Deflations

SUMMARY

Inflation is currently low and stable in industrialized countries, but might deflation replace inflation as a major policy concern? We present a broad cross-country historical study of deflation over the past two centuries in order to shed light on current policy challenges. In the light of the relevant theoretical approaches, we empirically characterize 'good, bad and ugly' deflations, assess similarities between the current low-inflation environment and that of the gold standard period, and discuss lessons from the historical record as to policies to escape undesirable deflation and the relative merits of interest rate and monetary instruments.

— Michael Bordo and Andrew Filardo

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Deflation and monetary policy in a historical perspective: remembering the past or being condemned to repeat it?

Michael Bordo and Andrew Filardo

Rutgers University; Bank for International Settlements

1. INTRODUCTION

After 20 years during which inflation was viewed as public enemy number one, the spotlight has recently shifted to deflation (for a brief overview of recent aggregate price level declines, see the Web Appendix). Although deflation has been treated as a new and daunting policy challenge, it is far from new and need not be daunting. In the century before World War I, price levels in many countries declined as often as they rose and, moreover, falling prices were not always associated with recessions. Indeed many deflation episodes were 'good' in the sense that they were associated with productivity-driven economic growth.

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Our paper looks back in history to the time when deflation was commonplace in order to draw lessons for the current policy environment. Deflation and near-deflation experiences in recent years around the world have raised important monetary policy questions, such as: How bad is deflation? How can an unwelcome deflation be avoided? How can one escape a deflation? What type of institutional frameworks are more immune from the negative aspects of deflation? To be sure, there are differences between the policy environment today and the ones in the distant past. But the similarities are sufficiently close to shed light on current policy challenges. In other words, the historical record provides a fertile 'laboratory' to study how an economic environment behaves in deflationary times and to gain some insight into the policies that may help current policy makers.

The paper begins with a brief survey of some theoretical issues and monetary policy dimensions of deflation. This discussion provides a backdrop with which to interpret much of the evidence on deflation that we present, which draws from the historical records of many countries with several having data going back as far as the past two centuries. Our survey of history corroborates the view that historical deflations fall into three broad categories: 'the good, the bad and the ugly'. To understand the differences, we first use historical narratives to identify and illustrate each of these three types of deflation. We then provide a more formal statistical evaluation of the determinants of different types of deflationary episodes, subject of course to the various limitations inherent in existing historical data. Armed with these results, we turn in the last section to lessons to be learned about the efficacy of monetary policy in dealing with both the threat of and reality of deflation. The historical record suggests that all deflations are not alike and therefore may require different approaches.

Our historical approach leads us to conclude that most central banks today put too little emphasis on the role of monetary aggregates in assessing the broad strategic policy trade-offs presented by deflation and that economists are often too eager to characterize low inflation economies as being in a liquidity trap. In the broader context of monetary frameworks, our analysis sheds some light on the importance of mixed monetary policy strategies. History suggests that a monetary framework that combines the best features of monetary aggregate and interest rate targeting, not unlike the current approach of the European Central Bank, is more likely to be useful in addressing the policy challenges ahead.

2. CONCEPTUAL ISSUES

Deflation can be a confusing concept for policy makers. At the most simple level, deflation is a statistical definition – a falling price level. But in policy discussions, deflation can represent both the symptom and the cause of different economic phenomena. In this section, we discuss various features of deflation to set up our historical analysis of the different types of deflations.

2.1. Types of deflation

History suggests that deflations come in three basic types: the good, the bad and the ugly (Bordo *et al.*, 2004 and Borio and Filardo, 2004). The differences among these types arise from the shocks that cause them and the impact of falling prices on how the economy subsequently responds.

Bad deflations are those associated with recessions. In the pre-1960 period, economic contractions arising from demand deficiencies, that is, the leftward shift in aggregate demand, were more likely associated with deflation. In the 1960 to mid-1990s period when the trend rate of inflation was positive, economic weakness was associated with disinflation. An empirical question still remains about whether deflation, in contrast to disinflation, made economic downturns worse than would otherwise be the case. If deflation was not simply a symptom of weak demand in a low inflation environment but rather the cause of additional rounds of economic weakness, bad deflations would be outcomes that policy makers might want to fight more vigorously. We will provide a more nuanced understanding of this issue of bad deflations in the following theoretical discussion of optimal inflation/deflation rates and in the empirical section by offering new evidence on the symmetry of the inflation/deflation processes in the historical data.

By means of contrast, good deflations are those that arise from positive supply shocks. In a standard aggregate supply and demand framework, an outward shift in the supply curve will put downward price pressures. If the initial inflation rate is low enough, deflation may be realized. Such shocks would be generally accompanied by lower product prices, but higher profits, rising real wages, higher asset prices and stronger financial sector performance.

Ugly deflations represent periods of steeply declining prices associated with severe recession. During these periods, declining prices arising from aggregate demand are sufficient to feedback to aggregate supply via onerous debt burdens, personal and corporate bankruptcies, financial crises and other adverse conditions; policy failures, especially from monetary policy, may add to the severity and the length of the downturns. As we will show, such conditions have occurred, but have been quite rare. The recent literature on deflation and monetary policy has focused on the possibility that monetary policy may lose its effectiveness in such extreme situations as when a liquidity trap occurs; while the theoretical literature offers novel solutions for such situations, we find little evidence that such extreme situations are of practical policy relevance today.

To be sure, the taxonomy of the good, the bad and the ugly is simplistic. But this rhetorical device gets at the heart of the policy issue. Not all deflations are alike. As the labels suggest, good deflations are likely to be less worrisome to a policy maker than a bad or ugly deflation. Therefore it is important to distinguish types of deflation.

Moreover, it is important to note that while deflation has the possibility of making an undesirable condition worse, it is also true that inflation can do the same. While

we will not be stressing the inflation record, it is well known that inflation can cause economic distortions that rise with the level of inflation. Inflation can lead to direct resource costs as agents expend time and effort to economize on cash balances. Moreover, high inflation has traditionally been associated with information-jamming volatility in relative prices which not only distorts final good allocations but can also 'throw sand in the gears' of the labour and capital markets. In emerging market economies, high inflation environments have led in the past to the closure of domestic long-term bond markets and to an increase in economic uncertainty, reduced investment and lower growth. Even though this paper will focus on what we can learn about the policy trade-offs in a deflationary environment, we use the inflation history as a means of comparison when framing the policy options.

2.2. The optimal inflation/deflation rate from a theoretical perspective

In theory, 'deflation is everywhere and always a monetary phenomenon', to paraphrase Milton Friedman (1968). It is monetary in the sense that the sustained growth in some monetary aggregate relative to the trend growth of real output (adjusted for the trend in velocity) determines the rate of change in the price level.

Theory also provides insights on the costs and possible benefits of deflation. On the one hand, Friedman (1969) argued that deflation might be optimal. In an economy with fully flexible wages and prices, the costs of inflation arise from the opportunity cost of holding money balances. Friedman advocates a negative optimal inflation rate – that is, deflation – equal in absolute value to the long-run growth of the real economy or, in general, equal to the real interest rate. In other words, when the nominal interest rate is zero, the return on money and risk-free bonds would be equilibrated, thereby leading to an optimal outcome.[1] Extending this model to the world of public finance leads to a refinement of this finding. Under particular circumstances, it would be optimal to tax money balances at the Ramsey tax rate. This could imply a nominal interest rate above zero. But other versions of this model, for example one where money is viewed as an intermediate good, would endorse the original Friedman rule because of the general principle in public finance that only final goods should be taxed (Chari *et al.*, 1991; Schmitt-Grohé and Uribe, 2001). Feldstein (1999) also argues that the interaction of the tax code and inflation causes significant welfare losses even at low levels of inflation.

On the other hand, theories of inflation in economies subject to nominal rigidities lead to higher optimal inflation/deflation rates. In an economy subject to non-trivial price stickiness, for example, the optimal inflation rate would generally be zero, ignoring the costs arising from holding money balances. If both sticky prices and

[1] Optimality can also be achieved by paying interest on money balances equal to the yield on close money substitutes. In terms of the size of the benefits, Lucas (2000) estimates, while admittedly with a wide potential range, that the decline in the steady-state inflation rate from zero to a deflation of roughly 3% could yield the same economic benefits as a decline of inflation from 11% to 0%.

costly money holding motives were operative, the optimal *deflation* rate would be somewhere between zero and the real interest rate (Chari, 2004). Simulations of a model that includes costs to holding money and costly price adjustment and is calibrated to the post-World War II period show that the optimal rate of price change is between −0.75% and −2.3% (Kahn *et al.*, 2003). Of note, this range is below conventional implicit and explicit inflation targets used by central banks today.

Other forms of nominal rigidities have been emphasized in theoretical studies to justify an optimal positive inflation rate. Akerlof *et al.* (1996) have argued that downward nominal wage inflexibility (i.e., the reluctance of employees to accept cuts in nominal wages) could be a significant source of economic costs that would be avoided by keeping the inflation rate sufficiently high.[2] Such rigidities would also alter the time-series behaviour of inflation. Consider a given-sized shock leading to a downturn that interacts with the downward nominal wage constraint. The constraint would prevent the real wage from falling, resulting in a slower adjustment and hence a more persistent output gap than otherwise. All else the same, such asymmetric output gap dynamics would translate into more persistent disinflation than inflation. While this view is logically consistent from a theoretical point of view, the empirical support at the macroeconomic level has been weak. Lebow *et al.* (1995), for example, raised doubts about the macroeconomic significance of this view. They argue that this type of downward nominal rigidity would imply highly asymmetric Phillips curves, which does not appear to be consistent with the post-World War II data.[3] We will adopt this approach to assess the macroeconomic significance of downward nominal wage constraints in the historical record.

Another cost of deflation is related to redistributive losses. Friedman's optimum quantity of money assumes that deflation is fully anticipated. If this is not the case, then those agents who fail to fully anticipate deflation and are unable to index their contracts would suffer losses relative to those who could. History shows that such redistributive costs can be rather significant, as the losers (for example, debtors, farmers, workers, etc.) had at times reacted to their situation through political agitation (Humphrey, 2003). Moreover, debt deflation – a fall in the price level that raises the real value of nominal debt – can exacerbate the costs of a deflation (Fisher, 1933). This redistributive cost, however, would not obviously be any different than that of a similarly sized disinflation in an environment of positive inflation.

[2] Selgin (1997) argues that fixed nominal wage contracts are a more important source of economic distortions than sticky final goods prices. In this 'productivity norm' world, the optimal inflation rate would be deflation at the rate of productivity growth. Precursors of this view go back to Keynes and his contemporaries.

[3] This theory rests heavily on the assumption that employees dislike nominal wage cuts more than real wage cuts of the same size – a form of price illusion. The macroeconomic significance of this view has been questioned (e.g., Lebow *et al.*, 1999) and empirical evidence supporting the assumption has been challenged in the recent past (e.g., McLaughlin, 1994, 2000). Moreover, recent wage setting behaviour, especially in Asian economies, has raised doubts about the significance of this type of price illusion in a deflationary environment; in Asia, downward nominal wage flexibility became increasingly evident as the deflation environment became more familiar (Kimura and Ueda, 2001). Looking further back in time, Hanes (1993) finds that nominal wage flexibility was high, but generally fell, during the gold standard period. This raises the possibility that the costs of deflation may have been smaller during the gold standard period.

Financial stability could also be affected by unanticipated price movements. In an economic environment without complete financial markets in nominal risk sharing, unanticipated price shocks could have important consequences for financial instability and the associated macroeconomic costs (Schwartz, 1995). Bordo *et al.* (2002b, 2003b) document that, in the pre-1934 period, aggregate price shocks had a significantly negative impact on financial conditions. By the 1970s, however, inflation shocks rather than price shocks were playing the dominant role in this respect.

In sum, theory provides some guidance on the optimal inflation rate, but such guidance is somewhat wide ranging. The precise estimate would depend on critical, yet controversial, assumptions. In other words, reasonable, or at least not implausible, assumptions could justify a range of estimates. In general, the optimal inflation rate should be low, possibly as low as a moderate deflation.[4] From the tenor of the current policy debate, however, one would be led to believe that most policy makers consider deflation to be a subpar outcome. In a narrow sense this might be tautologically true. For explicit and implicit inflation targeters, a deflation outcome indicates a policy failure because, to our knowledge, no central bank targets deflation. But, in a broader sense, the debate about how low the inflation rate should be is still open, with modest steady-state deflation deserving ample consideration.

2.3. Beyond theory: monetary policy considerations

In policy circles, some of the theoretical conclusions might still sound impractical, imprudent and, in the extreme, wrong-headed. In this section we review various important dimensions of deflation dynamics that may lead policy makers to take a more averse view of deflation. We emphasize the potential effects of deflation on the effectiveness of monetary policy, the role of the monetary policy regime on deflation expectation formation and the potential complications from asset price booms and busts. The historical record can provide some insights into the relevance of the factors as well as the trade-offs.

2.3.1. The effectiveness of monetary policy. Deflation is also thought to complicate the conduct of monetary policy in various ways. First, the recent spectre of deflation represents a relatively unfamiliar territory in which central banks have to operate. To the extent that economic relationships that hold in moderate inflation regimes break down during deflations, a central bank may find it harder to interpret economic developments and to understand the monetary transmission mechanism. This new policy environment could also make it more difficult for the monetary authority to communicate its policy stance and future intentions to the public. This, of course,

[4] In assessing the appropriate rate, policy makers have to factor in statistical biases in conventionally-measured inflation rates. In the United States, for instance, the bias has been estimated to be somewhere between 0.5 and 1%, which is consistent with estimates for other economies (Rodriguez-Palenzuela and Wynne, 2004).

could have real effects on the ability of the private sector to form expectations and plan optimally. One would expect, however, that these costs would be transitory as central banks and the public became accustomed to the new environment.

Second, the zero lower bound for short-term nominal interest rates would also adversely complicate monetary policy, if only because central banks could not rely on interest rates to pursue their inflation and output goals. Again, such an environment would be a challenge, at least in the short run, as policy makers would have to alter their tactics and recalibrate their policy tools. The interwar period during the twentieth century offers a glimpse into some of the possible complications and will be discussed below.

Third, deflationary environments can hinder the ability of central banks to pursue countercyclical monetary policies. In the extreme, if a deflation was deep enough and expectations became sufficiently entrenched, a liquidity trap could form (Keynes, 1936, Krugman, 1998, Svensson 2003). Economists often point to the 1930s as an example of such conditions. Liquidity traps represent an extreme situation where the tools of monetary policy would be ineffective in stimulating aggregate demand. Such a situation would preclude the generally presumed benefits of countercyclical policies on economic welfare.[5]

All these policy complications are potential costs that would have to be factored, along with their uncertainties, into the decision to pursue a low inflation/deflation policy. Arguably, most of the costs could prove to be transitory as a central bank became accustomed to the new policy environment.

2.3.2. Deflation, monetary regimes and credible nominal anchors. One perennial issue in monetary economics is the design of nominal anchors and their role in shaping private sector expectations. In the past several decades, economists and policy makers have emphasized the importance of low, stable inflation. Part of the emphasis reflected the history of the fiat currency regime in the twentieth century. Reining in high inflation was a challenge. Should current fiat money regimes put greater emphasis on price stability? In the nineteenth and early twentieth century, the emphasis was squarely on a credible price level anchor in the form of the gold standard, which offers some insights about how a more effective anchor may influence the economic environment.

The classical gold standard provides a good example of how important the monetary regime is in determining the aggregate price level and shaping expectation about the future level. Under the gold standard, the world price level was determined by the demand and supply for monetary gold and, in turn, by a function of gold production and the relative demands on gold for monetary and non-monetary uses (Bordo, 1999). Moreover, the international monetary arrangements at the time meant

[5] Goodfriend (2000) and Buiter and Panigirtzoglou (2003) have raised the possibility of imposing a Gesell tax on money as an alternative means to increase the room for manoeuvre with interest rate instruments when a liquidity trap would have otherwise formed. While theoretically interesting, its practical relevance in the current policy environment seems remote.

that the price levels of individual countries would be tied together by commodity market arbitrage and capital flows. Deviations of one country's price level from its trading partners and interest rates from the world financial centre in London, provided incentives for both corrective gold flows and short-term capital flows.

The self-correcting nature of the gold standard had powerful effects on price expectations. Shocks to the gold market, such as gold discoveries, naturally caused the price level to move but it would be expected to revert back towards some stable value, that is, prices would tend to be mean-reverting. In the long run, prices were anchored by the marginal cost of producing gold. In the short run, periods of generalized global inflation following gold discoveries were expected to be succeeded by periods of deflation because gold discoveries would increase the total world gold stock, and hence the world price level. This, in turn, reduced the real price of gold (given the fixed nominal price set by the monetary authorities) and led to lower gold production and greater substitution of gold from monetary to non-monetary uses.[6]

Consistent with the belief that prices were mean-reverting, the expected inflation rate hovered around zero and long-run price level uncertainty was low (Klein, 1975). This had important implications for the stability of nominal interest rates (Friedman and Schwartz, 1963), especially expectations over long horizons. Expectations about short-term interest rates could be more variable. This partly reflected the ability, albeit limited, of monetary authorities to offset demand and supply shocks within the target zone provided by the gold points framework.[7] In the interwar period and possibly pre-1914, for example, central banks engaged in sterilization policies to offset the impact of international gold movements (Bloomfield, 1959; Dutton, 1984; Nurkse, 1944). In addition, some of the effects of deflation were offset by the use of key currencies as central bank reserves instead of gold and by the increasing use of bank money and convertible fiduciary money as gold substitutes (Triffin, 1960).[8]

Are the lessons from the gold standard regime still valuable today? Current fiat money regimes provide central banks with much more flexibility than a commodity standard regime but they lack the self-correcting mechanisms inherent in the gold standard. To be sure, the fiat currency regime in the latter half of the twentieth century, especially in the 1970s and early 1980s, showed little resemblance to the gold standard regime as prices appeared to be unmoored. But, recent history has shown

[6] It should be noted that in an environment of positive productivity-driven real growth there would be a tendency towards secular deflation unless offset by technical innovation in gold production or by gold discoveries (by contrast, if gold was a depletable, durable resource then steady-state deflation would be inevitable – Bordo and Ellson, 1985).

[7] During the gold standard period, gold parity was bounded by the gold points (the cost of shipping gold among the various financial centres). Following Svensson (1994), Bordo and MacDonald (2005) show that the gold points served as a target zone in the sense of Krugman (1991) and implied some scope for the core countries in the gold bloc to temporarily offset real and nominal disturbances such as was the case in England, France and Germany. An important feature of the flexibility was that markets believed that the gold parity would be preserved under virtually all circumstances.

[8] Smaller countries which lacked financial maturity and credibility had less room for manoeuvre and hence were less able to shield themselves from the full brunt of deflation because they had difficulty maintaining the convertibility of their currencies, but when they opted for floating they often suffered capital flight. Their options were to adopt a currency board arrangement with close to 100% gold reserves or to decouple themselves from capital flows.

that well-designed fiat money regimes can provide an effective nominal anchor. The holding power of the anchor in the fiat money regime, however, depends on the ability and willingness of the monetary authority to pursue its low inflation goal, not the more mechanistic features of a commodity monetary standard.

Beyond the lesson that a credible nominal anchor can deliver price stability, the gold standard experience could conceivably offer further insights for current policy makers about the conduct of monetary policy but such insights are likely to be subject to considerable uncertainty. To be sure, monetary models can be used to describe the current environment as well as the gold standard period (e.g., Bordo *et al.*, 2003a). Moreover, the monetary channels may in many ways be common over long periods of time (e.g., Friedman and Schwartz, 1963, 1982). But, the ability to draw more precise implications from then for now would be model specific and depend critically on being able to translate changes in economic fundamentals in the past to today, not least of which would be the transformed financial landscape.[9]

Nevertheless, the basic lesson from the gold standard period about the importance of a credible nominal anchor still applies. Notably, the success of monetary authorities using fiat currency regimes in the past decade to achieve low, stable inflation rates around the world is evidence that when regimes emphasize nominal anchors, they can deliver price stability.

Looking forward, a key policy question is whether such fiat money regimes can be improved upon. Some economists have advocated that central banks put further emphasis on price stability by adopting 'price level' targeting regimes. Proposals for price level targeting generally have come in two distinct flavours. One version emphasizes a fixed price level target. In this case, a monetary authority would target a given price level at a particular policy horizon. If the price level exceeded (or were expected to exceed) the target, the monetary authority would tighten policy; and if it fell below target, the monetary authority would ease policy. As under the gold standard, this policy would generate alternating periods of transitory inflation and deflation. Such an approach would have the advantage of long-run price predictability, which conventional inflation targeting regimes do not (Bordo *et al.*, 2003a; Riksbank, 2003; Svensson, 1999). But it could have the disadvantage of short-run volatility if downward nominal rigidities were important. In an alternative version of the scheme, a monetary authority would target a rising price level – in a sense, this would be equivalent to *average* inflation targeting rather than a conventional period-by-period inflation rate target (King, 1999). This approach would still share the favourable

[9] Thus the more limited menu of financial instruments with which to hold one's purchasing power in the distant past meant that narrow monetary aggregates may have been more valuable measures of monetary conditions than might be the case today with a greatly expanded array of financial instruments (Feldstein and Stock, 1994). This issue is still an important policy issue as financial innovations continue; McCallum (2003) argues that a role for money will continue while Friedman (2000) expresses scepticism. Moreover, such aggregates may also have become more complicated to use as measures of the stance of monetary policy. On this point see, for example, Galí *et al.* (2004); for a dissenting view, see Issing (2002). The changing nature of the monetary aggregates indicates that there might be difficulties drawing implications for the conduct of policy from an earlier regime for monetary policy today.

feature of long-run price predictability. If a shock were to cause the price level to fall below target, then the central bank would take an accommodative monetary stance to put upward pressure on prices until the price level returned to target. If, however, a shock were to cause the price level to exceed the target, the central bank would respond by tightening monetary conditions to return to target. If the central bank were sufficiently patient towards achieving its target, the return of the price level could be achieved without engendering deflation, or at the very least minimizing the need to engender deflation. In either variant of price level targeting, the policy regime would more closely approximate the workings of the gold standard period, and hence enhance the policy relevance of studying the historical record.

2.3.3. Deflation spirals, asset prices and credit cycles. An important monetary policy concern arises from the possibility of deflation spirals – self-reinforcing waves of downward price pressures. An oft-mentioned mechanism that could generate a spiral is consumer expectations. If a deflation were expected, consumers might refrain from spending today in the hope of paying lower prices tomorrow. This would lower velocity, which in turn would reduce prices, and so on.

Another, possibly more policy-relevant, mechanism that is thought to be associated with spiralling deflation is asset price boom and bust behaviour, an issue that has attracted considerable attention in recent years.[10] One implication from this literature has been that the risks of deflation might be understated in the conventional focus on supply and demand shocks. In this scenario, a spectre of deflation may cause forward-looking investors to expect a reduction in profits and a general decline of economic activity, especially if the economy is subject to downward nominal rigidities. The collapse in asset prices could have a chilling effect on economic activity which would then add to the deflationary pressures. This process could be reinforced by balance sheet problems of firms and households, who might retrench or even renege on debt obligations in bankruptcy (Fisher, 1933; Kindleberger, 2000; Tobin, 1975; Bernanke, 1983). In such a case, the interaction of the policy regime, the vagaries of human psychology and the economic environment would conspire to generate a perverse disequilibrium. And, of course, such developments would have the potential of distorting the monetary transmission mechanism, which in turn would have implications for velocity.

Credit cycles, often associated with excessive leveraging of financial assets, appear to be empirically linked to the incidence of booms and busts (Borio and White, 2003). In one variant of the view, an initial productivity boom would engender over-confidence among various agents in the economy. Loan demand would rise rapidly as confident investors reach for higher and higher perceived risk-adjusted yields. The early stages of such a boom might be self-reinforcing as perceptions of risks became

[10] This view, which has its antecedents in Kindleberger (2000) and Minsky (1982), emphasizes the cumulative process of financial imbalances and the possibility that such imbalances may cause sharp, debilitating adjustments or crises, which could generate equally sharp, and probably unanticipated, deflation.

increasingly exuberant. Credit supply would also be spurred on as risks would appear, at least initially, low. If the boom continued, and the optimistic scenario materialized, all might be well. But, if the productivity gains disappoint the high expectations, the economy would likely retrench. And, if leverage were sufficiently excessive, the retrenchment could cascade into a self-reinforcing contraction. Price pressures would likely fall as inside money would plummet. Real debt service burdens would increase, asset qualities would decline, bankruptcies would inevitably ensue and the potential for banking and financial crises would arise. Although these types of forces have been experienced in the distant past, they have also been relevant in the past decade. In some sense, such boom and bust cycles may be thought of as a permanent feature of the policy environment going forward (Borio *et al.*, 2003).

For good reason, the general consensus among policy makers and economists is that deflationary spirals should be avoided. The empirical question is how best to do so. For insights into answers to this, as well as to other important questions, we turn to the historical record.

3. LOOKING BACK AT THE HISTORICAL RECORD

Table 1 presents data on the incidence of deflation for 30 countries over two centuries. In this section we discuss those experiences, arguing that, historically, deflation was viewed in a more positive light than it is today. The reason why, we believe, reflects the relatively benign experience in the pre-World War I deflationary environment and beliefs about the importance of having a strong nominal anchor to maximize private sector performance. We note with some cautious optimism that the recent inflation and output behaviour in the United States, among others, may indicate the emergence of a sea change in thinking about the true costs and benefits of price stability. Even though deflation may be a lower target than most would be comfortable with at this time, recent inflation outcomes – especially when factoring in a statistical bias – are much lower than some would have thought prudent just a decade ago.

We examine below both the historical and statistical record to understand the costs of deflation. One important advantage in looking to the experience of the distant past is that it provides a clearer perspective on deflation behaviour. In history, deflation has often coincided with robust economic growth.[11] This is in sharp contrast to the conventional wisdom that generally is drawn from a more limited focus on deflation in Japan in the 1990s and deflation episodes in the Great Depression. This section takes a closer look into historical deflations to better understand the determinants of the different types of deflation.

[11] See Atkeson and Kehoe (2004), Bordo *et al.* (2004), Bordo and Redish (2004) and Borio and Filardo (2004) for alternative ways to measure the positive correlation.

Table 1. Deflation frequency, annual, 1801–2002

	1801–1879	1880–1913	1914–1949	1950–1969	1970–1989	1990–2002
United States	42.4	23.5	30.6	5.0	0	0
Euro area	...	...	...	0	0	0
Japan	...	29.4	27.8	10.0	0	38.5
Germany	29.1	29.4	11.1	10.0	5.0	0
France	40.6	26.5	22.2	10.0	0	0
Italy	33.3	32.4	25.0	0	0	0
United Kingdom	51.9	44.1	33.3	0	0	0
Canada	66.7	23.5	25.0	5.0	0	0
Belgium	43.2	44.1	25.0	15.0	0	0
Switzerland	...	36.4	36.1	15.0	0	0
Netherlands	22.2	32.4	36.1	10.0	5.0	0
Sweden	27.1	44.1	30.6	0	0	7.7
Denmark	48.4	41.2	25.0	5.0	0	0
Spain	...	42.4	27.8	5.0	0	0
Finland	47.4	32.4	25.0	10.0	0	0
Ireland	...	...	33.3	5.0	0	0
Norway	45.5	35.3	36.1	0	0	0
Australia	61.1	44.1	22.2	5.0	0	0
New Zealand	...	...	20.0	0	0	7.7
China	...	...	...	...	0	23.1
Hong Kong SAR	...	...	...	33.3	0	30.8
Indonesia	61.0	55.9	30.6	10.0	0	0
India	33.3	35.3	36.1	20.0	5.0	0
Korea	...	...		5.0	0	0
Malaysia	...	...	100.0	55.0	0	0
Singapore	...	...	100.0	45.0	10.0	15.4
Thailand	...	...		25.0	5.0	0
Taiwan (China)	...	...	...	16.7	10.0	15.4
Argentina	...	41.4	36.1	5.0	0	23.1
Brazil	27.8	44.1	13.9	0	0	0
Mexico	...	38.5	25.0	10.0	0	0
Chile	48.1	32.4	13.9	0	0	0
Venezuela	...	...	42.9	15.0	0	0
Colombia	6.7	38.2	36.1	10.0	0	0
Peru	...	...	33.3	0	0	0
Egypt	...	...	41.2	25.0	0	0
South Africa	...	33.3	33.3	0	0	0
Mean	40.9	36.7	32.3	10.7	1.1	4.4
Median	42.8	35.9	30.6	7.5	0.0	0.0

Notes: Defined as the percentage of negative annual changes as a proportion of all available price index data in each episode. Details of the dataset are described in the Appendix of Borio and Filardo (2004).

3.1. Historical narrative: evidence from the nineteenth century

As we discussed above, the historical record is a comparatively fertile environment to study deflation because price level declines were much more frequent in the long century ending with 1914. Alternating waves of inflation and deflation were an integral part of the commodity-based classical gold standard regime with a general tendency for falling prices from the 1820s to the mid 1840s; then rising prices following

the Californian and Australian gold discoveries in the late 1840s until the early 1870s; then deflation from 1873 to 1896; and finally inflation from 1897–1914 following gold discoveries in South Africa and Alaska. This section explores some historical episodes of different types of deflation in the nineteenth and twentieth centuries.

3.1.1. 1873–1896: a good deflation that turned somewhat bad. The 1873–96 episode is a clear example of a 'good deflation' when prices fell in many countries by about 2% per year, accompanied by growth of about 2–3% per year (Bordo *et al.*, 2004). Deflation in that era was driven by both a productivity boom (reflecting the 'second industrial or mechanical revolution and the proliferation of railroads across the world (Crafts, 2000), and by a number of major countries (Germany, Netherlands, Belgium and Scandinavia in the early 1870s and France later) joining the gold standard.

Although secular deflation was accompanied by positive growth, it was controversial because of its distributional consequences. Groups whose real incomes fell, such as debtors, farmers or those whose real incomes were perceived to have fallen in an age before price indices, complained bitterly and engaged in often disruptive social and political agitation.[12] In the United States, this was manifested in the free silver movement and the rise of organized labour. In Europe it appeared in the growth of both labour unions and labour political parties and in a demand for tariff protection by agricultural groups.

Although real output grew on average in the deflation episode of 1873–96 in most countries, growth was punctuated by several recessions (1873–75, 1884–85, 1890–96), the worst of which was the last – which may even possibly be characterized as bad. It began with the Baring Crisis of 1890 when Argentina defaulted on its debt. This shock led to banking crises (and stock market crashes) in London, elsewhere on the continent and the United States and other parts of Latin America, especially Brazil (Bordo and Murshid, 2003; Triner, 2003). Recession was further aggravated by a wave of banking panics which began in the United States in 1893 and spread to Europe (especially Italy) and Australia (Bordo and Eichengreen, 1999).

3.1.2. 1837–1843: bad deflation. An earlier nineteenth century episode of deflation from 1837 to 1843, often viewed as bad, began with financial crises in London and the Continent (Kindleberger, 2000) and especially in the United States in 1837. Another wave of crises occurred in 1839. In the United States, debate still swirls over whether the crisis and deflation reflected the 'Bank War', the struggle between President Andrew Jackson and Nicholas Biddle, President of the Second Bank of the United States (an early central bank) (Rousseau, 2003; Wallis, 2001) or events in Europe such as a series of bad harvest failures in England, which led to the importation of wheat from the continent and a drain on the Bank of England's gold reserves leading it to raise its discount rate and precipitate capital flight from periphery

[12] Discontent seems to have been less when nominal wages continued to rise than when they fell, although real wages rose in both circumstances (Friedman and Schwartz, 1963).

countries, especially the United States (Temin, 1969).[13] The annual data for this period may be subject to some questions about their accuracy. For example, although prices fell by 5.6% in the United States, 2.1% in the United Kingdom and 2.0% in France, narratives by contemporary observers viewed the episode as one of serious recession (Thorp, 1926). Available measures of real GDP show an increase in the United States of 3.9% and of 1.3% in France.[14] The United Kingdom, in contrast, experienced a real GDP decline of 2.6%.

3.2. Historical narrative: evidence from the twentieth century

3.2.1. 1919–1921: bad, possibly ugly for some, deflation. During the immediate post-World War I period, there was a short period of downward price movement in many countries that corresponded with a global contraction in economic activity. For example, annual GDP fell on a peak-to-trough basis by 18% in the United States, 29% in the United Kingdom, 20% in Germany and 24% in Canada. Moreover, these years were also accompanied by considerable volatility in output.[15] Given the poor output performance, these deflations would be characterized as 'bad'. The serious recession and deflation, many would argue, was engineered by tight monetary policies followed by the Federal Reserve, Bank of England, Banque de France and other monetary authorities in countries dedicated to rolling back the high inflation created during World War I and restoring the pre-war gold parity. The expectations of such policies and their likely effects also contributed to the deflationary environment. The collapse in aggregate demand appeared mostly in falling prices, which had increased rapidly during and after the war as a consequence of both wartime scarcity and speculation. It is, however, interesting to note that although real output declined significantly, the decline was not out of line with the experience of earlier severe cyclical contractions (Zarnowitz, 1992).[16]

3.2.2. 1921–1929: good deflation. The 1920s period represents an example of a good deflation, preceded, as discussed above, by serious recession in many countries in 1919–1921. The rest of the twenties – 'the roaring twenties' – observed rapid real growth in many countries (with the principal exception of the United Kingdom mired in a 20-year stagnation) punctuated by two very mild recessions. The period also

[13] It is also useful to note that Jackson, a populist, strongly opposed the Second Bank under Biddle for its alleged monopoly power over the US banking system.

[14] Without a doubt, the farther one pushes back in history, the less confidence one should have in data for GDP. However, industrial production estimates from Davis (2004) for the United States corroborates this view.

[15] At a higher data frequency in the United States, for example, the unemployment rate rose from 4% in 1920 to 12% in 1921, and industrial production fell 23% (Meltzer, 2003); at the same time, the GNP deflator fell 28% from peak to trough (based on quarterly data from Balke and Gordon, 1986).

[16] To be sure, demobilization could have contributed to the severity of the recession. Further analysis of this episode is left for future research because of the difficulty of parsing out the various post-war demobilization effects from the policy effects. In addition, the volatility and short duration of the episode complicates the analysis using annual data.

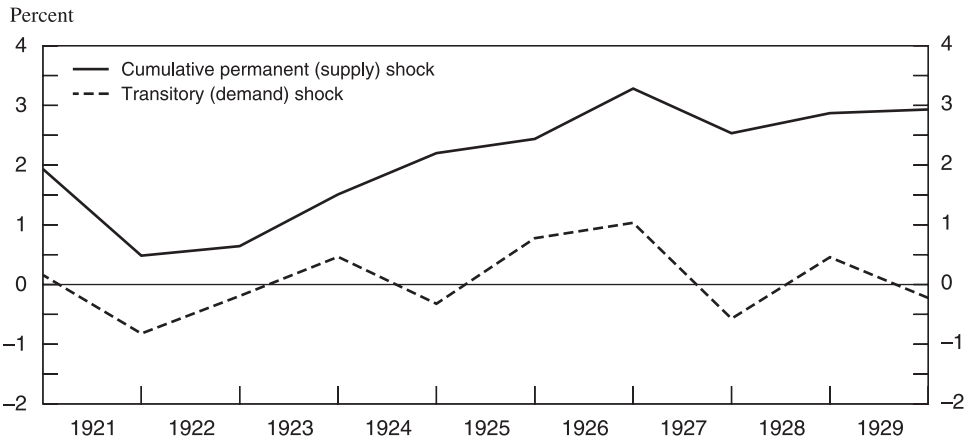

Figure 1. Supply and demand shocks during the 1921–29 period

Notes: The supply and demand shocks were estimated using a Blanchard–Quah (1989) shock identification method on the 1880–1938 time series of output growth and inflation. Following Keating and Nye (1998), we estimate a VAR model of output growth and inflation while imposing moving average coefficient restrictions to identify temporary and permanent shocks to output, which are interpreted as demand and supply shocks, respectively. Formally, the two equations estimated are

$y_t = \alpha_y d(t) + \theta_{11}(L)\gamma_t + \theta_{12}(L)e_t$

$\pi_t = \alpha_\pi d(t) + \theta_{21}(L)\gamma_t + \theta_{22}(L)e_t$

where y and π are output growth and inflation, $d(t)$ is a vector of an intercept and time trend, and (γ, e) are the permanent and temporary shocks. The estimation procedure imposes the constraint that $\theta_{12}(1) = 0$.

exhibited mild deflation of 1–2%. Many attribute the 1920s prosperity to a post-war recovery and the proliferation of new 'high tech' industries such as automobiles, telephones, radios and refrigerators (White, 1990); Figure 1 illustrates the importance of positive supply shocks during this period. The resolution of the post-war reparations and war debt problems in the late 1920s, the renewal of international trade with the end of post-war restrictions and the renewal of international capital movements after the major belligerents stabilized their currencies and the gold exchange standard was restored in 1925, and extensive direct and portfolio flows from the United States to Europe (especially Germany) and to Latin America played important roles in spreading the prosperity worldwide (Bordo *et al.*, 1999).[17]

3.2.3. 1929–1933 (the Great Contraction): an ugly deflation. The contraction of 1929–33 was characterized by both drastic declines in average annual real output (for example, United States −7.6%, Canada −8.4%, Germany −2.7%, United Kingdom −1.0% and France −2.2%) and deflation (United States −6.8%, Canada −6.2%, Germany −5.7%, United Kingdom −3.8% and France −4.4%). In Figure 2, the size of the output decline associated with this episode indeed appears much larger than comparable deflations during other periods. In addition, more of the contraction

[17] Sargent (1986) points to the Poincaré miracle as evidence that sound monetary and fiscal reforms allowed France to engineer a relatively costless stabilization of prices, returning the country to the gold standard albeit at an 80% depreciation of the Franc.

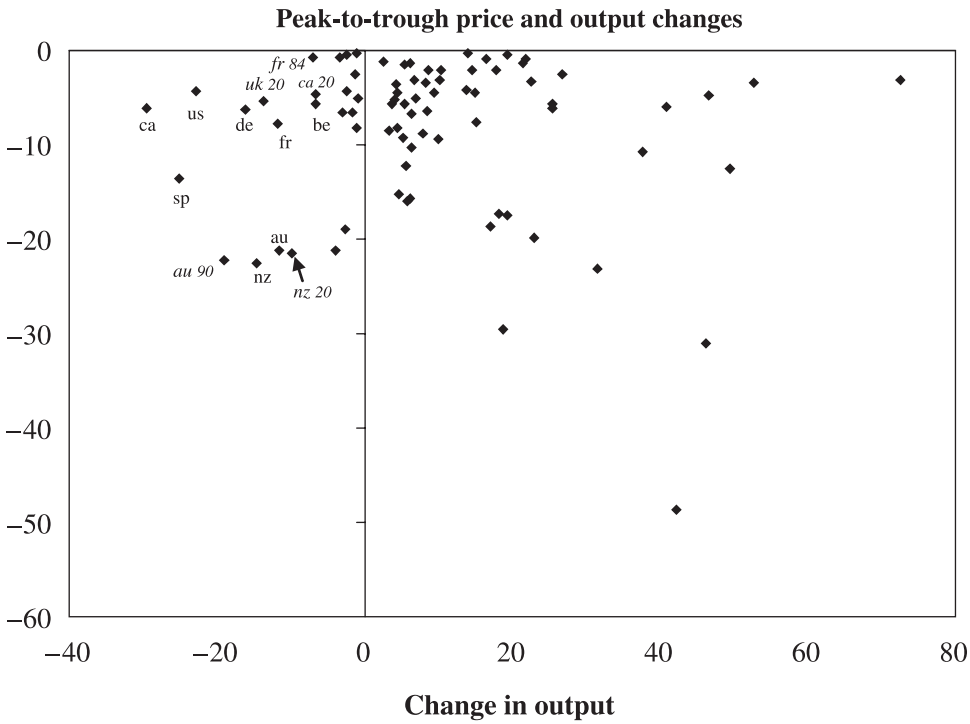

Figure 2. Deflation episodes and output performance

Notes: The data are from Table 2. The non-dated, labelled data points are from those in the Great Contraction era: au = Australia, be = Belgium, ca = Canada, de = Germany, fr = France, sp = Spain, nz = New Zealand, uk = United Kingdom, us = United States. The following dated labels denote deflations with peaks before the Great Contraction: fr 84 = France (peak 1884), au 90 = Australia (peak 1890), ca 20 = Canada (peak 1920), nz 20 = New Zealand (peak 1920), uk 20 = United Kingdom (peak 1920).

of aggregate demand went into output than into prices and nominal wages than in 1919–21, reflecting in large part the presence of important structural rigidities (Bordo *et al.*, 2000; Hanes and James, 2003; O'Brien, 1989).

A voluminous literature exists on the episode. The current consensus view is that the contraction was caused by monetary forces in the United States. The Federal Reserve began tightening monetary policy in early 1928 to help moderate the Wall Street stock market boom which had been underway since 1926. The Federal Reserve was wedded to the real bills doctrine which proscribed bank lending to finance speculative activity (Meltzer, 2003). Deflationary pressure was enhanced by the Banque de France which was following a deliberate gold sterilization policy of gold inflows induced by France's return to the gold standard in 1926 at a greatly depreciated and undervalued parity (Eichengreen, 1992). Tight money then precipitated a recession beginning in August 1929 and the stock market crash in October. Most commentators today believe that the crash was not the main cause of the Great Contraction which followed (Friedman and Schwartz, 1963; Romer, 1992) but it did contribute heavily to the first years of serious recession, 1929–30. The transformation

of a serious recession in the United States in 1929–30 into the Great Contraction is universally attributed to a series of banking panics beginning in October 1930 which were unchecked by expansionary Federal Reserve actions (Friedman and Schwartz, 1963).[18]

The contraction was then transmitted to the rest of the world via the fixed exchange rate linkages of the gold standard and by 'golden fetters' which prevented the monetary authorities of gold standard adherents from following the expansionary policies needed to offset collapsing demand and a rash of banking panics across the world (Bernanke and James, 1991), without triggering a speculative attack on the gold parity (Temin, 1989; Eichengreen, 1992).

The Great Contraction ended by 1933 in most countries except the gold bloc (France, Belgium, the Netherlands, Switzerland, Italy, Poland and Czechoslovakia) which suffered depression until they left gold in 1935–36. Once countries cut the link with the gold standard, they were able to follow expansionary monetary policies to reflate and recover (Bernanke, 1995; Choudhri and Kochin, 1980; Eichengreen and Sachs, 1985; Eichengreen, 1992; Temin, 1989). The process began with the United Kingdom leaving gold in September 1931 followed by two dozen other countries linked to sterling. The United States suffered depression until March 1933; recovery involved expansionary gold purchases by the US Treasury and devaluation of the dollar. Debate continues over the propagation mechanisms of the contraction in the United States, whether it was via sticky nominal wages (Bernanke and Carey, 1996; Bordo *et al.*, 2000), financial disintermediation (Bernanke, 1983), rising real interest rates (Schwartz, 1981), and debt deflation (Fisher, 1933).

The experience of the Great Contraction has coloured subsequent views on deflation but the historical record suggests that it is *sui generis*. There is no clear-cut evidence on the role of deflation in making the Great Contraction great. We do not know conclusively if falling prices worsened the recession via Irving Fisher's debt deflation process (Bernanke and James, 1991) or whether the problem was that prices did not fall enough to clear markets as seems to have been the case in 1919–21. Thus in our work we do not place the Great Depression at centre stage in our analysis of deflation but rather we focus on the other experiences with deflation because we view the Great Contraction as special.

3.2.4. 1937–1938 and 1948–1949: two episodes of bad deflation and the zero nominal bound. Meltzer (2003) documents two recessions in US history characterized both by falling prices and by extremely low interest rates. The recession of 1937–38 was one of the most severe recessions of the twentieth century, characterized by an 18% decline in GNP from peak to trough and the unemployment rate reaching

[18] The Friedman and Schwartz hypothesis has been supported over the years by considerable research. Bordo *et al.* (1995), for example, present simulations which show that had the Federal Reserve followed expansionary monetary policies to offset the effects of the banking panics on money supply that the great contraction could have been avoided. Christiano *et al.* (2003) reach the same conclusion using simulations of a dynamic stochastic general equilibrium model of the US economy in the Great Depression.

20%. Prices declined about 5% from the quarterly GNP deflator peak in the third quarter of 1937 to the trough in the second quarter of 1939. It was triggered, according to Friedman and Schwartz by a doubling of reserve requirements by the Federal Reserve, beginning in 1936. Other factors include a tight fiscal policy stance by the Roosevelt administration. Short-term interest rates in this episode ranged between 0.03% and 0.5%. Meltzer demonstrates that real interest rates and the real monetary base were highly correlated in this episode reflecting the common influence of deflation.

Real interest rates were perversely related to the evolution of real output whereas movements in real money balances seem to explain well the pace of both recession and recovery. This evidence, he argues, strengthens the case for using monetary aggregates as the major policy instrument when interest rates reach the zero lower bound for nominal interest rates. A similar pattern is observed in the much milder post-World War II recession of 1948–49 which also exhibited falling prices with short-term rates still pegged close to zero. Again, movements in the real base track the real economy whereas real interest rates do not.

3.2.5. Modest deflation in the mid-twentieth century. In the immediate post-World War II era and 1950s, several countries exhibited some proclivities toward very short periods of deflation. In general, the episodes were short-lived when compared to the interwar or pre-1914 period. This may have been a normal aspect of cyclical experience over most of the period before World War II when business cycles typically showed both output and price levels moving procyclically (Zarnowitz, 1992). After the mid-1960s, however, we observe a positive price trend in most countries, and, over the business cycle, the pattern of price movements has changed from procyclical levels to procyclical inflation rates. It is only since the return to a low inflation environment in the past 15 years, similar in many respects to the environment that prevailed for much of the preceding century and a half, that the spectre of deflation has re-emerged.

3.2.6. Summary: the historical setting in which deflations occur. Most of the historical deflationary episodes that we document occurred under some variant of the gold standard. Moreover, the episodes of deflation that occurred in fiat money regimes were during periods of postwar resumption to the gold standard.

Under the gold standard, deflation was generally of the good variety reflecting positive aggregate supply shocks. When they turned bad it was mainly because of banking crises aggravating the effects of negative aggregate demand shocks. Such crises in large part reflected the fragility of early banking systems (and financial markets) in an environment of asymmetric information, poor governance and, above all, the absence of a lender of last resort. Such episodes generally ended when the forces driving the crisis naturally subsided or when some lender of last resort intervened.

Bad deflations were also associated with disinflations after various wars when monetary authorities following the classical orthodoxy pursued the tight monetary and fiscal policies needed to return to gold convertibility at the original parity. Such episodes occurred twice in British monetary history, after the Napoleonic wars (Bordo

and White, 1991) and, as mentioned above, after World War I. In the United States, this was also the case in 1920–21. However, after its Civil War, apart from a deliberate contractionary policy which lasted a year following the Contraction Act of 1866, the 12 years of deflation prior to the successful resumption on 1 January 1879 was best characterized as being benign, reflecting the US Treasury's pursuit of a policy allowing the real economy to grow up to a constant money supply (Friedman and Schwartz, 1963).

The deflation of the 1920s and 1930s was also associated with a variant of the gold standard – the interwar gold exchange standard – in which the world's fiduciary money supply was a multiple of the gold base. The money-to-gold multiplier in each country was the product of the ratio of international reserves (gold reserves plus foreign exchange) to gold reserves, the ratio of the monetary base to gold, and the money multiplier (the ratio of money supply to the base). As Bernanke (1995) demonstrates, this leveraged situation increased the danger for a drastic deflation as did occur from 1928 to 1933. The massive worldwide deflation, according to him, reflected the confluence of three key forces which were alluded to in Section 3.2.2: a scramble for gold as authorities liquidated foreign exchange reserves, a contraction of the monetary base to preserve gold and disintermediation by the banking system.

There seem to be very few historical episodes of deflation under a fiat money regime which were not in any way linked to a commodity nominal anchor. Sweden successfully followed a price norm in the 1930s, gearing its monetary policy to stabilize a price index. In many respects, this was an attempt to mimic the price stabilization features of the gold standard while eliminating the volatility produced by shocks to the gold market, as advocated by Fisher, Wicksell and Marshall (Bordo, 1984; Berg and Jonung, 1999). Presumably, a credible commitment to such a policy could anchor expectations in a way similar to adherence to a commodity standard. Whether the recent deflationary experience can be characterized as a serious source of concern may reflect, among other things, the extent to which the nominal anchor is perceived to be as strong as was the case under the pre-1914 gold standard.

3.3. Statistical analysis of past deflations

Our understanding of historical deflations benefits greatly from the historical narratives which provide a rich qualitative characterization of the deflationary environments in the distant past. But this understanding can be further enhanced by considering the quantitative record. To this end, we turn to historical time series. Such data analysis, however, is not without inferential risks. As data series are pushed further back in time and expanded to include a wider range of variables and country coverage, the data's reliability is naturally subject to qualification, especially as we move beyond simple stylized facts to the realm of interpretation.

3.3.1. Deflation episodes. Table 2 presents statistics from past deflationary episodes, focusing on the size of the price decline from peak to trough, the duration of each

Table 2. Peak to trough measure of price and corresponding output changes, by country and episode

	CPI					GDP				
	Peak year	Average peak-to-trough decline	Total % decline	Duration	Year of extreme deflation	Peak year	Average peak-to-trough decline	Total % decline	Duration	Max annual decline during deflation
United States	1837	−5.6	−29.2	6	−15.5	1837	3.9	25.5	6	3.4
	1847	−4.2	−12.1	3	−12.1	1847	4.4	13.8	3	4.3
	1857	−4.5	−12.9	3	−8.7	1857	4.7	14.9	3	4.6
	1866	−3.1	−31.4	12	−6.8	1866	4.6	72.5	12	0.6
	1881	−2.1	−9.9	5	−3.9	1881	2.7	14.5	5	1.4
	1891	−0.9	−5.3	6	−2.7	1891	3.3	21.9	6	−0.9
	1920	−8.5	−16.3	2	−10.8	1920	1.7	3.4	2	−2.4
	1926	−4.4	−26.9	7	−10.3	1928	−5.0	−22.8	5	−13.3
Japan	*1920*	−6.1	−46.7	10	−18.7	1920	2.3	25.5	10	−7.3
Germany	1820	−8.0	−34.1	5	−25.0					
	1831	−5.8	−26.0	5	−15.9					
	1847	−17.4	−43.6	3	−33.8					
	1855	−2.9	−25.6	10	−18.5					
	1874	−8.2	−15.7	2	−8.4	1875	−0.6	−1.1	2	−0.6
	1881	−2.1	−11.7	6	−4.0	1881	2.8	17.9	6	0.7
	1891	−1.3	−6.5	5	−1.4	1891	4.0	21.4	5	−0.2
	1928	−6.2	−22.6	4	−9.6	1928	−4.3	−16.1	4	−7.6
France	1824	−9.4	−39.0	5	−20.4	1824	1.9	10.0	5	1.8
	1838	−5.2	−14.9	3	−12.1	1838	1.3	4.1	3	1.3
	1847	−1.5	−7.4	5	−3.9	1847	1.1	5.4	5	1.0
	1856	−1.2	−3.5	3	−2.2	1856	0.9	2.6	3	0.8
	1871	−0.8	−3.2	4	−2.2	1872	−7.0	−7.0	1	−7.0
	1877	−0.4	−2.2	5	−2.2	1875	−0.5	−2.4	5	−8.2
	1884	−0.5	−6.4	13	−2.3	1884	1.4	19.3	13	−2.1
	1902	−0.3	−1.0	3	−1.0	1900	−0.4	−1.1	3	−1.6
	1930	−7.7	−33.0	5	−14.2	1929	−2.1	−11.8	6	−6.5
Italy	1874	−2.1	−19.2	10	−14.4	1874	1.0	10.3	10	−6.7
	1891	−0.7	−5.5	8	−1.9	1890	−0.5	−3.4	7	−5.6
	1926	−5.6	−36.7	8	−19.1	1926	0.7	5.4	8	−4.9

Table 2. *Continued*

	CPI					GDP				
	Peak year	Average peak-to-trough decline	Total % decline	Duration	Year of extreme deflation	Peak year	Average peak-to-trough decline	Total % decline	Duration	Max annual decline during deflation
United Kingdom	*1847*	−6.5	−23.5	4	−12.1	1849	−1.7	−1.7	1	−1.7
	1860	−4.5	−12.9	3	−11.3	1860	3.0	9.4	3	−0.8
	1873	−3.3	−35.2	13	−9.4	1873	1.6	22.5	13	−6.1
	1891	−4.3	−8.4	2	−8.2	1891	−1.3	−2.5	2	−2.0
	1920	−5.3	−42.3	10	−27.5	1918	−1.4	−13.6	10	−16.3
Canada	1882	−6.4	−12.3	2	−11.6	1882	4.1	8.5	2	0.4
	1889	−2.5	−14.2	6	−8.8	1891	−0.6	−1.2	2	−0.6
	1920	−5.6	−20.7	4	−12.0	1918	−1.7	−6.6	4	−10.8
	1929	−6.1	−22.4	4	−9.7	1928	−6.8	−29.6	5	−15.4
Belgium	1842	−7.3	−14.1	2	−14.1					
	1847	−2.9	−11.2	4	−7.1					
	1856	−5.3	−15.0	3	−7.1					
	1862	−6.1	−11.8	2	−7.3					
	1867	−2.5	−7.3	3	−3.7					
	1873	−2.6	−28.7	13	−7.9	1873	1.8	26.8	13	−0.2
	1891	−3.1	−14.4	5	−3.8	1891	2.0	10.2	5	0.2
	1901	−5.0	−14.3	3	−12.4	1901	2.3	7.0	3	0.9
	1929	−4.7	−25.2	6	−9.7	1928	−1.2	−6.7	6	−4.5
Switzerland	1892	−0.9	−3.5	4	−1.2	1892	3.9	16.5	4	2.5
	1898	−0.3	−1.2	4	−1.2	1898	3.3	13.9	4	2.9
	1919	−5.9	−34.4	7	−22.2	1919	5.0	40.8	7	−2.5
Netherlands	*1892*	−5.0	−18.6	4	−10.8	1894	−0.4	−0.8	2	−3.8
	1920	−3.4	−29.3	10	−14.1	1920	4.3	52.8	10	−0.2
Sweden	1842	−5.7	−11.0	2	−6.7	1842	1.8	3.7	2	1.7
	1847	−1.4	−4.2	3	−2.9	1847	2.0	6.2	3	2.0
	1857	−8.2	−15.7	2	−10.4	1857	2.2	4.5	2	2.2
	1862	−3.2	−9.2	3	−5.0	1862	2.2	6.8	3	2.2
	1874	−2.1	−23.7	13	−6.6	1874	0.6	8.7	13	−4.4
	1891	−3.6	−10.4	3	−5.0	1891	1.4	4.3	3	0.2
	1920	−4.8	−38.7	10	−19.8	1920	3.9	46.6	10	−3.7
Denmark	1831	−5.5	−15.7	3	−7.5	1831	2.0	6.1	3	2.0
	1836	−2.5	−18.6	8	−12.8	1836	2.0	17.0	8	2.0
	1847	−5.6	−15.9	3	−11.4	1847	1.9	5.8	3	1.9

Table 2. *Continued*

	CPI					GDP				
	Peak year	Average peak-to-trough decline	Total % decline	Duration	Year of extreme deflation	Peak year	Average peak-to-trough decline	Total % decline	Duration	Max annual decline during deflation
	1856	−4.3	−12.2	3	−8.3	1856	1.8	5.6	3	1.8
	1867	−3.2	−9.3	3	−6.2	1867	1.7	5.2	3	1.7
	1874	−1.9	−23.1	14	−7.8	1874	2.0	31.6	14	−2.7
	1891	−3.1	−17.4	6	−5.7	1891	3.0	19.4	6	1.9
	1902	−1.7	−3.4	2	−3.4	1902	4.0	8.2	2	2.1
	1920	−3.6	−31.0	10	−12.2	1920	3.9	46.2	10	−2.9
Spain	1890	−2.7	−10.3	4	−6.9	1890	1.5	6.3	4	1.5
	1907	−1.7	−6.6	4	−3.6	1909	−3.0	−3.0	1	−3.0
	1926	−4.5	−8.8	2	−6.9	1926	3.8	7.8	2	−0.4
	1931	−3.6	−13.6	4	−12.5	1929	−3.6	−25.2	8	−20.0
Finland	1876	−3.1	−29.6	11	−9.8	1876	1.6	18.7	11	−2.7
	1892	−6.1	−17.3	3	−9.9	1892	5.7	18.1	3	−3.0
	1928	−4.6	−21.2	5	−11.2	1929	−1.3	−4.0	3	−2.4
Norway	1856	−2.2	−19.9	10	−7.9	1856	2.1	22.9	10	2.0
	1874	−4.1	−18.9	5	−10.4	1876	−1.3	−2.7	2	−3.0
	1882	−3.2	−15.2	5	−5.9	1882	0.9	4.6	5	−0.4
	1891	−1.7	−6.7	4	−2.5	1891	1.5	6.3	4	0.3
	1900	−1.5	−4.5	3	−2.3	1900	1.4	4.4	3	−0.4
	1920	−6.4	−48.6	10	−19.6	1920	3.6	42.3	10	−8.3
Australia	1873	−1.7	−12.6	8	−4.2	1873	5.2	49.5	8	−0.3
	1882	−2.2	−10.7	5	−3.2	1882	6.6	37.7	5	−5.6
	1890	−6.1	−22.2	4	−8.9	1891	−5.2	−19.1	4	−12.3
	1902	−3.9	−7.6	2	−5.5	1902	7.3	15.2	2	1.0
	1929	−5.8	−21.2	4	−9.3	1927	−3.0	−11.5	4	−4.9
New Zealand	**1920**	−7.8	−21.5	3	−12.0	1920	−5.0	−9.8	2	−6.6
	1929	−6.2	−22.6	4	−7.6	1929	−5.1	−14.6	3	−8.5
Mean		−4.2	−17.8	5.4	−9.4		1.1	9.3	5.3	−2.3
Median		−4.0	−15.5	4.0	−8.6		1.7	6.3	4.0	−0.6

Notes: Each episode was identified by smoothing the underlying price series with a 5-year moving average. Tentative peaks and troughs were identified, thereby eliminating transitory price fluctuations. Then the actual peak and trough dates were chosen using the unsmoothed series. The algorithm to identify peaks and troughs is consistent with the methodology of Bry and Boschan (1971). The years in italics denote bad deflations and in bold denote ugly deflations.

episode and the size of the largest one-year decline during each episode. In contrast to Table 1 which provided an analysis of deflation with an annual frequency, this table emphasizes more persistent deflationary episodes. The preference for peak-to-trough measures reflects the relative uncertainties in calculating simple correlations from annual frequency historical data and the potential insights of such measures compared to decadal averages found in previous work.

In contrast to the pattern exhibited in the post-World War II period, long periods of deflation were fairly prevalent. The mean peak-to-trough decline for these episodes was −4.2%. The average duration was 5.4 years. What is particularly important to note is that some of the annual declines in the price level were rather large – in many cases, double digit one-year declines were not uncommon. Of course, the average bundle of consumer goods a century or so ago was relatively dominated by commodities rather than services, as is true today. As a consequence, the wide price swings of the past may be viewed as being more of a reflection of the consumption basket of the past than an indication of the magnitude of price volatility to be expected in today's low inflation environment.

The table also shows quite clearly that deflation episodes were not always associated with a contraction in output. In fact, deflations associated with output contractions were rather rare in the pre-1930s period. This stylized fact may help to explain why prominent economists and policy makers around the turn of the century did not view deflation as something to be avoided. In fact price stability was often seen as a virtuous outcome, and periodic deflation was a part of the price stability goal. Figure 2 highlighted this stylized fact and showed that deflations associated with large declines in output were mostly concentrated in the Great Depression period. Nonetheless, the extreme experiences of the Great Depression arguably still shape – rightly or wrongly – the concerns of the public and of policy makers. Moreover, the uniqueness of the Great Depression shed new light on the relevance of theoretical models developed over the past decade that appeal to Keynes' arguments about the importance of downward nominal frictions in justifying positive rates of optimal inflation.[19]

3.3.2. Asymmetric persistence of deflation and inflation. To gain further insights into the empirical importance of downward nominal frictions, we turn to the nature of inflation persistence in the historical data. First we highlight some simple stylized facts about inflation persistence. Table 3 shows that inflation persistence was generally low in the early period, rose significantly in the twentieth century and then recently fell. This hump-shaped time-series pattern is consistent with the unit root tests on the historical data (Borio and Filardo, 2004); the nineteenth century and early twentieth century inflation data exhibit stationarity, the Great Inflation period

[19] Using an ordered probit model, Bordo and Filardo (2004) report results that are generally supportive of the view that monetary conditions, supply shocks and banking crises are important factors shaping the different types of deflation. These results are consistent with the broad themes coming from the historical narratives.

Table 3. Estimates of inflation/deflation persistence (with standard errors)

	Pre-1880	1881–1913	1918–1939	1945–1969	1970–1989	1992–2001
United States	0.201	0.383	0.573	0.476	0.703	0.274
	(0.129)	(0.163)	(0.155)	(0.185)	(0.169)	(0.235)
Japan	...	0.144	0.666	0.713	0.665	0.538
	...	(0.168)	(0.156)	(0.147)	(0.18)	(0.201)
Germany	0.191	0.418	–0.048	–0.005	0.8	0.772
	(0.111)	(0.159)	(0.223)	(0.208)	(0.136)	(0.184)
France	0.294	–0.045	0.123	0.778	0.854	0.518
	(0.081)	(0.177)	(0.212)	(0.131)	(0.138)	(0.198)
United Kingdom	0.197	–0.241	0.029	0.199	0.677	0.080
	(0.099)	(0.174)	(0.224)	(0.208)	(0.169)	(0.228)
Italy	0.054	0.116	0.262	0.194	0.788	0.688
	(0.251)	(0.171)	(0.192)	(0.017)	(0.130)	(0.177)
Canada	0.284	0.088	0.440	0.408	0.788	–0.048
	(0.362)	(0.179)	(0.168)	(0.189)	(0.144)	(0.180)
Argentina	...	0.109	0.052	0.106	0.997	0.145
	...	(0.191)	(0.21)	(0.206)	(1.079)	(0.017)
Australia	0.047	0.056	0.297	0.521	0.638	0.281
	(0.248)	(0.18)	(0.213)	(0.175)	(0.158)	(0.370)
Belgium	0.096	0.117	0.386	0.581	0.785	0.399
	(0.152)	(0.178)	(0.193)	(0.146)	(0.149)	(0.272)
Brazil	–0.183	0.403	0.567	0.764	0.429	0.590
	(0.246)	(0.164)	(0.182)	(0.132)	(0.392)	(0.295)
Chile	0.500	0.032	0.075	0.539	0.794	0.706
	(0.098)	(0.180)	(0.222)	(0.173)	(0.144)	(0.052)
Colombia	–0.775	0.647	0.040	–0.174	0.532	0.876
	(0.281)	(0.137)	(0.219)	(0.204)	(0.184)	(0.165)
Denmark	0.156	0.253	0.362	0.345	0.69	0.295
	(0.127)	(0.165)	(0.213)	(0.193)	(0.162)	(0.335)
Finland	0.087	0.456	0.266	0.063	0.765	0.460
	(0.245)	(0.145)	(0.203)	(0.208)	(0.133)	(0.219)
India	0.217	0.281	0.560	0.104	0.227	0.255
	(0.438)	(0.141)	(0.161)	(0.195)	(0.221)	(0.334)
Ireland	...	...	0.181	0.181	0.834	0.392
	...	...	(0.319)	(0.209)	(0.142)	(0.386)
Mexico	...	–0.062	0.091	0.092	0.699	0.417
	...	(0.245)	(0.213)	(0.208)	(0.162)	(0.344)
Netherlands	0.178	0.064	0.491	0.251	0.857	0.586
	(0.347)	(0.18)	(0.193)	(0.198)	(0.134)	(0.474)
New Zealand	...	...	0.326	0.337	0.445	0.079
	...	...	(0.209)	(0.195)	(0.206)	(0.354)
Norway	0.21	0.445	0.273	0.401	0.210	0.016
	(0.152)	(0.148)	(0.157)	(0.189)	(0.216)	(0.319)
Peru	...	...	0.572	0.114	0.778	0.170
	...	...	(0.161)	(0.209)	(0.152)	(0.029)
Spain	...	–0.047	0.523	0.392	0.805	0.730
	...	(0.182)	(0.197)	(0.195)	(0.114)	(0.175)
Sweden	0.416	0.389	0.688	0.197	0.522	0.188
	(0.122)	(0.159)	(0.136)	(0.202)	(0.174)	(0.167)
Venezuela	...	...	0.28	0.111	0.669	0.605
	...	...	(0.218)	(0.178)	(0.177)	(0.317)
Mean	0.13	0.19	0.32	0.31	0.68	0.40
Median	0.19	0.12	0.30	0.25	0.74	0.40

Note: The measure of persistence is the autoregressive coefficient in the specification $\pi_t = \alpha + \rho\pi_{t-1} + \varepsilon_t$. For Peru and Venezuela, the fifth sample is shortened to 1970–86 in order to abstract from an explosive root that arises from the burst of inflation in the late 1980s; for a similar reason, a dummy variable on the first lag of inflation is added in the equations for Argentina and Brazil in 1975–85 and 1985–89, respectively.

is consistent with more persistent changes in inflation rates as would be suggested by a unit root process, and in the past decade there is some evidence that inflation rates have generally become less persistent.

This low-persistence behaviour in the distant past was, of course, consistent with the monetary regime implied by the gold standard, both for the core and periphery countries (see Burdekin and Siklos, 2004, for further detail on some of the differences between the regions). Any bursts of inflation or deflation were naturally reversed in short order because of the rules of the game. And, the recent time-series behaviour of inflation, as well as the greater frequency of deflation, suggests that the current monetary policy environment has begun to resemble more that of the distant past than that of the past 40 years.

Not only would the regime make a difference but also the presence of nominal rigidities would too. One way to draw inferences about the macroeconomic importance of downward nominal rigidities is to examine whether transitory deflations were more persistent transitory inflation, as theories emphasizing downward nominal rigidities would suggest. To draw inferences about this possibility of asymmetry, we use a threshold autoregressive (TAR) model of inflation (π) that is adapted from Enders and Granger (1998):

$$\Delta\pi_t = \beta + I_t\ \rho_1\pi_{t-1} + (1 - I_t)\rho_2\pi_{t-1} + \varepsilon_t$$

where I_t is a (heaviside) indicator function defined as $I_t = \begin{cases} 0, \textit{ if } \pi_{t-1} \geq 0 \\ 1, \textit{ if } \pi_{t-1} < 0 \end{cases}$.

While there is an inherent risk that we are putting demands on the historical data that are simply too high to estimate this non-linear regression, the results were surprisingly robust and warrant due consideration. The statistics in Table 4 offer little evidence of more persistency of deflation than inflation for the pre-1914 period: few of the country histories show statistically significant differences in persistence. As a crude summary statistic, the mean value of the persistence parameter for all the countries in the sample during deflation periods is 0.05 versus 0.15 during inflationary periods. So, if anything, the persistence during deflations was less than the persistence in inflations. One interpretation of these results is that there is little role for downward nominal rigidities in most of these countries, at least during the pre-1914 period. Moreover, theory would suggest that to the extent that downward nominal rigidities were not important, modest deflations during this period were likely to be no more costly than modest inflations.[20]

The implications for the current policy environment may be subject to even more caveats because of obvious changes in the economic environment between then and

[20] Applying these same methods to the immediate post-World War I period is complicated by episodic non-stationarities and other data problems: hyperinflation in some countries, adverse effects of price controls in others during the 1930s and 1940s and some missing data. Some of these factors may be responsible for generating behaviour consistent with unit roots. For the cases where the data are less likely to have been unduly influenced by episodic non-stationarities, the evidence for asymmetry is weak.

Table 4. Asymmetric persistence tests for price changes in the pre-1914 period

Countries	Period	Percentage of observations $I_t = 1$	$1 + \rho_1$	$1 + \rho_2$	F-stat
Argentina	1886–1913	43	–0.41	0.78	17.03***
Australia	1880–1913	44	0.05	0.07	0.01
Belgium	1880–1913	44	0.18	0.12	0.02
Brazil	1880–1913	44	–0.14	0.52	2.53
Canada	1880–1913	24	0.00	0.12	0.11
Switzerland	1882–1913	38	0.87	0.25	4.48*
Chile	1880–1913	32	–0.25	0.58	6.94**
China	...	...	...	...	...
Germany	1880–1913	29	0.09	0.49	1.17
Denmark	1880–1913	41	0.19	0.09	0.07
Spain	1882–1913	44	–0.16	0.02	0.22
Finland	1880–1913	32	0.37	0.30	0.04
France	1880–1913	27	–0.76	0.03	2.02
Hong Kong	...	...	...	...	...
Indonesia	1880–1913	56	–0.38	–0.92	2.50
Ireland	...	...	...	...	...
India	1880–1913	35	0.27	0.00	0.53
Italy	1880–1913	32	0.09	0.05	0.01
Japan	1880–1913	30	–0.21	0.40	4.17
Korea	...	...	...	...	...
Mexico	1902–1913	42	–0.30	0.12	0.94
Malaysia	...	...	...	...	...
Netherlands	1880–1913	32	0.04	0.07	0.01
Norway	1880–1913	35	0.54	0.11	1.40
New Zealand	...	...	...	...	...
Sweden	1880–1913	44	0.69	0.08	2.89
Singapore	...	...	...	...	...
Thailand	...	...	...	...	...
Taiwan	...	...	...	...	...
United States	1880–1913	24	0.24	0.47	0.43
United Kingdom	1880–1913	44	0.08	–0.54	3.31*
Mean			0.05	0.15	
Median			0.06	0.11	

Note: Inflation tests of the threshold autoregressive (TAR) model during the gold standard period is specified as the following: $\pi_t - \pi_{t-1} = \beta + I_t\rho_1\pi_{t-1} + (1 - I_t)\rho_2\pi_{t-1} + \varepsilon_t$ where I_t is a heaviside indicator function such that $I_t = \begin{cases} 0, \text{ if } \pi_{t-1} \geq 0 \\ 1, \text{ if } \pi_{t-1} < 0 \end{cases}$. The significance level of the test of the null of symmetry, $H_0 : \rho_1 = \rho_2$, is reported in the final column using Monte Carlo generated critical values: * = 90%, ** = 95% and *** = 99%. This tests whether inflation persistence was similar during deflationary and inflationary periods during the heyday of the gold standard period. Assuming that inflation was stationary, the appropriate measure of persistence is $1 + \rho_i$. Enders and Granger (1998) focus on unit root tests in the presence of asymmetric persistence. Consistent with their approach, we account for the possibility of non-standard probability distributions of the test statistics by using Monte Carlo methods even when there is little evidence of unit roots.

now. These differences would include the nature of wage and price rigidities, the relative importance of supply and demand shocks, the possible changing importance of debt deflation and the nature of the anchored inflationary expectations. Nonetheless, if in these cases most of the deflation shocks were productivity (i.e., supply) driven, the negative consequences of any downward nominal rigidities would be mitigated

by offsetting profit and rising real wage developments relative to the situation of a similarly sized demand shock.[21]

3.3.3. Further investigations into asymmetry. We check the robustness of the symmetry results in the country-by-country analysis for the gold standard period using panel estimation methods. The gold standard in theory should have imposed inflation linkages across economies. In practice, however, the system was far from perfect and deviations occurred, especially for those economies outside the core countries. Table 5 summarizes the results from two groupings of countries. The first grouping is the United States and the United Kingdom. The linkages were likely to be tighter between these two countries than between most others, and the quality of the data is likely to be the highest for these countries. The second grouping is for the G10 countries. This provides a larger sample and offers a slightly different snapshot but likely rests too heavily on assumptions of fixed coefficients across all the countries. Another key difference between this test and the previous one is that we include additional regressors that may alter our interpretations of the key factors influencing inflation. In both cases, the statistical analysis is largely suggestive of the underlying robustness of the symmetry hypothesis rather than a formal test of how well the gold standard experience accords with textbook treatments of a fixed exchange rate system.

The statistical model of inflation is $\pi_{i,t} = K_i + \rho_1 I_{i,t}\pi_{t-1} + \rho_2(1 - I_{i,t})\pi_{t-1} + \beta X_{t-1} + \varepsilon_{i,t}$, where the model is estimated using a pooled regression (unbalanced panel). In this equation, π is the annual inflation rate in country i, K_i is a country specific constant, and X is a set of economic variables associated with inflation determination. I_t is an indicator function as defined above. The error term is assumed to be distributed normally.

The estimation methodology is straightforward. If the country constants were statistically different at the 95% confidence level, we estimated the model with fixed effects; otherwise, we used a common constant. In nearly all the cases, we could not reject the hypothesis that all the country constants were equal to each other. The results are consistent with the view that the gold standard played a role as a global

[21] Following up these tests for the post-World War II period would not be possible because of the lack of deflationary episodes. To gain some insights into the time series persistence properties, we examine periods when inflation was above and below its trend. The results, reported in Bordo and Filardo (2004), are rather similar in spirit to those in Table 4: negative and positive deviations of inflation around trend exhibit symmetric persistence. In addition, inflation persistence since the beginning of the Great Inflation period has been recently taken up by various authors (e.g., see Romer and Romer, 2002; Sargent, 1999, 2002; Cogley and Sargent, 2001; Rogoff, 2003). Explanations for the rise and fall of inflation emphasize ways policy makers learned about the inflation–output trade-off. Romer and Romer (2002) argue that central bankers learned from academics that there was no exploitable trade-off, and hence redirected their focus away from stabilization to inflation control. Sargent (1999, 2002) considers a wider range of learning mechanisms that might explain the facts without relying on the central bankers experiencing a denouement. Rogoff (2003) links the recent decline in international inflation rates to trends in globalization and the incentives for central banks to orchestrate surprise inflation. These explanations imply fundamental shifts in the money supply process but not necessarily changes in the symmetry of the inflation process beyond the fact that higher inflation likely reduced the incidence of binding downward nominal rigidities.

Table 5. Panel symmetry tests for inflation, 1880–1913

	United States and the United Kingdom					G10 countries			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$\pi_{t-1} < 0$	0.05	–0.02	–0.02	0.22	0.23	0.17	0.17	0.18	0.01
	(0.20)	(0.20)	(0.20)	(0.36)	(0.09)**	(0.10)*	(0.10)*	(0.12)	(0.14)
$\pi_{t-1} \geq 0$	–0.01	–0.13	–0.12	–0.10	0.18	0.14	0.16	0.19	0.09
	(0.23)	(0.23)	(0.23)	(0.37)	(0.08)**	(0.08)	(0.09)*	(0.11)	(0.13)
Money growth$_{t-1}$		0.18	0.22	0.08		0.15	0.14	0.14	0.12
		(0.09)*	(0.10)**	(0.12)		(0.03)***	(0.03)***	(0.03)***	(0.06)*
Output gap$_{t-1}$			–0.002				–0.001		
			(0.002)				(0.001)		
Supply shocks$_{t-1}$				–0.06				–0.01	
				(0.10)				(0.03)	
Demand shocks$_{t-1}$				0.01				–0.00	
				(0.05)				(0.02)	
Bank crises$_{t-1}$									0.01
									(0.01)
Equity prices$_{t-1}$				0.08					0.05
				(0.05)					(0.02)**
$\bar{R}^2$	–0.03	0.01	0.02	0.01	0.04	0.11	0.11	0.09	0.05
Symmetry test	0.86	0.74	0.78	0.39	0.71	0.84	0.92	0.95	0.69
Number of obs.	68	68	68	66	371	324	324	319	163

Notes: The statistical model is $\pi_{i,t} = \rho_1 I_{i,t}\pi_{t-1} + \rho_2(1 - I_{i,t})\pi_{t-1} + \beta X_{t-1} + \varepsilon_{i,t}$, where the model is estimated as a pooled regression (unbalanced panel). If the country constants were statistically different at the 95% confidence level, the model was estimated with fixed effects instead of a common constant. The regressors include the first lag of the country-specific annual growth rate of money, output gap, supply shocks, demand shocks, banking crisis variable and annual growth rate of real equity prices. The banking crisis indicator and money growth are from Bordo *et al.* (2001). The supply and demand shocks are constructed using a Blanchard and Quah (1989) long-run restrictions model for real GDP growth and inflation; they are rescaled by 100 for the purposes of reporting the coefficients of the table. The standard errors are in parentheses and the asterisks indicate the 10%, 5% and 1% significance levels, respectively. The G10 countries include Belgium, Canada, Germany, France, Italy, Japan, the Netherlands, Sweden, Switzerland, the United Kingdom and the United States.

nominal anchor. The range of the country-specific results in Table 4, however, tempers the strength of our inferences because it is possible that the power of these panel tests with annual historical data might require factoring in a grain of salt.

The hypothesis of symmetry of the inflation process was tested again by comparing ρ_1 and ρ_2. The evidence is quite clear for both groupings: there is no statistically significant evidence that the inflation process is asymmetric. This suggests, as noted above, if there were downward nominal rigidities at the microeconomic level during the gold standard period, they did not exhibit a macroeconomic impact on the inflation process. The other regressors, *X*, included in the regression are the first lag of the country-specific annual growth rate of money, the output gap, supply shocks, demand shocks, a banking crisis variable and the annual growth rate of real equity prices (see note to the table for further details). In general, they have plausible, economically meaningful signs, with the lagged of the money growth variable being the most significant. Their inclusion did not change the robustness of the symmetry result.

4. MONETARY POLICY CHALLENGES IN A LOW INFLATION ENVIRONMENT FROM A HISTORICAL PERSPECTIVE

The historical record has provided a wide range of experiences from which to draw some conclusions about the appropriate conduct of monetary policy in a low inflation/deflation environment. There is little disagreement in policy circles today about the importance of price stability. The more contentious issues of late are how low central banks should aim with respect to the inflation rate and how best can central banks navigate such a policy environment because the zero lower bound for nominal interest rates may compromise the usefulness of short-term interest rates as policy instruments. In this section we draw lessons from history about these issues but remain mindful about extrapolating linearly from the past to the present. To this end, we highlight factors that may be useful in translating the lessons from the past for the future.

After decades of the march toward low inflation, a low-to-moderate deflation (roughly 0% to 3% deflation on a measured bias-adjusted basis) might be viewed by some as the next logical step towards truly realizing the theoretical benefits of monetary policy. While the historical record provides support for this step, recent history raises doubts about the eagerness of central banks to pursue such a goal. In contrast to the distant past, policy makers have shown a reluctance to target, let alone allow, deflation; if anything, monetary policy makers around the globe have generally perceived deflation as being undesirable. The attractiveness of the moderate deflation policy should depend on the dispassionate analysis of the empirical relevance of several important assumptions in the theories, not least of which includes the importance of downward nominal rigidities and the size of the benefits of steady-state deflation. The historical record suggests that the analysis should not focus on the Great Depression era but rather the earlier era.

An important potential policy concern that arises in today's low inflation environment is the proximity of the zero lower bound for nominal short-term interest rates and the possibility of falling into a liquidity trap. The historical evidence suggests that the presence of liquidity traps is highly elusive. Indeed, Meltzer (2003), Orphanides (2004) and Hanes (2004) have recently argued that in the 1930s, in what is generally considered the prototypical example of a liquidity trap, the United States in fact did not experience one. Looking further back, nominal interest rates rarely came close to zero and remained quite stable, despite wide swings in inflation/deflation in much of the historical record. This is true across countries, across different levels of financial maturity, across maturities of interest rates and across time during the pre-interwar period. For example, Great Britain and France surely had some of the most developed financial markets during the nineteenth century; Norway and the United States were emerging market economies early on, but later caught up (see Figure 3). The story looks very similar for short-term and long-term rates across all these experiences – interest rates simply did not vary much.

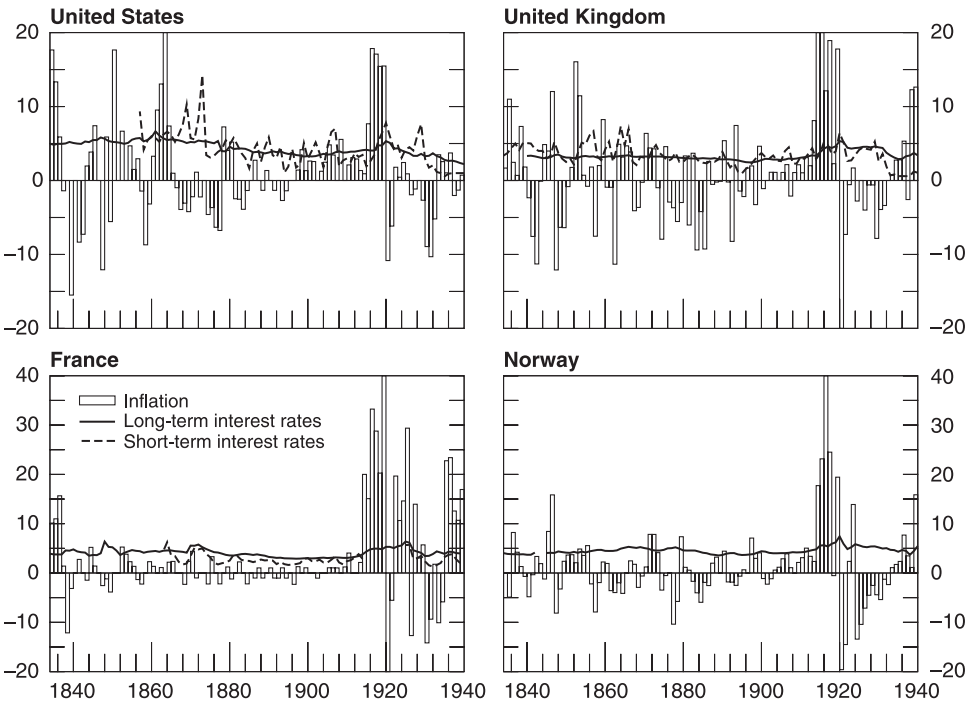

Figure 3. Interest rates and deflation

Notes: The inflation bars represent annual consumer price inflation. The short-term rates: US call money rates; Great Britian 3-month Sterling interbank deposit rate (from 1864), minimum rate of discount (from 1936); France discount rate. The long-term rates: US yield on long-term Treasury bonds; GB yield on consul bonds; France yield on long-term government notes; Norway long-term government bond yields.

In addition, if it is true that liquidity traps are sufficiently rare events, the implication of the recent theoretical literature on monetary policy and liquidity traps takes on much less practical significance. First, central banks need to be less wary about the prospect of ugly deflations than has been suggested by recent reactions to deflation scares. The historical record suggests that it is unlikely that a modest shock would initiate a sequence of events that could cause the economy to career uncontrollably into an ugly deflation. While it is impossible to rule out such possibilities, the historical record suggests that deflationary spirals are extreme outcomes that rarely occur in isolation but rather are a product of the confluence of bad economic shocks, bad policies and bad luck.

Second, and perhaps most important, the zero lower bound for the short-term nominal interest rates should not be mistaken to mean that the monetary authority necessarily loses its room for manoeuvre. To be sure, a monetary authority would generally find it increasingly difficult to use short-term interest rates as an accurate measure of the stance of policy or as a reliable policy guide as the policy rate approaches zero. And, short-term policy rates could prove to be a poor means to communicate the policy intentions of the monetary authority, thereby undermining

the ability of central banks to ensure a credible nominal anchor through its policy actions. But, the historical record makes clear that the monetary authority may still have effective policy tools, especially if the financial sector remains healthy.

Indeed, the recent debate over the implications of the zero lower bound has emphasized the various options available for policy makers (Bernanke and Reinhart, 2004; Yates, 2003). The monetary authority could adopt non-conventional measures to conduct policy such as targeting long-term interest rates, pursuing unsterilized foreign exchange intervention, adopting quantitative easing (by focusing on monetary targets) and purchasing goods and commodities outright.[22] History suggests that the most time-tested means at a central bank's disposal is the expansion of the money supply via the monetary aggregates – both narrow and broad measures. By using open market operations to increase the reserves of the commercial banks, the central bank would still be able to boost aggregate demand and achieve its desired inflation rate (Lucas, 2004).[23]

Naturally, the closer the economy initially is to the zero lower bound for short-term nominal interest rates, the more likely the bound would be reached. The likelihood of reaching a zero nominal rate would depend on the steady-state deflation rate and on the type of shocks affecting the real interest rate (Coenen *et al.*, 2004; Borio and Filardo, 2004). Negative demand shocks, for example, would likely generate both transitory declines in the real interest rate and disinflation. In this case, the zero lower bound for short-term nominal interest rates would more likely bind than if the steady-state inflation rate were higher. A similarly sized supply shock would present less of a problem because of the tendency for the real rate to increase, and therefore offset the disinflationary effect on the probability of hitting the zero lower bound.

This issue associated with the zero lower bound suggests several possible policy options. Of course, the central bank could steer clear of the zero lower bound by choosing a higher steady-state inflation rate; this would naturally yield a lower incidence of deflation but at the foregone cost of a steady stream of losses associated with the higher inflation for the foreseeable future.

Alternatively, the historical evidence suggests that the central bank could rely more heavily on quantitative measures of monetary policy rather than on short-term interest rates to guide monetary policy. Looking back to the Great Contraction of 1929–33, many have argued – persuasively in our view – that expansionary monetary policy would have softened the blow to the economy. But, as contractionary forces became sufficiently strong and the monetary transmission mechanism sufficiently

[22] Andrés *et al.* (2004) have recently shown that imperfect asset substitution in a general equilibrium setting can provide an additional channel for monetary policy by operating on long-term interest rates; the simulation results suggest at least a modest influence is available.

[23] The recent academic debate on the monetary aggregates suggests that even at low levels of inflation the monetary aggregates are sufficiently correlated with inflation to be of importance in the conduct of monetary policy. This line of argument using new Keynesian models is most forcefully argued by Nelson (2003); Gerlach and Svensson (2003) also provide some evidence to suggest the P-star model might be useful in European monetary policy. For a more sceptical view, see Rudebusch and Svensson (2002).

impaired, expansionary open market purchases could have driven down short-term interest rates to the zero lower bound without the expected stimulus permeating the economy. Clearly, if such an extreme event were to occur again, a monetary aggregate targeting strategy might arguably be superior. Indeed in the 1930s US experience, short-term interest rates did approach zero by the end of 1932. When the Federal Reserve conducted open market purchases of US$1 billion in the spring of 1932, it did succeed in temporarily stimulating the economy. This policy was abandoned after several months, some argue, because of concern over the Federal Reserve holdings of free gold (gold reserves in excess of statutory requirements) (Eichengreen, 1992); the evidence, however, is not thoroughly convincing on this point (Bordo *et al.*, 2002a; Meltzer, 2003). Others argue that it was abandoned because Congress, which had pressured the Federal Reserve to stimulate the economy, went on recess in July 1932 and the Federal Reserve reverted back to its original 'liquidationist stance' (Friedman and Schwartz, 1963).[24]

Although the zero lower bound was reached in late 1932, a successful reflationary monetary policy was initiated in March 1933 by the US Treasury actively purchasing gold (and silver) in a deliberate attempt to devalue the dollar. This evidence supports the cases both for conducting open market operations in assets other than short-term paper and for the use of monetary aggregate targeting in the case of severe deflation. In the case of the US Great Contraction, although monetary policy did eventually end the 'ugly' deflation, the recovery was attenuated by other policies followed by the Roosevelt administration. The NIRA (National Industrial Recovery Act), established to artificially raise wages and prices by restricting the supplies of labour and commodities reduced aggregate supply in 1934–35 below what it would otherwise have been (Bordo *et al.*, 2000; Cole and Ohanian, 1999).

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

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

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

One interesting policy option that offers a synthesis of the recent emphasis by central banks on interest rate tools and the historical experience with quantitative tools comes from the theoretical research of Benhabib *et al.* (2002). They argue that a central bank could eliminate some of the problems associated with the zero lower bound for nominal interest rates by switching from an interest rate rule to a monetary aggregate rule when nominal interest rates become sufficiently low.[25]

The historical record also provides insights into policy targets that might assist central banks in shaping favourable private sector expectations in a low inflation/deflation environment. One option is to adopt a policy regime with a stronger nominal anchor, in particular a price level target. As the gold standard period illustrates, a transparent price level target was effective in preventing the zero lower bound for nominal interest rates from being hit. Part of the reason was that it led to mean reverting inflation expectations. A decline in the price level would naturally lead to positive short-term inflation expectations, and vice versa. In addition, expectations appeared to be much more 'sticky', and hence this regime was less likely to cause a deflationary spiral.[26]

Along these lines of reasoning, a set of intriguing alternative proposals for escaping liquidity traps has been advocated in recent years. Svensson (2003), Krugman (1998) and Eggertsson and Woodford (2003) have argued that central banks could manipulate private sector expectations about future price levels, which in turn would boost inflation expectations once the policy was adopted. Svensson (2003) offers what he calls the 'foolproof' way of escaping a liquidity trap by simultaneously announcing a depreciation of the exchange rate and elevated price level target.[27] Once the price level target was realized, the monetary authority would then initiate a preannounced

[25] Arguably, the Bank of Japan switch in recent years from interest rate targeting to quantitative easing reflects the difficulty of formulating monetary policy in terms of short-term interest rates when the zero lower bound for nominal interest rates is binding.

[26] The historical record suggests that the speed of expectation updating was linked to the monetary policy regime. Regimes with low credibility such as the regime during the Great Inflation would provide incentives for rapid updating; to not do so would be very costly. Regimes with high credibility and a strong nominal anchor would provide incentives to update less frequently (DeLong, 2000; Borio and Filardo, 2004). This view is consistent with the extensive literature on the Gibson paradox (Friedman and Schwartz, 1982). This view is also consistent with the recent empirical evidence presented by Bordo and Haubrich (2004) indicating that term structure spreads are poorer predictors of recessions during more credible monetary regimes. In addition, the importance of the regime is corroborated using a less model-dependent approach by the fact that returns on gold bonds (i.e., bonds that are paid off in gold) never diverged much from the returns on paper bonds during the Greenback inflation/deflation episode following the US Civil War, during which the price level doubled and subsequently halved (Friedman and Schwartz, 1963).

[27] For further discussion of this broader interpretation of the historical record, see Bordo and Filardo (2004). By highlighting the wide range of experiences, from high inflation to deep deflation, the authors argue that the monetary policy trade-offs are largely dependent on the inflation/deflation zone in which policy makers find themselves. This new 'zonal view' reinforces the general policy conclusions of this paper.

exit strategy of a floating rate regime with an inflation (or price level) targeting regime. While sensible in theory, the ability of the monetary authority to precisely and credibly manipulate private sector expectations via conditional policy statements in a well-orchestrated manner is still an open question.[28]

5. CONCLUSIONS

This broad-brush historical approach has yielded important insights about deflation and monetary policy both in the past as well as in the present. One striking feature of the historical record is that deflation was a common phenomenon in the pre-World War II period owing in large part to the low inflation environment and the monetary regime that naturally led to waves of inflation and deflation. In many ways, the current policy environment better resembles that of the distant past than of the period from 1970 to 1995. This not only suggests that looking to the past may help resolve some current policy issues but also that policy models might benefit from being calibrated to those developments in the distant past.

To an observer looking at the long history, current concerns about deflation may seem to be somewhat overblown. It is abundantly clear that deflation need not be associated with recessions, depressions, crises and other unpleasant conditions. The historical record is replete with good deflations. There are, of course, plenty of bad deflations too. But, it is unclear to us that the bad deflations within the context of stable nominal anchor (i.e., price stability) regimes were any worse than a similarly sized disinflation in an inflationary environment. The empirical tests suggest that the asymmetries at the macroeconomic level were not particularly daunting and might be regime-dependent. Recent experiences with deflation suggest that real rather than nominal compensation plays an increasing role in decision making, as theory would suggest. To be sure, some historical episodes of deflation were, in our typology, labeled as 'ugly'. But the historical record makes it evident that most of those were isolated to the Great Depression period. While a return of such conditions cannot be completely ruled out for any particular economy, it is also true that once one digs into the reasons for deflation in the Great Depression it becomes quite clear that the possibility of its reappearance is hard to even imagine. Moreover, recent research has found that even during these extreme conditions there is little evidence that liquidity traps developed, thereby putting the recent theoretical literature on liquidity traps, and the need for unconventional monetary policy measures, in quite a different light.

The perceived costs of deflation are also important. The possible asymmetric nature of the costs associated with deflation has been used to justify asymmetric monetary policy approaches to deviations of inflation around a central bank's target

[28] Kugler and Rich (2002) have raised some doubts about whether the foolproof way would have worked well in the case of Switzerland in the 1970s. Mishkin (2004) has argued that conditional policy statements may be too complex for the public to fully appreciate. Such a view would raise doubts about the practical application of contingent policy statements that rely so much on the revision of the public's expectations.

rate, i.e., a more aggressive reaction to a deflation scare than to upside risks to inflation of the same size. If the costs are real and asymmetric, such policy reactions might be optimal, but they will nonetheless imply a tendency toward an upward bias to inflation; this policy approach would also tend to be procyclical. However, if the costs of deflation were not asymmetric, as the historical record suggests, such a policy could generate periodic overshooting of the inflation target – particularly during recovery periods – and the costs associated of reining it in.

The gold standard period provides another vantage point with which to compare current regimes to those in the past: the credible nominal anchor. The success in the past decade or so in lowering the average inflation rate underscores the importance of adopting sound and credible monetary policy regimes. A key question going forward is whether the current regimes are really offering the best nominal anchors. In some respects, the current regimes can be improved by adopting an explicit price level target or flexible price targeting versus an inflation targeting regime. One additional issue with respect to credibility is the importance for a central bank to operate in an environment of sound fiscal and prudential frameworks. Having sound policies in place will not only reduce the likelihood of a bad or ugly deflation but will also help to strengthen the monetary policy transmission mechanism in the case of an unwelcome, but transitory, disinflation.

Our discussion of monetary policy highlights several key trade-offs for monetary policy makers. First, what is the optimal inflation rate for a particular central bank? Most central banks have chosen, by revealed preference, low average inflation. Theory and history suggests going lower might be even better.

Second, the choice of the low average inflation rate, and if in the future a low-to-moderate deflation rate, would generally dictate the adoption of a mixed strategy towards the conduct of monetary policy. The ECB's two-pillar approach is an example of such an approach (Issing, 2002; Masuch *et al.*, 2002). At the very least, the pathological problems associated with short-term interest rate instruments near the zero lower bound demand more attention. These considerations naturally lead central banks to place greater weight on the monetary aggregates as their policy instruments. Indeed, the historical record clearly points to greater reliance on the monetary aggregates, if only for cross-checking purposes. If velocity changes were better understood, the role of the monetary aggregates might play a more central role. This, of course, is ultimately an empirical issue.

Third, in the end the trade-offs for monetary policy appear to be fairly stark. On the one hand, central banks operating in a low inflation environment face the fact that they will always be one recession or strong supply shock away from deflation. This means that interest rate rules will routinely become ineffective guides for monetary policy. In our view, this suggests that the study of the role of money in the conduct of monetary policy needs to be reinvigorated at central banks with the goal of designing a mixed policy strategy that relies on both the interest rate rules and monetary aggregate targeting. Of course, the relative weights on these strategies in

practice will depend on the inflation/deflation goals as well as the stability of velocity for the monetary aggregates and the constellation of shocks hitting the economy.

Finally, if policy makers were contemplating a shift to a low-to-moderate deflation policy, various uncertainties would represent potential costs that they would have to factor into their decision making. One key source of uncertainty would arise from changing private sector behaviour. The historical record is clear that when low inflation regimes were replaced with high inflation regimes, private sector behaviour changed dramatically. And, one might expect that as policy makers enter relatively unfamiliar territory, unexpected changes would be likely. To be sure, the historical record could help to understand the broad contours of what a low-to-moderate deflation environment might resemble. But there are limits. The underlying changes in specific aspects of the economy over the past century, not least the financial system, sectoral composition of output, extent of globalization etc., certainly puts limits on how precisely the past lessons can be applied today. Yet, these limits might be relaxed through further historical study.

Discussion

Andrés Velasco

KSG, Harvard University

Concerns about deflation are back in fashion – or at least they used to be until the US economy began to recover and the price of oil skyrocketed. But Japan and a handful of other passing cases notwithstanding, recent experience with deflation is limited. It makes sense, therefore, to turn to history as a source of guidance and policy lessons.

The paper by Bordo and Filardo reviews nineteenth and early twentieth century experience with bouts of inflation and deflation to make three points. First, deflation may be viewed as a rare and threatening phenomenon nowadays, but in fact it was quite common during the nineteenth century.

Second, not all deflations are bad deflations. In the nineteenth century deflation often went hand-in-hand with growth, not recession. This was to be expected – if, for instance, positive productivity shocks caused growth spurts, which then necessitated falling prices under the gold standard.

Third, there have been, however, some bad and even some ugly deflations, the nastiest of which was the Great Depression. Evidence unearthed by Bordo and Filardo strongly suggests that banking crises sharply increase the probability of a deflation turning ugly and being associated with large output decreases.

The historical reading provided by the paper is informative and quite compelling. Particularly important is the observation that the most feared consequences of deflation – debt deflation, rising real interest and real wages and the attendant unemployment

– follow only from *unanticipated* deflation. Therefore, if expectations of mild deflation get entrenched in the system (as reportedly happened in Hong Kong recently), real costs should diminish accordingly. This point follows directly from standard theories of inflation/deflation and their consequences, but it often gets lost in policy debates.

The paper goes beyond history to try and extract policy lessons from past episodes of deflation. The overall message is optimistic: 'To an observer looking at the long history, current concerns about deflation may seem to be somewhat overblown. It is abundantly clear that deflation need not be associated with recessions, depressions, crises and other unpleasant conditions.'

Two lessons follow from this general assessment. First, 'the central bank could steer clear of the zero lower bound by choosing a higher steady-state inflation rate.' Most economists would be in agreement with this proposition.

Second, when inflation is low and deflation threatens, 'the historical evidence suggests that the central bank could rely more heavily on quantitative measures of monetary policy rather than on short-term interest rates to guide monetary policy.' This conclusion is more controversial.

True, Benhabib *et al.* (2002) have a model that suggests that a central bank could eliminate some of the problems associated with the zero lower bound for nominal interest rates by switching from an interest rate rule to a monetary aggregate rule when nominal interest rates become sufficiently low. But the paper does not make an effort to match the historical episodes discussed to the logic and details of that model.

At heart, the issue is as old as monetary economics. If with low inflation or deflation velocity is volatile, and therefore the correlation between money and prices is weak, monetary aggregates provide a poor tool for controlling price changes. As the paper itself points out, 'If velocity changes were better understood, the role of the monetary aggregates might play a more central role.'

It is slightly strange that the reliance on two pillars (interest rates and aggregates) is justified by reference to the policy of the ECB, when it is precisely this feature of European policy that has been most controversial. Galí *et al.* in the report on the European Central Bank published by the CEPR (2004), write: 'The ECB should abandon the "Two Pillars" and adopt a simple inflation targeting strategy. Keeping inflation in check is the ultimate goal of the ECB: it is hard to see why the growth rate of M3 should have a special role, which goes beyond that accorded to many other indicators . . . In fact inflation targeting is just a way of setting monetary policy so as to keep output close to potential while keeping inflation close to its target.'

If zero interest bounds and deflation are the concern, there are strong theoretical and practical reasons to think that price level or inflation targets can do a better job, as recently suggested by Krugman (1998), Svensson (2003) and others. Those are useful 'anti-liquidity-trap' policies that should be in the toolkit of every prudent central bank.

Carlo A. Favero
IGIER, Bocconi University and CEPR

This paper considers the recent (although now somewhat obsolete) worries about the perception of deflation as a new and daunting policy to illustrate how deflation ". . . is far from new and need not be daunting . . .".

The review of literature on inflation illustrates that the optimality of a negative rate of inflation cannot be ruled out on theoretical grounds. An interesting analysis of the historical record of the international evidence from the last two centuries of data is used to illustrate that not all deflation episodes were ugly (deflation, and persistent recession), but that some were just bad (deflation and moderate recession) and others were even good (fall in prices paired with growth). The main conclusion of the paper is that not all deflation episodes are similar and therefore different policy approaches might be required to deal with them, in particular an eclectic monetary framework that combines the best features of monetary aggregate targeting and interest rate targeting is possibly the most appropriate one in addressing the policy challenges generated by deflation.

In this discussion I will not enter the debate on the definition of the optimal rate of inflation. I will limit my comments here to two remarks. First, it is well known that inflation is measured with error. Therefore, it seems important to distinguish between targets for the true, unobserved, inflation rate and targets for the observed rate of inflation. Second, given that most probably the measurement error is not constant over time, it would be really nice to see the comparative analysis of two hundred years of data supported by some analysis of the evolution of the relevant basket used to compute inflation and of the measurement error related to it.

The analysis of the historical record is the most interesting part of the paper. I will focus most of my comments on it.

First, the overwhelming majority of the deflation episodes considered occurred under the gold standard regime. The importance of learning from the past crucially depends on the absence of structural breaks. Is not the absence of the self-correcting mechanism of the Gold Standard in current regimes an important structural break? In particular, under the gold standard mean reversion of inflation is warranted, while in inflation targeting regimes, operationally implemented via a Taylor-type rule, the convergence of inflation to the target set by the monetary policy maker depends crucially on the correct response of monetary policy to macroeconomic fluctuations. The zero bound on nominal policy rates, which is irrelevant to determine convergence of inflation to its mean in a Gold Standard, might instead prevent is in an inflation targeting framework. The resulting uncertainty on the convergence of inflation to its target will then probably fail to generate the anchor for inflation expectations that is crucial for the control of the process generating inflation.

Second, the classification of deflation episodes as good, bad or ugly is much more natural when a loss function for the policy maker is made explicit. The relative weights on the inflation gap and the output gap are an important determinant of the

welfare loss generated by the different deflationary episodes considered. Moreover, asymmetries in the loss function might also be important to help determine the evaluation of different outcomes as good, bad or ugly.

Third, any macroeconomic outcome is determined by shocks and by the policy response to these shocks. The authors apply the Blanchard and Quah decomposition to differentiate the impact of demand and supply shocks on inflation, but they devote less attention to the issue of identification of the policy maker's responses to shocks. Moreover, all the empirical analysis concentrates exclusively on inflation, while the classification of episodes into good, bad or ugly depends crucially also on output fluctuations. It would be nice then to see an empirical analysis of the determinants of the joint process for output and inflation.

Finally, I believe that the policy conclusion in favour of the adoption of a monetary framework mixing the best features of monetary aggregate targeting and interest rate targeting deserves more discussion. The authors favour the eclectic approach because, conditional on being in a deflationary regime, it is useful to have some monetary aggregate targeting to circumvent the problem generated by the zero bound on the nominal interest rate in an inflation targeting regime. However, it is important to complement the conditional evaluation of costs and benefits of alternative regimes with some unconditional evaluation. In fact, the recent experience of the ECB seems to show that having an eclectic approach in a (moderate) inflationary regime might create some communication problems. The problems are particularly relevant when the monetary aggregate seems to be heavily affected by demand shocks and cannot be used without some persistent updating of the definition of the relevant concept of money or before the application of some filter to separate out the impact of money demand shocks. Such modifications are in general very difficult to explain to the public and might negatively affect the transparency of the policy making process and the accountability of the monetary policy maker.

Panel discussion

Many panel members wondered to what extent institutional changes might prevent currently useful lessons being learned from historical data, and some raised technical issues as to the empirical evidence contained in the panel version of the paper. Andrea Prat thought that the institutional environment was fundamentally different today due to better-developed financial markets. He thought that, for instance, a bubble bursting 100 years ago would have a different result than it would today. Hans-Werner Sinn thought that the key institutional difference was the presence of the welfare state: as social benefits provide a nominal lower bound to wages, deflation would increase this lower bound in real terms and compress the wage distribution. Gabrielle Demange thought that the modern use of indexed sovereign debt might be

important as a determinant of the government's incentives to control both inflation and deflation. Philippe Martin was concerned about the impact of globalization and whether it might lead to deflation, noting a historical parallel between the periods of rapid globalization at the end of the nineteenth and twentieth century, and the role of international linkages in the subsequent deflations.

WEB APPENDIX

Available at http://www.economic-policy.org

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