that the outlook for inflation has taken centre stage. Instruments were then set to achieve the desired objective, generally two or three years out. At regular intervals, this process was repeated with all new

[114] These differences apply to size of committees, voting procedures, publication of minutes (length of time delay before publication) and a host of other issues.

information being incorporated.[115] This might seem a rather straight forward process that might be carried out with relatively few resources. However, the devil is in the details. Three particular problems can be identified, and there have been significant changes in practice over the course of the years.

The first practical complication is the need to choose the policy instrument. A few decades ago text books (and some central bankers) would have talked of base money and money multipliers. Eventually, however, this approach was completely replaced by the use of a short term policy rate as the main instrument of policy[116]. The essential reason was the belief that the relatively high variance in the demand function for central bank reserves would lead to wide fluctuations in short term rates given a policy of base control[117]. Coincident with this reorientation, central banks also introduced various administrative rates to provide a corridor of stability within which the policy rate would fluctuate

A second practical complication has to do with central banks' different attitudes to the speed with which the policy rate should move. Some central banks seem more inclined to move their policy rate by large amounts than do others. On the one hand, large movement might seem required given changes in the forecast, but they might then have to be reversed (embarrassingly so) if the forecast proves wrong. On the other hand, smaller movements might imply the central bank will be "behind the curve" in meeting its objectives. In successive cycles since the early 1980's, the movements in policy rates do seem to have become more extreme (particularly during easing phases). However, it is unclear whether this reflected changing preferences, or rather changing perceptions about the need for more vigorous policy action.

The third practical complication is that information about the state of the economy arrives continuously, whereas forecasts are revised only periodically. Under what circumstances should such information be allowed to feed through to policy instruments in the period between forecasts. A pertinent example would be a sudden downward move in the exchange rate. Should the policy rate move upward automatically to offset this easing in the "monetary conditions index" (MCI)[118], or not? The Bank of Canada first invented this MCI concept in the

[115] A further trend has been to try to model explicitly the implications for the objective sought of different assumptions about exogenous variables (not least, developments in other countries) and uncertainty about the model itself.

[116] Note, however, that central banks control this rate essentially by altering the supply of central bank reserves relative to the perceived demand for such reserves. Again, there are a wide variety of practices in this area.

[117] The seminal article here is Poole (1970)

[118]The MCI was originally defined by the Bank of Canada as a weighted average of the policy rate and the exchange rate. The weights were supposed to reflect the relative effects of each on real spending on Canadian produced goods and services, and were calculated as a rough average of the elasticities derived from the various models

1980's, and initially concluded that the policy rate should be allowed to rise. A number of other central banks came to the same conclusion.

However, dating from the 1990's, there was a significant change of views. It became increasingly understood that the source of the shock to the exchange rate mattered in determining how to respond. A decline due to a deterioration in the terms of trade is very different from a speculative run on the currency. The former implies a weaker economic outlook that should not be met by a higher policy rate. In contrast, a speculative run would imply more inflationary pressure and a higher policy rate would be the appropriate response. Evidently, the insight that it matters "why" things happen, has also played a big role in various aspects of the rules versus discretion debate [119].

Looking forward in light of the crisis, a number of the processes referred to above look likely to change. First consider the choice of instrument to be selected for use by a central bank. In current circumstances, with policy rates effectively at zero, emphasis has once again shifted back to quantitative instruments to stimulate aggregate demand. The different practices in this area and the uncertainties they give rise to were discussed above. However, looking further ahead, to a time when a new "normal" has been established, the possibility that financial stability might become part of the objective function of central banks has major implications. In recent years, there has been growing interest in the use of "macroprudential" instruments to help control excessive credit growth. Which instruments, when, in what order, and what should be the role of traditional monetary instruments? These questions are all now open to vigorous debate.[120]

The speed with which policy instruments are used would also be affected. As Borio (2012) points out, financial imbalances tend to build up slowly over time, and then culminate in a sudden and violent crisis. He concludes that policy instruments directed to financial stability should have a similar asymmetric quality. In contrast, others have noted the need to retain market confidence in a crisis. Thus, there is always a danger that a sharp easing in the use of macroprudential instruments (for example, bank capital requirements) might destroy such confidence and then have restrictive effects on lending and the real economy. This

---

then in use at the Bank. Today, many central banks, and institutions like the OECD, compute such indices using a much broader range of financial variables.

[119] This is essentially the same issue raised by Poole (1970). When policymakers are confronted with a sudden rise in the quantity of money, should they raise rates or not? Poole states that it depends on the source of the movement. If the higher quantity of money reflects increased money demand due to higher (unexpected) spending, then rates should rise. However, if the underlying cause is a shift in the demand for money function itself, then rates should not rise.

[120] See CGFS (2010), CGFS (2012), Galati and Moesner (2011)) and Moreno (2011)

disagreement leads to the conclusion that prudential requirements prior to a crisis have to be high enough to offset such a danger[121].

Finally, the crisis has shown that central banks need to be prepared to react more quickly and more powerfully to market signals than they were used to doing in the past. The economic forces affecting growth and inflation tend to work rather slowly, and a measured response to unexpected movements in market indicators (say monetary aggregates or the exchange rate) was generally possible without significant implications for these objectives. However, the crisis has clearly indicated that unexpected movements in market indicators can also be a sign that markets are no longer working normally. The collapse of the interbank market after the failure of Lehman Brothers demanded a rapid central bank response to prevent an even greater degree of financial instability. Central banks will be significantly more conscious of such possibilities going forward[122].

Conclusions

Looking back at the conduct of monetary policy over the last fifty years, one must be impressed by the changes observed in every aspect of the business. Exchange rate frameworks have undergone sometimes radical change. Domestic monetary frameworks have also undergone significant changes, with the analytical, political and philosophical aspects all being affected in various ways. Similarly, all of the practical problems that must be confronted when conducting monetary policy have elicited quite different solutions at different times, and often quite different solutions in different countries. The objectives sought in the conduct of monetary policy have also changed repeatedly, albeit increasingly focused on price stability prior to the crisis. As well, central bankers came increasingly to recognize the complexity of the monetary transmission mechanism, not least the importance of a properly functioning financial sector. Nevertheless, prior to the onset of the crisis, they generally failed to incorporate such concerns about excessive credit expansion and its subsequent "headwinds" (both real and financial) into their decision making frameworks.

Looking forward, against the backdrop of the crisis, it seems likely that the issues posed by complexity will have to be addressed more systematically. Domestically, it is not clear that the pursuit of price stability and financial stability can be easily compartmentalized. Nor is it clear

[121] In the current crisis, the unfortunate truth is that these pre crisis conditions were not met. Thus, we have a continuing debate as to whether it made sense to have tightened capital requirements for banks before the crisis was over. This debate is particularly pertinent to Europe.

[122] There might, however, still be differences about precisely how to respond. Whereas most central banks continued to target their policy rate, even as the interbank rate soared, the Swiss National Bank set a target for the interbank rate and adjusted its "policy" rate accordingly.

that policies can be pursued for their short term results, as in the past, without thinking about the longer term consequences. The expectational feedbacks between central banks, Main Street and Wall Street are also of baffling complexity and can easily change over time. Similarly, fundamental and ongoing changes to the structure of the economy must also be taken into account. Internationally, it is clear that domestic monetary policies can have important implications for others through a variety of channels; exchange rates, capital flows, bond rates and induced policy responses among others.

Recognizing all this complexity, where do we go from here? Perhaps the first required step is a more whole hearted affirmation of the need for a new analytical framework to deal with all these issues. As noted above, the rapidly advancing and interdisciplinary study of complexity theory might have a lot to offer to macroeconomics. Closely related, such an approach might lead to the conclusion that our current "fiat money" system invites complexity with all its associated dangers. This might then led to a reopening of some old debates, about "narrow banking" in particular. A second required step is to recognize more clearly the international spillovers from domestic policy actions. We urgently need to rethink the foundations of our current international monetary (non) system.

Finally, recognizing both past uncertainties and future uncertainties about how "best" to conduct monetary policy, we should not rely excessively on the use of monetary policies to cure all ills. Monetary policy remains more art than science and the artists remain all too human and fallible. This final conclusion, that we need to widen the array of policy tools directed to economic stabilization, clearly applies to the prevention or moderation of the next crisis. It applies, however, equally or even more strongly to the management of the current one.

Bibliography

Adrian T and Shin H.S (2008) "Financial Intermediaries, Financial Stability and Monetary Policy" Federal Reserve Bank of New York Staff Reports, no. 346, September

Adrian T, and Hyun Song Shin (2010) "The Changing Nature of Financial Intermediation and the Financial Crisis of 2007-2009" Annual Review of Economics 2 pp. 603-618

Backhouse R E and Bateman B W (2011) "On Post Keynesian economics and the economics of Keynes" Mimeo, June

Ball P (2012) "Why Society is a Complex Matter" Sringer-Verlag, Berlin and Heidelberg

Bank for International Settlements (2010) Annual Report, Chapter 6, Basel, July http://www.bis.org/publ/arpdf/ar2010e6.pdf

Barell R, Davis E P, Karim D and Laidze I (2010) " Calibrating Macro prudential Policy" NIESR and Brugel University , 10 September

Beckworth D. (2008) "Aggregate Supply Driven Deflation and Its Implications for Macroeconomic Stability" - Cato journal, Vol 28, No 3, Autumn.

Berk J M and Knot K H W (2001) "Testing for Long Horizon UIP Using PPP-based Exchange Rate Expectations" Journal of Banking and Finance 25, pp377- 391

Blanchard O, Dell'Ariccia G and Mauro P (2010) "Rethinking Macroeconomic Policy" IMF Staff Position Note 10/03, Washington, 12 February

Blanchard O (2000) "What do we Know about Macroeconomics that Fisher and Wicksell Did Not?" NBER Working Paper 7550, Cambridge Mass., February

Blanchard O and Leigh D (2013) "Growth Forecast Errors and Fiscal Multipliers" IMF Working Paper 13/1, Washington, January

Blinder A (1995) "Central Banking in Theory and Practice" The Marshall Lectures, Cambridge UK

Blinder A S and Reis R (2005) "Understanding the Greenspan Standard" Prepared for the Symposium "The Greenspan Era: Lessons for the Future" Sponsored by the Federal Reserve Bank of Kansas City, Jackson Hole Wyoming 4 August

Bordo M D (2008) "History of Monetary Policy" In "The new Palgrave Dictionary of Economics" Edited by S N Durlauf and L E Blume Second Edition, Volume 5

Borio C. E. V. and Dhremen M. (2009) "Towards an Operational Framework for Financial Stability: Fuzzy Measurement and its Consequences" BIS Working Paper 268, Basel, June.

Borio C and Lowe P (2002) "Asset Prices, Financial and Monetary Stability: Exploring the Nexus" BIS Working Paper 114, Basel, July

Borio C, Disyatat P and Juselius M (2013) "Rethinking potential output:embedding information abot the financial cycle" BIS Working paper 404, Basel, February

Borio C and Shim I (2007) "What can (macro) prudential policy do to support monetary policy?" BIS Working paper 242, Basel, December

Borio C.E.V and White W.R (2003) "Whither Monetary and Financial Stability : the Implications of Evolving Policy Regimes?" – Presentation at the Symposium "Monetary Policy and Uncertainty: Adapting to a changing Economy" Sponsored by the Federal Reserve Bank of Kansas City, Jackson Hole, Wyoming, August

Borio C (2012) "The Financial cycle and Macroeconomics: What Have We Learnt?" BIS Working Paper 395, Basel, December

Brainard, W (1967) "Uncertainty and the Effectiveness of Policy." *American Economic Review* 57, pp. 411-425.v

Brunner K and Meltzer A (1969) ".The Nature of the Policy Problem" In Karl Brunner, ed., "Targets and Indicators of Monetary Policy" Chandler, San Francisco

Cagliarini A, Kent C and Stevens G (2010) "Fifty Years of Monetary Policy: What Have we Learned" Presentation at 50th Anniversary Symposium of the Reserve Bank of Australia, Sydney, 9 February

Capie F (2013) "Can Central Bank Independence Survive Crises?" Paper Presented at the 41st Economic Conference of the Austrian National Bank, Vienna, 10 June

Cecchetti S, Fender I and McGuire P (2010) "Towards a Global Risk Map" BIS Working Paper 309, Basel, May

CGFS (2010) "Macroprudential Instruments and Frameworks: A Stocktaking of Issues and Experiences" CGFS Paper 38, Basel, May

CGFS (2012) "Operationalizing the Selection and Application of Macro prudential Instruments" CGFS Paper 48, Basel

Claessens C, Pozsar Z, Ratnovski L and Singh M (2012) “Shadow Banking: Economics and Policy” IMF Staff Discussion Note 4 December

Clarida R, Gali J and Gertler M (1999) “The Science of Monetary Policy: A New Keynesian Perspective” Journal of Economic Literature, Vol 37, No 4, December, pp1661-1707

Committee on International Economic Policy and Reform (2011) “Rethinking Central Banking” Brookings Institution, Washington

Crow J. (1993) “Monetary Policy and the Responsibilities and Accountabilities of Central Banks” Gerhard de Kock Memorial Lecture, University of Pretoria, Pretoria, February.

Davies G (2002) “A History of Money from Ancient Times to the Present Day” 3rd. ed. University of Wales Press, Cardiff.

Debelle, G. and Fischer S (1994) “How Independent Should a Central Bank Be?” in J.C. Fuhrer (ed.), “Goals, Guidelines and Constraints Facing Monetary Policymakers”, Federal Reserve Bank of Boston, 195-221.

Fahr S, Motto R, Rostagno M, Smets F and Tristani O (2011) “Lessons for Monetary Strategies from the Recent past” In “Approaches to Monetary Policy Revisited: Lessons from the Crisis” European Central Bank, Frankfurt am Main, July

Financial Stability Board (2012) “The Financial Crisis and Information gaps” Staff of the IMF and Financial Stability Board, Washington and Basel, September

Fischer S (2001) “Exchange Rate Regimes: Is the Bipolar View Correct?” *Journal of Economic Perspectives*, 15(2): 3-24.

Fleming, J M (1962). "Domestic financial policies under fixed and floating exchange rates". *IMF Staff Papers* **9**: 369–379. Reprinted in Cooper, Richard N., ed. (1969). *International Finance*. New York: Penguin Books.

Fratzscher M, Lo Duca M and Straub, R (2012) “Quantitative easing, Portfolio Choice and International Capital Flows” Draft , European Central Bank, Frankfurt, 22 February

Friedman M (1959) “A Program for Monetary Stability” Fordham University Press, New York

Friedman M (1956) “The Quantity Theory of Money: a Restatement” In “Studies in the Quantity Theory of Money” University of Chicago Press, Chicago

Friedman M (1953) “The Case for Flexible Exchange Rates,” in *Essays in Positive Economics*, Chicago: University of Chicago Press, pp. 157-203.

Friedman M (1968) “The Role of Monetary Policy” American Economic Review 58(1) March, pp1-17

Frydman R and Goldberg M D. (2011) “Beyond Mechanical Markets” Princeton University Press, Princeton and Oxford

Funibashi Y (1988) “Managing the Dollar: From the Plaza to the Louvre” Institute for International Economics, Washington

Galati G and Moesner R (2011) “Macroprudential Policy – a Literature Review” BIS Working Paper 337, Basel, February

Galati G and Melick W (2006) “The Evolving Inflation process” BIS Working Paper 196, Basel, February

Ghosh, Atish R., Gulde, Anne-Marie and Wolf, Holger C (2000) “Currency Boards: More Than a Quick Fix?” Economic Policy, Vol. 15, Issue 31, October

Goodhart CAE (2010) “The Changing Role of Central Banks” Presentation at the Annual BIS Research Conference , Luzern, 24 June

Gorton, Gary B. and Andrew Metrick (2010) “Regulating the Shadow Banking System” Brookings Papers on Economic Activity, Fall, 2010, pp. 261-97

Grim R (2009) “How the Federal Reserve Bought the Economics Profession” Huffington Post, 23 October

Haberler G (1984) “Reflections on Hayek’s business cycle theory” Cato Journal, Vol 6, Autumn

Haberler G (1939) “Prosperity and Depression” League of Nations, Geneva

Hall T E and Hart W R (2010) “The Samuelson- Solow Phillips Curve and the Great Inflation” Miami University Department of Economics, Working paper 2010.08, October

Hanke S and Schuler K (1994) “Currency Boards for Developing Countries: a Handbook” ICS Press, San Francisco

Hanoun H (2012) “Monetary Policy in the Crisis: Testing the Limits of Monetary Policy” – Speech delivered at the 47th SEACEN Governor’s Conference, Seoul, Korea, 13-14 February

Haring N and Douglas N (2012) “Economists and the Powerful” Anthem Press, London

Hayek (1979) “The Counter-Revolution of Science: Studies in the Abuse of Reason” Liberty Press, Indianapolis

Hayek F A (1944) “The Road to Serfdom” George Routledge and Sons, London and New York

Hicks J (1977) “Economic perspectives: Further Essays on Money and Growth” Clarendon Press

Hicks J M (1937) “Mr. Keynes and the Classics: a Suggested Interpretation” Econometrica Volume 5, Issue 2, April, pp 147-169

International Monetary Fund (2012) “The Liberalisation and Management of Capital Flows: an Institutional View” Washington, 14 November

International Monetary Fund (2013) “The interaction of monetary and macroprudential policies” Washington, 29 January

Issing Committee (2009) “New Financial order – Recommendations by the Issing Committee, February

Issing O (2013) “A New Paradigm for Monetary policy?” Centre for Financial Studies Working Paper No 2, Frankfurt

James H (2012) “Making the European Monetary Union” The Belknap Press of Harvard University, Cambridge Mass.

Jorda O, Schularick M and Taylor A.M (2012) “When credit bites back: leverage, business cycles and crises” – Paper prepared for a conference on “Debit and Credit Growth and Crises” hosted by the World Bank and the Bank of Spain, Madrid 18-19 June

Keen S (1995). "Finance and Economic Breakdown: Modeling Minsky's 'Financial Instability Hypothesis.'."Journal of Post Keynesian Economics, 17(4), 607-35.

Keynes J M (1923) “A Tract on Monetary Reform” Macmillan and Company, London

Koo R (2003) “Balance Sheet recession” John Wiley and Son. Singapore

Kregel J (2011) “Was Keynes’s Monetary Policy, à Outrance in the Treatise, a Forerunner of ZIRP and QE? Did He Change His Mind in the General Theory?” Policy Note 2011/4, Levy Economics Institute of Bard College

Kuhn T (1962) “The Structure of Scientific Revolutions” University of Chicago Press

Kydland F E and Prescott E C (1977) “Rules Rather than Discretion: the Inconsistency of Optimal Planning” Journal of political Economy Vol. 5, Issue 3, June, pp473-492

Laidler D (2007a) “Successes and Failures of Monetary Policy since the 1950’s” University of Western Ontario, Working Papers 2007-2, October

Laidler D (2007b) “Financial Stability, Monetarism and the Wicksel Connection” University of Western Ontario Working Paper 2007-3, October

Laidler D (2009) “Lucas, Keynes and the Crisis” Mimeo, July

Leeson R (2000) “Inflation, Disinflation and the Natural Rate of Unemployment: A Dynamic Framework for Policy Analysis” In “The Australian Economy in the 1990’s” edited by D Gruen and S Shrestha, Reserve bank of Australia Sydney, July

Leijonhufvud A (1968) “On Keynesian Economics and the Economics of Keynes” Oxford University Press, New York

Leijonhufvud A (2009) “Out of the Corridor: Keynes and the Crisis” – Cambridge Journal of Economics 33, PP. 741-757

Lucas R E (1980) “Methods and Problems in Business Cycle Theory” Journal of Money, Credit and Banking, Vol 12, No 4, Part 2, November

Mankiw N G (1988) “Recent Developments in Macroeconomics: A Very Quick Refresher Course” Journal of Money, Credit and Banking, Vol. 20, No 3, August

McCloskey D (1985) “The Rhetoric of Economics” University of Wisconsin Press, Madison, Wisconsin

Meltzer A (2009a) “ A History of the Federal Reserve ,Vol. 2, Book 1: 1951-1969” University of Chicago Press, Chicago

Meltzer A (2009b) “A History of the Federal Reserve, Volume 2, Book 2; 1970-1986” University of Chicago Press, Chicago

Minsky H (2008) “Stabilising an Unstable Economy” McGraw Hill, New York

Mishkin F S (2011) “Monetary Policy Strategy: Lessons from the Crisis” in “Approaches to Monetary Policy Revisited- Lessons from the Crisis” Sixth ECB Central Banking Conference, European Central Bank, Frankfurt

Mishkin F S (2009), “Will Monetary Policy Become More of a Science?” in Deutsche Bundesbank, ed., Monetary Policy Over Fifty Years: Experiences and Lessons (Routledge: London 2009), pp. 81-107. Reprinted in Volcker Wieland, Editor, The Science and Practice of Monetary Policy Today (Springer-Verlag: Berlin, 2010), pp. 81-103

Moreno R (2011) “Policymaking from a Macroprudential Perspective in Emerging Market Economies” BIS Working Paper 336, Basel, January
Morley J (2010) “The Emperor has No Clothes” Macroeconomic Advisors Macro Focus, Vol 5, No 2, 24 June

Mundell, Robert A. (1963). "Capital mobility and stabilization policy under fixed and flexible exchange rates". Canadian Journal of Economic and Political Science 29 (4): 475–485. doi:10.2307/139336. Reprinted in Mundell, Robert A. (1968). International Economics. New York: Macmillan.

Murray J and Khemani R (1989) “International Interest Rate Linkages and Monetary Policy: a Canadian Perspective” Bank of Canada Technical Report 52

Nelson E (2012) “ A Review of Allen Meltzer’s A History of the Federal Reserve, Volume 2” International Journal of Central Banking, June

OECD (2013) “Aid for Trade at a Glance: Connecting to Value Chains” Paris, 8 July

Orphanides A (2001) Monetary Policy Rules Based on Real Time Data” American Economic Review 91, pp964-985

Phelps E S (1968) “Money-Wage Dynamics and Labour-Market Equilibrium” Journal of Political Economy, Chicago University Press 76, pp 678-711

Phillips A W (1958). "The Relation Between Unemployment and the Rate of Change of Money Wage Rates in the United Kingdom, 1861 to 1957". *Economica* **25** (100): 283–299

Poole W (1970) .Optimal Choice of Monetary Policy Instruments in a Simple Stochastic Macromodel., Quarterly Journal of Economics, 84, 197-216

Poole W (2012) “ Monetary Policy Flexibility: Solution or Problem” In “Challenges to Central Banking in the Context of the Financial Crisis” Edited by S Gokarn, Reserve bank of India and Academic Foundation, New Delhi

Popper, K (1972) “Objective Knowledge. An Evolutionary Approach” Oxford University Press

Pringle R (2012) “The Money Trap” Palgrave Macmillan, Basingstoke Hampshire

Reinhart C and Reinhart V (2010) “After the Fall” Presentation at the Symposium “macroeconomic Challenges: the Decade Ahead” Sponsored by the federal Reserve Bank of Kansas City , Jackson Hole Wyoming, August

Reinhart C and Rogoff K S (2009) “This Time is Different: Eight Centuries of Financial Folly” Princeton University Press, Princeton NJ

Reinhart C M and Sbrancia M B (2011) "The liquidation of government debt" NBER Working Paper 16893, Cambridge Mass., March

Robinson J (1962) "Review of Johnson" Economic Journal 72:690-692.

Roger S and Vlcek J (2011) "Macrofinancial modeling at Central Banks: Recent developments and Future Directions" IMF Working Paper 12/21 Washington, January

Romer C D and Romer D H (2002) "The Evolution of Economic Understanding and Post war Stabilisation Policy" In "Rethinking Stabilisation Policy" Sponsored by the Federal Reserve Bank of Kansas City, Jackson Hole Wyoming, August

Samuelson P A and Solow R M (1960) "Analytical Aspects of Anti-Inflation Policy" American Economic Review papers and proceedings 50(2) pp 177-194

Sargent T J and Wallace N (1975) "Rational Expectations, the Optimal Monetary Instrument and the Optimal Money Supply Rule" Journal of Political Economy, Vol 83, No 2

Schularick M and Taylor A M (2009) "Credit Booms Gone Bust: Monetary Policy, Leverage Cycles and Financial Crises 1870-2008" NBER Working Paper Series No 15512, Cambridge Mass.,

Selgin G. (1997) "Less than Zero: the Case for a Falling Price Level in a Growing Economy"- IEA Hobart Paper No 132, London.

Selody J (1990) "The Goal of Price Stability: A Review of the Issues" Bank of Canada Technical Report 54, Ottawa

Siklos P L (2007) "Revisiting the Coyne Affair: A Singular Event that Changed the Course of Canadian Monetary History" Wilfred Laurier University, Draft, February

Silber W L (2012) "Volcker" Bloomsbury Press, New York

Taylor J (2010) "Rethinking Monetary Policy in Light of the Crisis" In "Macroeconomic challenges: the decade ahead" Symposium ssponsored by the Federal Reserve Bank of Kansas City, Jackson Hole Wyoming

Turner Lord A (2013) "Debt, Money and Mephistopheles: How Do We Get Out of This Mess" Lecture at Cass Business School, London, 6 February

Vikoren B (2013) "On Financial Imbalances and Monetary Policy" Presentation at the Soria Moria Hotel, Oslo, 2 February

White W R (2006) "Is Price Stability Enough" BIS Working Paper 205, Basel, April

White W R (2008) “Globalisation and the Determinants of Domestic Inflation” BIS Working Paper 250, Basel, March

White W R (2009) “Should Monetary Policy Lean or Clean” Federal Reserve Bank of Dallas, Globalisation and Monetary Policy institute, Working paper 34, Dallas, August

White W R (2010) “The Mayekawa Lecture: Some Alternative Perspectives on Macroeconomic Theory and Some Policy Implications” Monetary and Economic Studies, Institute for Monetary and Economic Studies, bank of Japan, Vol. 28, November

White W R (2011) “Why all Central Banks are Not the Same” In “Challenges to Central Banking in the Context of Financial Crisis”, Edited by S Gorkan, Reserve Bank of India and Academic Foundation

White W R (2012) “Ultra Easy Monetary Policy and the Law of Unintended Consequences” Federal Reserve bank of Dallas, Globalisation and Monetary Policy Institute, Working Paper 126, Dallas

White W R (2013) “Overt monetary Financing and Crisis Management” www.project-syndicate.org 12 June

Woodford M (2013) “Accommodation at the Zero Lower Bound” In “The Changing Policy Landscape” Symposium sponsored by the Federal Reserve Bank of Kansas City, Jackson Hole Wyoming, August

Yamaguchi Y (1999) “Asset Prices and Monetary Policy: Japan’s Experience” In “ New Challenges for Monetary Policy”, Symposium sponsored by the Federal Reserve Bank of Kansas City, Jackson Hole Wyoming, August

@inproceedings{White2013IsMP, title={Is Monetary Policy a Science? The Interaction of Theory and Practice Over the Last 50 Years *}, author={William Roy White}, year={2013} }. William Roy White. Published 2013. DOI:10.24149/gwp155. In recent decades, the declarations of â€œindependentâ€ central banks and the conduct of monetary policy have been assigned an ever increasing role in the pursuit of economic and financial stability. This is curious since there is, in practice, no body of scientific knowledge (evidence based beliefs) solid enough to have ensured agreement among central banks on the bes