The Zero Lower Bound on Nominal Interest Rates and Monetary Policy Effectiveness: a Survey

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Abstract

This paper surveys the literature on monetary policy at the zero lower bound on nominal interest rates. Certain crucial insights regarding expectations have been neglected in recent research in this field. Taking this into account, the interactions between demand and supply shocks appear crucial for hitting the zero lower bound and escaping form it. Restoring confidence can play a vital role in solving the zero lower bound problem, thereby avoiding a liquidity trap.

Keywords: Monetary policy, Zero lower bound, Liquidity trap
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Section 1 Introduction

In the 1980s and 1990s, inflation in the industrialised world has fallen from the high levels reached in the 1970s and early 1980s, when inflation waves occurred following the breakdown of the Bretton Woods system and two large oil price shocks. According to IMF statistics, average year-on-year CPI-inflation in OECD countries declined from 12% in 1980 to 5.0% in 1990, and 1.4% in 1999 (Figure 1). The variability of inflation in terms of standard deviations has also decreased over these years. A new era seems to have emerged with low and more or less stable inflation rates in the major capitalist economies[1] (Clarida et al. (1998), Viñals (2001)). This situation is comfortable from the point of view of monetary policy, the overriding objective of which is price stability. In the words of Greenspan (1989), price stability is defined to mean 'that expected changes in the average price level are small enough and gradual enough that they do not materially enter business and household financial decisions'. However, the achievement of price stability has not created a new Utopia for monetary policy. Instead, it has brought about new challenges (*e.g.* IMF (1999)). One of the main challenges is the decrease in the room for manoeuvre for monetary policy[2]. The fall in the inflation rate in the advanced economies has coincided with a decline in the monetary policy interest rates[3] (Figures 2a, 2b, 2c). The point is that – assuming zero storing costs for cash and perfect substitutability between non-monetary assets – nominal interest rates cannot go negative. In that case, the rate of return on cash (zero) dominates that on assets yielding a negative nominal return. In practice, nominal interest rates on (short-term) financial claims can be slightly negative if the cost of storing currency exceeds that of storing other claims (McCallum (2000)), although exceptions to the lower zero bound have been rare[4]. Since for theoretical discussions the exact level of the floor to nominal interest rates does not matter, I assume for simplicity that nominal interest rates

1 In 1995, the leading monetary authorities of the world also expressed this view. At a meeting of the Group of Seven in October 1995, the communiqué concluded: 'The ministers and central bank governors agreed that in most countries the conditions for continued growth and employment gains are in place and inflation is well under control.'
2 Another challenge concerns the effects of downward nominal wage rigidities on price stability. This is analysed in a stochastic general equilibrium framework by Akerlof et al. (1996).
3 For an historic account of (the volatility of) inflation and interest rates, see McFarlane & Mortimer-Lee (1994) and Homer (1977) respectively.
4 One recent example is the occurrence of slightly negative interest rates on Japanese short-term government bonds and some interbank lending in late 1998. Longer ago, in 1978, the Swiss authorities imposed negative interest rates on foreign deposits in order to fight speculative buying of the Swiss franc. During the Great Depression US T-bills occasionally gave a small negative yield in the context of exemption from personal property taxes in some States (Cecchetti (1988)).

cannot go negative. In this context, the so-called problem of the zero lower bound on nominal interest rates is that the monetary authority is no longer in a position to pursue a policy of monetary easing by lowering nominal interest rates[5]. Under these circumstances, monetary policy may still be effective via other transmission channels than nominal interest rates. For instance, inflationary expectations can be fuelled via higher money growth. In this paper, I follow Buiter & Panigirtzoglou (2000) in their definition of a liquidity trap[6]. An economy is said to be in a liquidity trap if all channels of monetary transmission are blocked. Only in one case, the liquidity trap and the zero bound on nominal interest rates are identical concepts. This applies if the nominal interest is the only monetary transmission channel. In other cases, a binding zero lower bound is a necessary but not a sufficient condition for the liquidity trap to prevail.

The zero lower bound on nominal interest rates has long been regarded as a phenomenon of the past. It has been related mainly to the Great Depression in the US (1929-1930s). The main monetary policy rate in the US by then, the three months 'T-bill' rate, was close to zero from 1932 onwards; it did not exceed 1% until 1948. The long-term interest rate was also very low in this period (Table 1). It has been suggested that monetary policy was completely ineffective by then, *i.e.* that a liquidity trap prevailed[7]. The only example of a binding zero lower bound in the period between the Great Depression and the 1990s is Switzerland. In the late 1970s, Switzerland went through periods with nominal interest rates at or close to the zero lower bound. However, in contrast to the US during the Depression years, the Swiss economy was buoyant in the late 1970s. The very low Swiss rates have been associated with the liberalisation of global exchange rates in the early 1970s, although the introduction by the Swiss authorities of capital controls also played a role (Mauro

5 In such circumstances, monetary easing is said to be like 'pushing on a string'. This expression is attributed to Fed governor Marriner S. Eccles in 1935.

6 In between these extreme positions on the interpretation of a liquidity trap, there exists a large range of slightly different interpretations of the liquidity trap. Since they all share common features, these differences are of limited importance to our discussion of the liquidity trap. For a detailed discussion of different interpretations, see Patinkin (1965, 1974) and Beranek & Timberlake (1987).

7 In the 1960s and 1970s, there was an intensive, but inconclusive, debate on whether the US economy was in a liquidity trap during the years of the Great Depression. This debate focussed on the interest elasticity of the money demand function. Some authors found that the interest elasticity was without limit when the short-term nominal interest rate approached zero. Therefore, they concluded that the economy was in a liquidity trap (Eisner (1963 and 1971), Spitzer (1976)); others found a fixed interest elasticity and came to the opposite conclusion (Bronfenbrenner & Mayer (1960 and 1963), Meltzer (1963)).

(1995)). The new exchange rate regime implied appreciation and expectations of further appreciation of the Swiss franc.

Developments in Japan in the late 1990s have revived interest in the zero lower bound phenomenon. From February 1999 to August 2000, the uncollateralised overnight call rate, which is the direct operational target of the Bank of Japan, was virtually zero. Like the US economy during the Depression years, Japan has been characterised by a substantial output gap since the early 1990s[8]. The level of potential real economic growth is estimated to be around 1% (OECD (2000)). Given that potential growth in other large economies is generally estimated to be considerably higher[9], it follows that even in steady state (*i.e.* output gap closed) the Japanese real long-term interest rate will be relatively low. Assuming identical risk and term premia across countries, this will go hand in hand with relatively low short-term nominal interest rates. The Japanese example illustrates that a zero lower bound can emerge in a modern capitalist economy. Krugman (1998, 1999b) and Svensson (2000) have warned explicitly that such a situation might also prevail in the US and the euro area, given the structural decline in nominal interest rates over the last two decades.

This paper surveys the literature on the zero lower bound on nominal interest rates and the related phenomenon of the liquidity trap. Section 2 sketches the main issues in the framework of a New-Keynesian model, which is a dynamic stochastic real business cycle model with nominal rigidities. Section 3 offers an appraisal of the four main strands in the literature. As it turns out, these theories are incomplete. In the concluding section 4, I argue that certain crucial insights in the literature got lost. This pertains in particular to expectations, which were totally left out in the static ISLM representation of a macroeconomy by Hicks (1937) to return only partly in later work. The inclusion of adaptive and, subsequently, rational expectations did not incorporate certain crucial insights regarding expectations by previous authors. It appears that supply factors that undermine confidence are depressing total demand in a situation with a binding zero lower bound.

8 According to the OECD (2000), Japan's output gap in 1999 is 4.0% of GDP. Applying Okun's law, Krugman (1998) concludes that Japan's output gap is even higher, in the order of 10%.
9 The OECD (2000) projects potential real growth in 2000 at 1.2% in Japan, 3.7% in the US and 2.4% in the euro area.

Hence, a lack of confidence is the main force driving the emergence of a liquidity trap; similarly, restoring confidence is the main challenge in escaping from it.

Section 2 The Consensus Model

The zero lower bound on nominal rates was recognised as early as 1896 by Irving Fisher (1896). However, Keynes (1936) was the first to elaborate on the problem of the liquidity trap[10] in Chapters 15 and 17 of The General Theory (see also Lerner (1952) and Ono (1994)). He emphasises the *liquidity preference* of economic agents, implying that the utility of holding money is always positive, even if more money is held than required by the transactions or precautionary motive (compare Modigliani (1944)). Keynes shows that a liquidity trap can emerge in an environment with liquidity preference and sluggish price adjustment. The basic idea is that an economic agent allocates his income to consumption, money holdings and bonds, assuming that all assets other than money are perfect substitutes for each other. Under normal circumstances, optimising behaviour will equalise the marginal rate of substitution between present and future consumption ((intertemporal) time preference rate), the marginal rate between present consumption and present money holdings (liquidity premium), and the nominal market interest rate. However, if the nominal market interest rate is below the liquidity premium, economic agents will keep consumption below the market clearing level. Persistent stagnation will occur, because economic agents will not be satiated with money, no matter how much they have accumulated. Liquidity preference prevails because of the speculative motive, based on uncertainty about future economic developments in general, and more specifically, about future nominal interest rates. If the long-term nominal interest rate is perceived to be very low (in the order of 2% according to Keynes (1936)), economic agents will expect this rate to rise and will hold

10 The liquidity trap as described by Keynes differs from the usual textbook description. The latter is based on Hicks' (1937) representation of a Keynesian economy in the famous ISLM framework. Hicks left out the intertemporal choice completely and put the economy in a static framework, thereby focussing on intratemporal choices that are key in Keynes (1936). In a one-period model, there is no role to play for (a change in) expectations. Hicks was well aware of the limitations of his simplification. He himself noted that the assumption of given expectations is not realistic.

liquid assets (money) in an attempt to benefit from it. In Keynes' (1936) view, money's role as a store of wealth is the reason that 'changing views about the future are capable of influencing the present situation'. With the market interest rate below the liquidity premium, consumption remains insufficient to restore market equilibrium, and money becomes a 'bottomless sink for purchasing power'. The economy is then said to be in a liquidity trap. In Keynes' (1936, page 207) own words:

'There is the possibility […] that, after the rate of interest has fallen to a certain level, liquidity preference may become virtually absolute in the sense that almost everyone prefers cash to holding a debt which yields so low a rate of interest. In this event the monetary authority would have lost effective control over the rate of interest.'

The classical economist Pigou (1943, 1947) disagreed with Keynes on this conclusion. In his view, the utility of money is satiable, meaning that ultimately the liquidity premium will decline sufficiently to reach the time preference rate when liquidity holdings increase[11]. In this view, rational economic agents will ultimately spend their cash holdings. The basic idea behind the mechanism that will restore equilibrium is the following. Eonomic agents realise that monetary growth will ultimately imply higher inflation (Fisher identity) and that future inflation will reduce their spending capacity. Hence, they have a strong incentive – at least in the long run – to spend before others do. If the time preference rate at the market clearing level is lower than the liquidity premium, economic agents will reduce consumption. This will imply disequilibrium in the goods market, and therefore generate deflation. As a result, real balances will rise over time, which will raise consumption until equilibrium is restored. This is the so-called Pigou effect.

By now, a consensus model has emerged to study the zero lower bound. In the long run, market clearing and the Pigou effect are generally believed to restore full employment equilibrium. Ultimately, there are no nominal rigidities and money is neutral. Hence, monetary policy has no real economic effects in the long run, and a liquidity trap is inconceivable as a persistent phenomenon.

11 Compare McCallum (1983) for a formal analysis.

As regards the short run analysis of the zero lower bound, different approaches have culminated in the New Keynesian synthesis[12], which can be regarded as a symbiosis of Neo Classical and Keynesian thoughts. New Keynesian models introduce nominal price and/or wage rigidities in a dynamic stochastic real business cycle framework. It took a long time until serious consideration was given to the zero lower bound for nominal interest rates in this framework. Summers (1991) and Fischer (1994) have revived this old concern. Since then, Fuhrer & Madigan (1997), Krugman (1998), Orphanides & Wieland (1998), Svensson (2000, 2001), Buiter & Panigirtzoglou (1999, 2000) and Wolman (1998) have studied the zero lower bound and the liquidity trap in a New Keynesian framework. Although this framework has important limitations when analysing the zero lower bound, it has proven to be a helpful workhorse to study certain aspects of this issue. I take it as a starting point and discuss its limitations and possible extensions along the way. Following Smets (2000) and Viñals (2001), a highly stylised New Keynesian macroeconomic model can be specified as follows (equations (1-4)):

$$(1) \qquad y_t = r_y y_{t-1} + (1 - r_y) E_t y_{t+1} - s r_t^{re} + e_{y,t}$$

$$(2) \qquad p_t = w p_{t-1} + (1 - w) E_t p_{t+1} + l y_t + e_{p,t}$$

$$(3) \qquad r_t^{re} = r_t - E_t p_{t+1}$$

$$(4) \qquad r_t = r_r r_{t-1} + b_p p_t + b_y y_t$$

y_t (in logs) is the percentage deviation of output from its steady state trend level in period *t*, r_t the nominal interest rate, r_t^{re} the real interest rate, and p_t the inflation rate. $e_{y,t}$ and $e_{p,t}$ are the (serially uncorrelated zero-mean) stochastic components of equations (1) and (2), representing demand and inflation disturbances respectively. $E_t x_{t+1}$ is the expected value at period *t* of variable *x* in period *t+1*; r_y, s, w and l are parameters. Equation (1) is a representation of the demand side of the economy. Equation (2) is a Phillips curve, representing the supply side. With r_y and w equal to zero, Goodfriend & King (1997) have demonstrated that these equations can be derived from micro foundations. However,

equations (1) and (2) consist of both forward and backward looking components in order to describe the inflation dynamics in industrialised economies satisfactory (Smets (2000)). Equation (3) describes the Fisher-relation between real and nominal interest rates. By definition, the zero lower bound is binding when the sum of the real rate of interest and the rate of expected inflation is zero. Nominal interest rates cannot go negative. For in that case, the zero rate of return on cash would dominate the rate of return on other assets, which is ruled out a priori. The model does not distinguish between short-term and long-term interest rates. Perfect substitutability is assumed between non-monetary assets. Finally, equation (4) is the Taylor type rule that describes the interest rate reaction function. The nominal interest rate is increased when current inflation exceeds its target (assumed to be zero) or when the output gap is positive. Equation (4) may require that the monetary authority set a negative real interest rate, which may be impeded by low or even negative expected rates of inflation. Then, the zero lower bound will be binding, and the economy will be in a liquidity trap in the absence of other transmission mechanisms than the nominal interest rate.
An economy with a low average real interest rate over the business cycle is in a more vulnerable position concerning the risk of drifting into a situation with a binding zero lower bound than an economy with a higher average real interest rate. Usually, however, an economic shock is necessary to trigger a sudden decline in the steady state real interest rates and/or the rate of expected inflation (*e.g.* Orphanides & Wieland (1998)). I discuss several kinds of shocks that can hit the economy.

First, a *downward cost-push shock* can trigger a binding zero lower bound. Examples are a downward shock in oil prices or increased competition. Such a shock implies a significant negative value of $e_{p,t}$ in equation (2). The direct effect is lower inflation in period *t*. As a result, the nominal interest rate will be decreased (equation (4)), moving in the direction of the zero lower bound. The real interest rate will decrease too, causing some counterbalancing upward pressure on inflation through y_t. In general, a downward cost-push shock is favourable, supporting output but reducing inflationary pressures[13]. Only if

12 The New Keynesian literature is surveyed in Goodfriend & King (1997) and Clarida, Galí and Gertler (1999).
13 *E.g.* continued price cuts in the computer industry in the 1980s and 1990s associated with technical progress have not undermined investment in this sector, because productivity gains have more than offset the price effect. Other sectors of the economy have clearly benefited from lower computer prices.

there is very strong initial downward pressure on inflation, there is a severe risk that the zero lower bound will be hit.

Second, a *downward demand shock,* $e_{y,t} < 0$ in equation (1), putting downward pressure on both output and inflation, can cause a binding zero lower bound. The output gap will fall first (equation (1)), resulting in lower inflation in the same period (equation (2)). Both effects are translated into a lower nominal interest rate (equation (4)), bringing closer a binding zero lower bound. A demand shock may originate from a collapse in aggregate demand, *e.g.* following a sudden lack of confidence. Contrary to the situation after a downward supply shock, both the output gap and inflation pressure have similar effects on the nominal interest rate. Therefore, this is potentially a more severe situation. Budgetary contraction offers an example of a negative demand shock that lowers real interest rates and can fuel deflationary expectations, as was the case in the US in the late 1920s/early 1930s.

Third, in an open economy, a sudden large *expected appreciation* can cause a binding zero lower bound (McKinnon & Ohno (2000)). To illustrate this, the model can be extended to include interactions with the outside world. I assume Uncovered Interest Parity (UIP), which can be stated as:

(5) $$r_t = r_t^* + \left(E_t s_{t+1} - s_t\right)$$

r_t^* is the foreign nominal rate of interest. $E_t s_{t+1}$ is the expected nominal exchange rate of the foreign currency expressed in units of the domestic currency for period *t+1*. So, an increase in *s* means a nominal depreciation of the domestic currency. In real terms, UIP can be written as:

(6) $$r_t^{re} = r_t^{re*} + \left(E_t q_{t+1} - q_t\right)$$

q is the real exchange rate ($s_t P_t^* / P_t$), where *P* is assumed to be temporarily fixed; P^* is treated as given, because it is beyond the influence of the domestic monetary authority. The central bank can influence *q* via foreign currency interventions that alter *s*. I restate the model (equations (1-4)) in an open economy context as follows (equations (7-10)):

$$(7) \qquad y_t = r_y y_{t-1} + r^*_y y^*_t + (1 - r_y) E_t y_{t+1} - s r^{re}_t + a_1 (E_t q_{t+1} - q_t) + e_{y,t}$$

$$(8) \qquad p_t = w p_{t-1} + (1-w) E_t p_{t+1} + l y_t + a_2 (E_t q_{t+1} - q_t) + e_{p,t}$$

$$(9) \qquad r^{re}_t = r_t - E_t p_{t+1} = r^{re*}_t + (E_t q_{t+1} - q_t)$$

$$(10) \qquad r_t = r_r r_{t-1} + b_p p_t + b_y y_t$$

r^*_y, a_1 and a_2 are parameters. In equation (7), $r^* y^*$ represents spillover effects from the foreign on the domestic economy[14]; $a_1 (E_t q_{t+1} - q_t)$ is an expression for changes in competitiveness. In equation (8) the term $a_2 (E_t q_{t+1} - q_t)$ is added to include the effects of expected costs of imported intermediaries. Equation (9) follows from equation (6). With a large expected real appreciation, the direct effect on the inflation rate will be downward (equation (8)), bringing closer a binding zero lower bound (equation (10)). There is also an indirect downward effect on inflation via a lower output gap (equation (7)). Exchange rate arrangements that cause substantial real appreciation can turn out to be problematic in this respect. Keynes (1923) was well aware of the international propagation of deflationary pressures through the fixed nominal exchange rates of the gold standard, which limited the scope for domestic policy actions in an international environment with free capital movement (incompatible triangle). In the 1980s, the Plaza and Louvre agreements set similar mechanisms in motion, with negative effects on Japan (Siebert (2000)). The international movement towards stable and low inflation rates (section 1) has reduced the risk of the emergence of a sudden large expected appreciation in today's advanced economies.

Economic shocks are most devastating when they lead to persistent deflationary expectations, lifting real interest rates, and set in motion a chain of events that lead to stagnation, *i.e.* a *deflationary spiral* (Krugman (1999a)). Persistent deflationary expectations can stem from prevailing adaptive expectations (high value of w in the model). They can also stem from price and/or wage stickiness (*e.g.* DeLong & Summers (1986)). The implied slowness of price reductions can fuel (rational) expectations of still further price reductions ($E_t p_{t+1}$ lower). Fisher[15] (1933), Tobin (1975, 1980), Minsky (1982), King (1994) and

14 In an open economy, net additional demand via net exports reduces the risk of very low real interest rates.
15 Fisher's debt-deflation theory is clearly analysed in Dimand (1999).

Bernanke (1995) have emphasised that high nominal indebtedness will make a deflationary spiral more likely to occur due to the heterogeneous nature of economic agents. More specifically, debtors, who spend a higher proportion of their income than creditors, get into trouble by deflation since their real incomes decline substantially. So, even if net debt is modest (with debtors and creditors offsetting each other), debt distribution is relevant. High nominal indebtedness can arise during an asset price bubble (Minsky (1982), Wolfson (1996)). When the bubble collapses, the debt may turn out to be unbearable, especially in a deflationary climate. A vicious circle can then develop, with falling asset prices, rising real debt levels, lower aggregate demand, consumer price deflation and downward spiralling expectations. Note that a deflationary spiral is not the mirror image of an inflationary spiral. In the latter case, the monetary authority can stabilise the economy by raising the real rate of interest via an increase in nominal rates (assuming nominal price and/or wage rigidities). However, in a deflationary environment, the monetary authority will not be able to lower real rates below a certain level, due to the lower bound on nominal interest rates.

Usually, the risk of a binding zero lower bound is regarded as limited. According to Orphanides & Wieland (1998), the risk of hitting the zero bound would be negligible for the US with an average nominal interest rate over the cycle of 3%. To get this result, they use stochastic simulations of a small structural rational expectations model. They suppose stochastic shocks similar in magnitude to those over the 1980s and 1990s. Only with a lower level of the average nominal interest rate, they found a significant risk of a binding zero bound. Using a similar model, Viñals (2001) has compared the US and the euro area chance of hitting the zero lower bound. His findings for the US are more or less in line with those of Orphanides & Wieland (1998). For the euro area, his results suggest an even smaller chance than for the US of hitting the zero lower bound due to the structural characteristics of the euro area. However, finding that shocks that cause a binding zero lower bound are unlikely, does not rule them out altogether. The probability of a binding zero lower bound depends on the likelihood of a combination of extreme shocks. Since the frequency of such shocks is limited, they are hard to assess econometrically (King (1999)). Typically, in a financial crisis, several different shocks can reinforce themselves. Mishkin (1991, 1996) defines a financial crisis as ‘a disruption to financial markets that sharply and severely increases asymmetric information […] so that financial markets are no longer able to

efficiently channel funds to those who have the most productive investment opportunities'. He has found that most financial crises in the US started with a combination of shocks, including a sharp increase in interest rates, a stock market crash, and a sharp increase in uncertainty due to economic recession. In addition, the terrorist attacks on New York and Washington on 11 September 2001 offer an example of a rare combination of shocks. Lower demand as a result of the virtual stand-still of the US economy for several days, falling asset prices, together with strong negative confidence effects, can potentially trigger a binding zero lower bound.

Section 3 Different views on the Zero Lower Bound: an Appraisal

Four main strands of the literature can be distinguished to discuss the zero lower bound. First, Krugman and his followers have emphasised the importance of lifting expected inflation to lower the market real interest rate at the zero lower bound. Second, Meltzer and other Monetarist authors have argued that transmission mechanisms other than the nominal interest rate will be effective at the zero lower bound. Third, Buiter & Panigirtzoglou and Goodfriend have proposed to introduce *Gesell money* to circumvent the interest rate floor. Fourth, Svensson has tried to combine several other approaches, and claims to have found a 'foolproof' way to escape from the liquidity trap. These different approaches are discussed below in the context of the consensus model. Meanwhile, it is important to keep in mind that Japan has been struggling for many years with a binding zero lower bound. This suggests that the theories put forward are incomplete. From this perspective, this section also evaluates the limitations of the main strands in the literature.

Krugman's view

Several years before Krugman (1998), Summers (1991) had emphasised that a (very) low level of average inflation and low inflationary expectations will imply (very) low average short-term nominal interest rates. If the monetary strategy leads to inflationary expectations close to or below zero, this will make the emergence of a binding zero lower bound more likely. Krugman (1998) has triggered a discussion on Japanese monetary policies. In his

analysis, *lifting expected inflation* is the way forward for Japan and other economies struggling with a binding Zero Lower Bound. He makes a strong case for the announcement of an *inflation target* in a deflationary environment in order to guard inflationary expectations. Then, lifting expected inflation (equation (3)) can reduce the real interest rate, which is the interest rate decisive for economic performance (equation (1)).

According to, among others, Svensson (2000) and Smets (2000), *price level targeting* might be a better way to anchor expectations than an inflation target. This is because, in contrast to an inflation targeting regime, undershooting of the price level target in period *t* leads to inflationary expectations in period *t+1*. Berg & Jonung (1999) describe how Sweden dropped the gold standard in 1931 and adopted an explicit price level target. It turned out that price level targeting was a successful way for Sweden to stop deflationary expectations and mitigate the output decline. The potentially better performance of price level targeting as compared to inflation targeting is subject to the confidence of the general public and financial markets in the monetary authority's ability to reflate the economy. In this respect, the public can be expected to be more confident if the central bank has at its disposal instruments with which it can create future inflation directly.

In addition to the long turn orientation of monetary policy, monetary tactics (*i.e.* the way in which monetary policy is executed on a short-term basis) may also matter. Reifschneider & Williams (2000) have argued that if the central bank follows a Taylor-type rule and targets a (close to) zero inflation rate, the rule can be modified slightly to reduce dramatically the detrimental effects of the zero lower bound. In their paper, one possible modification with promising results is to lower the nominal monetary policy rate pre-emptively if a binding zero bound is expected. This would involve a higher value for b_p in equation (4) if there were a serious threat of a binding zero bound in the near future. The suggested policy reaction is in line with what several authors (*e.g.* Mundell (2000)) have concluded on Fed policies in the late 1920s. With hindsight, they have stated that the Fed should have lowered nominal interest rates sooner and more forcefully and should have injected reserves via its lender of last resort-function. Then, the Fed might have been in a position to prevent the

rapid decline in broad money and the collapse of the banking sector. The deflation of the Great Depression would probably have been more modest, or even avoided.

Krugman launched his ideas in order to influence Japanese policies at the end of the 1990s. The Japanese authorities and others have been very sceptical about his recipes. In their view, the Bank of Japan cannot explicitly show how to achieve the desired inflation level. They fear following Krugman's advice would result in a loss of credibility (Okina (1999)). Whereas Krugman acknowledges that creating inflationary expectations might be difficult, especially when the public is convinced of the central bank's commitment to price stability, Buiter & Panigirtzoglou (1999) regard this virtually impossible. In their words 'targeting a higher rate of inflation after you are caught in the trap would be like pushing toothpaste back into the tube'. The problem is that Krugman's recipe is conditional on the central bank's ability to increase expected inflation[16]. In reality, the central bank has no instruments available to force higher expected inflation. It might also be difficult to raise inflationary expectations because price stickiness can make the expected future price also sticky (Fuhrer & Madigan (1997) and Orphanides & Wieland (1998)). Krugman's ideas fit in the literature on time-inconsistency and credibility by Kydland & Prescott (1977), Barro & Gordon (1983) and their followers that credible central bank commitment to price stability can anchor expected inflation at a low and stable level. If his recipe works, it is important to avoid that creating higher inflationary expectations paves the way for a future inflationary spiral, which would be suboptimal from a microeconomic perspective. Therefore, it is crucial to base monetary policies on a nominal anchor provided by the medium term monetary policy strategy (Taylor (2000)). In so doing, the monetary policy strategy helps in reducing uncertainty about the future. Similarly, Svensson (2000) argues that the mere announcement of an inflation target is not likely to be enough to fuel inflationary expectations. Instead, it would be necessary to set up an inflation-targeting framework, including transparent inflation reports and published inflation forecasts among other things. In the words of Blinder (1998), it is about 'words matching deeds'. All in all, it seems unlikely that the exact set-up of the monetary policy strategy is essential for its success in

16 Wolman (1998) models an economy in which the monetary authority can always create inflationary expectations. Not surprisingly, in this case a policy regime where nominal interest rates are occasionally bounded by the interest rate floor generates higher welfare than a regime that always avoids nominal rates at zero.

solving the zero lower bound problem. What matters, is that it helps anchoring medium term inflationary expectations. But if a central bank is initially lacking credibility, it is unlikely that it is able to commit itself credibly to higher inflation.

Meltzer's Monetarist view

Monetarists argue that the monetary transmission channel[17] is much more complicated than is incorporated in equation (1). The Monetarist view differs from the consensus model in so far that monetary easing will still be successful with short-term interest rates at the lower bound because of other transmission channels (*e.g.* Mishkin (1996)). Meltzer (1963, 1995, 1999) and Brunner & Meltzer (1968) focus on the transmission mechanisms of monetary policy working through relative price adjustments of non-monetary assets that are imperfect substitutes in investors' portfolios. These relative price changes are transmitted along the yield curve and also impact on the exchange rate[18]. Meltzer's reasoning is based on the assumption that when the short-term nominal interest rate cannot fall due to the zero lower bound, yields on non-monetary assets are not necessarily at their lower bounds[19]. Bernanke & Gertler (1995) have emphasised the credit channel in the monetary policy transmission process. This channel is not hampered by the lower zero bound on nominal interest rates. Monetary easing will reduce the exposure by debtors to the wedge between the cost of external and internal funds. This will support current spending.

The Pigou effect can be seen as an abstraction of 'alternative' transmission channels that do not work through the nominal interest rate. Adding the Pigou effect to equation (1) in the model can approximate this idea. Here, the Pigou effect is introduced in the short run analysis. Note that in the consensus approach, the Pigou effect only appears in the long run analysis. At first sight, the Pigou effect seems at odds with the micro foundations of the consensus model, which is a representative agent model. Money is not perceived as net

17 Walsh (1998) presents a useful overview of monetary transmission channels and empirical evidence of their importance in Chapter 7.

18 In this paper, the monetary policy channel that works through foreign exchange markets is discussed in the context of Svensson's eclectic view.

19 In practice, monetary easing with the short-term interest rate at the zero lower bound might involve additional open-market transactions in other assets, such as commercial paper. Since late 1995, the Bank of Japan is implementing repurchasing agreements using commercial paper. In 1998, the Bank of Japan held circa one-third of the outstanding commercial paper stock. Transactions in longer-term debt, equity or property are also conceivable.

wealth in this kind of models, since wealth cannot be transferred across individuals. If the assumption of homogenous agents is relaxed, for instance by differentiating between different generations, money becomes net wealth (Ireland (2001b)). Ireland (2001a) has shown that the cross-equation restrictions require that real balances can be included in the demand function if and only if they are also contained in the supply function. In order to demonstrate Monetarist thinking, it is possible to add a money demand relation to the basic model (equations (1-4)), without altering its basic properties:

$$(11) \qquad m_t = g_0 + g_1 y_t + g_2 r_t + e_{m,t} \qquad g_1 > 0, g_2 < 0$$

m_t (in logs) is the percentage deviation from steady state of the nominal value of the real money demand (*i.e.* nominal amount of money divided by the price level, M_t / p_t); g_0, g_1 and g_2 are coefficients; $e_{m,t}$ is an error term. Notice that the endogenous variables y_t and r_t are determined by equations (1-4). Therefore, equation (11) merely describes which amount of money is necessary to implement the policy rule (equation (3)). The model (1-4, 11) is extended as follows (12-16):

$$(12) \qquad y_t = r_y y_{t-1} + (1 - r_y) E_t y_{t+1} - s r_t^{re} + r_{y,m} m_t + e_{y,t}$$
$$(13) \qquad p_t = w p_{t-1} + (1 - w) E_t p_{t+1} + l y_t + w_m m_t + e_{p,t}$$
$$(14) \qquad r_t^{re} = r_t - E_t p_{t+1}$$
$$(15) \qquad r_t = r_r r_{t-1} + b_p p_t + b_y y_t$$
$$(16) \qquad m_t = g_0 + g_1 y_t + g_2 r_t + e_{m,t}$$

The parameters $r_{y,m}$ and w_m have been added. As before, there is only one instrument variable. It is useful to regard m_t as the instrument variable, since lifting the real amount of money can boost output and inflation, even if the nominal interest rate is at the zero lower bound. With output below potential, real balances will increase until the price level and output are back in equilibrium.

From a theoretical point of view, the Monetarist assertion that monetary transmission channels other than via nominal interest rates can prevent a liquidity trap is conditional on the assumption that the marginal utility of money eventually becomes zero as real balances expand[20]. However, if liquidity preference as defined in section 2 is assumed, the demand for money will asymptote to infinity as the interest rate asymptotes to zero. On mature financial markets, this can be thought of as a high preference by market participants for liquid assets. Monetary policy would then have no effect on total demand, because hoarding would absorb any additional money created. Money then becomes 'a bottomless sink for purchasing power'. The consensus model takes on board liquidity preference in so far that there is no explicit Pigou effect. Apart from that, an increase in uncertainty or a decline of confidence can manifest itself in economic shocks.

From a more practical point of view, an important caveat concerning alternative monetary transmission mechanisms in a zero lower bound environment is that empirical evidence on the effectiveness of these channels in such a context is lacking. For instance, Clouse et al. (1999) have investigated which theoretical options are available for the Fed for stimulating aggregate demand by increasing monetary supply after the short-term interest rate has reached zero. They concluded that the Fed has a wide range of policy responses at its disposal, but they did not find convincing evidence of substantial quantitative effects. The most far-reaching policy option along these lines is allowing companies and individuals lending directly from the central bank on a massive scale. However, if the central bank is purchasing lower rated private sector securities, it will take substantial credit risks on its balance sheet. This can backfire on its credibility. Because of this risk, central bank legislation usually rules out this kind of transactions.

20 Preferences for money balances would then exhibit satiation and money creation would ultimately be translated in demand for other assets and spending.

Buiter's and Goodfriend's view: Abolition of the zero bound

Buiter & Panigirtzoglou (2000) and Goodfriend (2000)[21] have suggested the introduction of so-called *Gesell money*. This would imply decreasing the zero nominal interest floor by taxing money (and other monetary liabilities on the central bank balance sheet). In terms of our model, the restriction that nominal interest rates cannot go negative is circumvented. With Gesell money it will always be possible to reduce the interest rate floor, even below zero.

The possible success of Gesell money is conditional on the availability of technologies that make it feasible without high costs. This is questionable in practice. The introduction of Gesell money will bring about high transaction and administrative costs, reducing its liquidity and thereby the main advantage of money (see Brunner (1971)). Moreover, the replacement of conventional money by Gesell money would make currency less attractive as compared to today's alternatives, such as foreign currency and e-money, assuming that e-money is not subject to the same tax (Grasham's law). This could impair the central banks monetary policy effectiveness, as explained by Friedman (1999).

Svensson's eclectic view with an important role for exchange rate policies

In line with Monetarist reasoning about different transmission channels of monetary policy, some authors have stressed the exchange rate channel in a zero lower bound situation.

A medium term strategy to devaluate/depreciate the currency (an increase in $E_t s_{t+1}$ in the model embodied in equations (7-10) can increase inflationary expectations. This strategy is only applicable to relatively open economies. It is assumed that the targeted country is not in a zero lower bound situation. Johnson et al. (1999) show that – assuming UIP holds – foreign exchange interventions at the lower bound can only have direct effects if they signal future further depreciation, or if domestic and foreign assets are imperfect substitutes. Both channels can be expected to be of minor importance, as is well known from the literature on

21 Fisher (1932) and Keynes (1936) have hinted at this idea in the 1930s.

foreign exchange intervention (Edison (1993), Eijffinger (1999)).

McCallum (2000) drops the UIP assumption explicitly[22]. In his model, the exchange rate replaces the short-term nominal interest rate as the monetary policy instrument. The central bank can determine real exchange rates via its control over nominal exchange rates, as is the case in our model (7-10). In the absence of UIP, McCallum is able to show that monetary stabilisation policy can still be effective via foreign exchange markets[23]. In line with McCallum, McKinnon & Ohno (2000) argue that if deflation is caused by expectations of appreciation of the domestic currency, the forward rate of the exchange rate should be brought down, *e.g.* by international exchange rate agreements. Elaborating on these ideas, Svensson (2000, 2001) indicates that exchange rate pegging, involving a commitment to arbitrary large non-sterilised foreign exchange interventions, might play an important role. Since this strategy would involve putting into circulation domestic currency and buying foreign reserves, the central bank cannot run out of reserves. He drops UIP for his short-term analysis by assuming a sticky domestic price level, so that the real exchange rate can be influenced in the short run. In Svensson (2001), he has presented a very transparent model to explain his ideas. He claims to have found a 'foolproof' way for an open economy to escape from the binding zero lower bound. The idea is to jump-start the economy by a real depreciation of the currency via unlimited interventions and in so doing increase inflationary expectations. Initially, an exchange rate peg is established, which is later replaced by a price-level or inflation target when the price-level target has been reached. In so doing the risk of overheating is avoided.

A problem with Svensson's 'foolproof' solution is that the expected real exchange rate depreciation in the initial phase will raise real interest rates with limited maturities relative to world real interest rates (Swank (2001)). This will counteract the exchange rate mechanism. If the real interest mechanism dominates, the inflation rate will not rise initially.

22 Empirical research tends to suggest that exchange rate movements are inconsistent with UIP (*e.g.* Froot & Thaler (1990) and Lewis (1995)).

23 Meltzer (1999) is of the same opinion, stating 'Suppose that with its short-term interest rate at zero, the Bank of Japan announces that it wants the dollar exchange rate to fall by 25 percent and that it is prepared to print yen to buy dollars until that occurs. Does anyone doubt that the yen would depreciate or that the depreciation would affect spending, output and

A persistent low or negative inflation rate can undermine the credibility of the monetary authority and puts at risk the strategy as a whole. A practical problem is that the central bank cannot steer the exchange rate as it can steer interest rates. In the specific Japanese context, a problem is the relatively closed nature of the Japanese economy. Thus, very large exchange rate changes would be needed. Another practical obstacle to putting exchange rate targeting in place is that generally governments are in charge of exchange rate policies, not the central bank. This can make it difficult to pursue exchange rate policies as an integral part of the monetary policy strategy. Finally, such a large and persistent depreciation can significantly affect the economies of trading partners, which might give rise to retaliation measures.

Section 4 Concluding remarks

What brings the suggested solutions to a binding zero lower bound together is their mechanical character. However, it is not certain that a solution that works in a specific economic model will also work in reality. Besides, all suggested solutions will in one way or another involve costs. These two considerations may explain why the Japanese authorities have so far not followed the non-orthodox recipes put forward.

A factor not incorporated in the models discussed is the general level of confidence. Using the concept of liquidity preference, Keynes has shown that lack of confidence is a crucial element of persistent zero lower bounds. In the current literature, the precondition that a high degree of confidence must be in place to escape from a binding zero lower bound is undervalued. Policies to increase the expected rate of inflation can only be effective if monetary policy is credible, or if a framework is introduced that makes it credible. This is only feasible in an environment in which the central bank can create inflation. This implies that confidence must be in place. Otherwise, economic agents would increase their hoarding after monetary easing. Alternative monetary transmission channels, which feature

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prices in Japan?' McCallum's arguments can be interpreted as a special case in Meltzer's rejection of the liquidity trap framework.

prominently in Monetarist thinking, will only be effective if economic agents spend more after monetary easing, *i.e.* if they have confidence in the future. Then, economic agents will have no incentive for excessive hoarding. On the other hand, if confidence is lacking, the situation may arise that economic agents are characterised by liquidity preference, and do not increase spending after monetary easing. As discussed, *Gesell money* can only be expected to offer an effective escape route from a binding zero lower bound under strict conditions. However, it may help in restoring confidence by supporting nominal interest change effectiveness. As regards Svensson's (2001) promising approach offering a 'foolproof' way of escaping from a binding zero lower bound, it must be noticed that his solution works only in the specific context of his model. Because the central bank can devaluate the exchange rate of the domestic currency without limit, its policies will be credible. In practice, the economy is much more complicated than the stylised model suggests. *E.g.* a central bank cannot steer the exchange rate precisely, as assumed in his model. Hence, it is impossible to proof that a certain solution to the zero lower bound will work always and everywhere. Without 'foolproof' solutions to the zero lower bound, restoring confidence will be of paramount importance to steer the economic agents towards spending more.

As long as confidence remains firmly in place, an economy may hit the zero lower bound due to particular circumstances, but this situation will not cause severe output losses. The Swiss case in the late 1970s offers an example. In such an environment, monetary policy with nominal interest rates at the lower bound can be expected to be effective. Unless confidence is restored, monetary policy cannot help in escaping from the zero lower bound. With monetary policy impotent, the economy is in a liquidity trap. Japan is currently in such a dreadful situation.

So, if there is a persistent zero lower bound and monetary policy is ineffective, the lack of confidence may be the main challenge. Here, demand and supply factors meet. The zero lower bound problem is usually seen as a demand side phenomenon. As the Japanese example shows, a binding zero lower bound can persist much longer than usual demand side problems, suggesting that supply factors also play a role. A lack of confidence is a supply factor that can undermine demand for a considerable span of time. The clearest example of a

joint supply and demand shock is a financial stability crisis. By definition, such a shock implies that financial market intermediation is interrupted (supply side effect). This will go hand in hand with lower demand, since business activity is severely hampered. The mechanism works also the other way around. In term of the illustrative model (equations (1-4)) an increase in the degree of confidence will manifest itself in lifting potential output and the output gap (*y)*, as well as the average real interest rate over the business cycle, which is exogenous in the model. With favourable economic prospects, profit prospects will be high, as will investors' propensity to invest. Also, consumers' propensity to save will be low because future income prospects are advantageous. In general terms, good governance (adherence to the rule of law, well-defined property rights, financial sector stability, flexible markets) creates an environment in which the economy can flourish, and steady state real interest rates will *ceteris paribus* be higher than without. What can government policies do to bring about such a situation?

In general terms, it is important that economic agents are confident that political leaders and economic and monetary policy makers are capable of their duties. If they lack public confidence, people that are trusted should replace them. The policy makers must pursue policies that restore confidence in economic prospects. As regards *monetary policy,* the monetary policy strategy is important for anchoring inflationary expectations. Actual policy decisions must show that the monetary authority acts according to its own words. *Budgetary policies* can be used to increase demand, and in so doing try to kick-start the economy. This will lift average real interest rates over the business cycle. The average real interest rate can rise partly through a direct expenditure channel. However, this channel is generally believed to be weak because of (partial) Ricardian equivalence (Bernheim (1987)) and crowding out effects. In addition, the government may not be in a position to borrow because of a mounting public debt[24], a loss of credibility or Stability and Growth Pact-like constraints on government borrowing (Buiter & Panigirtzoglou 2000). Government expenditure can also raise the average real interest rate through an indirect confidence channel by revitalising economic prospects. Budgetary policies can support structural policies, for instance in financing the writing off of possible bad-loans. In this context, quality of government

24 It is all about the government budget constraint. A large debt may raise questions about government solvency in the long run. The budget constraint is relevant in spite of a zero interest rate, because this situation will not last forever.

expenditure is important[25]. *Structural change* can offer a lasting channel to raise the average real interest rate. Of course, the direct effects of structural policies can take many years before they bear fruit. But in the short-term they can help in the reestablishment of confidence by improving the long-term prospects for the economy. From a longer-term perspective, what matters is that the economic structure determines to a large extent in what context macroeconomic demand policies work. In a zero lower bound environment, this regards above all trend productivity growth. The key insight is that higher productivity growth can lift low (average) real interest rates. Higher real interest rates can be achieved via a higher 'natural' rate of growth[26] (summing the growth of the labour force and the rate of technical progress). A higher natural rate of growth can result from exogenous factors, such as the emergence of a 'New Economy' (see *e.g.* Buiter (2000)), or good structural policies. It is basically about a mixture of credible policies that restore confidence by setting up sound old age pension systems, disability schemes and the like, and promote competition by reducing trade barriers, pursuing microeconomic deregulation and similar policies. Safeguarding financial sector stability is also a key element of these structural policies, since an advanced market economy cannot function without efficient and effective credit intermediation[27]. In sum, an optimistic reassessment of expectations for economic growth by the public at large, and financial market participants in particular, will be crucial for escaping from a persistent zero lower bound.

25 In contrast to popular believe, Keynes (1936) did care about the quality of public expenditure. He preferred productive public expenditure to 'wasteful' expenditure. He departed from classical economics only when he stated that - in absence of productive possibilities for public expenditure - also 'wasteful' expenditure such as pyramid-building will enrich the community on balance when the economy is characterised by involuntary unemployment.
26 In the 1950s and early 1960s inflation in the US varied between approximately 0 and 4%, but the zero bound was never reached. This is because productivity growth and average economic growth were high, and therefore also the equilibrium real interest rate and the short-term policy rate of interest.
27 Viñals (2001) discusses the interactions between financial and monetary stability in a low inflation environment.

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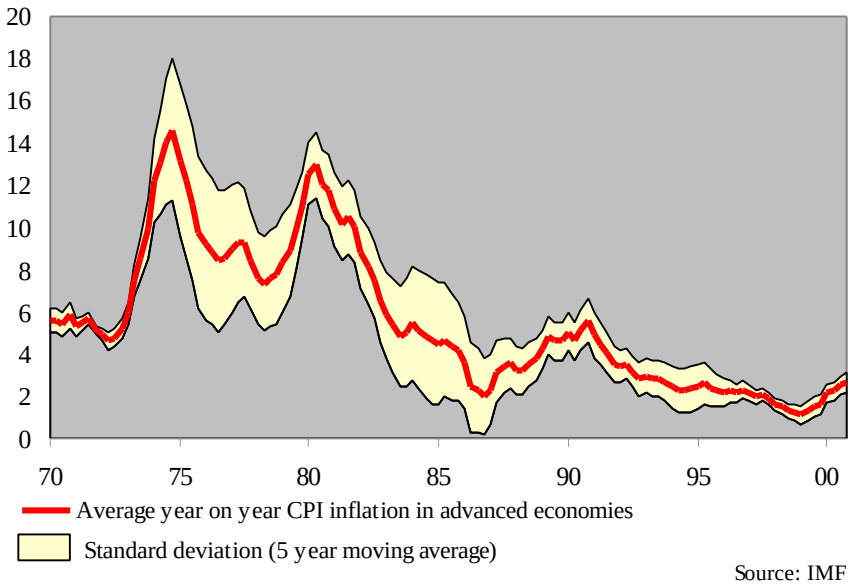
Figure 1
Consumer price inflation in advanced economies



Source: IMF

Figure 2a
US monetary policy interest rates

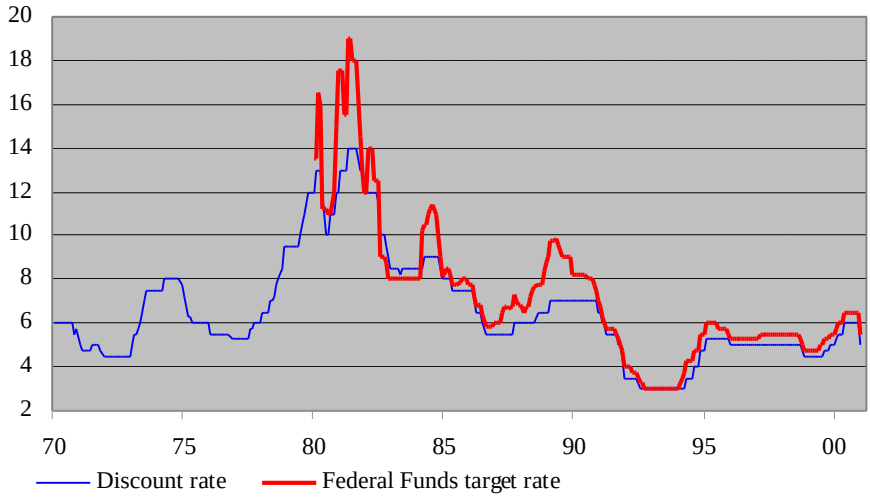


Figure 2b
European monetary policy interest rates

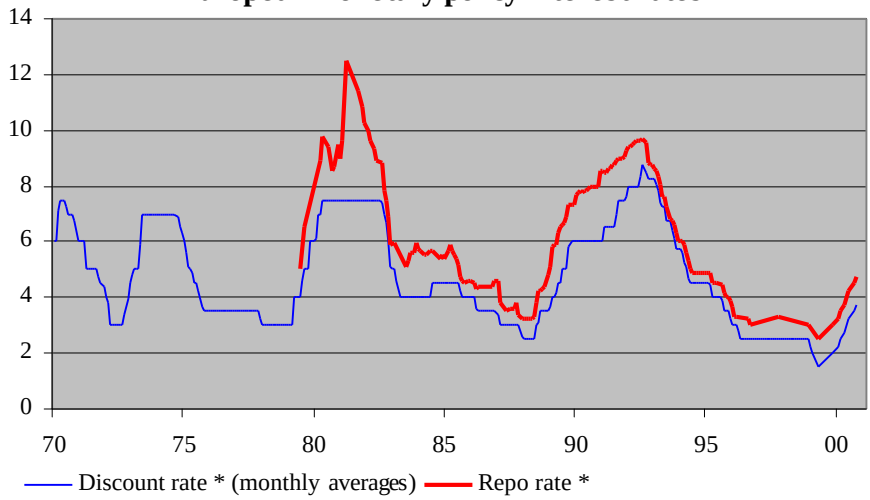


Figure 2c
Japanese monetary policy interest rates

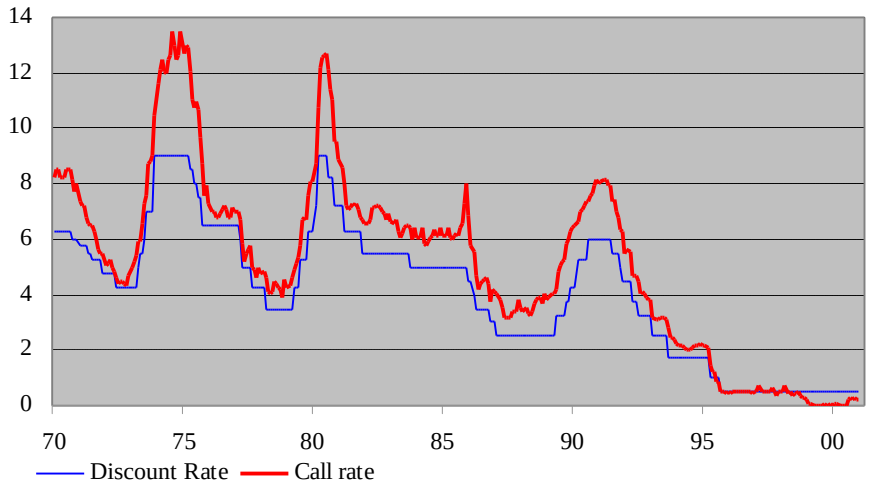


Table 1 Binding Zero Lower Bound in Practice

	Monetary Policy Interest rate	3-Month Money-market rate	Long-Term interest rate
United States			
1937	0,40 (3 month T-bills)	0,45	2,68
1941	0,10 (3 month T-bills)	0,13	2,50
Switzerland			
27-02-1978	1,00 (Discount rate)	0,25	3,33
Japan			
16-02-1999	0,00 (Call rate)	0,07	1,77