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Abstract

The work has two objectives. First, it presents the theories that compete to explain Japan's sluggish economic development in the 1990s. The discussion aims at finding the most influential theories and at drawing conclusions on their validity during the decade-long economic stagnation. The second objective is discussing the liquidity trap, or more broadly the zero interest trap, in the context of Japan. The work compares the traditional definition with a more up-to-date version of the trap and treats the different methods of escaping from the zero interest rate trap.

The explanations for the stagnant 1990s are analysed through a literary survey. The liquidity trap discussion is likewise based on various sources, although Krugman's models are given a central role. In accordance with Krugman's liquidity trap theory based on a negative equilibrium real interest rate, Japanese real interest rates are studied through structural time series models. The means of escaping from the trap are discussed first theoretically and then from the viewpoint of the Bank of Japan.

The results indicate that the significance of the competing theories has varied during the 1990s. Demand related issues are found crucial, as unwinding of the capital overhang, liquidity trap, credit crunch, mistaken macroeconomic policy and external shocks have decreased aggregate demand. Particularly, the structural time series analysis implies that the equilibrium real interest rate may have been negative at times during the late 1990s. As to escaping from the liquidity trap, inducing inflation expectations and depreciating the domestic currency are found efficient in theory. However, the nature of the Japanese economy might restrict their effectiveness in practise. The ability of the Bank of Japan to affect private sector expectations is repeatedly revealed crucial.

Key words: Japanese economy, economic stagnation, liquidity trap, real interest rates

Contents

1 Introduction

Although most of the world survived the economic problems faced at the turn of the 1980s and 1990s, Japan is still fighting for its life. Or at least the country has been suffering from prolonged stagnation and sluggish economic growth for a decade and the state of the economy is still far from being good. In fact, the economic outlook has again become gloomier in 2001. Why is the situation noteworthy? First, Japan is the second-largest economy in the world and therefore important. Weakened economic performance in the country might cause global instability and be especially harmful to other East Asian countries. Second, Japan is in a situation that was previously found impossible, as zero nominal interest rates now limit conducting monetary policy. As interest rates fall in the rest of the world, the probability of a zero interest trap rises also elsewhere. It is thus worthwhile to ponder what other countries could do to avoid the zero bound on nominal interest rates. Finding an escape from such a trap is likewise important.

Japan's economic development during the 1990s is quite a popular subject in literature. It is widely agreed that the problems date back to the rapid growth of the 1980s. The boom resulted in an overheated economy by the end of the decade, and both equity and land prices rose until the Bank of Japan raised its official discount rate in 1989. The tightened monetary policy led then to a collapse in asset prices and to a slowdown in output growth as both demand and production decreased. Finding the reasons behind the prolongation of the slump is nevertheless a more challenging task.

The theories most frequently blamed for Japan's stagnation comprise liquidity trap, structural inefficiencies and rigidities, financial disintermediation, inadequate macroeconomic policy responses and long-run wealth effects. First, the concept of the liquidity trap has re-emerged due to Japan's zero interest rates. Second, few deny that the Japanese growth model restricts competition and causes inefficiency even today, but significance attached to the hypothesis varies. Third, the credit crunch theory has been gaining on popularity since the late 1990s, as the credit conditions of especially small and medium-sized enterprises have clearly tightened. Fourth, Japanese government has been blamed for too tight fiscal policy while the criticism against the Bank of Japan has likewise been heavy. Fifth, the hypothesis of wealth effects is interesting since it takes a long-run approach in contrast to the other theories mentioned. Numerous papers analyse the theories using different methods, but most studies focus on a single approach and reveal thus only one perspective on the subject.

The first objective of this work is to define the main competing theories and draw conclusions on their validity during the decade-long economic stagnation in Japan. The second and more important objective is discussing the liquidity trap, or more broadly the zero interest trap, in which short-term nominal interest rates are at their lower bound. The options for conducting expansionary monetary policy are then limited, as the usual interest rate channel is blocked. Besides different liquidity trap models, the literature has mainly concentrated on two related subjects of how to avoid liquidity traps and how to escape from them. In this work, the weight is on the latter approach since as to Japan, avoiding zero nominal interest rates is no longer possible. Furthermore, most of the policies discussed here have also become familiar as actions recommended for the Bank of Japan.

My approach differs from those of the earlier studies with its broadness: I first gather the results of various papers together, and draw then conclusions based on all evidence presented. Moreover, I compare the traditional liquidity trap concept with the modern versions of the trap. Here I attach a large weight on Krugman's models since he has played a particularly important role in the re-emergence of the liquidity trap and in linking the concept to Japan. And because a negative equilibrium real interest rate is crucial in proving that Krugman is correct, I analyse Japanese short-term real interest rates through structural time series models. Before this, only few papers have tested the validity of Krugman's hypothesis by analysing ex ante real interest rates and even fewer through structural time series models. The various ways of escaping from the trap are likewise linked to Krugman's model when possible. In addition, the special traits of the Japanese economy are taken into account by giving the Bank of Japan an opportunity to explain its policy actions during the 1990s.

I begin in section 2 by introducing the Japanese economy after the Second World War concentrating on the 1990s. The historical perspective is however important in understanding how drastically the economic development has changed and in searching for valid explanations. Section 3 discusses then the main competing theories of liquidity trap, structural problems, credit crunch, mistaken macroeconomic policy and long-term wealth effects. The liquidity trap is only mentioned since it is the topic of sections 4 and 5.

Section 4 discusses the traditional definition of the liquidity trap through Keynes' and Hicks' models since the concept originates from the former and has usually been defined in the IS-LM framework of the latter. The criticism of the traditional model clarifies why the subject was not popular during the postwar inflationary decades. The liquidity trap has recently re-emerged because of Japan's situation, and section 5 treats thus Krugman's more up-to-date model of the trap. To emphasise that the liquidity trap is possible even in an open economy, I present two related open economy liquidity trap models.

In Krugman's model, negativity of the equilibrium real interest rate plays an important role. Section 6 concentrates therefore on short-term real interest rates in Japan. After analysing ex post real interest rates, I use a structural time series model to estimate the current ex ante real interest rate. Furthermore, I discuss the probability of a negative equilibrium real interest rate during the late 1990s and at the beginning of the 21st century through Krugman's model.

Section 7 follows the two paths of the current liquidity trap research. Since the work concentrates on Japan, the ways of avoiding the liquidity trap are discussed only shortly. The literary survey of escaping from the trap is more exhaustive. The approaches can be divided in two categories: the first one tries to find an operating channel instead of the blocked interest channel while the second one searches ways of removing the lower bound on nominal interest rates. Most policies discussed are different options for conducting monetary policy. Section 8 gives finally the Bank of Japan an opportunity to explain the monetary policy conducted in the 1990s.

2 Japanese economy

Understanding the challenges Japan faces today requires knowledge of the society and the principles that govern it. Furthermore, comparing Japan's past and present economic performance highlights the significance of the change. I will thus start with a short overview of the Japanese economy and its development after the Second World War. After the historical perspective, I concentrate on the post-bubble economy of the 1990s and macroeconomic policy conducted in it. Finally, I will present the current situation and an outlook for the future.

2.1 Japan as the number one: A postwar review until the 1990s

Japan needed a new direction after the lost Second World War, as bombings had caused massive destruction. The need resulted in the so-called Japanese growth model, which had its roots in the time before the war. The model was based on tight government control, the priority of which was an internationally competitive manufacturing sector. The Japanese postwar economic system has been a popular topic in literature and a short description of it can be found for example in OECD (1999). The following survey is based on pages 18–31 if not stated otherwise.

Between 1950 and 1973, the Japanese economy grew amazingly fast at an average rate of almost 10% annually (Lincoln 1998). The state-led process of catching up with the Western world proceeded well and Japan's growth rates of GDP and exports were the highest among the G7 countries all the way from the early 1960s to the early 1990s. The frequently debated reasons for the success include state-led industrial policy, stable macroeconomic policy, external orientation of the economy, high level of savings and fast factor accumulation (OECD 1999, 119).

Despite the rapid growth, inflation and unemployment were low and external trade surplus large. Also fast labour force growth and a high investment rate hastened economic growth increasing thus Japan's competitiveness and world market share and allowing a move into higher value-added sectors. Japan introduced various flexibility-increasing manufacturing processes, which made the manufacturing sector internationally even more competitive. As is generally known, the country was a forerunner in automation and systems of enhancing logistics performance and was therefore able to cut costs and improve productivity within sectors. In addition, industry policy initiatives and flexibility in labour inputs facilitated the shift out of declining sectors to sectors performing better.

After 1973, real annual growth slowed down to about 3% for the rest of the 1970s partly because of the oil price shocks. Even if Japan adapted to the shocks more successfully than many other countries, the government faced new challenges. Expansionary fiscal policy became necessary, and fiscal deficit peaked at 6.5% of GDP in 1978 (Lincoln 1998). The fiscal deficits of the 1970s affected the way economic policy was conducted in the 1980s.

The demands of Japan's trading partners caused by the large external trade surplus resulted in trade limitations. In addition, the effective exchange rate

against the dollar appreciated substantially by 47% between 1973 and 1980, which decreased Japan's competitiveness. The export performance continued nevertheless to be stronger than in other G7 countries. Furthermore, the structure of exports shifted toward higher value-added products such as motor vehicles and consumer electronics.

By the early 1980s, Japan caught up with the other OECD countries measured by per capita GDP and real GDP growth was again rather fast averaging at about 4% annually. Low interest rates spurred investment and fiscal balance was restored. However, inefficient non-traded goods sector had gradually become a burden to exporting manufacturing industry, which resulted in transferring production overseas. All in all, the positive growth prospects decreased reform willingness.

The appreciation of the yen from spring 1985 to 1987 threatened the economy and the Bank of Japan (BOJ) eased monetary policy in response. It thus lowered the official discount rate for a total of five times between January 1986 and February 1987 from 5.0% to 2.5%.[1] By doing this, it was able to lower its operating target, the uncollateralised overnight call rate. Expansionary policy reached its goal of restoring economic growth and annual real growth averaged 5% between 1987 and 1991 (OECD 2001b). However, the Ministry of Finance was more cautious since the large fiscal deficits experienced in the 1970s had not been forgotten.

The price pressure caused by the strong yen prevented high inflation in general but did not restrain asset and land prices from rising. In fact, the value of Nikkei average index of stock prices tripled between 1985 and 1989 while it took the urban real estate prices in the six largest cities two years longer to do the same (Lincoln 1998). The inadequate regulation in the partially liberalised financial sector contributed to the size of the bubble, as generous lending based on overvalued collaterals raised asset prices further.

There are various definitions and explanations regarding the Japanese bubble. For example, Okina et al. (2001) define the bubble economy of the late 1980s as a rapid rise in asset prices, overheating of economic activity and a sizeable increase in money supply and credit. They claim that the bubble resulted from complicated interaction between various different factors, which they classify generally as "intensified bullish expectations".

Besides the appreciation of the yen, international policy co-ordination affected the policy conducted, as Japan was forced to try to expand domestic demand to lower the current account surplus. In spring 1987, signs of economic recovery made the BOJ more cautious. However, shifting to monetary tightening was not easy, as the government and the private sector were not convinced that it was necessary. After all, inflation remained low. The efforts to raise interest rates were suspended after the Black Monday in the United States and the low interest rates were maintained. Expectations of low interest rates also in the future were thus quite strong. (Okina et al. 2001)

The BOJ has been blamed for protracted monetary easing that helped to generate the bubble since the Bank did not act before May 1989. It then raised the official discount rate to 3.25%. Despite this, the economy continued to expand rapidly, and the interest rate was raised for four additional times to 6.0% of

[1] The official discount rates have been accessed at the Bank of Japan homepage.

August 1990. The tightening of monetary policy affected the economy quite slowly but led finally to a collapse in asset prices.

It is widely agreed that the tightened monetary policy and the resulting asset price collapse triggered the slump of the 1990s. For example Okina et al. (2001) state that they induced the prolonged recession through balance-sheet adjustments, a decline in economic activity accompanying the correction of bullish expectations and a reduction in the economic value of capital equipment and reduced supply capacity. However, various theories compete to explain the duration of the sluggish economic activity. I will discuss these theories later in section 3.

2.2 Economic development and macroeconomic policy responses in the 1990s

The contrast between Japan's economic performance in the 1980s and 1990s is striking, as the past success did not prevent the downturn of the early 1990s from becoming a decade-long period of stagnation. Besides slow growth,[2] the main characteristics of the 1990s were a substantial decline in asset prices, low growth of monetary aggregates, deterioration of company balance sheets and accumulation of non-performing loans in the banking sector[3] (Mori et al 2001). Real annual GDP growth averaged only 1.6% compared to 3.8% of the 1980s. Moreover, volatility measured by the coefficient of variation of quarterly GDP rose nearly sixfold from 0.65 in the 1980s to 3.75 in the 1990s, while the development in the United States was just the opposite. (IMF 2000, 5–6)

I have enclosed some graphs of essential indicators during the 1990s and earlier in appendix A figures A.1–A.7. The time series presented comprise annual changes of GDP and its components, unemployment, inflation, yen/dollar exchange rate, some interest rates, money supply and fiscal indicators of gross debt level and financial balances. The purpose of the figures and this section is to present a general picture of the economic development and monetary and fiscal policy in the 1990s. I mainly follow Mori et al (2001). Moreover, I use their division of the decade into three sub-periods.

2.2.1 The slowdown of 1991–1993

The fast GDP growth of the 1980s lasted until February 1991, and the following slowdown did not end before October 1993. During this period, real GDP growth averaged only 0.8% annually and industrial production declined by 5.2% annually (Okina et al 2001). Also asset prices declined rapidly. Stock prices measured by Nikkei 225 bottomed in August 1992 more than 60% below the peak reached in December 1989 while land prices of all Japan peaked in the second half of 1991 and have been falling since then. According to Shirakawa (2001, 3), the asset price fall led to both over-indebtedness and under-capitalisation.

[2] The yearly GDP growth and unemployment figures are from OECD (2001b) if not stated otherwise.

[3] East Asian economic crisis of 1997–1998 had similar elements.

In spring 1991, residential investment and business fixed investment of small and medium-sized enterprises (SMEs) started to fall in response to higher interest rates. Moreover, overinvestment during the bubble economy has been found one of the most important explanations for the diminished investment (Ramaswamy 2000). According to Mori et al, the fall in business fixed investment can nearly explain the entire GDP decline during the sub-period. Furthermore, a substantial inventory adjustment was initiated around 1992. The slowdown did not affect the unemployment rate that remained low at around 2%.

The BOJ eased monetary policy in response to the slowdown and reduced the official discount rate in seven steps from 6.0% to 1.75% between July 1991 and September 1993. On the other hand, the yearly growth of the monetary aggregate composed of M2+CDs turned negative in 1992 reflecting stagnant asset transactions and sluggish demand for funds. The monetary aggregate started to rise again in 1993, as bank lending to the public sector increased. Besides monetary easing, fiscal stimulus was provided in the form of three stimulus packages totalling 29.9 trillion yen. The 1992 package amounted to 2.2% of GDP while the corresponding figure for 1993 was 4.1%.

2.2.2 The temporary recovery of 1994–1996

Expansionary policy was successful and the economy showed signs of a recovery in 1994, even if real GDP grew by only 0.6%. Residential investment, which had started recovering in the beginning of 1993, continued to increase, in addition to which inventory adjustments were nearly completed. Despite these positive factors, land prices fell further, balance sheet adjustment of the private sector companies accelerated and the appreciation of the yen decreased the competitiveness of the manufacturing sector. The government announced a stimulus package amounting to 3.2% of GDP and recognised deregulation as a key component to economic recovery (IMF 2000, 30; OECD 1999, 15).

In 1995, the constant appreciation of the yen eroded private sector confidence and especially business sentiment. Stock prices fell. In addition, external shocks such as the Kobe earthquake in January eroded confidence further. Also unemployment rate started to rise climbing to over 3%. Deflationary pressures accumulated at the same time, as wholesale prices declined and even consumer prices turned to a temporary fall. However, real GDP growth amounted to 1.6%.

In April 1995, the BOJ reduced the official discount rate from 1.75% to 1%. Monetary policy was eased further in September as the discount rate was lowered to 0.5%. Long-term interest rates decreased correspondingly. As to fiscal policy, the government announced expansionary policy packages in April and June. The packages aimed mainly at promoting deregulation and imports. In April, the government resorted to foreign exchange market intervention. In addition, a stimulus package of 14.2 trillion yen was launched in September. The package totalled 3.0% of GDP, and its stimulating effect was felt clearly the following year.

Business fixed investment turned positive in 1995, as IT and telecommunications sectors expanded rapidly due to the deregulation efforts of the government. Increased investment could be observed from revived bank lending and other fund-raising in capital markets. Stock prices recovered from mid-July onward, and the yearly change of M2+CDs turned positive to 2–3%.

In 1996, the economy achieved a 3.5% real growth and recovery seemed strong. Both public expenditure and private investment supported the recovery. Mori et al state that a major factor behind the recovery was the progress in adjustment of equipment and reductions in excess liabilities. Morsink and Bayoumi (2000, 159) find that the recovery was driven by real instead of financial factors. However, the advance announcement of a consumption tax rise in April 1997 increased private consumption in late 1996 and as a result, the strong performance of the year may have been exaggerated. Deflation measured by the yearly averages of changes in the GDP deflator peaked at –2.5% (Taylor 2001).

Despite the positive economic outlook, non-performing loans of the banking sector continued to accumulate. Especially SMEs suffered from the continuous decline in land prices and had difficulties in paying back their loans. The political nature of the problem delayed its solving. Finally, the reputation of the Japanese banks was seriously hurt when the public found out about the scope of the non-performing loan problem. The distrust was even larger overseas, which resulted in the rise of the Japan premium,[4] which amounted to 50 basis points in October 1995. The government tried to secure financial system stability by introducing several measures aiming at stability.[5] Furthermore, a structural reform programme aiming at deregulation of the economy was launched in December 1996 (OECD 1999, 15).

2.2.3 The further deterioration of 1997–1999

The government started fiscal consolidation in 1997 in the form of tax increases,[6] withdrawal of a special tax reduction and a reform of the medical insurance system. Policymakers expected the negative effects of the tightening to be temporary and to fade out by summer 1997. However, the timing proved unfortunate, since the East Asian economic crisis of 1997–1998 hurt exports seriously[7] and resulted in new non-performing loans for the banking sector. Aggregate demand suffered from a fall in consumption expenditure besides the declining exports, as the average propensity to consume declined.

The collapses of some major financial institutions[8] in autumn eroded public confidence in the banking sector further and drove down the stock prices of financial institutions. The Japan premium rose to nearly 100 basis points. The BOJ responded by extending special loans to troubled financial institutions and by providing ample reserves. Despite these supporting measures, banks restricted their lending. Financial intermediation problems started to affect economic development, as especially SMEs had to cut their investment.

In 1998, the outlook became even gloomier. Real GDP fell for five consecutive quarters starting from the fourth quarter of 1997 and the economy was therefore officially in recession. Unemployment rose to over 4%. Because of

[4] The Japan premium is the extra amount a Japanese bank must pay for raising funds in overseas financial markets.
[5] See Mori et al (2001).
[6] For example, the consumption tax mentioned above was increased from 3 to 5%.
[7] In 1997, the eight countries most affected by the crisis accounted for 35% of Japanese exports. The sales to the area fell by 27% in 1998. (Boltho and Corbett 2000)
[8] The collapsed financial institutions were Sanyo Securities, Hokkaido Takushoku Bank and Yamaichi Securities.

the stagnant economy and declining exports, fixed investment of SMEs decreased substantially. Furthermore, the deteriorated state of the financial sector aggravated the fall in investment. The decline in final demand decreased production, which caused a further decline in corporate investment and final demand through diminished corporate profits.

In response to the negative development, the government returned to expansionary fiscal policy. The measures comprised a special tax reduction of 2 trillion yen (0.4% of GDP) in February 1998, an announcement of a 16 trillion yen (3% of GDP) stimulus package in April, a revision of the Fiscal Structure Reform Law in June and a 24 trillion yen (4.7% of GDP) emergency package in autumn. In addition, the government introduced new measures to encourage bank lending to SMEs. As to monetary policy, the BOJ guided its operating target, the uncollateralised overnight call rate down to 0.25% in September. The discount rate was not changed, however. The concern of the financial system stability resulted in further public funding for major financial institutions and in October, the funding was increased to 60 trillion yen (11.6% of GDP). Furthermore, close to 8 trillion yen (1.5% of GDP) was injected to major banks. Monetary base grew by 8.6% and M2+CDs by 4.0%, but private banks' lending decreased despite this by 2.4% (Shirakawa 2001).

The BOJ adopted so-called zero interest rate policy in February 1999 in order to stabilise interest rates from overnight to term rates at a level close to zero. The policy consisted of the two components of quantity and policy duration. The quantitative aspect of a virtually zero call rate was to be fulfilled by providing ample funds that exceeded required reserves by 1 trillion yen,[9] while the duration aspect aimed at affecting market expectations by committing to the policy "until deflationary concerns are dispelled". (Fujiki et al 2001) The policy was successful in that the target rate was almost stable at 0.02–0.03% for the whole period the policy was effective (Oda and Okina 2001). Given transaction costs, this seemed to be the lower limit.[10] Likewise, low short-term interest rates affected longer-term interest rates through the intermarket arbitrage function, and the whole yield curve was thus affected (Fujiki et al 2001). McKinnon and Ohno (2000, 4) emphasise that the yen remained strong despite the measures taken. Furthermore, an economic stimulus package of 18.1 trillion yen was launched in November 1999, and the stimulus amounted therefore to 3.6% of GDP (IMF 2000, 30).

Real GDP growth turned positive in the first quarter of 1999. Also residential investment started to recover and the economic outlook seemed more positive as public sector demand and exports fuelled economic growth. Private banks' lending decreased nevertheless by 5.4%. However, public support to major financial institutions had restored financial system stability to some extent even if overall concerns of financial system stability had increased during the three-year period. According to Okina et al (2001), non-performing loans of major Japanese banks accounted for 4.1% of nominal GDP at end-March 1999. If the accumulated write-offs since fiscal year 1992 are included in the figure, they totalled 9.0% of nominal GDP.

[9] Although the BOJ offered funds at virtually zero interest rate, private financial institutions did not subscribe for the full amount offered.

[10] The interest rate is even lower in autumn 2001.

2.3 The state of the economy at the beginning of the 21st century

The zero interest rate policy was terminated in August 2000, as the BOJ believed that the gradual upturn was likely to continue and that deflationary concerns were dispelled. The growth of M2+CDs slowed down to 2.1% while monetary base grew by 7.6%. Private banks' lending continued to decrease, this time by 4.7%. (Shirakawa 2001, Figure 3)

Economic growth slowed down in the second half of 2000 as exports decelerated. The trend continued in 2001 and industrial production fell as the sectors associated with information and communication technologies, which had accounted for half of the rise in production in 2000, were hurt by the fall. Deflationary pressures remained strong and consumer sentiment deteriorated as labour market conditions worsened. The government responded in November with a stimulus package of 11 trillion yen (2.1% of GDP). (OECD 2001a, 9–10)

In February 2001, the discount rate was lowered by 15 basis points to 0.35%. Monetary policy was eased further in March, as the discount rate was lowered to 0.25%. As a result, the overnight call rate decreased to practically zero. Furthermore, the BOJ decided to choose the outstanding balance of the current accounts at the Bank of Japan as the main operating target instead of the uncollateralised overnight call rate. The balance was to be increased to about 5 trillion yen from 4 trillion yen. The BOJ signalled in addition its willingness for stepped-up outright purchases of long-term government bonds in order to achieve the reserves target. The new policy will be in use until deflationary pressures measured by the change of CPI (consumer price index) slacken, and the former target rate is expected to remain at a level close to zero. (Shirakawa 2001, Figure 12)

Shirakawa (2001, 8–10) analyses the policy and claims that it is expected to reduce short- and long-term interest rates and lead to private sector's portfolio rebalancing in the direction of riskier assets. Corporate funding might be slightly improved, and the yen could depreciate as the lower domestic return will stimulate investing abroad. Linking the policy to CPI signals of commitment and means that expansionary power could become quite large if the expected real rate of return on tangible assets increased.

At the same time, continuous expansionary fiscal policy has resulted in a high ratio of public debt to nominal GDP (figure A.7). The ratio amounted to approximately 130% in May 2001 (Shirakawa 2001, 2). The level of the debt has started to affect conducting fiscal policy, as the question of the nation's solvency has arisen. The new government aims thus at limiting the future deficits, which means that other means besides expansionary fiscal policy have to be searched. Especially the non-performing loan problem is on the agenda. Corporate restructuring is likewise supported.

Bank of Japan (2001) warns that adjustments in economic activity are becoming more severe since the fall in exports and especially in the demand of IT-related goods has caused a substantial decline in production. The decline has resulted in an unemployment rate of over 5% for the first time in the postwar history. Increasing consumer uncertainty is having a detrimental effect on consumption although the fact that private consumption has remained flat instead of decreasing has been one of the few good news lately. Deflationary pressures

remain strong and are likely to persist for a while. The terrorist attacks in the United States in September 2001 increased uncertainty further and the BOJ lowered the official discount rate to 0.10% in the wake of other major central banks.

The outlook for the near future is bleak, as the forecasts for the world economy have constantly been revised downward. According to the Bank of Japan (2001), all components from public investment and net exports to private consumption are expected to follow a declining trend. Because also inventory adjustments particularly in electronic parts and materials are expected to continue, industrial production is likely to decline further. The question "why this has happened to Japan?" is still without a precise answer, although various theories have been presented.

3 Explaining the slump of Japan

The decade of slow economic growth in Japan has made clear that the stagnant activity cannot be explained solely by normal business cycles. However, even if finding a hypothesis trying to explain the situation is not difficult, it is more challenging to determine which theory is right. Or, more likely, which theories are at least partly right. The various competing explanations are sometimes overlapping and sometimes expressing opposite views. Furthermore, the relative importance of explanations has varied during the time periods presented above in sections 2.2 and 2.3.

It is obvious that the Japanese economy faced a succession of unfavourable shocks in the 1990s and it is possible that many of the problems faced during the decade would not have emerged without the shocks. For example, between mid-1992 and mid-1995 the yen appreciated by approximately 50% in real terms. The extreme overvaluation of the currency decreased competitiveness and harmed external demand.[11] In 1997, macroeconomic policy was tightened too sharply in response to the temporary recovery of the economy. In addition, the Asian crisis of 1997–1998 hurt Japanese exports seriously[12] and resulted in new non-performing loans for the banking sector. Also the Kobe earthquake caused massive destruction. The effects could be observed as real GDP started falling in 1997 (figure A.1). The shocks affected the economy both directly and indirectly by increasing uncertainty and thus by destabilising expectations (Boltho and Corbett 2000). However, the usual and also my view is that the shocks alone cannot explain the economic development.

I begin by discussing supply and demand related issues, which play a crucial role in determining whether macroeconomic stimulus is capable of restoring economic growth at all. I then introduce the theories of structural problems, credit crunch, inadequate policy responses and wealth effects. These are the most important explanations that compete with the liquidity trap hypothesis discussed

[11] The results of Ramaswamy and Rendu (2000, 54–55) support the view. They indicate negative shocks to the trade balance during the strong appreciation and positive shocks during the following depreciation. Somewhat surprisingly, similar conclusions cannot be drawn for the early 1990s.

[12] In 1997, the eight countries most affected by the crisis accounted for 35% of Japanese exports. The sales to the area fell by 27% in 1998.

here only shortly. And even if I use the word "compete" here, it should not be forgotten that in reality, the theories supplement each other.

3.1 Supply and demand related issues

It is not self-evident that macroeconomic stimulus can restore growth. In fact, if the post-bubble sluggish growth depends almost solely on declined potential output, benefits of expansionary policy are limited. However, Posen (1998, 14–16) finds that this is not the case. For start, he notes that the asset price collapse did not cause a corresponding collapse in financial infrastructure, technological capabilities or physical or human capital. Likewise, he claims that there were no large international shocks and that the rate of return on capital had declined already a decade earlier. The structure of Japanese trade has also been sufficiently complex to buffer the economy against changes in external trade. In the absence of expanding regulation, competitive sectors should in addition have grown in relative importance reducing thus the effects of existing rigidities. And, instead of new stricter regulation, deregulation loosened government control in the 1990s.

From the viewpoint of fundamentals, a country's economic growth results from accumulation of physical and human capital and increases in total factor productivity. Declining growth would therefore require notable decreases in one or some of these, which is something that, according to Posen (1998, 16–17), could not be observed during the 1990s. Capital accumulation slowed only a little as the level of savings remained high and the rise in the unemployment rate was not large enough to significantly reduce the stock of human capital at least during the early 1990s (figure A.2). Otherwise demographic and educational factors change so slowly that their impact cannot have been large. Likewise, although the total factor productivity growth decreased in the 1990s, the drop was small enough to be within the usual business cycle variation. Altogether, Posen concludes that the potential growth rate cannot have decreased markedly. His notion concerning capital accumulation might nevertheless be an understatement, as investment decreased clearly in the 1990s (figure A.1). This does not however make Posen's claim on still high potential growth invalid.

As to the often-blamed demographic factor, the Japanese population is expected to start declining already during this decade (Statistics Bureau & Statistics Center 2001). But this does not mean that the potential growth rate has to fall. For example Yoshikawa (2000) claims that capital accumulation and total factor productivity are far more important in determining the growth rate than labour is. He notes that in the past, labour has contributed relatively little to Japan's growth. In addition, he emphasises that a decline in labour force does not necessarily result in a corresponding decline in human capital. Instead, Yoshikawa highlights the correlation between technical progress and economic growth. He claims that total factor productivity plays a significant role in increasing demand. On the other hand, Japan's labour force increased quite strongly in the early 1990s and started to decline only at the end of the decade, which might have affected the further deterioration of economic performance (Congdon 2001, 3).

According to a related point of view, the need for restoring growth depends on the size of the output gap, ie the gap between actual and potential output. Bayoumi's (2000) estimates of the gap for the year 1998 range between –5.7% and –1.8% of GDP, while Krugman (1998a) finds that the gap might have

exceeded –7% by the end of 1998. The estimates of the Bank of Japan (2000a, Chart 7) are also high at close to –10%, but the official estimates of IMF and OECD have been more modest even if they have been on the rise during the last years. Krugman claims nevertheless that the estimates of both IMF and OECD are biased and too low. He reasons that since the output gap must be large and growing rapidly, the return from finding a way to improve the economy would be enormous. Also I am inclined to believe that although the potential growth rate of the Japanese economy decreased during the 1990s, the economy is operating clearly below its capacity and that a supplementing explanation for the sluggish growth should be sought. After all, rising unemployment and deflation indicate that aggregate demand is lagging behind output.

For example Meltzer (2001) blames low investment for the slow growth in the 1990s, which seems to indicate that the economic problems originate from the demand side. Also Mori et al (2001) note that excessive investment of the bubble period prolonged the period during which economic growth suffered from adjustment pressures. In addition, Ramaswamy (2000) finds that especially the unwinding of the capital stock overhang from the 1980s and the debt burden played major roles as to the overall decline in investment. Also corporate governance related problems worsened the situation. Ramaswamy notes likewise that deindustrialisation and growing importance of the service sector, which is not as capital intensive as the manufacturing sector, may have affected the slump in business investment. The economy will likely be depressed as long as profitable investment opportunities remain absent.

Also Ramaswamy and Rendu (2000, 54–59) find that private investment (both residential and non-residential) suffered from large negative shocks between 1991 and 1993. As stated, the unwinding of the overinvestment during the bubble economy of the late 1980s could explain the sluggish investment. The following large negative shock to residential investment could be observed in 1997. Interestingly, the results indicate that shocks to private consumption played only a minor role. Such shock appeared immediately after the bubble burst, after which new negative shocks could not be observed before 1996. The authors note also that the private savings ratio remained fairly stable even in the aftermath of the asset price collapse. They find however that this is consistent with the special features of the Japanese economy. First, Japanese households hold a relatively low share of their financial assets as equities, which means that the effects of share price fluctuation can be expected to remain small. Second, unemployment started rising only in the late 1990s when also consumption suffered from negative shocks. Third, home ownership is relatively low in Japanese cities, which means that private consumption is less affected by property prices. Moreover, the Japanese housing market is quite illiquid, which dampens the wealth effects further.

Meltzer (2001) claims in addition that a decline of more than 20% in real export growth caused the economic deterioration of the late 1990s. It therefore seems likely that the problems of the Japanese economy relate more closely to demand than supply factors. The next section presents the most popular theories with which the deficient demand has been explained.

3.2 Competing theories

Besides the liquidity trap theory presented in detail in sections 4 and 5, many competing theories exist. I start this section by introducing the liquidity trap very shortly before discussing structural problems, after which I present one of the favourite hypotheses, namely the credit crunch theory. I then consider Posen's claims on mistaken macroeconomic policy. In addition, I deal with the theory of long-run wealth effects.

3.2.1 Liquidity trap

Even if the liquidity trap was for long found only a theoretical curiosity, many economists nowadays view the current situation in Japan as an example of the trap. The new emergence of the liquidity trap began when Summers warned about the dangers of a zero interest rate trap in 1991. He then argued that there is a trade-off between achieving zero inflation and macroeconomic stability. Today Krugman, Svensson, Goodfriend and Bryant among others seem to believe that the liquidity trap is a genuine issue.

As to Japan, Krugman (1998a) finds the common explanations inadequate. As he points out, one of the least controversial subjects in macroeconomic theory is that increases in money supply should raise the equilibrium price level. The assumption of the neutrality of money states more specifically that an increase in the money supply leads to an equal proportionate increase in prices. The proposition is unconditional in the sense that it does not require financially healthy banks or a competitive service sector. Krugman reasons that even if the explanations widely supported were not entirely false, they are inadequate since they do not explain why increases in the monetary base would not raise prices, output or both.

However, the proposition of monetary neutrality would require an increase in the money supply also in future periods to raise the prices. The liquidity trap is thus possible if consumers believe that monetary expansion is not permanent. Krugman concludes that the failure of expansionary monetary policy in Japan must result from a credibility problem of this kind. I will discuss the subject in detail below.

On the other hand, Meltzer (2001) states that the liquidity trap hypothesis can apply, at most, to the years under the zero interest rate policy. All in all, he is sceptical about the explanatory power of the concept. I will return to the evidence on whether Japan is in a liquidity trap or not later, but I now move now on to consider the other explanations.

3.2.2 Structural problems

According to the theory of structural problems, the economic problems originate from the real side, as long-run supply and institutional features have decreased the growth potential of the economy. The theory is thus closely related to the potential growth rate discussed above. In the case of Japan, especially regulation and competition-inhibiting structures have been blamed for restricting growth.

Furthermore, private sector expectations have currently been adjusted for the gloomier outlook, which has increased saving at the expense of investment. The real-side story is also thoroughly intertwined with monetary explanations. Wilson (2000) notes that in the long run, structural reforms enhance productivity and should therefore help an economy to escape from a liquidity trap. In the short run, however, there is a conflict between the approaches. Structural reforms can further exacerbate demand-deficiency problems while monetary expansion may delay structural reforms needed in the long run.

Roubini claimed already in 1996 that the traditional Japanese growth model does not work anymore. He thought that the problems are of structural nature instead of cyclical and that a structural reform is thus necessary. Since both monetary and fiscal policy were already as loose as they could be, Roubini concluded that something else has to be tried. Roubini's solution of structural reform comprises financial market liberalisation, deregulation and fostering competition in domestic markets and administrative, political as well as educational reforms.

Roubini is not the only one demanding radical structural reform and micro-oriented policy. In fact, the view that economic structures and particularly government intervention hinder Japan's economic growth is quite commonplace and the need for structural reforms is emphasised in several sources. For example OECD (1999, 19) notes that "the problems in the Japanese economy (in the 1990s) were not purely macroeconomic or a result of external shocks, but were deeply embedded in domestic structures. Structural reform was necessary and could no longer be delayed." Both OECD and IMF recommend rapid and thorough changes to restore economic growth. Ramaswamy (2000) notes furthermore that business investment continued to rise even after the asset price collapse in transportation, communications and electricity, which are the sectors that benefited from deregulation.[13] His results indicate therefore that the economy benefits from deregulation. All in all, there is a strong consensus on the existence of structural problems but the weights attached to them and other theories vary.

I find that improving the efficiency of the Japanese economy is important in the long run, as the economy clearly suffers from structural weaknesses. For example, remaining barriers to competition should be lowered to improve efficiency and less weight should be attached to political games and personal relationships in the cases where the rate of return renders the activity in question unprofitable. However, as the economy at present operates below its estimated potential, eliminating structural problems does not alone solve the economic problems in the short run. After all, deficient demand has been limiting growth, not insufficient supply. Structural reform might nevertheless be useful even in the short run if it managed to convince the private sector of the government's commitment to restore economic growth. Expectations of a brighter future might then have a positive impact on aggregate demand.

There is an additional factor that should be taken into account. For example Boltho and Corbett (2000) stress that repairing the weaknesses of the traditional system would at the same time result in losing many of its strengths. They emphasise that Japan still has advantages in many areas. For example, they note that the rates of human and physical capital formation are among the highest in

[13] The decline in investment was steepest in manufacturing and construction, which are the sectors that rocketed during the boom.

the world and that the volume of research and development expenditure is likewise unusually large.

Many theories are closely related to the structural problems. Posen (1998, 2 & 144) reminds of a view mentioned in the connection. The theory based on demographic factors sees the growth slowdown as an inevitable outcome of the ageing society. Concern for the future is thought to inhibit growth and the government is expected to start caring for that future by tightening its macroeconomic policy already at present. However, the burden of demographic factors might be smaller than feared if, for example, female workforce participation, birth rate or immigration to Japan would increase. A higher retirement age would also help to close the social security gap. Likewise, Yoshikawa's findings presented above in section 3.1 imply that demographic factors might not be that significant after all.

One group lays the blame for the economic problems on corruption and complex relationships between different interest groups. In contrast to most other theories, macroeconomic stimulus is thought to be harmful besides ineffective unless the fundamental problem of a corrupt economic system is solved first. (Posen 1998, 2)

Also balance sheet problems have been blamed for the sluggish growth. A slump worsens the situation, as many enterprises that would do well during a boom fail during a slump. However, balance sheet problems can be thought to be self-correcting. Thus temporary support in times of depression might alleviate the problem. (Krugman 1999)

3.2.3 Credit crunch

The financial disintermediation theory blames the reduced ability of the undercapitalised banks to finance corporate investment for the economic slump of the 1990s. The theory has been gaining on popularity since a decline in bank lending during the (late) 1990s is easily detected and it is straightforward to conclude that a credit crunch has blocked the usual channels of central bank influence. After all, bank lending grew faster than monetary base and M2+CDs in the 1980s but the situation was reversed already in 1994, after which the differential has only become larger (McKinnon and Ohno 2000, 3). The theory is of special interest since in Japan, banks have traditionally played a crucial role in financial intermediation and especially small and medium-sized enterprises have been depending on bank loans.[14]

According to Hutchison (2000), the hypothesis comprises two parts. First, Japan's non-performing loan problem has resulted in a decline in bank capital and a significant fall in the capital-asset ratio. Insufficient reporting caused difficulties in getting additional capital for the banks, which responded by reducing their lending. The tightened standards on reporting and capital-asset ratios in the late 1990s resulted in a need of building the ratios. Accomplishing this goal through restricted lending is slow and induces a credit squeeze.

Second, the recent incidents have increased cautiousness among the banks. Numerous bankruptcies and tightened standards make many enterprises less

[14] Large corporations can usually get equity financing more easily and may thus be affected less by a credit crunch.

desirable potential borrowers than they used to be. The negative publicity to the financial sector has forced the banks to resort to stricter control of lending. The tightened credit conditions worsen the situation further and the economic slump deepens, as credit-constrained enterprises are unable to engage in profitable investment opportunities.

Third, McKinnon and Ohno (2000, 17) have a different explanation for the banks' unwillingness to lend. They claim that the low interest rates have simply made lending margins unprofitable for the banks. Thus both bank reform and restructuring balance sheets would be ineffective because they would not change the profitability of new lending.

In a credit crunch, base and narrow money expansion by a central bank does not increase aggregate demand through increased lending. Hutchison (2000) claims that this is just what has happened in Japan. Even if the narrow money aggregates grew clearly between 1997 and 1999, the broader aggregates more directly related to spending increased only modestly. Hutchison concludes that even if low interest rates, slow broad money growth and decreasing lending could indicate either a liquidity trap or a credit crunch, the Tankan survey of the Bank of Japan points to the direction of a credit crunch. Hutchison notes that the survey indicates that the credit conditions of both small and large enterprises have tightened significantly since mid-1997 despite low interest rates. Ramaswamy (2000) explains this late emergence of a credit crunch by the regulatory environment that was based on the expectation of an economy improving soon.

Also Mori et al (2001) state that the appearance of the non-performing loan problem deteriorated financial intermediation and had therefore considerable negative impact on macroeconomic activity. They claim that the credit crunch hypothesis has been valid especially since 1997, which is when the concern over the financial system stability mounted. On the other hand, the results of Motonishi and Yoshikawa (1999) indicate that the explanation applies especially to small companies. The authors find that credit crunch became reality in 1997 and estimate that it lowered the growth rate of real GDP by 1.6% in 1998. Krugman (1998b) claims however that decreased lending is not entirely negative if it leads to a healthier banking sector.

Krugman (1998a) notes likewise that the earliest evidence of a credit crunch dates back to 1997. Thus the hypothesis does not explain the prolonged slump of the first half of the 1990s. He claims further that since depositors have not abandoned the Japanese banks, the theory of moral hazard suggests that the banks should in fact be trying to lend more than less. Also Posen (2001b) states that overinvestment of the bubble period continued through the mid-1990s as bad loans were repeatedly rolled over instead of writing down due to moral hazard. Hutchison (2000) remarks however that even if excessive lending could be observed at the early stages of the banking crisis, that kind of activity is not possible any more. The supervision of the financial sector has been tightened along with the transparency requirements so that the banks simply have to monitor the borrowers closely.

As to the significance of the banking sector, the results of Morsink and Bayoumi (2000) confirm that banks play an important role in transmitting interest rate and broad money shocks to Japanese economic activity besides being a significant source of shocks. The authors claim also that other sources of financing have not been enough to offset the decline in bank lending to corporations and households. The effects of a shock to bank loans are found

significant and long-lasting while shocks to securities do not have a similar impact. Furthermore, business investment seems especially sensitive to monetary shocks in Japan. Compared to other private demand, the reactions of business investment are two to three times larger even if the reaction time is longer. This underlines the significance of the bank lending channel because such investment is frequently financed by bank loans, especially as to small enterprises.

Furthermore, Bayoumi (2001) notes that financial intermediation plays an important role in magnifying the effects of asset prices on the real economy. His tests indicate a significant co-linearity between the residuals of land prices, stock prices and lending to the private sector. The variables are clearly interrelated and an increase in one of them leads to increases in the others. Bayoumi states that the interactions reflect the importance of domestic asset prices in the behaviour of the banks. After all, land is the most often used collateral and share holdings have traditionally been an important source of capital for Japanese banks. The economic downturn of the 1990s can be explained at least partly by this mutually reinforcing interaction and the credit crunch hypothesis is thus supported. Further evidence implies that the majority of the impact of asset prices on output is transmitted through financial intermediation, which therefore plays a central role in transmitting asset price shocks to the real economy. In addition, financial disintermediation restricts the effectiveness of macroeconomic policy.

Also Ramaswamy (2000) emphasises the tight relationship between bank lending and asset prices. He reminds that since Japanese banks have counted their capital gains on equity holdings as bank capital, equity prices have had a direct impact on bank lending. The asset price collapse of the early 1990s was therefore significant in this sense. The effects on the values of collaterals should not be forgotten either.

All in all, the evidence of a credit crunch even if only after 1997 is rather convincing. And the traditionally important role of the banking sector only confirms that decreased bank lending would certainly dampen Japanese growth prospects. However, other explanations must be found at least for the early 1990s, while the existence of a credit crunch in the late 1990s does not mean that other theories cannot not have any explanatory power.

3.2.4 Inadequate policy responses

The main advocate for the theory of mistaken macroeconomic policy is Adam S. Posen, who assumes that countercyclical macroeconomic policy and structural reform are largely independent of one another. He claims that the current economic slump results mainly from inadequate fiscal expansion.[15] As Posen (1998, 13) says: “An inadequate countercyclical policy response to the 1980s asset-price bubble and its burst accounts for most of the Japanese growth slowdown in the 1990s.” A major problem with Japanese macroeconomic policy has in addition been that the actors have often tried to force the other actors into doing something instead of acting themselves (Posen 2001a).

Posen (1998, 14) admits that the Japanese economic system suffers from structural problems but reminds that there has not been a sudden worsening of these factors that could be blamed for the slowdown. He finds that the potential

[15] Monetary policy is discussed later.

growth rate is still high although it has decreased somewhat since the 1980s[16] and states that structural reform is not necessary in the short run even if it increased growth potential in the long run. He concludes that other factors besides macroeconomic policy had little to do with the economic slump and speaks for fiscal stimulus that should aim at achieving faster than potential growth so that the current output gap could be closed by increasing employment and capacity used. Posen (2001a) admits however that the banking sector needs to write off accumulated non-performing loans.

As to efficiency of fiscal policy, Posen (1998, 6 & 29) claims that properly designed and implemented fiscal policy would have restored growth and that it should in fact be very effective in the situation Japan faces.[17] He dismisses most of the fiscal stimulus packages of the 1990s as inadequate and argues that they have been far less expansionary than announced. In fact, he calculates that the stimulus from 1992 to spring 1998 amounted to only a third of the initial announcements: total public investment of seven stimulus packages amounted to 23 trillion yen, that is 4.5% of GDP, although the amount announced was 65.75 trillion yen. Also Mühleisen (2000, 114) notes that the nominal increase in public investment has been significantly smaller than announced in the stimulus packages. If the output losses of the 1990s and historical fiscal expansion in other OECD countries are taken into account, the stimulus seems inadequate.

On the other hand, Ramaswamy and Rendu (2000, 54–60) find that there were large positive shocks to public investment during the 1990s and that the timing of the shocks corresponds to that of the stimulus packages. Large negative shocks to public consumption can however be observed at the same time. Ramaswamy and Rendu note that public consumption declined significantly in relation to its trend growth between 1973 and 1990 while public investment grew about twice as fast as before. They claim that this results partly from an institutional bias in favour of public investment. Furthermore, investment projects are more suitable for temporary fiscal expansion. All in all, the authors conclude that the decrease in public consumption largely offset the increase in investment.

Mühleisen (2000, 116–120 & 136) explains the inefficient stimuli with three factors. First, stimulus packages have been used to offset expenditure cuts of initial budget plans. In the post-bubble period, the government has aimed at fiscal discipline by contractionary initial budgets based on the previous year's initial budget, and supplementary budgets have been a necessary response to worsening economic conditions. This has decreased fiscal policy efficiency by increasing uncertainty. Second, local authorities play a major role in implementing central government's fiscal policy. Financial problems have however affected their ability to increase their investment particularly since 1995. Third, some of the funds provided by the stimulus packages may have been allocated to public enterprises or have not been used at all. Moreover, the packages have been partly offset by government expenditure cuts elsewhere.

Mühleisen (2000, 107 & 113) notes also that the demand impact of the stimulus packages has been limited because the financial measures included in the packages have not been effective in the cases where sluggish demand has not been caused by credit constraints. In addition, increases in public investment have formed an important part of the packages. The rate of return on public investment

[16] Posen (2001a) claims that Japanese potential growth rate is actually rising and that macroeconomic policy should try to take advantage of this.
[17] The point is discussed below in section 4.2.

has generally been quite low although it has traditionally played an important role during the postwar economic growth. Also Ishii and Wada (1998) point out that the quality of public works spending has been low in the sense that it has not led to productivity growth. Furthermore, Posen (1998, 29) claims that the stimulus was divided to too small and inefficiently administered doses.

My opinion is likewise that the stimulus packages should have been developed more carefully, since increasing public investment only in order to boost aggregate demand is not reasonable in the long run if the projects are not chosen carefully. Instead, investment projects should have been planned so that the economy could have benefited from them even after the project itself has been finished. Moreover, the way macroeconomic policy has been conducted has been such that it has probably increased uncertainty among the private sector, not to mention the very unfortunate decision to tighten fiscal policy in 1997. On the other hand, deciding the scope of expansionary fiscal policy is difficult and Japanese economic forecasts have frequently been too optimistic. In addition, it is not possible to know beforehand how effective fiscal stimulus of certain magnitude is. Also observing the results and reacting accordingly may have become more challenging since for example Weberpals (1997, 12) notes that policy lags may have become longer. It would likewise be unreasonable to forget that external shocks played an important role in the chain of events that led to a new downturn.

Also Ramaswamy and Rendu (2000, 63–67) find that economic activity would not have been significantly weaker in the absence of the macroeconomic policy conducted in the 1990s. Like Posen, they believe that macroeconomic policy would not necessarily be ineffective and conclude that policy could have been effective if it had been implemented in a less ad hoc manner and if it had concentrated on more effective measures. As an evidence of properly implemented macroeconomic policy Posen (1998, 41) mentions the 1995 fiscal package, which was besides sufficiently large also effective, since it succeeded in raising GDP growth above forecasts by about one percentage point.

Bayoumi's (2001) estimates of the impulse responses for output indicate likewise that an increase in government spending provides a temporary boost for the economy. However, the multiplier is quite small indicating that a 100 yen increase in public spending results in a 65 yen increase in output. Similarly, increases in tax level lower economic activity. All in all, fiscal policy seems to be effective but the multipliers are relatively low. The low multipliers are quite natural in the situation Japan faces: the private sector has lost its confidence in expansionary fiscal policy measures because of the ineffective stimulus packages of the past and financial sector problems are considerable. The multipliers would rise if the confidence in fiscal policy were restored.

Mühleisen (2000, 109 & 121–128) notes that increases in public investment contributed only one percentage point to the fall of general government's structural balance between 1990 and 1998 and that a decline in tax revenue was a more significant factor. The decline in tax revenue resulted from a large drop in tax revenue elasticity in the first place and tax policy measures only in the second place. Mühleisen's results indicate that the effects of tax cuts were small and were largely offset by the tax increase in 1997. Also Posen (1998) notes the budget deficits resulted directly from the economic downturn and not necessarily from expansionary policy measures.

Continuous fiscal deficits and long-run effects of an ever-increasing public debt are the main obstacles of conducting expansionary fiscal policy as is discussed in section 7.2. Posen (1998, 7) claims however that the ratio of debt to GDP would likely decline in better times. In addition, he (2001a) points out that since the Japanese net debt is still low,[18] concerns of sustainability should not arise. Moreover, the debt is entirely yen-denominated. According to Posen, the lack of market concern about the solvency of the Japanese government has in any case manifested itself as a relatively flat yield curve and deflationary expectations. He does not consider possible non-performing loans to foreigners a significant problem, although they would certainly mean that the net debt situation would become more serious.

Posen (2001a) points however out that the real problem with the government debt is its illiquidity. He fears that as long as the banking sector problems remain unsolved, the Japanese bond market is very vulnerable. Long-term interest rates are relatively sensitive to negative news, the effects of which could be observed for example in January 1999 when long-term interest rates spiked 175 basis points after Moody's downgrade of Japanese public debt. Posen (2001a) gives thus higher priority to banking sector problems than he did before and is also more careful with demands of expansionary fiscal policy. He does nevertheless emphasise that fiscal policy must not be contractionary in the situation Japan faces.

Mühleisen (2000, 128–135) finds that Japan has the weakest automatic stabilizers among the major industrialised countries, which has resulted in the need of active fiscal policy. The problems associated with the approach include implementation lags and the effects of forecast errors. The experience of the 1990s indicates likewise that discretionary policies were probably tightened in an early phase of recovery while they were loosened relatively later in a downturn.

However according to Posen (1998, 29–34), Japanese fiscal policy has traditionally been less countercyclical than in many other OECD countries.[19] This results partly from the structures of the economy, and for example labour force has directly an important role in the adjustment process, although through other channels than cyclical variability of unemployment. The public social security plays a less significant role than in Europe and self-insurance is clearly more important.

3.2.5 Long-run wealth effects

A theory presented by Ando (2000) gives primacy to wealth effects.[20] He blames the high saving rate and resultant deficient demand for the prolonged economic downturn. To explain the level of savings, Ando calculates that between 1970 and 1998, the household sector suffered a real capital loss of almost 400 trillion yen.

[18] In 2001, foreigners hold less than 6% of the Japanese long-term government bonds outstanding.

[19] Mühleisen (2000, 133) finds nevertheless that Japan's overall fiscal stance has been very countercyclical and that the fiscal position has reacted strongly to changes in the output gap compared to the other major industrial countries.

[20] Ando bases his theory on the Japanese National Accounts, the structure of which does not always allow separating different entities for analytical purposes. The nature of the accounts results in some uncertainty concerning the results of the analysis and prevents testing the hypothesis.

He finds that in contrast to the liquidity trap hypothesis, the rate of investment appears to have been too high in the long run. That is, a low rate of return on investment has caused the problems, not sluggish investment itself. The theory is particularly interesting since it analyses the economic problems from a long-term perspective unlike the other theories of this section. That is also why I have chosen to present Ando's hypothesis.

Ando begins by analysing the ratios of total net worth and of total net worth excluding land to total disposable income between 1970 and 1998. He notes that the latter ratio has remained small despite a high saving-income ratio of the households and even if the household sector has been a net seller of land since 1970. Since the relative price of land compared to the implicit deflator of total private income rose during the period, the private sector acquired capital gains on land. Ando thus concludes that the household sector must have suffered a significant real capital loss in its asset position excluding land.

Ando shows that the cumulated net saving of the household sector and the net sale of land between 1970 and 1998 amounted to 1,250 trillion yen. The net worth excluding land for the same period was 861 trillion yen meaning that the sector suffered a real capital loss of 389 trillion yen. Ando concludes that the source of the loss of this scale must be related to net financial assets and corporate equities, as land is already excluded from the analysis. By comparing the net financial position of the household sector against the corporate sector, he notes that a 75% share of the loss is due to a loss in the market value of sector's ownership of corporations. The remainder is due to a capital loss on other assets.

The abbreviated balance sheet for the Japanese corporate sector reveals the special features of the sector. First, the value of land approximately equals the reproduction cost value of reproducible tangible assets while in the United States, the value of land is estimated to be less than one-tenth of the reproduction cost value. Second, the accounting net worth of the Japanese companies is clearly larger than the market value of their equities. The question then is how the companies have managed to incur real capital losses of such a large scope in their market value.

A minor share of the market valuation discrepancy is due to the appreciation of the yen against other currencies, which resulted in a loss of some 46 trillion yen in terms of the 1990 private consumption price against the external sector. However, the low rate of return for the corporate sector seems to be a much more significant factor. Ando's estimates of the rate vary between 1.6 and 2.9% for the combined corporate sector including both financial and nonfinancial organisations. He believes that even these values might be overestimated. The observed decreases in the market value might therefore result from a market reaction to the small operating surplus of the companies.

In Japan, the gross income on capital is quite large: Ando finds that the share of gross income accruing to capital amounts to 34% while the corresponding US figure is 29%. Thus a low share of income accruing to capital does not explain the low rate of return. However, a partial explanation is given by the high rate of depreciation in Japanese National Accounts. The rate is much higher than in the United States, which does not seem reasonable. But if the capital values are recounted by using the US rate of depreciation, the Japanese stock turns out to be even larger. All this indicates that the Japanese corporations have accumulated a too large capital stock. In addition, the value of land is very high.

Excessive capital accumulation has been possible since the share of retained earnings has been high and dividends paid to shareowners correspondingly small. If there are no profitable investment opportunities present, the strategy results in a low internal rate of return and capital losses to owners. The companies have also taken advantage of the structure of the Japanese financial markets: until recently the households have had limited options besides investing their savings at a low rate of return in financial institutions, which have lent the money further to nonfinancial companies. Overinvestment and the low rate of return on investments have then resulted in large capital losses for the household sector. Since the net worth of households has decreased, they try to correct the situation by saving more and consuming less.

Ando also makes some calculations to prove that the observation of the capital loss is important. If the marginal propensity to consume out of net worth were 0.05, the household consumption in 1990 prices would have been approximately 20 trillion yen larger without the capital loss. With a multiplier of 1.5, additional consumption in 1998 would have amounted to 30 trillion yen, which is 6% of the year's GDP. This would have had a clear positive impact on investment and macroeconomic policy could have been less expansionary.

Ando concludes that if his analysis is correct, macroeconomic policies alone will not be able to end the slump. Structural reform is needed especially to encourage more rational investment decisions, and a major shift of resources from companies to households is likewise necessary. In the short run, the government could for example exempt dividends from the corporate profit tax. In the long run, however, a more fundamental reform of corporate governance should be considered.

4 Historical roots of the liquidity trap

By the traditional definition, a liquidity trap is "a situation in which an increase in the money supply does not result in a fall in the interest rate but merely in an addition to idle balances: the interest elasticity of demand for money becomes infinite" (Pearce 1992). The problem arises if nominal interest rates are near or at their lower bound, which typically is zero. From now on, the term zero bound is thus used interchangeably with the term lower bound. At the zero bound, the private sector views base money and bonds as perfect substitutes.

This section is dedicated to exploring the history of liquidity traps. Keynes introduced the concept in 1936, and Hicks treated the subject in the context of his famous IS-LM model the following year. I will therefore start by going through Keynes' thoughts on total liquidity preference and move then forward to clarifying the concept via the IS-LM model. I will also present some evidence on whether Japan is in the traditional liquidity trap.

4.1 Keynes' view on the liquidity trap

The most usual perception is that John Maynard Keynes stated the conditions for a liquidity trap but claimed that the world had never experienced one. That is, he admitted the possibility of the trap but denied that the Great Depression had been

one. Even today, many economists are highly sceptical of the existence of the liquidity trap. However, some of them claim that the Great Depression is an example of it and that the current situation in Japan is in this sense similar to that of the early 1930s in the United States.

Keynes' theory of liquidity preference lays the foundation for the liquidity trap, which can be seen as an example of total liquidity preference. Liquidity preference represents here "the return that must be paid on illiquid assets to make investors indifferent to holding more liquid assets". The theory questions the basis of the traditional quantity theory, namely the mechanical relationship between money creation, price level and nominal level of economic activity. (Kregel 2000, 1 & 6)

Keynes' view on the liquidity trap is closely related to the model of two assets he developed. Here assets are divided to money and government bonds, which are conceived broadly as all risky assets that carry a rate of return and that cannot be used as a medium of exchange. The speculative demand for money then arises because there is an inverse relationship between bond prices and the interest rate.[21] According to Keynes (1936, 172 & 233), reducing interest rates through increases in the quantity of money may become impossible if market participants are unanimously uncertain about the future. In other words, if they believe that the interest rates have already reached the bottom, the interest rates can become insensitive even to large-scale monetary expansion, as market participants are unwilling to purchase bonds, the prices of which they expect to decline in the future. Under such circumstances, monetary expansion will only lead to increased holdings of excess cash and sales of bonds.

Brunner and Meltzer (1968) present a theoretical analysis showing that a liquidity trap cannot occur if there are three distinct asset types of money, bonds and capital. If the number of different assets amounts to more than two and at least one of these yields a positive return, all assets are not perfect substitutes and the central bank can successfully engage in open market operations. A liquidity trap in the presence of the zero bound requires thus a situation in which the return on all assets is zero. One way of stating this is that the entire yield curve has to be flat at the zero level (Buiter and Panigirtzoglou 2000). For example Meltzer (1999) finds that all assets cannot be thought to be perfect or even close substitutes for the monetary base and short-term government bonds. He emphasises that bonds and real capital or domestic and foreign assets are not perfect substitutes. Meltzer claims further that empirical evidence implies specifically that the assumption of perfect substitution is untrue if the economy is in transition from one long-run equilibrium to another. He finally concludes that liquidity trap could only happen in a world without information costs.

According to Kregel (2000, 6–7), Keynes did not agree with Irving Fisher's theory on interest rates and inflation:[22] he objected Fisher's assumption of perfect foresight of future incomes and prices. Likewise, he thought that the impact of an

[21] The price of a bond that pays a coupon of c forever is c/r where r is the interest rate. It is thus clear that the higher the interest rate, the lower the value of the bond. If interest rates are expected to rise, there are no incentives to buy bonds.

[22] Fisher relation is based on time preference, which relates real income today and in the future. The interest rate is the discount that equates the utilities of future and present income at the margin (Kregel 2000, 6). The relation can be written as $1+i = (1+r)(1+\pi^e)$, where i is nominal interest rate, r real interest rate and π^e inflation expectation. The nominal interest rate $i = r+\pi^e+r\pi^e$. Since the term $r\pi^e$ is small , it can be ignored. The Fisher equation is thus $i = r +\pi^e$. An alternative presentation is of the form $1+i_t = (1+r_t)[E(P_{t+1})/P_t]$.

interest rate change on the capital value of existing financial assets should be taken into account. Namely, the effect of an inflation rate change depends on the maturity of the bond an investor holds at the time of the change. The longer the time to maturity, the larger the effect should be. Keynes claimed that the Fisher relation is biased, since the higher yields required to preserve real yields under rising inflation result in capital losses that will more than offset the increased interest earnings of existing bondholders. He therefore claimed that there is no reason to expect the Fisher relation to hold and developed a rule called the square rule to prove his point.[23] The rule states that an interest rate change must equal the square of the interest rate to leave the capital value of existing bondholders unchanged. The Fisher relation will hold only if interest rates rise by more than this.

The square rule gives an opportunity for an alternative way of defining the liquidity trap. According to it, the liquidity trap will occur if investors expect the interest rate to rise by more than the square of the current interest rate. Furthermore, Keynes claimed that the trap is more likely at low interest rates since the probability that the rates will start rising is then higher. It takes also longer to recoup the capital loss through higher interest earnings. However, since liquidity preference is a relative concept, the liquidity trap can occur even if the interest rate were higher than at the critical two per cent level for long-term bonds proposed by Keynes.[24] (Kregel 2000, 11)

The expectations of future bond prices depend on the recent volatility of interest rates and play a crucial role in Keynes' theory of liquidity traps. In a volatile environment, influencing the demand for money through interest rate changes is more difficult since the changes have to be larger to have an effect on the demand. (Kregel 2000, 11)

4.2 Hicks and the liquidity trap

The traditional liquidity trap model presented most often originates from John Hicks and differs slightly from that of Keynes even if the distinction is not always made. However, Hicks' assumptions concerning the high elasticity of supply of consumption goods and the income elasticity of the interest rate were extraneous to Keynesian theory. Kregel (2000, 2–5) emphasises that Keynes never accepted the presentation and that it is actually consistent with the traditional quantity theory.

The Hicksian liquidity trap is based on the IS-LM model, which Hicks developed in the 1930s and which can be used to describe short-run equilibrium. The framework has its roots in Keynesian fixed price income determination and models therefore an economy in which prices are fixed for a moment. The consequence of the fixed prices is that there is neither unemployment nor need to consider nominal and real interest rates separately. The simultaneous equilibrium for the goods and the money market can be reached by combining the IS relation of the former and the LM relationship of the latter. Geometrically the equilibrium is situated at the intersection of the curves. According to Stevenson et al (1988, 2–

[23] See Kregel (2000) for details.
[24] Weberpals (1997, 3)

12), the equilibrium values (labelled with asterisk) of output Y and the rate of interest on bonds r are functions of the exogenous variables so that

$$Y^* = Y^*\left[AE_A, (M_A/P), T_A\right]$$

and

$$r^* = r^*\left[AE_A, (M_A/P), T_A\right],$$

where AE_A is aggregate real expenditure, M_A/P is outstanding real money stock and T_A is tax revenue. The terms labelled with the lowercase symbol A are autonomous variables.

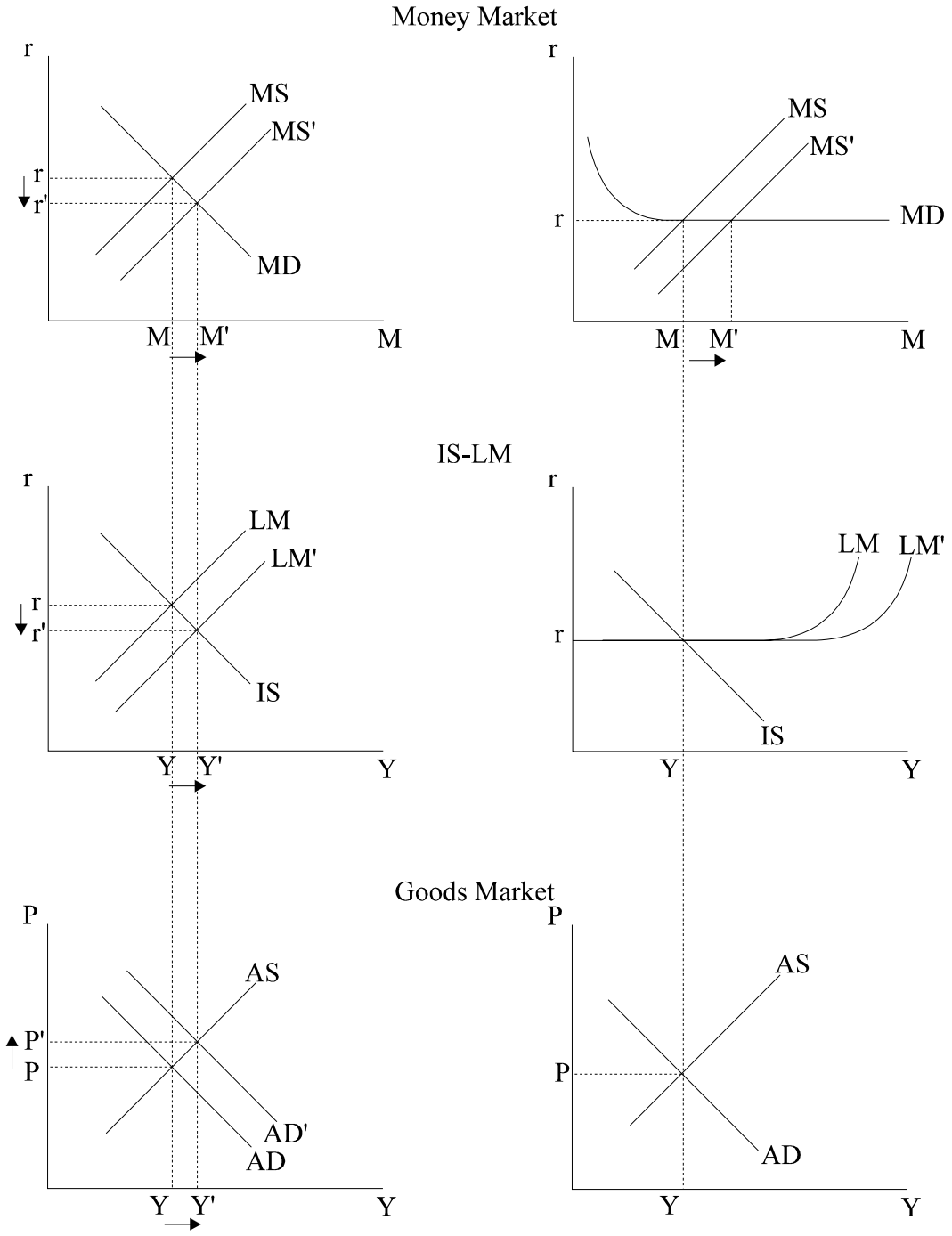
Hicks (1937) notes that there is probably a minimum level below which the interest rate is unlikely to fall. A near zero interest rate might thus cause problems concerning the effectiveness of monetary policy. The shape of the LM curve (or the LL curve as Hicks initially named the curve) relates to this conclusion. If costs of holding money are negligible, a negative nominal interest rate would lead to a situation in which money would dominate bonds as an asset. Since this is not possible, the leftmost part of the LM curve has to be flat as a result of infinitely elastic money demand. In other words, the curve is horizontal when the interest sensitivity of the demand for money approaches infinity.

The liquidity trap arises if the IS curve intersects the LM curve in its flat region. Under these circumstances monetary policy becomes ineffective since even if changes in policy will shift the curve, its horizontal parts will not be affected and interest rate and output remain thus unchanged by monetary expansion (Hicks 1937). The normal situation in which monetary policy is effective is depicted in part a of figure 1 (next page) while liquidity trap is shown in part b.

Figure 1 shows that monetary policy does become powerless in a liquidity trap just as described by Hicks. The traditional solution to surviving from the trap has therefore been expansionary fiscal policy, which would move the IS curve rightward out of the flat part of the LM curve by increasing aggregate demand. In fact, fiscal policy should be at its most effective since in a liquidity trap, a shift of the IS curve should not result in a rise of interest rates or crowding out. The necessary scope of the expansion depends on the size of the multiplier of public expenditure or taxes. However, obstacles discussed in section 7.2 might prevent using fiscal policy effectively.

Since most economists define the liquidity trap in accordance with Hicks, the majority of the criticism presented is directed against his model. Particularly, the IS-LM model has been criticised for the simplifying assumptions it makes: it does after all leave out many important aspects from price determination to the determinants of consumer behaviour. Both the money supply and the price level enter the model only once, namely on the left-hand side of the money market equilibrium equation $M_A/P = l(Y,r)$. They clearly affect the aggregate demand through the same channel, which means that one cannot claim that increases in M are ineffective without claiming that also a decrease in price level is ineffective in raising demand. However, Pigou has noticed that this simply cannot be right: a fall in the general price level will increase demand through the wealth effect. (Krugman 1999)

Figure 1. **Hicksian Liquidity Trap**



Source: Weberpals ((1997, 13).

Furthermore, if monetary policy works through other channels besides returns, also these channels need to be blocked for the monetary policy to be ineffective (Buiter and Panigirtzoglou 2000). The liquidity trap is thus less likely in an open economy in which the exchange rate channel is operative. However, conducting open market operations through other assets might have undesirable consequences as discussed in section 7.3.

4.3 Evidence on the traditional liquidity trap in Japan

As to Japan, the demand of a flat yield curve at the zero level is not fulfilled exactly. The yield curve has however been somewhat flat, as the ten-year government bond rate declined to below 1% for a brief period in late 1998 (Krugman 1998a). In September 2001, yields on long-term government bonds were moving around 1.35% (Bank of Japan 2001). McKinnon and Ohno (2000, 17) note in addition that even if the yield curve is still upward sloping at the current long-term interest rates, the longer rates can be thought to be close to zero when properly risk adjusted. That is, as nominal rates on long-term bonds become low, their market prices become very sensitive to changes in market interest rates and the risk premium on holding them rises.

In any case, recent economic development seems to support the liquidity trap hypothesis, at least in the light of simple economic indicators. First, GDP growth has been sluggish for a decade after the asset price collapse despite the temporary pick up in economic activity in the mid-1990s (figure A.1). At the same time, the yearly increases in money supply have been significant and the Bank of Japan has lowered its target rate to practically zero (figure A.5). Expansionary monetary policy could partly explain the temporary economic recovery of the mid-1990s since at the time of the pick up, the M1 growth rate was at its highest and the interest rates declined.[25] However, after these events there has been little or no room for the central bank to operate in interest rates and GDP growth figures have again given reason for increasing pessimism. Considering the traditional central bank policies, monetary policy thus seems to have become ineffective.

If Japan has entered a liquidity trap, savings should have increased to account for the decreased level of investment. Household saving ratio did indeed increase from 10% in 1990 to about 12% in 1993 but decreased then, although unsteadily, to about 9% by the year 2000 (IMF 2001, 5). This is somewhat unexpected but not quite surprising if the thoughts of Ramaswamy and Rendu (2000) presented in section 3.1 are borne in mind. Diminished interest in investing in bonds is however expected since, as was observed in the section 4.1, it is not profitable if interest rates are expected to rise. And if the interest rates are currently at their lower bound, expectations of higher interest rates must eventually come true.

In addition to the economic indicators, Weberpals (1997) examines whether the Japanese interest rate elasticity of money demand is negatively correlated with the interest rate and whether the money demand function shows evidence of a significant positive liquidity floor. In other words, she tries to find out whether the function becomes horizontal at some critical level. The results do not indicate that Japan has fallen into a liquidity trap. First, the interest rate elasticity of money

[25] According to Bayoumi (2001), both fiscal and monetary policy boosted output by about 1% in the economic revival of the year 1996.

demand seems to have decreased in absolute terms, as interest rates have approached the zero lower bound. The near zero interest rate elasticity of money demand implies that the money demand function is nearly vertical instead of horizontal. Interest rate changes can therefore have a limited impact on money demand and output growth, indicating that monetary policy is not very effective. In addition, though the results present some evidence of a positive interest rate floor, the received estimate of the floor is insignificant. Weberpals emphasises however that the approach used might be biased in the sense that it lessens the probability of accepting the liquidity trap hypothesis.

Also Hondroyiannis et al (1999) try to find out whether the demand for money has become more interest rate sensitive during the 1990s. They note that both the deposit and the money market rate declined clearly during the observation period of the study: the former fell from the peak of 4.6% (1991Q4) to 0.3% (1997Q2) while the latter fell even more drastically from about 8% (1991Q1) to 0.5% (1997Q2). At the same time, the elasticity of the deposit rate decreased from about –0.02 of the late 1980s to –0.003 of 1997. The elasticity of money market rate decreased also even if not quite as clearly. The results are therefore consistent with the findings of Weberpals, and the decreasing trend is of course in contrast with the traditional theory of the liquidity trap.

Hondroyiannis et al explain the decline in the absolute value of the interest rate elasticity of Japanese money demand by the deregulation process of the financial sector, because of which the proportion of the instruments that offer market-determined interest rates has risen. In a deregulated financial system, market rates are more volatile than the opportunity cost of holding money,[26] and the demand for deposits has thus become less sensitive to the general interest rate level. Hondroyiannis et al conclude that sustained monetary expansion would be effective in reviving the Japanese economy. The conclusion differs therefore from the results of Weberpals (1997), which indicate that monetary policy might be somewhat ineffective in Japan.

The results of Weberpals and Hondroyiannis et al date back to the mid-1990s. It would be interesting to see whether corresponding results would be achieved with more up-to-date data. After all, during the time period used in the papers the state of the economy seemed to be improving. The recovery was only temporary. Moreover, the zero interest policy did not become effective before February 1999, which means the zero bound was not really binding before that. Despite these shortcomings, I will move on to discussing the re-emergence of the liquidity trap.

Because of the criticism and the general economic conditions of the postwar decades, the liquidity trap has not been among the most popular research subjects until recently. As Krugman (1998a) writes: “To the extent that modern macroeconomists think about liquidity traps at all … their view is basically that a liquidity trap cannot happen, did not happen, and will not happen again.” However, the concept re-emerged in the latter half of the 1990s mostly as a result of the prolonged slump of Japan. Since then the theory has been brought up to date and it has gained eager advocates, some of whom are presented in the next section.

[26] The opportunity cost is defined as the spread between the own rate of return on money and the market rate on substitute financial assets.

5 The re-emergence of the liquidity trap

Paul R. Krugman (1998a) presents his theory of Japan's prolonged slump in *It's Baack: Japan's Slump and the Return of the Liquidity Trap*, on which this section is mostly based. In the article, Krugman develops a succession of simple models to prove that liquidity traps can happen even without the limiting assumptions of the IS-LM model and links then the concept to Japan. He states reasons for his opinion that Japan has fallen into a liquidity trap and suggests finally a somewhat unconventional solution to the problem. And since probably the most common criticism against the liquidity trap is that it cannot happen in an open economy, I present another open economy liquidity trap model, which originates from McKinnon and Ohno (2000).

Since the IS-LM model is blamed for inaccuracy and vagueness, Krugman (1998a) supplements the traditional model by adding some features central to modern economic theory. First, he takes the intertemporal nature of decision making into account by introducing expectations in the model. In addition, financial intermediation plays such an important role in the crisis of Japan that he cannot totally ignore its impact. Finally, Krugman examines liquidity trap in an open economy in contrast to the most of the earlier analyses.[27]

5.1 A simple exchange economy with flexible prices

Krugman first develops a simple model of a single consumption good, representative agent closed economy. Prices are assumed to be flexible to show that the liquidity trap does not depend on the price stickiness of the traditional Keynesian analysis. The model is a no-production framework, in which each individual receives an exogenous endowment of Y_t every period. The equilibrium real interest rate depends thus solely on individuals' rates of time preference and utility functions. Krugman defines the utility function to be of the form

$$U = \frac{1}{1-\rho}\sum C_t^{1-\rho} D^t, \tag{5.1}$$

where C_t is consumption in period t, ρ (<1) is relative risk aversion and D is the subjective discount factor defined as $1/(1+\delta)$. δ denotes the subjective discount rate.

A two-stage process is assumed to take place in each period. At the beginning of a period, individuals can trade cash for one-period bonds, which carry a nominal interest of i_t. Additional cash can be received by selling a part of the initial endowment. Cash in advance constraint defines the upper limit of consumption so that $P_tC_t \leq M_t$, that is the nominal value of consumption cannot exceed money holdings.

The public sector has two options of influencing the market. Namely, the central bank may participate in the capital market at the beginning of a period and

[27] For other liquidity trap models see for example Svensson (1999) and Buiter and Panigirtzoglou (2000). Furthermore, McCallum (2001), Svensson (2001a) and Buiter (2001) present models of the liquidity trap in an open economy.

the government can collect lump sum taxes or distribute lump sum transfers at the end of a period. The public sector faces also a budget constraint.

Krugman then makes some simplifying assumptions to ease calculations. First, output remains constant at $\overline{Y}$ from the second period onward, in addition to which also money supply remains constant at $\overline{M}$. Since $\overline{C} = \overline{Y}$ in market equilibrium, the price level can be determined from the binding cash in advance constraint[28] so that $\overline{P} = \overline{M} / \overline{Y}$. And for simplicity, the first (or current) period variables can now be written without the lowercase letter t.

The solution of the current period becomes crucial because of the assumptions. When the nominal interest rate is positive, the cash in advance constraint is again binding and P = M/Y. This is the condition defined by the monetary side. Another condition follows from the intertemporal nature of decision-making. Namely, each agent must be indifferent between consuming 1/P units less in the first period and consuming $(1+i)/\overline{P}$ units more in the following period. Given the utility function (5.1) and the marginal utilities for the periods, this yields

$$\frac{1}{P} C^{-\rho} = \frac{1+i}{\overline{P}} D(\overline{C})^{-\rho}, \tag{5.2}$$

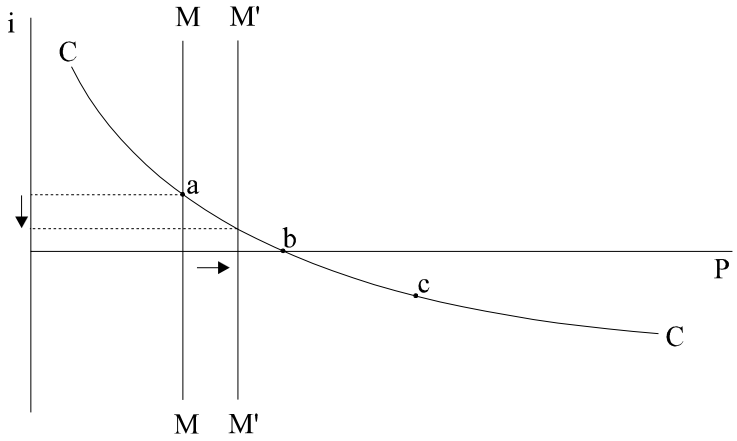
which is a version of the Euler condition on consumption, nominal interest rate and prices. The equation can be expressed in the form

$$1+i = \frac{\overline{P}}{DP} (\overline{Y} / Y)^{\rho}, \tag{5.3}$$

as consumption must equal output in each period. The curve (5.3) is named CC in figure 2, which originates from Krugman. The higher the current price level, the lower the nominal interest rate since the price level is constant from the second period onward. The curve is thus decreasing in a system of P–i co-ordinates.

[28] If the nominal interest rate is positive, individuals will not want to keep more cash than they consume.

Figure 2. **Krugman's liquidity trap in a flexible-price economy**



Source: Krugman (1998a, 145).

The cash in advance constraint of the current period and equation (5.3) define the equilibrium nominal interest rate and the price level in the i, P space of figure 2. An increase in M shifts the money market curve MM to the right and should therefore lead to a decrease in the nominal interest rate and an increase in the price level. However, monetary expansion works only as long as the nominal interest rate is positive. As was discussed above, the nominal interest rate cannot become negative. This observation plays a crucial role in Krugman's models. An increase in the money supply will not work to the right of point b[29], after which both the price level and the nominal interest rate will remain unaffected. In other words, the cash in advance constraint ceases to be binding and the economy stays at point b. Monetary policy has therefore lost its ability to increase the price level. The contrast to Keynesian liquidity trap is noteworthy, since under the assumption of sticky prices monetary policy loses its ability to increase output instead of prices.

According to Krugman there is an equilibrium real interest rate the economy will deliver regardless of the nominal prices. The real interest rate can be calculated by combining the equation (5.3) and the Fisher relation

$$1 + i = (1 + r)\frac{\overline{P}}{P}. \tag{5.4}$$

At the zero bound, that is when the nominal interest rate is zero, this means that

$$1 + r = \frac{P}{\overline{P}}. \tag{5.5}$$

The equation implies that at the zero bound, expectations of a higher future price level can lower the real interest rate. Based on the previous, the equilibrium real interest rate of Krugman's model can be written as

[29] Krugman remarks that only short-term interest rates are at zero at point b, and that long-term rates might still be positive. This, as he notes, is the current situation in Japan.

$$r = \frac{\left(\overline{Y}/Y\right)^{\rho}}{D} - 1. \tag{5.6}$$

An alternative way of analysing the situation exists. The cash in advance constraints of the two periods can namely be combined into

$$\frac{\overline{P}}{P} = \frac{\overline{M}Y}{M\overline{Y}}, \tag{5.7}$$

which is the vertical line in figure 3. Equation (5.3) is likewise graphed in the figure, where it depicts the zero bound on nominal interest rates by intercepting the y-axis at 1. The lower the expected inflation, the lower nominal interest rate equation (5.3) implies. Low inflation increases therefore the risk of falling into a liquidity trap. Furthermore, the equations indicate together that increasing current period money supply can actually lower the nominal interest rate (ceteris paribus), since expected inflation rises only if a promise of monetary expansion also in the next period is credible. On the other hand, the key to escaping from a zero interest rate trap is thus increasing credibly the expected price level of the next period.

Figure 3. **The role of inflation expectations**

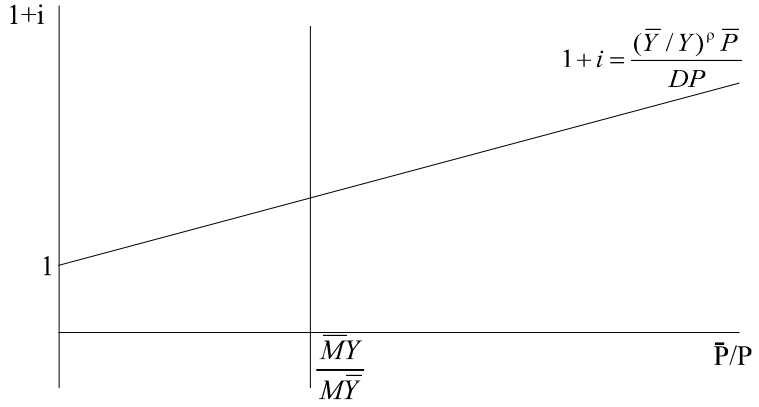


Figure 3 is also consistent with Krugman's analysis of the situation. He notes that if the central bank increases money supply through an open market operation at the beginning of the current period, the expected rate of money growth $\overline{M}/M$ decreases ($\overline{M}$ is constant). In addition, if the central bank is successful in raising the price level, the expected rate of inflation $\overline{P}/P$ decreases as well. Equation (5.5) states that this results in a higher real interest rate, which encourages saving at the expense of consumption. To avoid the effect, the central bank must succeed in convincing the public that also the next period money supply is large enough. The role of expectations is crucial.

The constant real interest rate and the requirement of a positive nominal interest rate lead to Krugman's conclusion that "the economy has a minimum rate of inflation, or a maximum rate of deflation". If the required real interest rate is

negative[30], the economy needs inflation to get into the equilibrium. Under these circumstances, policy aiming at price stability will only lead to a zero nominal interest rate and excess cash holdings.

In the model formulated by Krugman, the equilibrium real interest rate is negative if the marginal utility of consumption is larger in the future than it is at present. This will be the case if future output is expected to be sufficiently smaller than the current output. Declining output could result for example from an equity premium[31] or demographic factors. Given the equation (5.6), the condition for a negative real interest rate is

$$\left(\overline{Y}/Y\right)^{\rho} < D. \tag{5.8}$$

After having shown that the existence of a liquidity trap does not depend on the IS-LM model, Krugman returns to this more familiar framework. The next section introduces his model of a production economy in which prices are sticky.

5.2 Production and sticky prices

After the no-production framework of the previous section, Krugman formulates a Hicksian model in which production takes place. The maximum productive capacity in the current period is Y_{POT}, all of which need not be used. As above, the production from the following period onward is constant at $\overline{Y}$. The first-period price level is now predetermined at P_0, and output adjusts to consumption rather than the other way around. Consumption demand is familiarly decreasing in the interest rate. Given the equation (5.3), the IS curve can be written as

$$Y = \overline{Y}\left(\frac{\overline{P}}{DP_0}\right)^{\frac{1}{\rho}}(1+i)^{-\frac{1}{\rho}} \tag{5.9}$$

or as

$$1+i = \frac{\overline{P}}{DP_0}\left(\frac{\overline{Y}}{Y}\right)^{\rho}. \tag{5.10}$$

The cash in advance constraint is again binding as long as the nominal interest rate is positive, which gives the MM curve

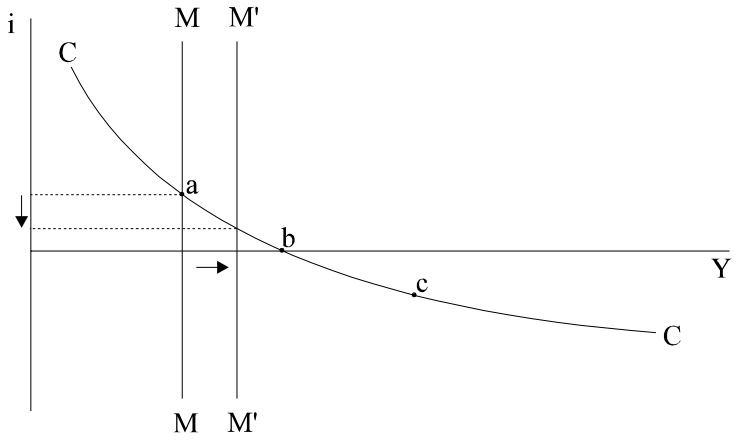
$$Y = \frac{M}{P_0}. \tag{5.11}$$

[30] Summers (1991) introduces a liquidity trap, in which equilibrium real interest rates are low but positive. In his scenario, the liquidity trap may prevent the use of countercyclical policy if the policy would require a real interest rate below its equilibrium level. Krugman's liquidity trap is more serious in the sense that the equilibrium real interest rate is negative.

[31] The equity premium is the extra return investors demand for holding equities instead of bonds, which have more predictable returns.

In figure 4, output is on the x-axis instead of prices. The analysis is similar to that of the previous model of flexible prices, and the economy is in a Hicksian liquidity trap from point b rightward. If the nominal interest rate is at zero, open market operations cannot be used to return the economy to full employment.

Figure 4. **Krugman's liquidity trap in a sticky-price economy**



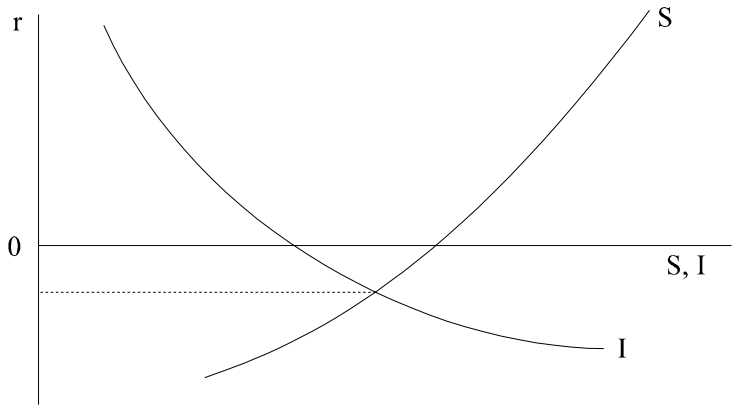
Source: Krugman (1998a, 149).

In figure 3 of the previous section, the denominator of inflation expectations is now fixed but the analysis is not fundamentally different. Expectations of the future price level still play a crucial role in determining the nominal interest rate, and expected money supply affects these expectations. In contrast to Keynes' liquidity trap caused by expected bond yields, Krugman's trap depends thus on the expectations of future overall price level.

According to Krugman, the described liquidity trap could occur under two conditions. First, if the private sector expects deflation, people consume sluggishly, as even a zero nominal interest rate is a high real rate. Second, if the current capacity Y_{POT} is high compared with $\overline{Y}$ or if the expected future real income of the private sector is low relative to the consumption needed to use the current capacity, consumption is again sluggish and the rate of savings high. If people thus have low expectations of their future incomes, they may want to save more than the economy can absorb. Increasing aggregate demand might require a negative real interest rate, which may be infeasible with downwardly inflexible prices. The condition is discussed closer below.

Krugman (1998b) supplements the view expressed above by stating that in a liquidity trap, savings S have to exceed investment I even at a zero nominal interest rate. That is, $S(0,Y_{POT}) > I(0,Y_{POT})$. The problem lies in the negative full-employment real interest rate (figure 5). At a zero nominal interest rate, equation (5.5) states that higher inflation expectations (ie an increase in $\overline{P}$ relative to P) are necessary to decrease the real interest rate. The Bank of Japan's reputation in fighting inflation is however strong and expectations of future inflation therefore low. Since the target overnight interest rate is already near zero, the BOJ seems incapable of reducing the real interest rate further.

Figure 5. **The equilibrium real interest rate**



Source: Krugman (1998b).

In Japan, the structural saving rate has historically been high but has been partially offset by a high level of investment. For example Meltzer (2001) claims that the saving rate is high compared to domestic investment opportunities and that Japan therefore exports capital and has a trade surplus. According to Krugman, increasing uncertainty and decreasing growth expectations reduced investment willingness during the 1990s, which induced a large imbalance between savings and investment even at near zero nominal interest rates. This is consistent with the demand related issues discussed in section 3.1. The imbalance could actually be treated as a theory of its own: the caution of the private sector can be blamed for the prolonged slump since the sluggish demand of the sector cannot be fully offset by external demand and expansionary fiscal policy. Boltho and Corbett (2000) find some evidence that supports the hypothesis. First, they note that Japanese long-term real interest rates have declined relative to those of the rest of the world. Second, as mentioned above most estimates agree that a significant output gap exists in Japan.

I want to emphasise again that Krugman's liquidity trap is fundamentally an expectational issue and a credibility problem in the sense that monetary expansion is ineffective only because the private sector does not believe that expansionary policy will be sustained in the future. If expansion was conceived as permanent, it would raise prices in a full-employment model or, with fixed current prices, output. The IS curve of equation (5.9) shows clearly that an increase in $\overline{P}$ moves the curve to right. In Krugman's model, the reason behind a persisting liquidity trap is thus the central bank's strong reputation in fighting inflation. To make monetary policy effective the bank should promise credibly to be irresponsible in the usual sense of central banking.

Krugman admits that the idea of a negative equilibrium real interest rate might seem strange in a true economy with productive investment opportunities. He suggests the equity premium as a partial answer. He notes that if the equity premium is for example as high as the US average[32] has been, the liquidity trap is possible even in the presence of a 5% return on physical capital. Furthermore, the return on an investment depends also on the expected change of its price. A

[32] Between 1926 and 1999, the US equity premium has been estimated to average about 6 percentage points. (Jagannathan et al 2001)

declining Tobin's q[33] could thus result in a negative real rate of return despite a positive marginal product on capital.

As to Japan, the country fulfils Krugman's requirements stated above. That is, industrial production is expected to fall in the short run and people may therefore have low expectations of their future income. The population is in addition projected to decline already during the current decade, which means that the labour force will decline in the long run. The human capital may thus decrease. According to Krugman, this implies that Japan's long-run economic growth could eventually slow down even at full employment. He concludes that only the bubble economy of the late 1980s prevented the investment from weakening already earlier. However, a declining labour force does not necessarily mean that economic growth has to slow down, as was discussed in section 3.1.

5.3 Financial intermediation

Financial intermediation plays a large role in modern economies and as to Japan, banking sector problems have been a subject of lively discussion.[34] Krugman (1998a) therefore introduces financial intermediation in his model by considering the cash in advance constraint in the context of a theory by Diamond and Dybvig.[35] He returns to the original one-good endowment economy but assumes now that a process of three phases takes place at the beginning of each period. First, individuals can trade cash for bonds or make bank deposits. Then each individual finds out whether he or she benefits from consumption in the current period. Finally, the individuals who want to consume can withdraw cash from their bank accounts to finance their consumption.

If the nominal interest rate is positive, each individual wants to keep as little cash as possible and thus no currency is kept at the beginning of a period. The cash that might be needed for consumption is deposited at banks, which try to invest as much as possible in interest-carrying bonds. Because withdrawals are predictable through the law of large numbers, the banks can invest the rest of the deposited amount further. The model replicates the results of the basic model and an increase in the monetary base will lead to an equal proportional increase in deposits and the price level and a reduction in the nominal interest rate under full employment.

If the nominal interest rate is zero, consumers are indifferent between currency, bank deposits and bonds, and banks are indifferent between keeping reserves and holding bonds. Determining the effects of an increase in monetary base is now more difficult since there are three equally likely possibilities. First, consumers could substitute cash for bonds, which would increase broad monetary aggregates if only by the amount of extra currency hold. Second, consumers could substitute cash for deposits, which would lead to a decline in bank deposits. This

[33] Tobin's q is the ratio of the market value of a company to the replacement cost of capital.
[34] See section 3.2.3 for a short discussion on the credit crunch hypothesis.
[35] In the two-period model of the theory, consumers are uncertain about their consumption needs: they find out whether they benefit from consumption in the current or the following period only after they have made deposits or committed directly to illiquid investments. The problem is solved by depository institutions, which are able to predict the total amount of early withdrawals during each period and can then invest the rest of the made deposits in illiquid bonds.

would result in a decrease of bank lending. And third, banks could hold the increase as excess reserves, which would reduce bank credit further. Also McKinnon and Ohno (2000, 3) note that near-zero interest rates would decrease the opportunity cost of holding reserves to such a low level that financial institutions would likely hold excess reserves. Krugman (1998a) concludes that the effects of an increase in the monetary base would probably realise through all three channels.

Under these conditions, the failure of expansionary monetary policy to increase broad monetary aggregates results from the inability of a central bank to affect the aggregates, not from lack of trying. Moreover, Krugman points out that in this sense banking sector health has nothing to do with the transmission mechanism itself and the result would be the same even if the sector was not experiencing any financial problems.

Posen (1998, 60) remarks that the lower rate of growth in M2 instead of M1 in the 1990s together with falling short- and long-term interest rates indicates that banks and investors were hoarding cash. The rising share of cash in the monetary aggregate of M2+CDs implies the same. Also Krugman (1998a) notes that the expansions of the monetary base by the Bank of Japan have not been very successful in raising the growth rate of the broader money aggregates. He states that between 1994 and 1997, the monetary base grew by 25% while the broader aggregate of M2+CDs grew by only 11%. At the same time, no growth could be observed in bank lending. According to Hutchison (2000), the following two-year period seemed to prove that money hoarding by the public continued. Bank lending actually collapsed since early 1998 and aggregate demand remained sluggish.

5.4 An open economy

Perhaps the most common criticism against the liquidity trap is that it cannot occur in an open economy. Avoiding the trap is claimed to be possible as long as profitable investment opportunities are available abroad. After all, the basic accounting identity of international economics states that $S(r,Y)–I(r,Y) = NX(e,Y,Y^F)$. Here NX is net exports, while the symbol e denotes the logarithm of the real exchange rate measured as domestic currency per foreign currency and the uppercase letter F marks foreign production. According to this chain of thought, investing abroad would lead to a current account surplus and only winning the acceptance of the trading partners would be problematic. (Krugman 1998b)

A more popular view is that liquidity trap is simply less likely in an open economy. For example Svensson (1999, 28) notes that in an open economy with a flexible exchange rate, the exchange rate channel of transmission mechanism may improve the possibility of avoiding the zero interest trap by enhancing monetary policy effectiveness and by making the zero bound on nominal interest rates less binding.

5.4.1 Krugman's model

Conventional IS-LM models define an open economy in which monetary expansion lowering interest rates produces real depreciation, which in turn increases net exports. The limit to growth derives from the normal level of the real exchange rate to which the rate is expected to revert. Models of large economies such as Japan have shown that if international trade forms a relatively small share of GDP, for example because of a significant sector of nontradable goods and services, and if the price elasticities of imports and exports are likewise comparatively low, even nearly perfect capital mobility provides only limited extra scope for monetary expansion. Since the integration of goods and especially services markets is still limited, domestic real interest rates in terms of domestic consumption need not equal international ones. (Krugman 1998a)

Since Krugman's goal is to present the theory of liquidity traps without relying heavily on the IS-LM model, he formulates a modified version of the basic model presented in the beginning of the section. The economy now produces and consumes two goods, one of which is tradable (T) and the other nontradable (N). Tradable good's share of consumption is τ, which means that the nontradable share amounts to $1-\tau$. Utility function is then of the form

$$U = \frac{1}{1-\rho}\sum_t D^t \left(C_{Tt}^{\tau} C_{Nt}^{1-\tau}\right)^{1-\rho}. \tag{5.12}$$

Krugman assumes that the economy receives exogenous endowments of both goods in each period. And since the economy can lend and borrow on the world market at the real interest rate r_T in terms of the tradable good, consumption of a period need not equal production.

Because of the inclusion of nontradable goods in the model, the domestic real interest rate may differ from the international rate. Krugman claims that this is the case "if inflation is measured in terms of either the nontraded good or a consumption basket that includes both traded and nontraded goods". Assuming full employment, consumption equals production in the nontraded goods sector, and the equilibrium real interest rate r_{Nt} is determined by production as in equation (5.6) in section 5.1. A negative nontradable real interest rate is possible just as in the basic model and if $1-\tau$ is sufficiently large, the domestic real interest rate affected by the domestic nontradable rate r_{Nt} as well as the world rate r_T may be negative even if the world rate is positive.

If the nominal price of the nontraded good is assumed downwardly rigid, the effects of temporary monetary expansion will vary between tradable and nontradable goods. First, the resultant lower nominal interest rate will cause deflationary pressure in the traded good sector. But since the future price is tied down by the assumption that the expansion is temporary, the current price must rise to allow a fall in the future. The effect in tradables is therefore a nominal depreciation of the exchange rate. Second, in nontradables the Fisher equation states that the lower nominal interest rate will mean a lower real interest rate, and as a result both consumption and production will increase.

Krugman emphasises that the zero constraint on the nominal interest rate can be binding for the exchange rate as well as for the nontradable production.

Achieving full employment may thus be impossible, as both output increase and nominal depreciation have finite magnitudes.

The problem of Krugman's model is that the significance of a composite real interest rate constructed is somewhat questionable. It seems likely that the private sector would in fact make its consumption decisions based on the world interest rate r_T, because it can always consume one tradable good less in the first period in order to consume $(1+r_T)$ tradable goods more in the next period. The nontradable interest rate does affect consumption, but perhaps not as much as in Krugman's analysis. Moreover, including investment opportunities in the model would further decrease the probability of a negative interest rate, as the prospect of scarce nontraded goods in the future would shift investment into the sector, which would increase its future output and raise thus the interest rate. (Dominguez 1998)

Another point mentioned by Krugman (1999) is that although it is easy to assume that excess savings will automatically be translated into a trade surplus, in practice something has to happen to cause the changes in exports and imports. Under the assumption of full employment, the adjustment must take place through relative prices, namely (for simplicity) through the real exchange rate.

According to Krugman (1998b and 1999), the real exchange rate can be determined via an anchor model, in which investors have a view of the long-run equilibrium real exchange rate e_L. The exchange rate can be thought to correspond to zero net exports at full employment, and it is therefore defined implicitly by $NX(e_L, Y_{POT}, Y^F) = 0$. In addition, investors assume that the real exchange rate has a tendency to revert to its long-run average. If expected returns on domestic and foreign bonds are equalised, the arbitrage equation takes the form

$$r - r^F = \frac{de^e}{dt} = \lambda(e_L - e), \tag{5.13}$$

where λ is the fraction by which the gap between e and e_L is eliminated each year. The uppercase letter F denotes again foreign variables. Given the expected change of the real interest rate, the arbitrage will equalise the expected depreciation of the currency with the real interest differential. The real exchange equation is

$$e = e_L - \frac{(r - r^F)}{\lambda}. \tag{5.14}$$

The real exchange rate depends therefore on the real interest rate. This means that also net exports depending on the real exchange rate are affected by the real interest rate for any given Y. If the economy is relatively closed like Japan, changes in the interest rate have a smaller effect on the current account than in a comparatively open economy. Krugman now claims that even a zero or below zero real interest rate will not allow the currency to depreciate without limit. If the current real exchange rate is significantly weaker than the long-run equilibrium rate, that is if $e >> e_L$, the currency is expected to appreciate in the future, which makes domestic bonds an attractive investment. The limit on exchange rate depreciation means likewise that there is a limit to net exports growth.

Despite the criticism against the theory of absolute purchasing power parity and the law of one price, the theory can be useful in the long run and across

baskets of goods. In Krugman's model, absolute purchasing power parity equations of two periods

$$P = EP^F \quad \text{and} \quad \overline{P} = \overline{EP}^F \tag{5.15}$$

can be combined with the equation (5.3) so that the nominal interest rate can be expressed as

$$1 + i = \frac{\overline{EP}^F}{(EP^F)D}\left(\frac{\overline{Y}}{Y}\right)^{\rho}, \tag{5.16}$$

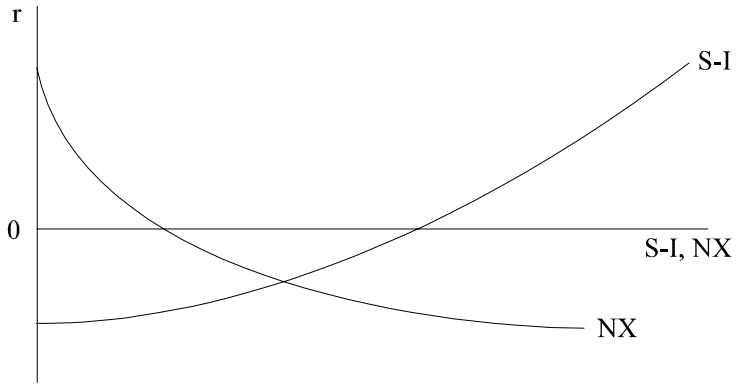
where

$$\frac{\overline{EP}^F}{EP^F} = \frac{\overline{P}}{P}. \tag{5.17}$$

It can thus be seen (ceteris paribus) that the larger the expected depreciation $\overline{E}/E$, the higher the inflation expectations $\overline{P}/P$ and the nominal interest rate. The relations are particularly important later in section 7, where different methods of escaping from the liquidity trap are discussed.

If the currency has a tendency to be too strong, and Krugman claims that the yen has, it is possible that the currency cannot depreciate enough to induce the needed current account surplus. All in all, expectations are once again crucial in the emergence of the liquidity trap: now expected future appreciation of the currency prevents the necessary export of capital. Krugman concludes that the liquidity trap can happen also in an open economy, though it is less likely than in a closed economy. The situation is illustrated in figure 6, which assumes that at a zero real interest rate domestic savings exceed investment and net exports are positive. However, net exports are not large enough.

Figure 6. **Krugman's liquidity trap in an open economy**



Source: Krugman (1999).

Krugman is not alone with his opinion of the yen's tendency of being too strong. In fact, McKinnon and Ohno (2000) base their theory of Japan's liquidity trap on this appreciation pressure. I will thus present their model here.

5.4.2 A special case

McKinnon and Ohno (2000) find that expected appreciation of a currency can make the probability of getting into a liquidity trap larger by inhibiting higher spending. The key difference between this and other liquidity trap models is the source of deflationary pressures: the pressure is now caused externally instead of internal aggregate supply and demand. The model could however be seen as a special case of Krugman's model. As to Japan, McKinnon and Ohno (2000, 5–7) claim that the constant US trade deficits and Japanese trade surpluses create appreciation pressure, which they call the mercantile pressure from the United States. And as can be seen from equations (5.16) and (5.17), such appreciation pressure increases the risk of hitting the zero bound. McKinnon and Ohno note further that the current account imbalance between the two countries reflects Japan's saving surplus as well as extremely low US savings. They admit that the pressure has eased after the yen peaked at 80 to the dollar in April 1995 but claim that appreciation expectations still inhibit domestic demand. After all, the United States might decide again that yen's weakness gives Japan a too large competitive advantage.

Japanese financial institutions have already invested heavily abroad, which has resulted in high exchange rate risk. As the current account surpluses continue, the proportion of foreign currency and especially dollar assets in the portfolios of Japanese financial institutions increases, which makes them even more vulnerable to exchange rate risk. The institutions have therefore become more cautious in investing abroad, because of which the Japanese current account surplus creates appreciation pressure. The Japanese government can try to absorb some of the risk by acquiring dollar reserves, but the strategy works only as long as the financial institutions believe that the government is committed to it. (McKinnon and Ohno 2000, 7–8)

McKinnon and Ohno (2000, 9–10) point out that since central banks cannot directly control long-term interest rates, they reflect expected exchange rate changes and inflation differentials. Based on open interest parity, the authors interpret the fact that Japanese long-term interest rates have been about 4 percentage points below their US counterparts since 1977 as an evidence of expectations of sustained yen appreciation against the dollar. McKinnon and Ohno claim that the expectations remain fairly stable in the long run despite short- and intermediate-term fluctuations. Thus when the US interest rates fell in the 1990s as inflationary expectations in the United States diminished, Japanese interest rates were forced down towards their lower bound. The authors conclude that the liquidity trap is an incidental outcome of US policies. If they are correct, escaping from the liquidity trap requires creating a credible expectation of future exchange rate stability. The problem is that the policy would require international co-operation especially between Japan and the United States, which is something that has proved difficult in the past.

Taylor (2001b) states that the appreciation pressure would cease to exist if the United States, the euro area and Japan adopted credibly similar inflation targets. If

the price measures in the different areas were approximately the same, the exchange rates would be expected to remain remarkably stable in the long run. In practise the strategy would mean that Japan would have to adopt explicit inflation targeting, which is one of the strategies discussed below. The method therefore corresponds to the solution suggested by Krugman, although the target rate would be more moderate here. The role of expectations is in any case again large. According to McKinnon and Ohno (2000, 18), monetary policy is rendered inefficient for two reasons to hold speculative cash balances. The first reason follows Keynes' original idea, that is an expected fall in domestic bond prices. The second reason explains why the liquidity trap is possible in an open economy. If domestic currency is expected to appreciate, buying bonds in foreign currency will become more profitable later. As mentioned, also Krugman states that expected appreciation of a currency makes domestic bonds an attractive investment.

In contrast to Krugman, McKinnon and Ohno (2000, 10–14) formulate a model of the liquidity trap in which Japan's real interest rate is greater than its nominal rate minus expected inflation. At the zero bound, real interest rate is thus higher than expected deflation. On the other hand, the real interest rate is greater than its US counterpart.

Meltzer (2001) claims nevertheless that the view of McKinnon and Ohno is incomplete since it applies to nominal but not to real exchange rate. In addition, he emphasises that the real exchange rate has not appreciated significantly during the 1990s. As to the real exchange rate, the results of Bayoumi (2001) indicate that an increase in it lowers output in the short run, though the effect is quite insignificant since Japan is a relatively closed economy. A 10% increase in the exchange rate results in a 0.2% decrease in output.

6 Short-term real interest rates in Japan

Real interest rates are important in savings-consumption and investment decisions and could thus play a large role in Japan just as Krugman claims. The ex ante real interest rate defined as $r_t = i_t - \pi_t^e$ is essential in this sense. As for example Mishkin (1988) points out, expected inflation π_t^e is not directly observable and has to be estimated in some manner in order to calculate r_t. He notes that one approach uses survey data on inflation expectations and states that the problem with the approach is that the calculated estimate of the ex ante real interest rate is only as good as the survey measure of inflation expectations.[36] In another approach, futures market data is used to construct own-commodity real interest rates, which can then help in determining the real interest rate for the aggregate economy.[37] In contrast to the ex ante real interest rate, the ex post real interest rate

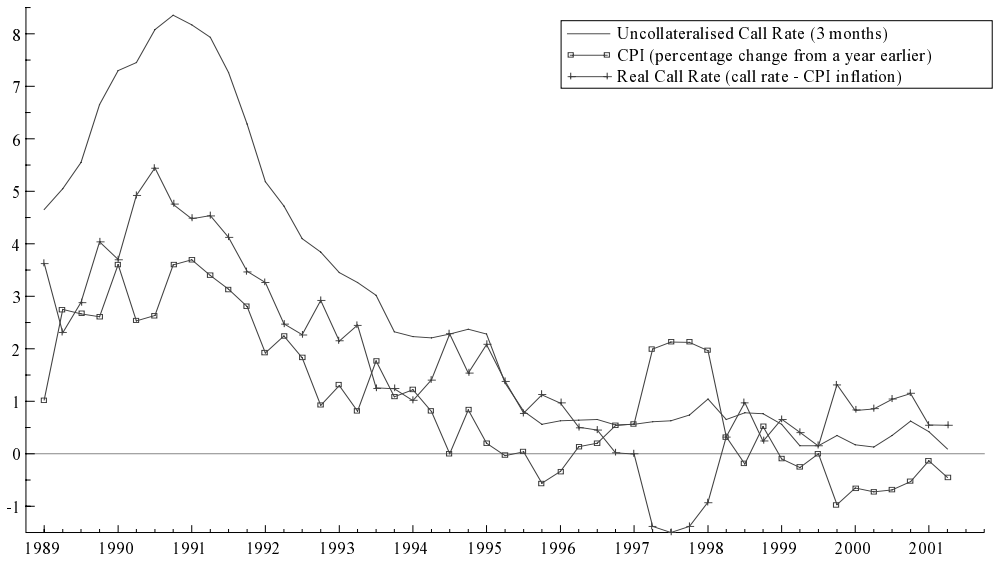
[36] Mishkin (1988) finds that survey respondents may have incentives not to reveal their true expectations and that market expectations are unlikely to be well measured by the average expectations of survey respondents.

[37] The approach suffers from the fact that futures market data contains information on ex ante relative price movements for the particular commodity besides the ex ante interest rate. Mishkin (1988) states that these price movements (noise) are remarkably larger than the changes in the aggregate real interest rate (signal) and concludes that the noise-to-signal ratio of the approach is very high.

defined as (ep) $r_t = i_t - \pi_t$ is observable since the actual inflation rate from time t to t + 1 enters now the relation instead of expectations.

In Japan, the ex post real short-term interest rate calculated as the difference between the uncollateralised 3 month call rate and CPI (consumer price index) inflation peaked at nearly 5.5% in 1990 (figure 7). As monetary policy turned expansionary, it began to fall reaching the lower bound of the neutral rate zone, that is 2%, in 1992. In 1993, the interest rate fell further before a short recovery in 1994. The rate fell to 0.5% in early 1995, as monetary policy was eased in response to the rapid appreciation of the yen (figure A.4). The rate continued to fall bottoming at –1.5% in mid-1997 due to temporarily climbing CPI inflation.[38] The real interest rate started to rise again as deflationary pressures on prices intensified and it remained at approximately 1% between end-1999 and 2001. In the two first quarters of 2001, the real interest rate decreased to about 0.5%. In accordance with Krugman's solution to Japan's economic problems, the interest rate movements show the importance of price development.

Figure 7. **The ex post short-term real interest rate (% per annum) in Japan**



Sources: Bank of Japan and OECD (2001b).

Price development plays therefore an important role in determining the real interest rate. According to Bank of Japan (2000a and 2000b), the low inflation during the 1990s reflected weak demand and the economic slowdown, and the output gap and fluctuations in the exchange rate and crude oil prices were the main determinants of price movements. Also technological innovation, deregulation, intensified global competition and streamlining of distribution channels affected the price level. Particularly, prices earlier protected from international competition converged closer to the international levels because of deregulation. The sustained deflationary pressures have contributed to the level of

[38] Also the long-term ex post real interest fell below zero in 1997 (IMF 2001, 13).

inflation expectations so that the Japanese real interest rate can be clearly positive even at near zero nominal interest rates.

As to Krugman's theory of the liquidity trap, negativity of the equilibrium real interest rate is in key position. After all, Krugman claims that Japan is in a liquidity trap because the real interest rate cannot decrease enough to close the savings-investment gap since nominal interest rates are already at their lower bound and the Bank of Japan has too strong reputation in fighting inflation. It is thus reasonable to test the validity of the hypothesis by examining Japanese real interest rates. For example Wilson (2000) takes this approach. He estimates[39] Japan's equilibrium real interest rate to be slightly positive at around 0.4% even in the presence of quite extreme assumptions.

My approach differs from that of Wilson. First, I calculate the current ex ante real interest rate under the assumption that the Fisher equation holds. To estimate inflation expectations, I use CPI. Second, I estimate Japan's current equilibrium real interest rate based on Krugman's model through the Euler equation. For the consumption forecast needed here, I use a time series of real final consumption expenditure. Third, I estimate the quarterly equilibrium real interest rates for years 1997–2001. The data used in the estimation procedures originates from the Bank of Japan, OECD (2001b), and Economic and Social Research Institute. The estimation period is 1980Q1–2001Q2, and the results are reported in detail in appendix B.

To forecast CPI and consumption for the third quarter of 2001, I use STAMP (Structural Time Series Analyser, Modeller and Predictor) software. Maximum likelihood estimation is carried out without explanatory variables and the forecasts are therefore based solely on the past values of the variable in question. STAMP employs Kalman filter, which is primarily a set of vector and matrix recursions, in the process. The importance of Kalman filter in time series models is based on (1) computation of one-step ahead predictions of observation and state vectors, and corresponding mean square errors, (2) diagnostic checking by means of one-step ahead prediction errors, (3) computation of the likelihood function via the one-step ahead prediction error decomposition, and (4) smoothing that uses the output of the Kalman filter (Koopman et al 1999, 150–151).

The Japanese economy has experienced significant structural changes in the 1980s and 1990s, which means that unit root tests for stationarity are not reliable. The stationarity is thus discussed through graphical analysis. Koopman et al (1999, 46) emphasise however that stationarity plays a significantly smaller role in structural time series modelling used here than in the ARIMA methodology of Box and Jenkins. In structural time series models, the trend is modelled together with the stationary part and differencing is not necessary.

I begin with CPI. Figure B.1 (Appendix B) indicates that the time series is nonstationary both in level and in first and second differences. As mentioned, the notion is not as significant here as it would be in the ARIMA methodology. Furthermore, the Box-Ljung Q-statistic indicates residual serial correlation in a model composed without a seasonal component, because of which I include seasonality in the analysis. Logarithmic CPI is now assumed to follow a stochastic trend model

[39] Wilson's estimate is based on the assumption that Japan's equilibrium real interest rate is increasing in the rate of population growth and the rate of technical change.

$$
\begin{aligned}
y_t &= \mu_t + \nu_t + \varepsilon_t && \varepsilon_t \sim \mathrm{NID}(0, \sigma_\varepsilon^2) \\
\mu_t &= \mu_{t-1} + \beta_{t-1} + \eta_t \quad \text{where} && \eta_t \sim \mathrm{NID}(0, \sigma_\eta^2). \\
\beta_t &= \beta_{t-1} + \varsigma_t && \varsigma_t \sim \mathrm{NID}(0, \sigma_\varsigma^2)
\end{aligned} \tag{6.1}
$$

Here μ_t is the trend, ν_t the seasonal and ε_t the irregular component. The seasonal component is defined in a trigonometric form so that

$$
\nu_t = \sum_{j=1}^{2} \nu_{j,t}, \tag{6.2}
$$

where each $\nu_{j,t}$ is generated by

$$
\begin{bmatrix} \nu_{j,t} \\ \nu^*_{j,t} \end{bmatrix} = \begin{bmatrix} \cos\lambda_j & \sin\lambda_j \\ -\sin\lambda_j & \cos\lambda_j \end{bmatrix} \begin{bmatrix} \nu_{j,t-1} \\ \nu^*_{j,t-1} \end{bmatrix} + \begin{bmatrix} \omega_{j,t} \\ \omega^*_{j,t} \end{bmatrix}, \qquad \begin{matrix} j = 1,2 \\ t = 1,\ldots,T \end{matrix}. \tag{6.3}
$$

$\lambda j = \pi j/2$ is the frequency in radians and the seasonal disturbances ω are two mutually uncorrelated NID disturbances with zero mean and common variance σ_ω^2.

The results are presented in table B.1. Promisingly, STAMP reports very strong convergence[40] and the Q-statistic implies no autocorrelation. Moreover, the model seems to be the most suitable in the sense that residual autocorrelation could not be removed from models constructed for forecasting the yearly inflation rate directly. The expected annual CPI inflation for 2001Q3 is then –0.59%, which indicates that the current short-term ex ante real interest rate is 0.65%. The value is low but nevertheless positive. It is also close to the ex post real interest rates calculated for the two first quarters of 2001.

As to the equilibrium real interest rate defined in Krugman's model, consumption is the appropriate variable for estimating the equilibrium real interest rate in an open economy. Since Krugman's intertemporal open economy utility function

$$
U = \frac{1}{1-\rho} \sum_t D^t \left(C_{Tt}^{\tau} C_{Nt}^{1-\tau} \right)^{1-\rho} \tag{5.12}
$$

is time separable, consumption allocation during the periods can be separated from dividing the total expenditure E between the periods. The optimisation can therefore be performed in two phases. The first optimisation problem can be written as:

$$
\max \quad C_{Tt}^{\tau} C_{Nt}^{1-\tau} \tag{6.4}
$$

$$
\text{s.t.} \quad P_{Tt} C_{Tt} + P_{Nt} C_{Nt} = E_t, \tag{6.5}
$$

where E_t is the total expenditure of a period.

[40] See Koopman et al (1999, 161–165) for the definitions of the convergence criteria.

Solving the maximisation problem through Lagrangian function and substituting the values for C_{Tt} and C_{Nt} in (6.4) yields (see appendix B, box B.1)

$$C_{Tt}^{\tau} C_{Nt}^{1-\tau} = \frac{\tau^{\tau}(1-\tau)^{1-\tau} E_t}{P_{Tt}^{\tau} P_{Nt}^{1-\tau}}. \tag{6.6}$$

Since $C_{Tt}^{\tau} C_{Nt}^{1-\tau} \equiv C_t$ and $P_{Tt}^{\tau} P_{Nt}^{1-\tau} \equiv P_t$, it can be inferred that using consumption expenditure to estimate the equilibrium real interest rate (as is done below) is consistent with the open economy model. To calculate the real interest rate in equilibrium, I now choose a logarithmic utility function of the form

$$U = \sum_t D^t \ln(C_t) \tag{6.7}$$

in order to avoid the need to estimate parameters. The equilibrium real interest rate defined through the Euler equation as in section 5 can then be expressed as

$$1 + r = D^{-1}\left(C_{t+1} / C_t\right). \tag{6.8}$$

The equilibrium real interest rate is therefore negative when

$$(1+\delta)\left(C_{t+1} / C_t\right) < 1, \tag{6.9}$$

where δ is the subjective discount rate. At $D = 0.997$, $\delta \approx 0.003 = 0.3\%$.

Although private consumption was found the proper variable to be used in the estimation, I use also GDP to see whether it produces the same results.[41] The series with their first differences are graphed in figures B.2 and B.3, which imply that the levels are nonstationary and the first differences stationary. To see how sensitive the forecasts are, I perform the analysis both in level values and in first differences if possible.

Forecasting logarithmic private consumption proves to be somewhat more difficult than forecasting CPI, since Box-Ljung and normality statistics imply that the models based on the whole estimation period as such are not valid.[42] STAMP reports that the problematic quarters are 1997Q1 and 1997Q2. The explanation is readily available: as mentioned in section 2.2.3, the government started fiscal consolidation in spring 1997. The effects of fiscal contraction can be observed also from figure B.2: consumption growth was particularly strong in 1996Q4 and weak in 1997Q1, as the expectations of the policy change affected the economy besides the change itself. The exceptional nature of the observations can be taken into account by capturing the unusual values by impulse intervention variables, which are then used as explanatory variables in the model.

However, if both quarters are specified with impulse intervention variables, eliminating autocorrelation between the residuals becomes difficult. On the other

[41] In Krugman's closed economy models, consumption equals production in equilibrium. As has been mentioned, Japan is a somewhat closed economy in international comparison. Furthermore, the growth rates of private consumption and GDP are equal in the long run.

[42] Private consumption model formulation in differences is not performed since a valid model was not found.

hand, the forecast for the period 2001 Q3 seems to be quite insensitive to model specification,[43] because of which the models of table B.2 are useful despite the high values on normality. The results indicate that a negative equilibrium real interest rate is possible at a positive subjective discount rate δ. In this case, δ could be 0.037% at maximum. The value is low but is not entirely impossible with the current low interest rates.

As to logarithmic GDP, STAMP reports 1997Q1 as an exceptional observation. If an impulse intervention variable is used to specify the quarter, the model seems satisfactory (table B.3). The model without the seasonal component (6.2) is slightly better, but the choice of the model between the two options presented in the table does not affect the outcome. The forecasts imply that δ would have to be negative so that the equilibrium real interest rate could be negative. If this were true, people would value their future consumption more than current consumption. This indicates a positive equilibrium real interest rate for 2001Q3. For comparison, the output of the model for differentiated GDP is presented in table B.4. The value of 1997Q2 is now exceptional because of the differentiation. The model is somewhat simpler than the previous ones since the seasonal factor as well as the stochastic slope are found unnecessary. The result implies again that if the equilibrium real interest rate were negative, also δ would have to be negative.

When the private consumption model is used to predict past values of output (table B.5), the results imply that a negative δ was not required in 1998Q3 or in 1999Q2–1999Q3.[44] The maximum value for δ was then nearly 1%, which is a quite high figure in comparison to 0.3% presented in the context of equation (6.9). Moreover, the zero interest rate policy was effective at that time. On the other hand, historical forecasts for GDP imply a negative equilibrium real interest rate for 1998Q4–1999Q2. The maximum value for δ was over 0.2% (without the seasonal component) or 0.5% (with the seasonal component). It is interesting to note that both private consumption and GDP forecasts indicate that a negative equilibrium real interest rate might have been possible in 1999Q2. The observed ex post real interest rate for the same quarter is 0.4%, which implies that Krugman's theory might be correct.

The private consumption model would have performed quite well historically (figure B.4) despite the questionable normality statistics for 2001: all observations fall inside the prediction intervals set at two root means square errors. Post-sample predictive tests indicate likewise that there are not significant prediction errors. However, the increased volatility of GDP growth in the 1990s has made forecasting GDP more difficult. Figure B.5 reveals the problematic nature of making GDP forecasts by showing that the model with the seasonal component would not have performed that well in 1999: two observations of four fall outside the prediction intervals. Although the prediction errors are not consistent with the model, it would have been more reliable in 2000 and 2001. The performance of the model seems thus to improve in time, which might indicate a diminishing impact of the problematic observations in 1996 and 1997. The forecasts for 2001Q3 could therefore be reliable.

All in all, the results imply that a negative equilibrium real interest rate is somewhat unlikely at least for the third quarter of 2001. This does not rule out the

[43] Also the other models constructed result in the same forecast for 2001Q3.
[44] I ignore the results for 1997Q1 because of the exceptional nature of the observations.

possibility of Krugman's liquidity trap in Japan. According to the results, the equilibrium real interest rate could have been negative at least during some quarters under the zero interest rate policy in 1999. And although the model is a simplification and does not prove indisputably that Japan has fallen into a liquidity trap, the discussion of the next section applies to all situations in which zero nominal interest rates restrict conducting monetary policy. As to Japan, the zero interest rate trap is a reality.

7 Avoiding the liquidity trap and escaping from it

The liquidity trap was not considered a real threat during the postwar inflationary decades, as inflation rates roamed clearly above zero. However, the economic development in Japan has stimulated lively discussion on two intertwined topics, namely the probability of hitting the zero bound and the ways of escaping from a liquidity trap. I follow both approaches in this section. Moreover, the solutions presented here are also options proposed to the Bank of Japan as different means of improving the Japanese economy. The discussion is thus relevant regardless of whether Japan is in a liquidity trap. In general, the discussion applies to situations where the zero bound on the nominal interest rate has rendered the interest rate channel inefficient. Different definitions of the liquidity trap are not in the key position.

7.1 Avoiding the liquidity trap

Since near zero nominal interest rates limit the use of expansionary monetary policy through the interest rate channel, it is important to keep the nominal interest rates high enough to retain the scope to lower them if necessary. And since nominal interest rates tend to correlate positively with expected inflation, preventing inflation from falling to a dangerously low level is likewise important in fighting the liquidity trap. Deflation and deflation expectations play a crucial role also in Krugman's model.

Announcing an explicit positive inflation target is altogether a widely agreed method of avoiding the liquidity trap. According to Svensson (1999, 9), setting a positive target can be justified for example by measurement bias, nonnegative nominal interest rates and possibly downwardly rigid nominal prices and wages. As to Japan, IMF (2001, 35) finds that inflation targets below 2% increase notably the likelihood of hitting the zero bound on nominal interest rates and that in comparison to other industrial countries, aggregate demand shocks can drive the nominal interest rates to their lower bound more easily. On the other hand, although wages are generally considered particularly problematic because of their downward rigidity, use of different bonus payments has traditionally made Japanese wages relatively flexible. Besides these Japan specific factors, studies of more general nature indicate that an inflation target below 1% might increase the

risk of reducing average output or increasing average unemployment.[45] However, there are other considerations that have to be taken into account. Namely, although a high inflation target reduces the risk of falling into a liquidity trap, the rate would have to be dangerously high to completely eliminate the risk. For example Goodfriend (2000) reminds of the significant costs of inflation and concludes then that higher inflation is not a satisfactory solution. His solutions to the liquidity trap problem are discussed below.

Svensson (1999, 9) notes that all countries that have chosen to target inflation have selected slightly positive targets.[46] The targets vary from 1.5% yearly rate used in New Zealand to 2.5% of the United Kingdom and Australia. The target rate could thus be set at about 2% per year. Moreover, the results of IMF (2001, 35) indicate that the optimal value for an inflation target in Japan might be 2.5%. Whatever the target in the range mentioned, Svensson (1999, 9) emphasises that announcing a target is more important than its exact value. Furthermore, he underlines the importance of a symmetric inflation target[47] since such a target is not likely to cause upward or downward bias in inflation expectations. It is equally important that the private sector perceives the inflation target as symmetric, which requires that the central bank act to downward risks as well as to upward risks.

Another way also mentioned by Svensson (1999, 32) is an upward-sloping price level target path, which might in fact have some benefits over inflation targeting. If the target is credible, a deflationary shock that would lead to a below target price level would immediately result in rising inflation expectations. By Fisher equation, these higher inflation expectations would then reduce the short-term real interest rate even at a constant nominal interest rate. Under credible inflation targeting, expectations would instead remain at the target level without affecting the real interest rate.

IMF (2001, 35) finds that the negative effects of the zero bound become more serious if the estimates of the monetary authorities are persistently biased as to potential growth. Also Svensson (1999, 30–32) emphasises that inflation targeting comprises monitoring the economic environment for upside and downside risks of future inflation, private inflation expectations and different economic shocks. Likewise, it includes reacting in time when necessary. Furthermore, Svensson believes that prudent central banks should, despite an adopted inflation target, prepare for the worst. He therefore recommends preparing an emergency programme to be followed under liquidity trap conditions and only then. The suggested measures comprise engaging in unorthodox open market operations for example in long-term government bonds and, if necessary, in corporate bonds, property and stock. Another way would be opening a lending window in order to lend directly to the private sector. Many of these measures are discussed below. In addition, fiscal and monetary expansion should be conducted co-ordinately so that fiscal expansion could be financed by a corresponding monetary expansion. Both central banks and fiscal authorities should actively participate in the process.

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[45] See for example Orphanides and Wieland (1998). On the other hand, Wolman (1998) finds that welfare could be larger in a deflationary regime in which nominal interest rates occasionally hit the zero bound than in a regime of moderate inflation and always positive nominal interest rates. Wolman's model incorporates money demand and in the presence of an inflation tax, deflation is preferable to inflation.

[46] Inflation targets comprise here point targets and midpoints of a target range.

[47] A symmetric inflation target means that only the size of the deviation from the target is important, not the direction of the deviation.

As to the effects of different monetary policy rules, McCallum (2001, 16–32) runs simulations to test under which rule the zero bound is hit most often. The model he uses is a dynamic open economy framework that incorporates rational expectations, optimising agents and slowly adjusting prices. The results indicate that as to the lower bound problem, inflation targeting[48] performs quite similarly with other growth rate targets of exchange rate and export demand. In comparison to a price level target, inflation targeting reduces the risk of hitting the lower bound. Exchange rate level targeting is the most vulnerable policy option because of exchange rate volatility while nominal income targeting performs quite well without actually dominating inflation targeting.

I will now move on to consider the options while already at the zero bound. Once in a liquidity trap, there are two means of escape. The first one is the traditionally recommended fiscal policy, which is discussed first. And since it was found out above that fiscal policy might become ineffective under certain circumstances, also monetary policy is considered. Here I want to remind that in a liquidity trap, co-ordination between fiscal and monetary policy is especially important. On the other hand, an alternative option is waiting for an autonomous recovery. This might prove to be a long and costly process, especially if the economy operates clearly below its potential.

7.2 The role of fiscal policy in escaping from the liquidity trap

The traditional solution to a liquidity trap is expansionary fiscal policy, which would most likely take the form of increased public expenditure, tax cuts or money transfers. The first option would affect sluggish aggregate demand directly and the others could be used to inject liquidity in a depressed economy, which would then, at least in principle, increase aggregate demand indirectly. In Hicksian liquidity trap, expansionary fiscal policy was already found even more effective than under normal circumstances. As to Krugman's theory, the situation is just the opposite because of Ricardian equivalence.

Various aspects should be taken into account when conducting expansionary fiscal policy. Svensson (1999, 31–32) notes that public expenditure should be directed to minimise possible compensating adjustments of the private sector, meaning that investing in for example infrastructure would be recommendable. However, if public capital were already overbuilt, this could result in wasteful activity (Goodfriend 2001, 21). For example the Japanese government has been blamed for choosing unproductive investment projects. As for tax cuts and money transfers, it is questionable whether these would in reality be used to increase consumption if the economy faces deflationary pressures. In addition, expansionary fiscal policy can at its worst distort competition (Goodfriend 2001, 22).

Expansionary fiscal policy can be ineffective or undesirable. First, Krugman's intertemporal model implies Ricardian equivalence, under which expansionary fiscal policy is ineffective. That is, if consumers believe that the current

[48] McCallum (2001, 2–3) defines inflation targeting as conducting monetary policy according to "a rule that specifies adjustments of an instrument variable in response to deviations of inflation, or expected future inflation, from a policy-specified target value".

expansionary policy will have to be reversed later, they do not increase their consumption. In fact, it has sometimes been claimed that Japan is closer to Ricardian equivalence than many other countries. Especially, some results indicate that when the public debt exceeds a certain level, Ricardian equivalence becomes more binding. In Japan, this critical level may have been exceeded although Posen (1998, 69) claims that Japanese savers have been acting primarily on precautionary instead of Ricardian motives. On the other hand, Goodfriend (2001, 21) claims that in reality, public purchases of goods and services create employment even at a low multiplier. One reason is that they ease the situation of temporarily credit-constrained individuals and companies, which can then increase their consumption.

In a flexible price model in which a binding cash in advance constraint restricts government consumption,[49] combined private and public consumption is constrained by

$$P(C + G) \leq M, \tag{7.1}$$

where G is government consumption. Equation (5.7) can now be rewritten as

$$\frac{\overline{P}}{P} = \frac{\overline{M}(C + G)}{M(\overline{C} + \overline{G})}. \tag{7.2}$$

Equation (7.2) implies that if the government increases public consumption in the current period, expected inflation rises unless Ricardian equivalence decreases private consumption at the same time. The total effect on inflation expectations and the real interest rate depends then on the relative sizes of the changes, which depend on the degree of Ricardian equivalence and on the multiplier on public consumption. In figure 3, increased government consumption results in a larger slope of equation (5.3), which is now of the form

$$1 + i = \frac{\left[(\overline{Y} - \overline{G})/(Y - G)\right]^{\rho}\overline{P}}{DP}. \tag{7.3}$$

Under sticky prices, output is demand-determined and a rise in G raises Y by the same amount. The outcome depends again on how the private sector sees government consumption. Under Ricardian equivalence, a decrease in C offsets the increase in G and inflation expectations remain therefore unchanged.

Second, continuous deficit-financed government expenditure leads to excessive government debt, which may eventually impair the government's creditworthiness even to the extent that it cannot borrow anymore. According to Krugman (1999), such debt burden does not cause problems as long as interest rates are close to zero. As to Japan, the yields on 10-year government bonds have remained at a modest level between 1 and 2% since 1997 (figure A.5). However, if the liquidity trap is not a permanent state of the economy, interest rates will eventually rise. At that point, the debt becomes a problem. McKinnon and Ohno (2000, 2) point further that Japan's ageing population and under-funded social

[49] As Krugman assumes. It would be possible to formulate a situation in which the cash in advance constraint would be less binding on the public than on the private sector.

security system, sizeable contingent government liabilities from the non-performing loan problem of the banking sector and the bad loan portfolio of the government itself all make further fiscal expansion at the expense of an ever-increasing public debt simply too risky. The risks are not eliminated even if virtually all of the public debt is held internally within Japan as because of high private sector saving. Furthermore, as discussed above even Posen (2001a) admits that the illiquidity of the government debt is a problem since it makes Japanese long-term interest rates sensitive to negative news.

Based on the previous, it is obvious that the government cannot use expansionary fiscal policy forever. The crucial question is then whether temporary fiscal policy can have permanent effects. Krugman (1998b and 1999) states that a possible answer is given by the theory of multiple equilibriums, according to which the rate of spending growth varies relative to the income level so that the relationship resembles the S-curve. The shape follows from two factors: at high levels resource constraints become binding while at low levels gross investment approaches its zero constraint. The theory is important since in the presence of multiple equilibriums, a temporary fiscal stimulus can jolt the economy from a lower to a higher equilibrium.[50] Fiscal policy can also serve as a bridge, if the trap seems to be a short-lived problem. This can be the case if the slump results from external factors that could be expected to improve. However, producing growth is not enough. Fiscal stimulus must lead to a self-sustaining process of recovery.

Another important issue is the necessary scope of expansionary fiscal policy, which was discussed shortly in section 3.2.4. All in all, finding the right scope is not easy, as forecasting economic development is difficult. Moreover, lags in policy implementation and transmission make monitoring the policy effects more difficult. But fiscal policy is not the only option even in a liquidity trap. I will now move on to consider monetary policy, to which also Krugman resorts after finding fiscal policy ineffective.

7.3 The role of monetary policy in escaping from the liquidity trap

The traditional view has of course been that monetary policy is ineffective in a liquidity trap. However, other channels exist besides the interest rate channel through short-term interest rates and there are thus various options for conducting monetary policy, some of which might work at least according to Krugman (1999). In addition to his favourite of creating inflationary expectations, he mentions explicitly the policies of quantitative easing and unconventional open market operations. Also Svensson (2001a) believes in monetary policy. His solution combines various methods presented here and is therefore the last monetary policy solution discussed.

[50] Existence of multiple equilibriums could explain how the Great Depression finally ended. According to the explanation, the Second World War resulted in massive fiscal expansion, which then pushed the economy into a more favourable equilibrium. The view has been questioned and for example Krugman concludes that the recovery resulted from a negative real interest rate that was caused by inflation expectations.

Another advocate for the use of monetary policy is Meltzer (1999 & 2001). He claims that the most of the liquidity trap models presented so far[51] have been too simple to capture the adjustment process in relative asset prices and that even if the models seem to prove that monetary policy becomes ineffective, the results are false. Among the assumptions Meltzer criticises most strongly is the assumption of only two assets. However, for example McCallum (2000, 20) points out that it is still uncertain whether monetary policy can truly affect relative asset prices.

Kono (1999) reminds that even if the traditional interest rate channel is blocked, monetary policy can still support fiscal policy. After all, expansionary fiscal policy results in an increasing amount of government bonds on the market. By providing liquidity, a central bank can lower the resultant upward pressure on long-term interest rates as well as the appreciation pressure of the exchange rate. Monetary policy can thus lessen the effects of crowding out and Mundell-Flemming effect and lessen therefore the adverse effects on both private and external demand.

It is also useful to note that even if the current short-term interest rates were at their lower bound, future short-term rates may differ from zero. Oda and Okina (2001) discuss possible strategies in such a situation. They note that decreasing uncertainty about future policy may lower future interest rates. For example, announcing a more detailed policy or committing to certain levels of announced target variables could work. It could even be possible to commit directly to a fixed level of future short-term interest rates. However, unexpected shocks are always possible and the policy has thus limits.

7.3.1 Inducing inflation expectations

If the zero bound on nominal interest rates is hit, Krugman (1998a, 1998b and 1999) speaks for creating inflation expectations. The recommendation is based on the same principles as Fisher's proposal during the Great Depression was.[52] If the price level is falling, inflation expectations are negative and the nominal interest rate is lower than the real interest rate. When the nominal interest rate is already at zero, the only way to lower the real interest rate is to induce expectations of higher inflation. Also Wolman (1998) claims that zero nominal interest rates do not prevent real interest rates from falling, as the central bank can decrease them by inducing inflation expectations. The results of IMF (2001, 35) indicate likewise that a credible commitment of the central bank to increase future inflation can stimulate aggregate demand through lower expected real interest rates.

To repeat, equation (5.7) depicts the nature of Krugman's liquidity trap: if the central bank increases money supply in the first period and the private sector believes that the monetary expansion will not be sustained in the next period, inflation expectations decrease. At the zero bound, Fisher relation (5.5) states that this is the opposite of the price development necessary to increase aggregate demand. Expansionary policy conceived as permanent would however raise prices

[51] See for example McCallum (2000, 2–8). The model implies that even if negative nominal interest rates are possible because of nonnegative storage costs of money, it is difficult to imagine circumstances under which the interest rate could be negative by more than a few basis points.
[52] For example Keynes questioned the Fisher equation, see section 4.1.

or, with fixed current prices, output. Krugman therefore concludes that the Bank of Japan should commit credibly to inflation. He reasons that by increasing the current money stock and by promising that the expansionary policy will be continued even if the economy started to revive, the BOJ could raise the expected future price level. However, convincing the public that the Bank is committed to the policy would be difficult. Krugman (1999) suggests a strategy of showing that the Bank has realised that times are unusual and that unconventional policy measures are therefore necessary. This could be accomplished by resorting to unusual policy. Despite the suggestion, Krugman has been accused of not specifying exactly how a central bank could create inflation.

In any case, the role of expectations is crucial. As Clouse et al (2000, 28) state: "Forward-looking expectations by the public have the effect of bringing into the present the expected power of future monetary policy". Also Svensson (1999, 2001a and 2001b) and Posen (1998) agree on the importance of expectations in creating a persistent liquidity trap.

Krugman (1998a) argues that inflation does not produce negative incentives or misallocations in a liquidity trap. However, Goodfriend (2000) emphasises that steering an inflationary economy could become difficult. In addition, he reminds that resorting to inflationary policy whenever the zero bound is starting to bind might increase the volatility of inflation expectations. Inflation scares might therefore become a problem especially because the central bank would have difficulties in deciding when and how much inflation is needed. On the other hand, Wolman (1998) claims that temporary inflation will not induce inflation scares as long as the private sector knows that it is only temporary. Posen (1998, 9) reminds nevertheless that inducing deflationary expectations might easily result in larger than intended effects.

Svensson (1999, 32) emphasises that anchoring the inflation expectations to a target would be beneficial even if any positive expectations were helpful in the short run, since a credible target would reduce the risks of a too high and unstable inflation rate. The necessary scope of such policy is uncertain, but the deeper the downturn, the more expansionary actions are needed. Not surprisingly, the suggested target rates for Japan vary. For example, Krugman (1998a) suggests a 4% inflation rate for 15 years, while Posen (1998, 124) suggests that the initial target rate of 3% could be reduced to 2% within a few years.[53] According to Svensson (2001a), Bernanke suggests an inflation target of 3–4% for a number of years. Fujiki et al (2001) underline that any measures to raise inflation are accepted and that the other options presented in this work can be used to support the policy.

Krugman (1999) emphasises that creating inflationary expectations is a theoretically sound method of fighting the liquidity trap. He points out that inflation targeting is a proper policy answer regardless the reason why Japan seems to need a negative real interest rate. In many other cases, the proper response depends crucially on the causes behind the problems. Krugman argues further that in a sticky-price world, inflation targeting is a way to achieve the

[53] Posen's strategy of restoring Japan's economic growth is composed of three legs. First, fiscal expansion should be comprised of large enough fiscal stimulus, permanent tax cuts and funding public deficits with short-term government debt. Second, monetary stabilisation should include avoiding intentional yen depreciation besides the inflation target mentioned above. Third, financial reform should follow the bank system cleanups that have taken place in other OECD countries. (Posen 1998, 8–10)

same result that would be achieved if the prices were fully flexible. The inflation target must simply be sufficiently high so that the real interest rate can fall enough to restore full employment. On the other hand, it is possible that real interest rates do not have that strong effect on demand when private sector confidence is low and the economy is operating clearly below its capacity.

As to Japan, some commentators have claimed that expected inflation would simply lead to transferring savings abroad. Krugman (1998b) criticises the view strongly. He reminds that the sum of capital account and current account must be zero and that capital export should thus lead to an increased current account surplus. This would help to close the gap between savings and investment, which is just what is needed to improve the state of the Japanese economy. Krugman finds the other objection of how a negative real interest rate would weaken the yen equally amazing. According to him, a negative interest rate would of course weaken the currency, but that is just the goal that would be aimed at if nominal interest rates were higher. Actually, some policies presented for the Bank of Japan are based on depreciating the yen. These methods are discussed in section 7.3.4. Furthermore, Krugman shows via a beggar thy neighbour model that inflating out of the trap need not damage the neighbours more than conventional expansionary monetary policy with flexible exchange rates (Krugman 1998a).

Kregel (2000, 8–10) states nevertheless that from a Keynesian point of view, creating inflation expectations would not be enough. In addition, the central bank would have to succeed in convincing the public that the entire yield curve would not shift upward because of the policy. Kregel concludes that the problem lies in interest rate policy instead of a lack of credible inflation policy. He argues further that Japan is more likely in an underemployment equilibrium with deficient aggregate demand than in a liquidity trap.

7.3.2 Quantitative easing

The method central banks use most often to increase the growth rate of the monetary base is trading in short-term government bonds. At near-zero nominal interest rates, individuals or banks could however simply hold the excess liquidity because of perfect substitutability between money and short-term government bonds. Such effect would render the policy ineffective in increasing aggregate demand. Furthermore, first-period increases in money supply lower inflation expectations unless future money supply is also increased (equation 5.7). Meltzer (1999 and 2001) and Taylor (2001a and 2001b) recommend nevertheless increasing the monetary base whenever the zero bound is hit.[54] Taylor (2001b) believes in addition that sustained growth of M2+CDs at 7–8% annually would improve the Japanese economy substantially.[55] Higher growth rate targets could therefore be imposed for broader monetary aggregates as well.

According to Meltzer (1999), money plays two roles. First, an increase in the monetary base enhances aggregate demand through the real balance effect. The change in real money balances can be thought to measure the gap between actual and desired real balances. Spending is then increased to reduce real balances when

[54] Meltzer (2001) finds in addition that the policy should aim at currency depreciation.
[55] The underlying assumptions are a 2% inflation goal, 3% potential GDP growth and velocity growth of 2–3%.

they are larger than desired while it is decreased when they are smaller than desired. The effects of the channel are however considered small, as real balances account for a minor share of real wealth in developed nations. Second, the gap can be viewed as a measure of the relative price adjustment required to restore equilibrium. The demand for real balances depends here on various different interest rates or assets prices relative to the prices of new production of the same assets. At the equilibrium, all assets sell at replacement cost. Expansion would therefore be achieved also through changes in interest rates and asset prices.

Clouse et al (2000, 22–28) state that monetary base expansion could stimulate the economy by increasing liquidity or by affecting the expected short-term rates, asset prices or inflation. As to the effects of increased liquidity, I am equally sceptical with the authors since at zero nominal interest rates, additional liquidity will most likely be held as excess reserves. As to Japan, the Bank of Japan's experience indicates that providing excess liquidity is ineffective in reviving the economy. Inducing expectations of higher inflation was already discussed. In this sense, increasing the monetary base could be seen as a tool instead of a target. All in all, the role of expectations is again important. Furthermore, increasing the monetary base could alleviate the problem of financial disintermediation through the credit channel (Clouse et al 2000, 30). Oda and Okina (2001) note in addition that huge excess reserves could encourage financial institutions to purchasing riskier assets simply through cost pressures.

Increasing the monetary base might at least be effective by signalling to the market that policy changes are taking place in future. Even Krugman (1999) does not find such policy completely useless because of its important role in changing expectations. Moreover, Benhabib et al (2001, 6) claim that increasing the growth rate of money is successful in escaping from a liquidity trap only if coupled with proper fiscal policy.[56]

Section 5.3 discussed that increasing the monetary base through purchases of short-term government bonds might be ineffective in Krugman's liquidity trap since individuals or banks could simply hold the excess liquidity. The central bank might thus be incapable of affecting the broader monetary aggregates and aggregate demand. Congdon (2001, 2) remarks in addition that since the central bank transacts directly only with banks, it has not direct influence on non-banks' deposits. As to the traditional liquidity trap, quantitative easing is naturally ineffective (see section 4). Also Fujiki et al (2001) state that it is not certain whether a central bank can increase money supply by expanding the monetary base. Specifically, if money supply is constrained by something else than inadequate liquidity, providing an ample monetary base does not significantly affect money supply. As to Japan, Morsink and Bayuomi (2000) find that the effects of quantitative easing may be limited.

Congdon (2001, 12–14) remarks furthermore that there are open markets operations of two types. He finds that open market operations between the government and non-banks (type I) have a direct and immediate effect on the quantity of money in contrast to type II operations discussed so far. Type II operations take place between the central bank and the banking system and rely on banks' response to the size of their holdings of monetary base. They affect

[56] According to the authors, fiscal policy should make the government intertemporally insolvent as nominal interest rates approach zero. Since the intertemporal budget constraint of the government is the mirror image of the intertemporal budget constraint of the representative household in a closed economy, the policy should increase private sector wealth and raise thus the price level.

therefore the quantity of money indirectly, and the effects are uncertain. Type I operations are typically conducted in long-term government bonds while type II instruments comprise short-term government bonds and possibly eligible commercial bills. Congdon concludes that the criticism against the Bank of Japan has been overstated since in his opinion, type I open market operations are necessary to increase the growth rate of the money supply to fight the current shortage of real money balances. The method is thus somewhat different from the central bank purchases of long-term government bonds discussed in the next section.

7.3.3 Open market operations in long-term government bonds

Non-zero long-term nominal interest rates and high risk premiums on private debt can hinder economic growth even when short-term nominal interest rates are at zero. Moreover, Clouse et al. (2000, 31) note that the recent experience in Japan seems to support the view. Engaging in unconventional open market operations to lower interest rates and risk premiums should therefore expand the economy even if the conventional policy of trading in the short-term bond market had become ineffective. Such trading could take place in the market for long-term government bonds or corporate bonds, which are not perfect substitutes with money or short-term government bonds. Fujiki et al (2001) note in addition that purchases of long-term government bonds could be seen as a natural extension to quantitative easing currently employed by central banks. In fact, the Bank of Japan has already engaged in such operations. In principle, the same effect could also be achieved through the use of derivatives (Oda and Okina 2001). The purchases of private debt are discussed below in section 7.3.5.

Krugman does not specify the interest rate used in his liquidity trap models. Based on the term structure of interest rates,[57] the interest rate can nevertheless be thought to represent long-term interest rates implicitly. To be more precise in the analysis of open market operations in long-term government bonds, I use the presentation of Clouse et al (2000, 32). They define the current long-term interest rate as an unweighted average of the current short-term interest rate and expected future short-term rates plus a risk premium:

$$i_t^L = (1/N)\sum_{j=0}^{N-1} E_t(i_{t+j}) + \theta_t^L, \tag{7.4}$$

where i_t is the short-term interest rate at time t and θ is the risk premium on long-term bonds. The risk premium reflects both interest rate risk and, particularly in the case of private sector securities, credit risk.

According to Clouse et al (2000, 32), purchases of long-term government bonds can decrease the long-term interest rate only by lowering the private sector's expectations of the future short-term interest rate. Such an effect could be achieved through the signalling channel. Namely, if a central bank purchases long-term assets, the value of its bond holdings will be higher if it delivers lower short-term rates in the future. Thus the private sector expects the future short-term

[57] The term structure of interest rates depicts interest rates in different maturities. The interest rates are typically approximated by a yield curve.

rates to be lower, because of which the expectations hypothesis[58] of the term structure of interest rates states that the long rates have to be lower today.

If short- and long-term government bonds are imperfect substitutes for example because of preferred habitat behaviour, Clouse et al. (2000, 33–35) note that purchasing long-term bonds from the public could expand the economy through two thoroughly intertwined channels, namely the portfolio rebalancing (ie portfolio balance) channel and the credit channel. Also Goodfriend (2000 and 2001) considers these two channels.[59] In contrast to Clouse et al, he finds them effective. I now discuss these channels and the mechanisms through which they work.

First, the advocates of the portfolio balance channel emphasise the neutrality of money in the long run over the influence of expectations (Fujiki et al 2001). The channel works through a decline in long-term interest rates. Clouse et al (2000, 33–34) consider the channel in the presence of risk averse investors, which means that a risk premium of the equation (7.4) is included in the analysis. The central bank can in principle affect the relative supply of assets through open market operations. By purchasing assets, it can reduce their relative share in the market and the risk premium on the asset, as Clouse et al assume, will decrease. However, the effects of such operations can remain negligible unless the relative supply of short- and long-term bonds changes drastically.

In the language of Goodfriend (2000 and 2001), the portfolio balance channel works by reducing the liquidity services yield on monetary assets, because of which the private sector attempts to rebalance its portfolio by acquiring a larger amount of less-liquid assets. These purchases raise the prices of for example consumer durables and physical capital, which results in a rise of asset prices. The higher asset prices expand then the economy further directly and through different side effects.[60]

Oda and Okina (2001) express the functioning of the channel yet differently. In their presentation, a representative agent tries to maximise his utility under a constraint of a maximum risk level. If bonds in the portfolio of the agent are then replaced by currency, the agent can acquire riskier assets to rebalance the portfolio. The process results in lower long-term interest rates and stimulates therefore aggregate demand through the interest rate channel. Higher collateral values might also increase lending by making it less risky and stimulate therefore demand. As a result, expected inflation would rise and real interest rates would decline. Oda and Okina note however that the magnitude of portfolio rebalancing activity depends on how risk averse the major fund providers are. In the case of Japan, banks and institutional investors have recently taken a rather cautious attitude towards risk-taking, which reduces the effects of the channel. The issue is discussed again in the context of the standpoint of the Bank of Japan in section 8.

Second, the credit channel is related to a decreasing external finance premium[61] that revives the economy by stimulating bank lending and activating credit channels. Fujiki et al (2001) note that the advocates of the channel attach importance to expectations besides the neutrality of money. However, the channel

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[58] According to the theory, short- and long-term assets will be held only if their expected returns are equal. That is, $(1 + i_{t,2})^2 = (1 + i_{t,1})(1 + i^e_{t+1,1})$.

[59] Goodfriend attaches somewhat unconventional meanings to the terms.

[60] See Goodfriend (2000, 22–24).

[61] External finance premium arises from agency costs due to information asymmetry and is defined as the difference between the costs of external and internal financing (ie retained earnings).

requires that the central bank commit to purchasing massive amounts of assets. For example Goodfriend (2000) concludes that such aggressive open market operations would be effective even at the zero bound. On the other hand, Bryant (1999, 10) is more sceptical. He admits that after open market operations like that, external finance premiums and credit-risk spreads would be less adverse than they would be without the operations but emphasises that the magnitude of improvement is uncertain. On the other hand, Clouse et al (2000, 35) claim that the channel could be effective if the purchases of assets from banks made the balance sheets of the banks more liquid. However, also they doubt that effects would be weak.

Fujiki et al (2001) note that a central bank can choose between inducing a decline in long-term interest rates and affecting private-sector expectations of future inflation and asset price developments. The first option requires increasing the purchases of long-term government bonds gradually (ie mild operations) while the second one requires operations that are more massive in order to change expectations (ie aggressive operations).

According to Fujiki et al, Iwata (original in Japanese) states that mild operations would affect long-term yields by decreasing risk premiums and by encouraging investing in high-risk assets. The authors claim however that such operations would only decrease nominal interest rates in the short run and that the interest rates would get higher along with the rising inflation expectations. The time lag between the operations and their real effects on output would likely be long. In addition, the effects would be uncertain. On the other hand, aggressive operations would affect the economy by changing private sector expectations. Besides asset prices, also bank lending should be affected. The scope of such operations would have to be large.

The effect of open market operations depends crucially on expectations of future operations. Clouse et al (2000, 35–41) note that a central bank must commit itself to maintaining zero short-term interest rates despite future economic conditions in order to be able to move long rates closer to zero. The public will have to believe that the monetary stimulus will not be withdrawn before the economy recovers. One way of signalling central bank commitment would be writing put options for the security in which open market operations are undertaken. The strike price would be chosen to correspond to the interest-rate ceiling aimed at.[62] Although derivative securities are usually assumed not to affect the values of the underlying securities, the central bank operations in derivatives may affect the economic fundamentals that define the values of securities.

In addition, defining the necessary scope of open market operations in long-term government bonds is a difficult task. The intervention would nevertheless have to be large enough to close the savings-investment gap or even larger than that, since the lower interest rates on long-term bonds would induce the private sector to swap long-term bonds for shorter-term assets or, under liquidity trap conditions, for money. Krugman (1999) estimates that the scope of the intervention in Japan would have to exceed 10% of GDP. This would increase the size of the Bank of Japan's balance sheet considerably. In fact, the BOJ has already engaged in open market operations in long-term government bonds in

[62] The private sector holders of the options would exercise the options if the market price of the underlying security fell below the strike price, ie the market interest rate rose above the interest rate ceiling.

order to meet the in the long run increasing demand for liquidity (Fujiki et al 2001). The point will be discussed below.

The nature of long-term bonds is such that the central bank would have to assume some interest rate risk because of acquiring them. The risk of capital loss would likewise become the sort of problem that would threaten the credibility of the policy. It has been claimed that the potential capital loss could be offset by an increase in the central bank's operating income, but Iwata et al. (2001) find that covering the loss this way would take quite long. Krugman (1998a) concludes that the scope and the questionable consequences of the policy mean that the policy should be only used in a multiple equilibriums economy or other situation in which temporary policy can lead to permanent results.

A frequently proposed solution to Japan's economic problems has been financing expansionary fiscal policy through central bank purchases of government debt. In this option, co-ordination of fiscal and monetary policy becomes even more important. The necessary scope and its consequences are discussed in section 3.2.4. The policy option is problematic in the sense that it might lead to a collapse in the market for government bonds.

7.3.4 Foreign exchange interventions

Although the traditional argument of how the liquidity trap is unconceivable in an open economy might be invalid, flexible exchange rates widen the array of possible open market operations. First, the central bank can try to revive the economy directly through currency purchases. Second, the central bank can trade in foreign bonds. For example Clouse et al (2000) consider the effects of such operations. Fujiki et al (2001) state that the advocates of the method "focus on the belief in purchasing-power parity theory in the long run and influence on expectations in the short run." Equation (5.17) clarifies the impact of the method: it shows that expected currency depreciation induces higher inflation expectations and decreases therefore the real interest rate according to equation (5.5). As was discussed above, the constant appreciation pressure on the yen has had an opposite effect. Foreign exchange interventions can thus help a country to escape from a liquidity trap by depreciating its currency. The most often heard counterargument is based on possible adverse effects on the competitiveness of trading partners.

As to Japan, the relatively low share of international trade of GDP as well as the size of the economy mean that the intervention would probably have to be very large by any past standard. In the language of Krugman (1999), the yearly intervention would have to be large enough to close the gap of figure 5. Furthermore, since an intervention weakening the yen would strengthen expectations of its future appreciation and induce thus private flows to the opposite direction, the intervention would have to be even larger. In fact, Krugman claims that it would probably have to be several times larger than in the absence of the private flows. He estimates that the Bank of Japan might have to acquire foreign assets at a rate of 10–15% of GDP over an extended period. Here additional problems are caused by the fact that in Japan, Ministry of Finance is responsible for foreign reserves instead of the central bank, which means that policy co-ordination would become important. On the other hand, Krugman finds

that it might be altogether impossible for the yen to depreciate enough to close the gap. The point was discussed in section 5.4.1.

7.3.4.1 Foreign currency

Trading in the currency market is an option to be considered when the zero bound on nominal interest rates is hit. If the rest of the world has positive interest rates, the domestic currency of the country in a liquidity trap is expected to appreciate (Svensson 1999, 33). Under flexible exchange rates, the central bank could then try to stimulate the economy by buying foreign currency with base money in order to depreciate the domestic currency. For example McCallum (2000) and Meltzer (2001) suggest that the central bank should adopt the foreign exchange rate as its policy instrument. Also Bryant (1999) finds the role of non-appreciating exchange rate policy important.

McCallum (2000, 20–28) formulates a model to prove that monetary policy remains effective in an open economy even when the usual interest rate channel through short term nominal interest rates is inoperative. He claims that although the central bank can hold only a finite stock of foreign currency and appreciation of the domestic currency is therefore limited, depreciation of the currency does not suffer from similar limitations. Domestic and foreign currency assets are assumed to be imperfect substitutes, which means that unsterilised purchases of foreign currency can cause a departure from the exact uncovered interest parity.

In a further-developed model (McCallum 2001, 32–36), the exchange rate is used as an instrument variable, through which the central bank can affect macroeconomic conditions. The policy rule is stated as

$$s_t - s_{t-1} = v_0 - v_1(E_{t-1}\Delta p_t - \hat{\pi}) - v_2 E_{t-1}(y_t - \hat{y}_t) + \zeta_t, \tag{7.5}$$

where $v_1 > 0$ and $v_2 > 0$. The variables s_t, p_t and y_t denote logarithms of exchange rate, price level and output, $\hat{\pi}$ is inflation target and $\hat{y}_t$ is potential output.

If either inflation or output exceeds its target value in equation (7.5), the rate of currency depreciation is lowered. McCallum points out that one of the benefits of using the exchange rate as a policy instrument is that the necessary scope of open market operations need not be known in advance since the effects on the exchange rate can be observed directly in the foreign exchange market. Bryant (1999) emphasises however that the approach taken by McCallum would expose the economy to risks associated with exchange rate rigidity. He concludes that foreign-exchange intervention is particularly important if the currency threatens to appreciate.

If the exchange rate is determined by an interest rate parity condition involving the interest rate differential relative to foreign interest rates, a zero domestic nominal interest rate results in appreciation pressure. The current exchange rate varies with the expected future exchange rate, which varies with the expected future price level if real exchange rate expectations remain unchanged. Unsterilised foreign exchange interventions seem thus unable to affect the current exchange rate as long as deflation expectations do not change. However, Svensson claims that arbitrarily large foreign exchange interventions in order to peg the exchange rate might work by breaking expectations of further appreciation. For the policy to be successful, the credibility of the peg is crucial

and can be achieved under the circumstances discussed in section 7.3.6. (Svensson 1999, 28)

Goodfriend (2000) agrees with Svensson regarding the point that exchange rate oriented monetary policy might not work well for a large country such as Japan. He reminds also that the trading partners might not be fond of the policy because of its adverse impact on their competitiveness. However, if the intervention is successful in improving the state of the economy, also imports accelerate. As a result, other countries could actually benefit from the intervention (Clouse et al 2000, 45–46). In the case of Japan, such positive effects might be remarkable especially in East Asia.

McKinnon and Ohno (2000, 18–19) remind of the role of expectations by stating that despite the depreciation, expectations of appreciation might remain strong or even strengthen. In other words, for example the yen could be expected to appreciate in the future since a common belief is that the United States would not allow the yen to depreciate. The Bank of Japan might therefore be incapable of depreciating the currency, which would eliminate the use of exchange rate channel in the presence of zero short-term nominal interest rates. Furthermore, the authors remind of possible domino effects on other Asian countries: they would probably be forced to depreciate their currencies in the wake of Japan.

McKinnon and Ohno (2000, 19–21) note also that almost 80% of today's exchange reserves have accumulated after the bursting of the asset price bubble and that there has still been some net appreciation of the yen. They emphasise that unilateral intervention of the Japanese government lacks long-term credibility and is thus ineffective. On the other hand, they note that a two-stage bilateral approach would work. First, Japan should conclude a commercial agreement with the United States to limit bilateral sanctions in trade disputes and end therefore the future mercantile pressure from the United States. Second, the exchange rate should be stabilised at a chosen level in the long run. The official interventions should in addition be concerted and well signalled.

Depreciating the currency is not everyone's favourite policy. For example Posen (1998, 9) states that a decline in the value of the yen would increase uncertainty and erode wealth, which would decrease both consumption and investment. Furthermore, he does not find the policy effective in comparison to domestic policies since it affects only the export-oriented sectors of the economy. Posen (2001a) finds however that the Bank of Japan should conduct monetary policy through purchases of dollars and euros with printed yen. He concludes that it is better for the BOJ to claim credit for the yen's decline resulting from the bank problems instead of trying to fight the depreciation without success. As discussed in section 7.3.6, preventing a currency from depreciating has limits.

7.3.4.2 Foreign bonds

Bryant (1999) states that for an open economy, foreign-exchange intervention and purchases of foreign short-term bonds might be a more important way of escaping from a liquidity trap than purchases of domestic long-term government securities. Clouse et al (2000, 42) emphasise that the usual difference between sterilised and unsterilised interventions need not be made here since in a liquidity trap, selling short-term government bonds cannot lower the short-term nominal interest rate further. Both intervention types have thus similar effects and all foreign-exchange

interventions can be analysed as sterilised interventions. However, if open market purchases of securities stimulated aggregate demand despite a zero nominal short-term interest rate, unsterilised intervention would become more effective.

Clouse et al (2000, 42–46) investigate the effects of a foreign-exchange intervention through the equation

$$i_t = i_t^F + E_t(s_{t+1}) - s_t + \theta_t^D, \tag{7.6}$$

where i_t is the interest rate on domestic short-term government bonds at time t, i_t^F is the corresponding interest rate on foreign short-term government bonds, s_t is the logarithm of today's spot exchange rate expressed as domestic currency per foreign currency, $E_t(s_{t+1})$ is the expected logarithmic future spot exchange rate and θ_t^D is the risk premium on domestic short-term government bonds.

On the one hand, if private agents are risk neutral, both domestic and foreign assets will be held only if the expected returns on them are equal. Under this open interest parity condition, the risk premium in equation (7.6) is either zero or a constant. In a liquidity trap, i_t is fixed at zero because of which an intervention can cause the domestic currency to depreciate only if the intervention results in a higher depreciation than expected earlier. That is, s_t can become higher only if $E_t(s_{t+1})$ rises. This is the signalling channel. Clouse et al state that sterilised intervention might work this way. On the other hand, the intervention would work through the portfolio balance channel if private agents are risk averse and there exists home-currency bias and, as a result, domestic and foreign bonds are imperfect substitutes. In other words, the risk premium is not constant. As in the context of open market operations in long-term government bonds discussed above, an intervention then affects the economy by changing the relative supplies of the assets and therefore the risk premium. The intervention can thus have an effect on the current exchange rate without changing the exchange rate expectations.

Clouse et al (2000, 44) emphasise moreover that the scope of the interventions would probably have to be quite large to significantly alter the exchange rate, in addition to which the effects might well be short-lived and vary from period to period. In addition, the problems discussed above in the context of open market operations in foreign currency are valid also here.

7.3.5 Methods approaching fiscal policy

If the approaches discussed above have not been successful, the central bank can consider even more unconventional policies. Many of these require that monetary policy support or substitute for the income transfer function of fiscal policy. This happens if the central bank provides capital instead of liquidity (Shirakawa 2001, 6). Such methods aim at increasing the purchasing power of the private sector, which would stimulate nominal aggregate demand and help therefore in fighting deflation. In Krugman's model, the goal is to move the CC curve to the right. When using equation (5.7), the analysis is similar to that of section 7.2 presented in the context of the role of fiscal policy in escaping from the trap. The outcome depends again on how the private sector sees the situation: if it believes that policy will have to be reversed (Ricardian equivalence), increased purchasing

power might not lead to growth in aggregate demand and the policy would be ineffective. Expectations of the future play once again a major role. On the other hand, the scope of the operations might have to be so large that the solidity of the central bank might become questionable.

Policies approaching fiscal policy are considered in Clouse et al (2000, 47–58). They discuss for example central bank purchases of private debt, which would provide the private sector with the financing needed for economic recovery. I repeat the equation (7.4) here for convenience: in the case of private debt, the risk premium θ reflects both interest rate risk and credit risk.

$$i_t^L = (1/N)\sum_{j=0}^{N-1} E_t(i_{t+j}) + \theta_t^L \qquad (7.4)$$

A crucial question is now whether the private sector debt carries a significant risk premium over the public sector debt and whether the relative shares of public and private debt can be affected through purchases of private debt. If so, such purchases might stimulate aggregate demand by decreasing the risk premium and thus long-term nominal interest rates on private debt even at zero short-term rates. The Bank of Japan has actually considered resorting to the policy.

More extensive credit window lending would have the same effect as purchases of private debt. These loans could be directed either to depository institutions or directly to households and companies. Such lending might lower credit-risk premiums or provide liquidity for the financial instruments used as collateral, which would result in lower private sector interest rates by lowering implicit liquidity premiums. Direct lending to households and companies by a central bank might be beneficial also because it would circumvent the terms of credit imposed by depository institutions. This would be especially useful in a credit crunch situation. (Clouse et al 2000, 59–63)

However, deciding which enterprises to finance does not belong to the tasks of a central bank since it does not have any comparative advantage in making such evaluations. All in all, credit allocation by a central bank might result in an ineffective outcome. Adverse selection related problems would lead to lending to the entities, the credit risk of which would be the most seriously underestimated. In addition, subsidised lending by a central bank means that the bank has to accept credit risk. Monitoring would likewise cause problems. Implied moral hazard problems lead to the conclusion that extensive credit window lending should be avoided. Furthermore, dismantling such credit allocation process might prove to be a difficult task even after the economic situation had improved. Since central bank lending is usually constrained by legislation, the possibilities of a central bank to lend directly to the private sector are also limited. (Clouse et al 2000, 64–65; Goodfriend 2000)

Clouse et al (2000, 66–67) consider even more drastic measures such as money rains, that is distributing currency to public either directly or through banking system. However, the problems in determining an equitable division of the money would be insurmountable. Another way of distributing money would be financing a tax cut by newly created money. The government would then issue debt, which the central bank would purchase. Alternatively, assets could be purchased above market prices or loans could be extended at subsidised interest rates. These policies begin to resemble fiscal policy by creating budget deficits.

7.3.6 Svensson's foolproof way

Lars E. O. Svensson (2001a) presents a detailed list of steps necessary to ensure escaping from a liquidity trap. His solution combines the options of inducing inflation expectations and conducting foreign exchange interventions presented above. All in all, it should by now be clear that the different ways of coping with the zero lower bound are interrelated. Svensson's method comprises introducing a price level target path corresponding to a small positive long-run inflation target and pegging the domestic currency at a level corresponding to a real depreciation relative to the steady state level. According to Svensson, real depreciation of the domestic currency, a lower long-term real interest rate and increased inflation expectations will then jump-start the economy.

The first step on Svensson's way out of a liquidity trap is announcing an upward-sloping price level target path for the domestic price level so that the long-run inflation target $\hat{\pi}$ is small but positive.[63] The approach differs therefore somewhat from the approach proposed by Krugman, although the role of expectations is equally important particularly during the later steps. The logarithmic price level target for period t can be expressed as

$$\hat{p}_t = \hat{p}_{t_0} + \hat{\pi}(t - t_0), \text{ where } t \geq t_0 \text{ and } \hat{p}_{t_0} > p_{t_0}. \tag{7.7}$$

The logarithmic price level target for the current period t_0 is thus larger than the logarithmic current price level of domestically produced goods. The difference between these two is the measure of how much the economy is intended to inflate and expand before the price level target path is reached. The faster the recovery aimed at is, the larger is the risk of overheating the economy before the target path is hit. As to Japan, Svensson (2001b) emphasises that several years of low inflation or deflation have resulted in a price level below previous expectations. The price development has increased the real value of debt deteriorating therefore balance sheets of banks and other companies. Svensson therefore concludes that the price level target path should start above current price level so that the price gap amounting perhaps to 10–20% could be undone.

The next step involves announcing that the currency will be devalued. Likewise, the step includes announcing that the exchange rate will be pegged to a crawling exchange rate target, which can be expressed as

$$s_t = \hat{s}_t = \hat{s}_{t_0} + (\hat{\pi} - \pi^F)(t - t_0), \tag{7.8}$$

where $\hat{s}_t$ is the exchange rate target. The variable s_t denotes the logarithmic exchange rate in units of domestic currency per unit of foreign currency. The uppercase letter F marks average foreign (log) inflation and t exceeds again t_0. The first term on the right-hand side is the initial exchange rate target after the devaluation. To cause appreciation pressure (instead of depreciation pressure), it must be chosen so that there is real depreciation of the domestic currency relative to the steady state. Svensson (2001b) specifies that the initial depreciation must be large enough to result in a real depreciation relative to any conceivable long-run

[63] Svensson proposes for an appropriate inflation rate 2% per year.

equilibrium real exchange rate. Yen should therefore be pegged at at least 140 to 150 yen/dollar. In practice, the central bank commits itself to buying and selling unlimited amounts of foreign currency at the target rate of $\hat{s}_t$. As to the methods presented above, McCallum (2001, 36) claims that his policy rule (7.5) implies a similar commitment.

Svensson emphasises that it is technically feasible for a central bank to devalue the domestic currency and then peg the nominal exchange rate at a level corresponding to real depreciation relative to the steady state. Appreciation pressure[64] of the devalued currency will increase demand for the currency, which the central bank can fulfil by issuing more currency. In addition, inflationary pressures caused by growing foreign exchange reserves are not a problem in a liquidity trap, and the central bank can in any case abandon the peg if inflation pressures become too strong or if the low interest rate that counters the appreciation pressure threatens to overheat the economy. The peg is thus credible. Furthermore, Svensson points out that his argument does not depend on possible portfolio balance effects of foreign exchange intervention. All in all, Svensson's method has thus similar traits with the policies that aim at currency depreciation.

After the peg is credible, the economy has to be moved out of the liquidity trap. This can be achieved by raising the nominal short-term interest rate to a level corresponding to uncovered interest rate parity. The correct level can be achieved by first combining the private sector exchange rate expectations under the credible peg

$$E_t(s_{t+\tau}) = \hat{s}_{t+\tau} \tag{7.9}$$

with the equation (7.8). If $\tau = t - t_0 = 1$, this yields

$$E_t(s_{t+1}) = s_t + \hat{\pi} - \pi^F. \tag{7.10}$$

This can be combined with the interest parity condition

$$i_t - i_t^F = E_t(s_{t+1}) - s_t + \varphi_t, \tag{7.11}$$

where φ_t is the foreign exchange risk premium, to achieve the above-zero[65] equilibrium interest rate

$$i_t = i_t^F + \hat{\pi} - \pi^F + \varphi_t. \tag{7.12}$$

If the central bank sets the interest rate equal to the equilibrium interest rate (7.12), it is no longer necessary for the central bank to intervene in the foreign exchange market to support the peg. The monetary base will then be demand-determined.

[64] Depreciation pressure would mean using foreign exchange reserves to buy the domestic currency. If the central bank would run out of its foreign exchange reserves, it would have to abandon the peg and float the currency.
[65] As Svensson assumes.

In accordance with McKinnon and Ohno (2000), the appreciation pressure on the currency results in private sector's expectation that the currency will eventually appreciate. The real interest parity equations of Svensson's model are

$$E_t(e_{t+1}) = e_t + [i_t - E_t(\pi_{t+1})] - [i_t^F - E_t(\pi_{t+1}^F)] - \varphi_t \tag{7.13}$$

and

$$e_t - e = -(\rho_t - \rho_t^F) + \frac{\varphi_t - \varphi}{1 - \gamma_\varphi}, \tag{7.14}$$

where e is again the logarithmic real exchange rate now defined as $e_t \equiv s_t + p_t^F - p_t$ and ρ is the sum of current and expected future deviations of the real interest rates from the steady state level of the real interest rate.

Equation (7.14) implies that the real depreciation relative to the steady state implies a low ρ relative to ρ^F. The long-term real interest rate is thus lower. In Krugman's liquidity trap, this would be an important achievement since it could help to close the gap between savings and investment.

By the definition of e_t and the equation (7.8)

$$e_{t+1} - e_t = -(\pi_{t+1} - \hat{\pi}) + (\pi_{t+1}^F - \pi^F), \tag{7.15}$$

which can be written

$$e_{t+1} - e_t = -(\pi_{t+1} - \hat{\pi}) \tag{7.16}$$

if the foreign inflation is assumed to be constant.

Thus real appreciation of the domestic currency requires that domestic inflation must exceed the inflation target. This will be reflected in private sector inflation expectations so that

$$E_t(\pi_{t+\tau}) - \hat{\pi} = -[E_t(e_{t+\tau}) - E_t(e_{t+\tau-1})] \tag{7.17}$$

is positive for some $\tau \geq 1$.

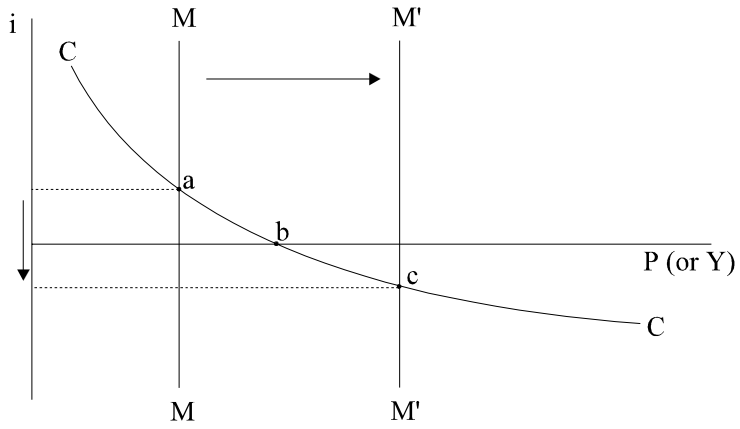
Monetary policy is therefore expansionary because of the real depreciation of the domestic currency, the lower long-term real interest rate and increased inflation expectations.

Since domestic inflation is higher than the inflation target, it is approaching the announced price level target path from below. Furthermore, Svensson shows that the path will be reached in finite time. The idea is that the peg will be abandoned when the economy has hit the path, which should also be announced to the public. The alternative policies then are flexible price level targeting with the same target path or flexible inflation targeting with the same inflation target. Long-term preferences determine which alternative is chosen.

7.4 Lowering the nominal interest rate floor

The methods presented above aim at getting the economy off the lower bound. However, another opportunity exists. Namely, lowering the bound eliminates the liquidity trap problem at least according to Buiter (2001, 18). He formulates the strategy as "a rule for the nominal interest rate on money that ensures that it will always be below the nominal interest rate on non-monetary assets". Despite the generally convincing claims of the unfeasibility of the implementation of the strategy, I will present the method here because it is an interesting attempt to approach the liquidity trap problem from another angle. Krugman's model clarifies the method: in figure 6, the zero bound is no longer binding and moving to point c is possible in contrast to figures 2 and 4. In other words, a negative real interest rate can now be achieved by lowering the nominal interest rate even at zero nominal interest rates.

Figure 8. **Lowering the zero bound**



Implementation of the rule might require taxing money. According to this solution, taxing currency or bank reserves would increase the opportunity cost of holding money to the point where the cost could still be positive despite a negative nominal interest rate on bonds. In other words, the usual lower bound on nominal interest rates could thus be lowered below zero. However, implementing a carry tax entails plenty of difficulties, some of which might be insurmountable. Both benefits and disadvantages of the solution are discussed in Buiter (2001), Buiter and Panigirtzoglou (2000), and Goodfriend (2000 and 2001).

The most frequently mentioned name in the connection of a carry tax on money is Silvio Gesell (1862–1930), who wanted to stimulate the circulation of currency by making its value depreciate with time. Imposing a carry tax on currency would likely entail various problems related to the bearer bond nature of currency. That is, since ownership of currency is established by possession and no register is kept on the holders of currency, it would be difficult to persuade the holder of a coin or a note to pay interest to the issuer, that is the government. Significant shoe leather costs would be incurred. (Buiter and Panigirtzoglou 2000, 36–41)

Goodfriend (2000) states that the zero bound on the interbank interest rate is set by the absence of storage costs and user fees on electronic reserve balances at

the central bank. A banking system results therefore in a zero bound on the nominal interest rate regardless of the physical cost of storing currency. However, Goodfriend claims that it is possible for a central bank to achieve negative nominal interest rates by imposing a carry tax on reserves.[66] The central bank could thus directly affect deflation expectations. Also Buiter and Panigirtzoglou (2000) support the view.

To be more precise, Goodfriend (2000) suggests a per period, per dollar carry tax on electronic bank reserves that could be used to govern the interbank interest rate. As the banks tried to avoid the tax, the interbank interest rate would drop below zero by the size of the cost of carry. The banks would then offer a negative interest on deposits to match the rate of the interbank market. Again, the short-term nominal interest rates could be pushed below zero by the size of the carry tax. And if the carry tax were large enough, it could be used to lower also long-term interest rates. In practice, the tax could be activated temporarily under liquidity trap conditions. Goodfriend claims that it could be used to adjust the interbank interest rate for example in 25 basis point steps and that the central bank could therefore conduct interest rate policy just as it does under more normal conditions.

The only restriction of a carry tax is that the tax could not be made larger than the cost of storing physical capital. If this were the case, the banks would simply store the capital as vault cash. To minimise the problem, Goodfriend suggests that a carry tax could be imposed also on vault cash and currency. This tax could be varied with the tax on electronic reserves or it could be set temporarily high enough to allow the central bank to determine the nominal interest rate by varying only the tax on electronic reserves. This kind of carry tax would serve as a powerful deterrent to hoarding currency.

Buiter (2001) notes that imposing negative interest on currency would require a method to recognise ex-interest currency and a penalty for holding such currency. To achieve this, Goodfriend (2000) suggests that a magnetic strip could be imbedded in each bill and that a carry tax would have to be paid whenever a bill is deposited in a bank. The size of the tax would be determined according to how long the bill had been in circulation. This would solve the problem of finding out whether interest had already been paid for a particular note. Buiter and Panigirtzoglou (2000, 40–46) suggest another way of enforcement by proposing that currency should be subjected to an expiration date and a conversion procedure. A note would thus expire at a certain date unless it was converted into a new note. The interest rate to be paid would be determined by the terms on which the conversion would take place. To minimise the administrative costs of the procedures, the intervals between conversions should be long enough. On the other hand, Goodfriend (2000) emphasises that the carry tax could be used only temporarily when necessary.

Goodfriend (2000) claims that a carry tax on currency would not result in resorting to substitutes of currency. He points out that despite inflation, there has been no movement away from the monetary base as the medium of exchange. But even if Goodfriend claims that a carry tax on currency would nowadays be technologically feasible, the costs would be extremely high. Imposing the tax would require excessive investments in enabling equipment and administration

[66] Goodfriend complements the carry tax policy by quantitative measures to be taken by the central bank. These measures include open market purchases of long-term government bonds and monetary transfers.

would cause to additional costs. Furthermore, even temporarily negative real interest rates would harm the people holding liquid assets and those depending on interest income seriously. Taxing currency would likewise be regressive since the poor hold a larger fraction of their wealth in currency. To overcome some of these problems, Goodfriend (2000) recommends encouraging individuals to position their portfolios for the possibility of negative nominal interest rates.

The lack of public acceptance would also cause serious complications. For example Bryant (1999) states that the problem would be far more serious than Goodfriend is inclined to believe and concludes that the biggest feasibility problems would be political. Likewise, since the current legislation does not recognise the concept of a carry tax, it would have to be changed. And this is something that Bryant does not find possible. As to Japan, the financial state of the banking sector is such that even the tax on electronic reserves might only make the existing distortions larger.

Bryant (1999, 4–5) notes further that Goodfriend does not consider the carry tax in an international context. Cross-border arbitrage opportunities would arise if only one or some of the major countries imposed a carry tax. If a slump were then expected or taking place in such a country (and since the tax is used only temporarily), substitution away from its currency would probably take place. Economic actors with large-scale currency holdings would have incentives to shift the denomination of their currency holdings, and the country that had imposed the carry tax would suffer from diminishing seigniorage gains. On the other hand, the currency would be subjected to depreciation pressure, which would be desirable at the zero bound and is actually the primary goal of some of the methods presented above.

However, a carry tax on currency would also result in taxing heavily cash-based grey as well as criminal activities. Bryant (1999, 5) finds this aspect attractive, since the tax could actually be used to inhibit illegal activities. In addition, this motive would be easier for the public to accept. The tax could likewise be imposed on high-face-value notes only, which means that the administrative costs would likely be less excessive and regressive. The Bank of Japan economists have also found the idea of lowering the nominal interest rate floor interesting, but hold despite this that the policy is infeasible. The next section gives them an opportunity to state what they think about the other policies recommended for the BOJ and whether they find the criticism directed against the BOJ entitled.

8 The standpoint of the Bank of Japan

Monetary policy has played various roles during the decade-long stagnation of Japan, and eager critics have repeatedly blamed the Bank of Japan for doing too little and too late. Cargill (2001) summarises the accusations: monetary policy was tightened too late in 1989, it was too tight in the early 1990s, in addition to which the BOJ should have increased money growth more aggressively and reacted more decisively to the deflationary pressures in the late 1990s. The critics have urged the BOJ to resort to unconventional or at least more aggressive monetary policy since the traditional methods seem to have become ineffective after the initiation of the zero interest rate policy.

Staff responses of the BOJ have concentrated on three points. First, the BOJ claims that the most appropriate policy for preventing deflation is targeting interbank interest rates close to zero. This has been the goal of the adopted zero interest rate policy. Second, the Bank holds that inflationary policy would not stimulate the economy, as the real interest rate would not decrease because increasing uncertainty resulting from higher inflation expectations would raise interest rates. Such effect would prevent Krugman's solution from working. Third, the BOJ emphasises the significance of the balance sheet constraints and the different roles played by fiscal and monetary policy. (Cargill 2001)

8.1 General observations

Compared to the academic circles, the BOJ has been more optimistic as to economic recovery and more pessimistic as to the effects of unconventional monetary policy. It has emphasised in several occasions that the risks associated with the proposed policies outweigh potential benefits. Even the advocates of the various approaches admit that the effects are uncertain, because of which the BOJ claims that it could only consider the methods if the economic situation were extremely serious. Thus the central bank will not resort to them if the economy seems to be recovering. And so far the BOJ has optimistically believed that the outlook is not quite as gloomy as the present.

The BOJ is also concerned about loosing its ability to react flexibly to changes in macroeconomic conditions. For example Oda and Okina (2001) and Shirakawa (2001, 11) note that even if committing to certain levels of policy variables increased the predictability of central bank actions and decreased therefore uncertainty, such commitment would hinder reacting flexibly to sudden changes in other variables. They claim that the risk is too serious to be taken unless the economy is in a truly grave situation. Shirakawa remarks in addition that if the private sector notices the existence of the risk, the commitment is no longer credible.

Another argument has emphasised the need for fiscal policy support. For example Fujiki et al (2001) conclude that it would be a mistake to investigate monetary policy independent of fiscal policy. They underline the importance of co-operation between central bank and government policy and state that the current situation might require that fiscal authorities assist the central bank. Particularly, the authors emphasise that monetary policy is not a panacea or a substitute for policy measures aiming at repairing structural problems. Also Mori et al. (2001) claim that during the 1990s, monetary policy alone could not have improved the situation significantly. They remind of the significance of the credit crunch, which has hindered the smooth functioning of financial intermediation. Shirakawa (2001) claims in addition that expansionary monetary policy might in fact delay structural reforms necessary in the long run. This is of course true, but the benefits of delayed economic recovery in the short run in order to promote structural reforms on the long run are nevertheless questionable. Although the future is important, also the present matters.

Furthermore, Mori et al (2001) state that even if monetary policy could have been more expansionary, the primary goal of maintaining financial system stability was achieved. They claim that the slow reaction to the non-performing loan problem was due to introducing proper bankruptcy procedures and an

appropriate safety net before letting the private sector know of the magnitude of the problems. A systemic crisis was therefore avoided. So even if the BOJ understood the graveness of the situation, it judged that the potential system-risk damage following its public announcement of the problems would have outweighed the costs incurred due to the retarded economic recovery resulting from the delay. On the other hand, preparing the safety net was delayed since the BOJ believed for a long time that asset prices would start rising and that the problem would thus be solved. The view has been criticised and a central bank's ability to withhold such information has also been questioned (Rich 2001).

Meltzer (2001) reminds that the BOJ was not truly independent before April 1998. The Ministry of Finance used to dictate exchange rate policy, and the BOJ could pursue monetary policy only if it was consistent with the Ministry's exchange rate target or target zone. Since it is generally not possible to achieve the goals of exchange rate and price stability simultaneously, Meltzer concludes that exchange rate policy is the main reason behind deflationary monetary policy. In addition, Cargill (2001) notes that willingness to preserve legal central bank independence may also limit willingness to resort to unconventional policy measures, as they usually require co-operation with the government. Likewise, the short history as an independent central bank may result in unwillingness to yield to political or other pressure since such a reaction could be interpreted as a sign of weak independence.

As to future policy of the Bank of Japan, Fujiki et al. (2001) think that the BOJ should begin with a particular modality for monetary policy and start by enhancing its transparency and accountability. Securing external credibility and conducting monetary policy in a flexible manner are likewise found important elements of enhancing the credibility of monetary policy.

The current gloomy outlook for the future means that the BOJ should still seek new policy options even if their outcomes were not quite certain. And since the Bank has already admitted that it does not expect the economy to improve in the near future, it should be more willing to try something new. After all, Japan cannot afford to wait that the world economy will improve. Besides, the country has already missed one upswing. On the other hand, it is easy for outsiders to recommend even uncertain policy measures for the BOJ. After all, only the Japanese have to live with the consequences.

8.2 The stance of monetary policy in the 1990s

The criticism against the Bank of Japan has blamed it for increasing the monetary base too slowly (figure A.6) and for lowering the interest rates too cautiously (figure A.5) during the 1990s. The staff responses of the Bank have then claimed that the increase has not been that slow after all and that the interest rate policy was such that was considered appropriate at the time it was conducted. In fact, Shirakawa (2001, 5) blames the Western economists for speaking for increasing money supply and bank lending when they should be discussing how to increase them. In any case, since deflation is a monetary phenomenon just like inflation, money supply growth should be fast enough to fight deflationary pressures. As was discussed in section 5.3, it is nevertheless uncertain whether the BOJ can affect the growth rate by increasing monetary base. Also Okina (1999) has some

doubts: he suspects that financial intermediation problems would inhibit usefulness of injecting ample reserves.

The critics claim that too slow monetary growth has caused the deficient demand. Okina (1999) admits that monetary aggregates have grown more slowly in the 1990s than in the 1980s. However, Shirakawa (2001) points out that the ratio of monetary base to nominal GDP has been high compared to the other G-7 countries. Furthermore, Oda and Okina (2001) note that excess reserves could not encourage financial institutions to purchasing riskier assets in Japan when the BOJ provided ample reserves to stimulate the economy in late 1990s and that the BOJ has thus been unable to increase the growth rate at least occasionally. On the other hand, the Bank of Japan (2000a, 2–4) notes that the relationship between monetary base and GDP growth weakened in the 1990s and particularly between 1997 and 1999. The change resulted from strengthened liquidity preference caused by financial system instability.

Mori et al (2001) note that Marshallian k[67] in terms of M2+CDs started to exceed its historical trend in the late 1980s when the monetary aggregate grew by more than 10% annually. The bursting of the bubble resulted in a temporary decline in k, but the deviation has remained constant and above the historical trend since end-1992. Mori et al conclude that increase in the monetary base has been sufficient and that it has been relatively ineffective only because of the financial intermediation problems.

Taylor (2001a) claims nevertheless that the rise in Marshallian k does not prove that the volume of monetary aggregates was sufficient. He reminds of the impact the monetary aggregate of the numerator has on denominator, that is on GDP. Taylor shows rather convincingly how a significant decrease in GDP growth characterises the 1990s besides lower growth rates of monetary aggregates. He notes further that the timing of changes in these variables was synchronised. He states that it is possible that the causation went from the decline in money growth to the decline in GDP growth.

Mori et al (2001) research the sufficiency of the monetary base growth also via a Taylor-type reaction function and conclude again that monetary policy responded properly to external shocks on inflation and GDP. However, the analysis of the equity yield spread movements against those of interest rates seems to indicate that a sharper interest rate cut might have been necessary after July 1991. The short-term real interest rate implies likewise that additional monetary stimulus would have been useful in fighting deflationary pressure, since it seems that the decline in the real interest rate was insufficient for coping with the balance sheet adjustment pressures that surfaced later. Mori et al conclude that the timing of policy reversal was swift but that the degree of monetary easing would have been enough only in an ordinary stock adjustment phase.

All in all, the unstable empirical relationship between money demand and the real economy makes evaluating the proper growth rate a difficult task. Comparing Marshallian k in terms of M2+CDs and in terms of monetary base reveals nevertheless that the deviation from the trend has been much larger in the latter. This might indicate that money multiplier has decreased, as the decline in financial intermediation has been offsetting the effects of expansionary monetary policy be that either low interest rates or expansion of the monetary base. (Fujiki et al 2001)

[67] Marshallian k is the inverse of the velocity of monetary aggregates. In this comparison k is (M2+CDs) or monetary base divided by nominal GDP.

8.3 Inflation targeting and inducing inflation expectations

According to the Bank of Japan Law, "currency and monetary control shall be aimed at, through the pursuit of price stability, contributing to the sound development of the national economy". The primary objective is thus maintaining price stability. The BOJ has been accused of following this policy even too tightly and the Bank has had to explain its actions during the economic downturn. I brief some comments on the subject here.

As to the frequently proposed inflation targeting, the Bank of Japan (2000b, 15–16) notes that in view of the current price development, setting a specific numerical value consistent with the sound development of the economy to the definition of price stability is difficult. The Bank states only that such value is likely to be lower in the short than in the long run. In addition, the BOJ does not believe that a single value could be valid for a long time under the current circumstances, because of which it claims that expressing a numerical target is not appropriate. And because the Bank finds attaching a numerical value to the definition of price stability difficult, adopting inflation targeting is found to be unrealistic and inappropriate. Oda and Okina (2001) claim also that a central bank with a strong reputation in fighting inflation does not benefit significantly from inflation targeting. Instead, they fear that the policy might reduce flexibility.

Furthermore, Oda and Okina (2001) state that it is difficult to know to what extent different measurement errors in price indices should be taken into account in setting the target rate for inflation. However, as Dale (2001) notes, even if the central bank did not publish its inflation target, it would still have to define it internally and the same measurement difficulties would therefore apply. Despite this, Okina (1999) emphasises that measurement errors could have particularly serious effects in Japan because of the historically low inflation. He reminds that Japan's situation differs from those countries that adopted inflation targeting to control inflation since Japan is in an opposite situation: it would have to raise inflationary expectations. This goal cannot be achieved by lowering interest rates already at their lower bound. Moreover, Okina states that setting an inflation target without announcing explicitly how it will be achieved could severe the central bank's credibility.

Fujiki et al (2001) fear that controlling inflation might become increasingly difficult if the BOJ resorted to more expansionary monetary policy for example through massive purchases of long-term government bonds. The view is reasonable since tightening monetary policy is never politically easy. Based on the same principle, Krugman's recommendation of a high inflation target is dismissed as a too risky strategy. In addition, higher inflation could seriously erode consumer wealth hold frequently in the form of bank deposits. For the same reason, the risk of hyperinflation is unacceptable. The BOJ is also reluctant to follow the suggestion of creating inflationary expectations for the fear of ruining its reputation as an independent and anti-inflationary central bank. It is likewise not clear whether it really is capable of credibly increasing current or future inflation and inflation expectations.

Oda and Okina (2001) claim that the suggestion does not consider the possibility that the risk premium might change. They suspect that higher inflation would increase volatility, which would then result in a higher risk premium on

long-term interest rates. Moreover, they fear that such a rise would lead to an increase in real debt burden.

8.4 Resorting to unconventional open market operations

The BOJ used to resist purchases of long-term government bonds by claiming that they were besides uncustomary against the Fiscal Law. Likewise, the Bank feared such purchases might impair fiscal discipline and actually increase long-term interest rates. The BOJ also suspected that exiting from such operations would be difficult. (Okina 1999)

Despite these claims, the BOJ has already engaged in purchases of long-term government bonds and holds as a result a considerable amount of them. The operations have been conducted to meet the in the long run increasing demand for bank notes i.e. liquidity. The goal differs therefore from the purpose of open market operations proposed by Goodfriend (2000). Since the beginning of 1998, the ratio of the BOJ's purchases of long-term government bonds has exceeded the growth rate of currency. Although long-term government bond holdings amount to nearly 40% of the total assets of the BOJ, there has not been any influence on long-term interest rates. Furthermore, since the amount held by the BOJ corresponds to only 11% of long-term government bonds outstanding, the effects of outright purchases of long-term government bonds are limited. (Fujiki et al 2001)

Shirakawa (2001, 7–8) states that it is uncertain whether central bank purchases could affect the relative supply of long-term government bonds. After all, the total amount of government bonds is expected to amount to over 600 trillion yen in 2002. Shirakawa concludes that even doubled purchases of 10 trillion yen a year would clearly not have any significant effect. He thus claims that to change the relative supply, it would be far more effective to shorten the maturity of newly issued government bonds.

Fujiki et al (2001) assess the risks associated with aggressive purchases of long-term government bonds. First, they note that the term premiums requested for long-term interest rates depend on expected inflation and the credit risk associated with the bond. They believe that the public would see aggressive purchases as a loss of fiscal discipline or keep them equal to central bank's underwriting of government bonds. The role of the credit risk premium would thus become more important and the term premium might rise. Likewise, expectations of higher future inflation might affect long-term interest rates. If the interest rates rose more rapidly than expected inflation, fiscal consolidation would become more difficult. The purchase of long-term government bonds might thus have an adverse impact on fiscal conditions through a hike in long-term interest rates.

Second, the BOJ might incur a substantial capital loss, which would burden future government budgets. In order to achieve price stability, the monetary base provided by such operations would have to be absorbed some day in the future. Private sector holdings of government debt would increase, as the BOJ would be forced to sell its long-term financial assets to account for the fallen prices of the long-term government bonds purchased in the beginning of the process. In such a case, monetary policy begins to resemble fiscal policy. Also Okina (1999) is worried about the BOJ's balance sheet. He fears the reactions of market

participants in Japan and abroad to possible erosion of the balance sheet following operations in long-term government bonds.

To conclude, Fujiki et al (2001) oppose aggressive operations strongly in a situation in which the economy is only sluggish and consumer prices are falling slightly. They find the effect of mild outright purchases of long-term government bonds likewise questionable: the authors note that the scope of such operations becomes highly limited if the potential capital loss is to be held within the BOJ's reserve for possible losses on securities transactions.

Oda and Okina (2001) note that the amount of bonds purchased would form only a part of the initial reduction in government bonds and under zero interest rates, the rest would be deposited in the central bank as excess reserves. The conclusion is based on portfolio rebalancing channel. Namely, if an agent constrained by a maximum risk limit sells a government bond to the central bank and acquires interest rate risk free currency instead, portfolio optimisation results in additional risk taking in the form of purchases of new risky assets. However, the price of these assets includes credit risk besides interest rates and the risk premium is thus larger than on government bonds. The risk limit of the agent will thus be reached before the entire stimulus has been translated into new loans.

As to foreign exchange interventions, the main argument seems to be that the exchange rate is within the jurisdiction of the Ministry of Finance and that the BOJ cannot thus use the policy option (Shirakawa 2001, 6). Furthermore, Fujiki et al (2001) state that it is not even feasible for Japan to make a foreign exchange rate commitment. They emphasise that the scope of foreign exchange interventions has so far been trivial, as the risks are generally thought to be larger than the potential benefits. Implementation problems are likewise conceived insurmountable. Okina and Shiratsuka (2000) stress in addition that foreign exchange intervention is only a fraction of the flow of funds in the money market and can thus have only a limited impact on the economy.

Oda and Okina (2001) link the risks associated with foreign exchange rate interventions to whether there has been misalignment among exchange rates. If there has not, they fear that an attempt to depreciate the yen might anger trading partners and especially the United States. East Asian countries might also see the policy as a beggar thy neighbour policy. However, it is easy to imagine that the trading partners would also benefit from the recovery of Japan through increased exports. Likewise, Oda and Okina note that such policy might violate Article IV of the IMF Agreement, which prohibits foreign exchange manipulation aiming at competitive advantage. The concern might be exaggerated. The authors fear also the possibility of speculative transactions, which might result in a collapse of the fixed exchange rate system if the central bank had not committed to a certain duration of the policy. Likewise, they believe that the exchange rate might return to the previous level immediately after the policy had been terminated.

All in all, it seems that some of the criticism directed against the BOJ is unreasonable and some justified, as the Bank has no direct influence on all aspects of the economy. The differences of opinion on the effects of unconventional policy measures reflect the attitudes of the parties: the BOJ feels that it cannot take unnecessary risks if it is possible to wait until the economy recovers while the critics claim that not acting has more serious consequences. I will return to the subject in conclusions, which will discuss Japan's stagnation as well as the liquidity trap and escaping from it.

9 Conclusions

Because of the two objectives of the work, conclusions are divided into two sub-sections. Section 9.1 is a summary of the competing theories and their influences on Japan's economic development in the post-bubble period, while section 9.2 concentrates on monetary policy related issues of what can be and should be done in Japan's trap.

9.1 Japan's stagnation

In the immediate aftermath of the collapse of the asset price bubble, Japanese economic development depicted quite natural cyclical behaviour but for some reason, the expected upswing was delayed. A large decline in investment gives a partial explanation, as the unwinding of the capital stock overhang from the 1980s and the debt burden of enterprises resulted in unwillingness to invest. Another reason is that the downturn was more serious than conceived at that time and the scope of expansionary policy was therefore inadequate. On the other hand, a promising recovery changed into a recession after the mid-1990s, partly due to a significant decline in real export growth that hindered further economic recovery. It is however obvious that a single factor cannot completely explain the post-bubble blues. Furthermore, the importance of theories has varied during the decade-long economic stagnation. Moreover, forgetting that Japan has also suffered from bad luck in the form of unfavourable external shocks would be unreasonable. The gloomier world economic outlook has in addition affected the economic development in 2001.

It is clear that some of the remaining features of the Japanese growth model restrict competition and that some sectors of the economy do not operate efficiently. Sustained below potential output indicates nevertheless that the most important problems originate from the demand side, which means that structural improvements are incapable of generating output growth in the short run. Their importance lies however in their ability to signal of government's commitment to restoring economic growth, because of which they can affect expectations. If the private sector conceives the outlook for the future more positive, aggregate demand increases. In addition, improving the efficiency of the Japanese economy is important in the long run.

The evidence of a liquidity trap in Japan is mixed and the outcome depends on the liquidity trap concept used in the analysis. At least the theory of expected currency appreciation and its implications seems to overrule the doubts of the possibility of a liquidity trap in an open economy. If the liquidity trap is then defined as zero nominal interest rates, sluggish demand, decreased bank lending and deflation, Japan during the zero interest rate policy fulfils the criteria. If the analysis follows Krugman's definition of a negative equilibrium real interest rate, the results of structural time series analysis imply that the liquidity trap could have been reality especially in 1999. Further research on Japanese equilibrium real interest rates would however be useful.

Various papers present rather convincing evidence of a credit crunch in the late 1990s. First, the yearly growth rates of narrow monetary aggregates have

exceeded those of broader aggregates since the early 1990s. This indicates that the money multiplier has decreased. Second, bank lending has grown more slowly than monetary base and M2+CDs since 1994, although the situation was the opposite in the 1980s. Moreover, bank lending has declined in the late 1990s. Third, the Tankan survey of the Bank of Japan implies that the credit conditions of both small and large enterprises have tightened significantly since mid-1997 despite low interest rates. It thus seems evident that lower demand for bank loans has not caused the decrease in bank lending. All in all, my view is that the credit crunch became reality in 1997. The regulation on reporting and capital-asset ratios tightened only in the late 1990s, which can explain the relatively late emergence of the financing problems. The significance of a credit crunch in Japan is unquestionable because of the crucial role banks have traditionally played in financial intermediation.

The claims of mistaken fiscal policy are entitled in the sense that the government could have planned the stimulus packages more carefully: now public investment projects with a low rate of return have been a too important part of the packages. Fiscal policy has likewise been conducted in a manner that has increased uncertainty among the private sector. General uncertainty and lack of confidence in the effectiveness of fiscal policy have in addition resulted in low multipliers on public spending and tax decreases, which might also reflect that Japan is close to Ricardian equivalence as Krugman claims. The most unfortunate decision was the decision to tighten fiscal policy in 1997, although it should not be forgotten that East Asian crisis played a significant role in the following downturn. All in all, Posen (1998) seems to underestimate the negative effects of public debt, as he seems to admit in his later paper (Posen 2001a) by stressing that the banking sector problems must be solved to decrease the vulnerability of the Japanese bond market. However, this does not mean that fiscal policy should turn contractionary.

Long-run wealth effects should not be forgotten either. If the household sector really has suffered a capital loss of the scope Ando (2000) calculates, it must have had an effect on consumption decisions. However, I am not convinced that the household sector would have conceived the true size of the loss, which means that the impact would be smaller than Ando estimates.

9.2 Japanese monetary policy at zero interest rates

Japanese monetary policy has probably been too cautious if the stagnant economic development is taken into account. On the other hand, most of the policy actions of the Bank of Japan would have been proper and sufficient under less serious circumstances. Until 1998, the BOJ was in addition unable to conduct monetary policy independent of exchange rate policy controlled by the Ministry of Finance, because of which inefficient monetary policy is not solely the Bank's responsibility. The BOJ has nevertheless been reluctant to follow the somewhat uncertain policies academics have suggested for it since it has found that times have not been desperate enough.

At the zero nominal interest rates Japan faces, inducing higher inflation expectations is in theory a valid method of increasing aggregate demand through lower real interest rates. The required scope of the policy depends on how deep the downturn is, but the suggested target rates for Japan vary most often between

3 and 4% for a number of years. Despite the recommendations, the BOJ claims that inflationary policy would not decrease Japanese real interest rates due to increased uncertainty. After all, the critics of the policy claim that it might make inflation expectations more volatile. The Bank finds also that the policy would be too risky, as it could make steering the economy harder. The BOJ fears likewise that resorting to the policy would hurt its reputation as an independent and anti-inflationary central bank. In practise, the Bank would have difficulties in convincing the public that it is committed to the policy, which could render the policy ineffective.

A temporary increase in the monetary base is inefficient in a liquidity trap, since the private sector can hold the excess liquidity in absence of significant storage costs. In Japan, providing excess liquidity has already proved inefficient at times, partly because the credit crunch has hindered the smooth functioning of financial intermediation. The policy can however affect inflation expectations by changing private sector expectations and be thus an effective tool.

Even if short-term nominal interest rates are at their lower bound, open market operations in long-term government bonds may revive the economy. The impact depends crucially on private sector expectations of future operations. However, the effects of the policy are uncertain, and the scope of the operations would have to be extremely large to truly affect economic growth. Moreover, the nature of long-term bonds is such that the central bank would have to assume some interest rate risk. If the private sector in addition viewed the purchases as a loss of fiscal discipline, long-term interest rates might actually rise. The BOJ economists have been particularly worried about the impact the purchases could have on the Bank's balance sheet. Despite the disadvantages, the BOJ has nevertheless purchased long-term government bonds. And even if these holdings now amount to nearly 40% of the total assets of the Bank, the amount corresponds to only 11% of long-term government bonds outstanding. All in all, the purchases would have to be truly sizeable to have a significant effect on the real economy.

Under flexible exchange rates, a central bank can also try to revive the economy by depreciating the domestic currency. The objective can be achieved by direct currency operations or open market operations in foreign bonds. As to Japan, the problem is again that the scope of the operations would have to be very large to close the current savings-investment gap, and I am somewhat uncertain whether it is possible to peg the yen at 140 to 150 yen per dollar, as Svensson suggests. The objection based on the adverse effects on trading partners' competitiveness can however be overruled by the positive impact a recovery would have on Japanese imports. Furthermore, policy co-ordination should be able to overcome the difficulties caused by fact that the Ministry of Finance is in control of exchange rate policy. The goals of the BOJ and the Ministry of Finance should after all be common, although the obstacles due to traditional political games are significant.

Methods approaching fiscal policy can be considered too risky. In addition, wealth allocation is not something that a central bank should do. Likewise, a carry tax on money is not a realistic way of lowering the nominal interest rate floor at present. As an interesting approach to the problem from the other side, it however warrants further research.

All in all, the role of expectations cannot be stressed too much: they are crucial in increasing expected inflation, in open market operations in long-term government bonds as well as in exchange rate policy. Finding out how a central

bank can credibly affect these expectations is thus important. Furthermore, as Svensson's method shows, it is more effective to conduct the different policies co-ordinately together. Such policy is also effective in decreasing general uncertainty and in signalling of commitment to revive the economy.

All in all, it is difficult to judge how the suggested approaches would affect the Japanese economy. It seems nevertheless clear that Japanese authorities should work together to end stagnation and deflation. The claims on how some specific problem does not belong to the responsibilities of a certain authority may be truthful, but it is time to stop waiting that someone else acts. Co-operation might actually be the only way to stable economic growth. However, some of the suggestions presented to the Bank of Japan do not take into account the special features of the Japanese economy. After all, approaches that might work somewhere else may be impossible to implement in Japan. It is easy for outsiders to propose different solutions and all but ignore the side effects, since their survival is not at stake.

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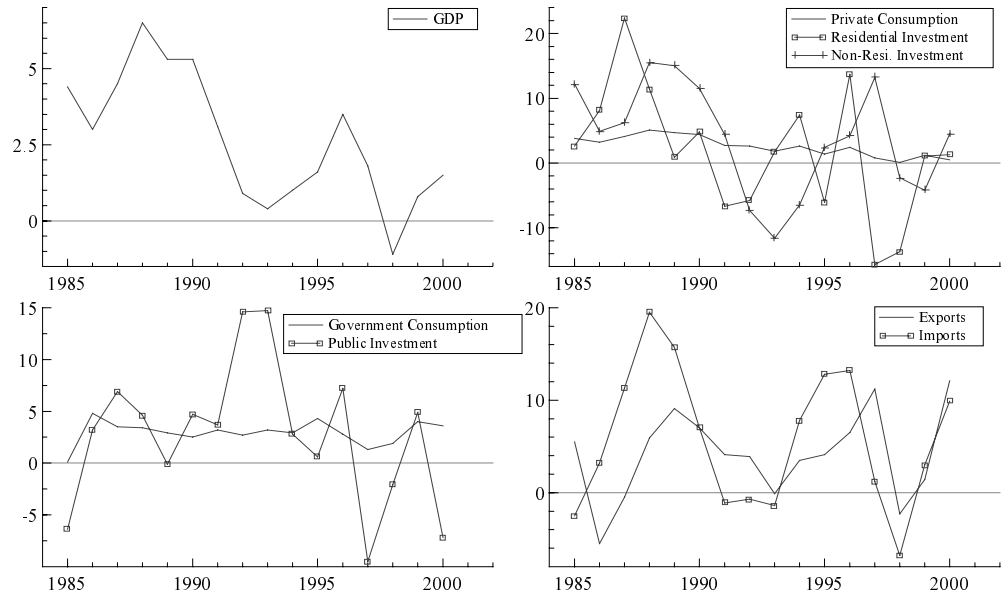
Appendix A

Economic indicators for Japan

Figure A.1 **Annual changes (%) of GDP and its components**

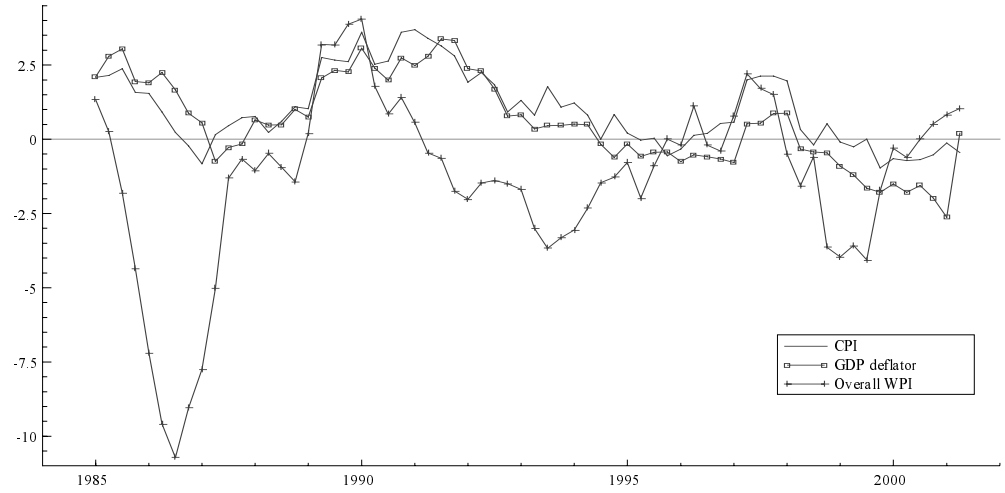


Source: Economic and Social Research Institute.

Figure A.2 **Unemployment rate**

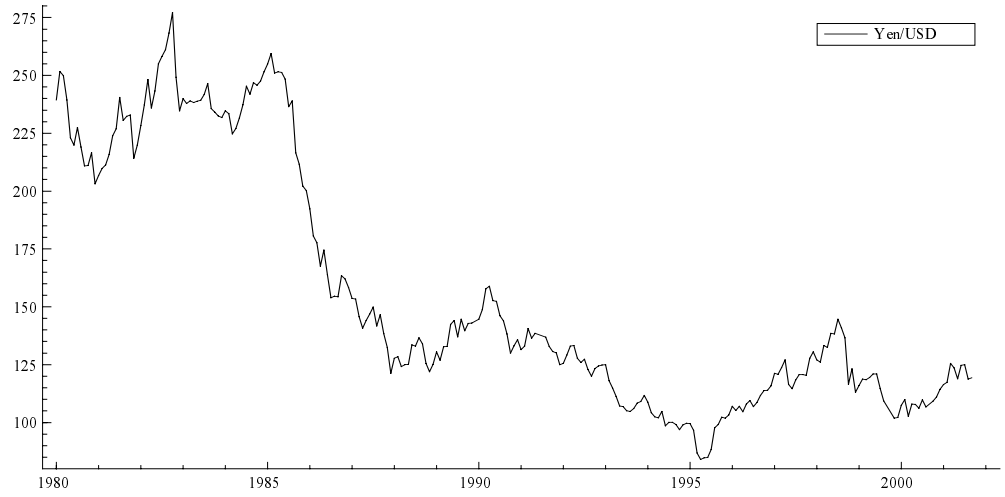
Source: OECD (2001b).

Figure A.3 **Quarterly inflation (% per annum)**



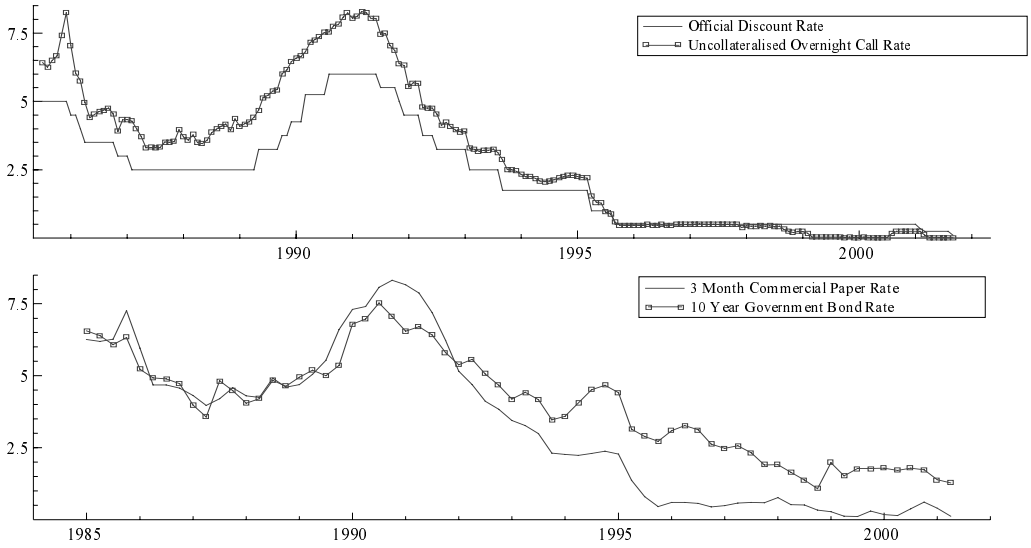
Source: OECD (2001b), Bank of Japan.

Figure A.4 **Nominal yen/dollar exchange rate (end of month)**



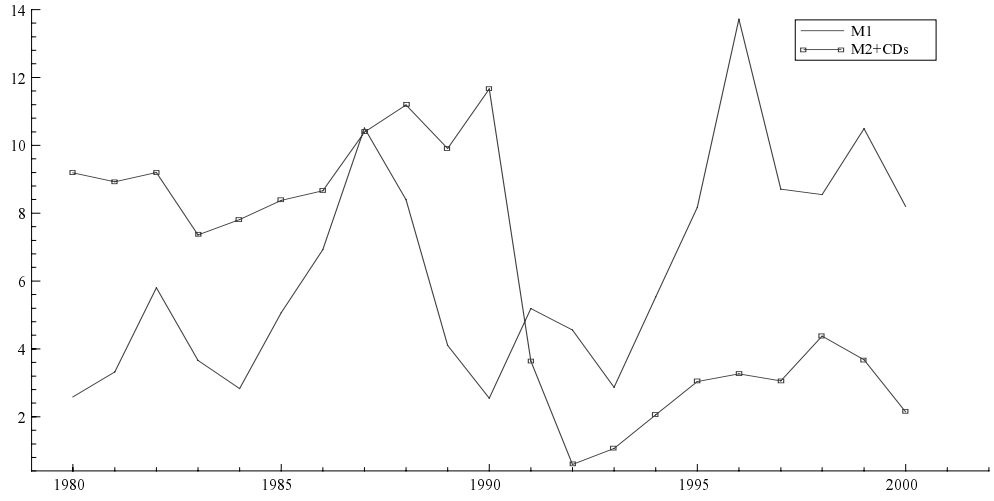
Source: Federal Reserve.

Figure A.5 **Interest rates (% per annum)**



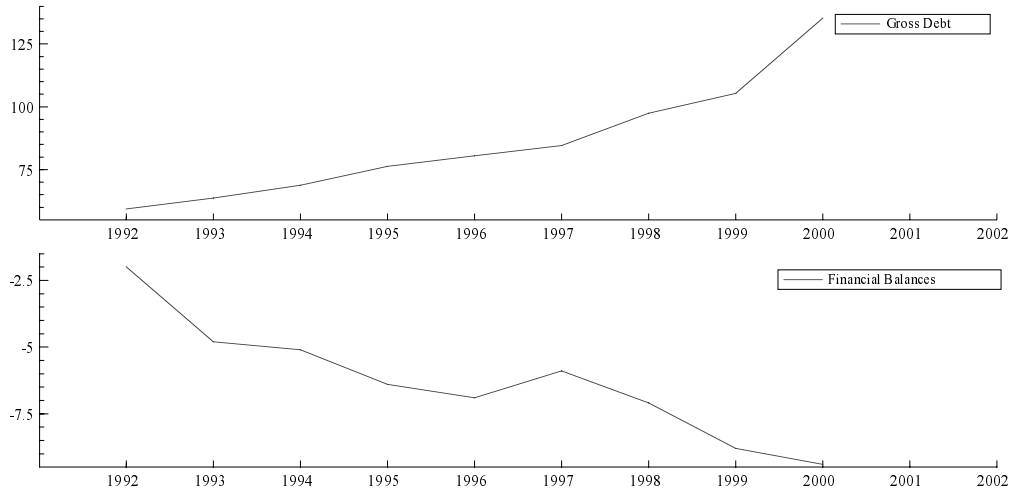
Source: Bank of Japan.

Figure A.6 **Money supply (12-month growth)**



Source: OECD (2001b).

Figure A.7 **Fiscal indicators (% of GDP)**

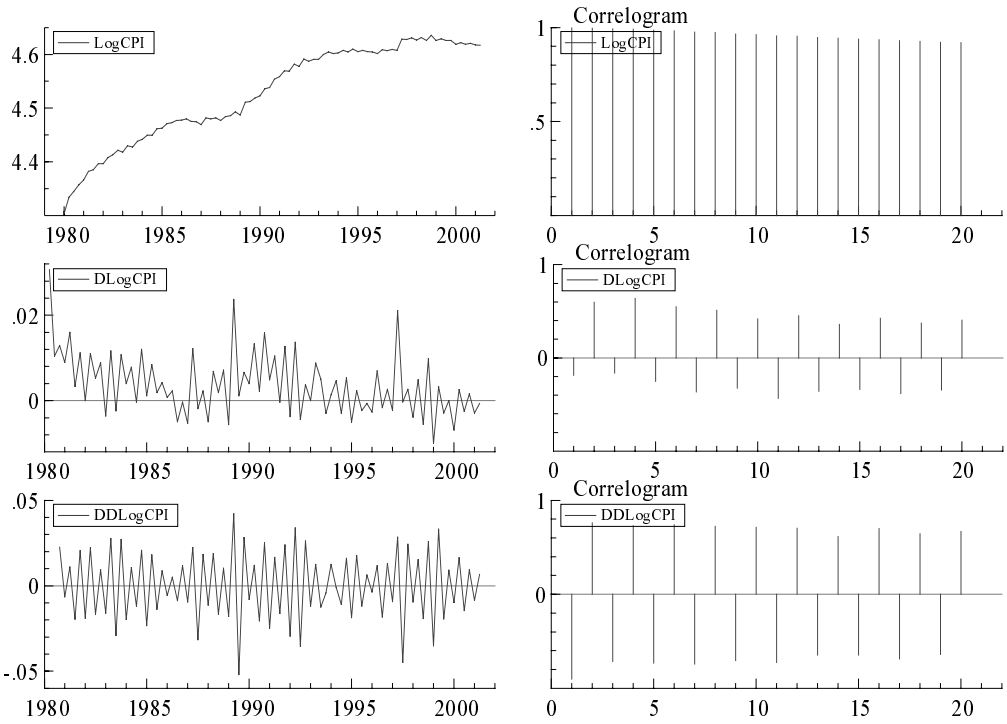


Source: Ministry of Finance.

Appendix B

Figures, tables and a box for section 6

Figure B.1 **Logarithmic CPI: Level and first and second differences**



Sources: OECD, Stamp calculations.

Table B.1 **A CPI model**

Model for logarithmic CPI	Level: stochastic Slope: stochastic Seasonal: trigonometric
Estimation sample	1980Q1–2001Q2
Convergence	Very strong in 13 iterations
Summary statistics	
Std.Error	0.0044448
Normality[1]	4.8925
H(27)[2]	0.91973
r(1)[3]	0.017858
r(9)	0.042223
DW[4]	1.8445
Q(9,6)[5][p-value]	3.5103 [0.7426]
Goodness-of-fit results for Residual LogCPI	
Prediction error variance (p.e.v)[6]	0.000020
Prediction error mean deviation (m.d)	0.000016
Ratio p.e.v./m.d in squares	0.994810
Coefficient of determination (r2)	0.997513
… based on differences (RD2)	0.616217
… based on diff around seas mean (RS2)	0.328205
Information criterion of Akaike (AIC)	−10.645976
… of Schwartz (Bayes) (BIC)	−10.417665
Expected inflation based on the forecast for 2001Q3	−0.59%
Ex ante real interest rate for 2001Q3	0.06% + 0.59% = 0.65%

[1]The Bowman-Shenton statistic with the adjustment of Doornik and Hansen is based on third and fourth moments of the residuals. The 5% critical value is 5.99 in a correctly specified model. (Koopman et al 1999, 119)
[2]The heteroskedasticity statistic H(h) is the ratio of the squares of the last *h* residuals to the squares of the first *h* residuals. Here *h* is set to the closest integer of *T/3*.
[3]The statistic *r(j)* gives the autocorrelation at lag *j*.
[4]Durbin-Watson test statistic.
[5]Box-Ljung test statistic.
[6]The variance of the residuals in the steady state.

Box B.1 **The role of consumption in estimating the equilibrium real interest rate in an open economy**

Since Krugman's intertemporal open economy utility function

$$U = \frac{1}{1-\rho}\sum_t D^t (C_{Tt}^{\tau} C_{Nt}^{1-\tau})^{1-\rho} \qquad (5.12)$$

is time separable, consumption allocation during the periods can be separated from dividing the total expenditure E between the periods. The optimisation can therefore be performed in two phases. The first optimisation problem can be written as:

$$\begin{aligned} &\max && C_{Tt}^{\tau} C_{Nt}^{1-\tau} \\ &\text{s.t.} && P_{Tt}C_{Tt} + P_{Nt}C_{Nt} = E_t, \end{aligned}$$

where E_t is the total expenditure of period t.

The first order conditions

$$\begin{aligned} &\tau C_{Tt}^{\tau-1} C_{Nt}^{1-\tau} - \lambda P_{Tt} = 0 \\ &(1-\tau) C_{Tt}^{\tau} C_{Nt}^{-\tau} - \lambda P_{Nt} = 0 \\ &P_{Tt}C_{Tt} + P_{Nt}C_{Nt} - E_t = 0 \end{aligned}$$

are obtained by differentiating the Lagrange function written on the optimisation problem. Then

$$\frac{\tau C_{Nt}}{P_{Tt}} = \frac{(1-\tau)C_{Tt}}{P_{Nt}}$$

and

$$P_{Tt}C_{Tt} = \pi(P_{Tt}C_{Tt} + P_{Nt}C_{Nt}),$$

where $P_{Tt}C_{Tt} + P_{Nt}C_{Nt} = E_t$. Therefore

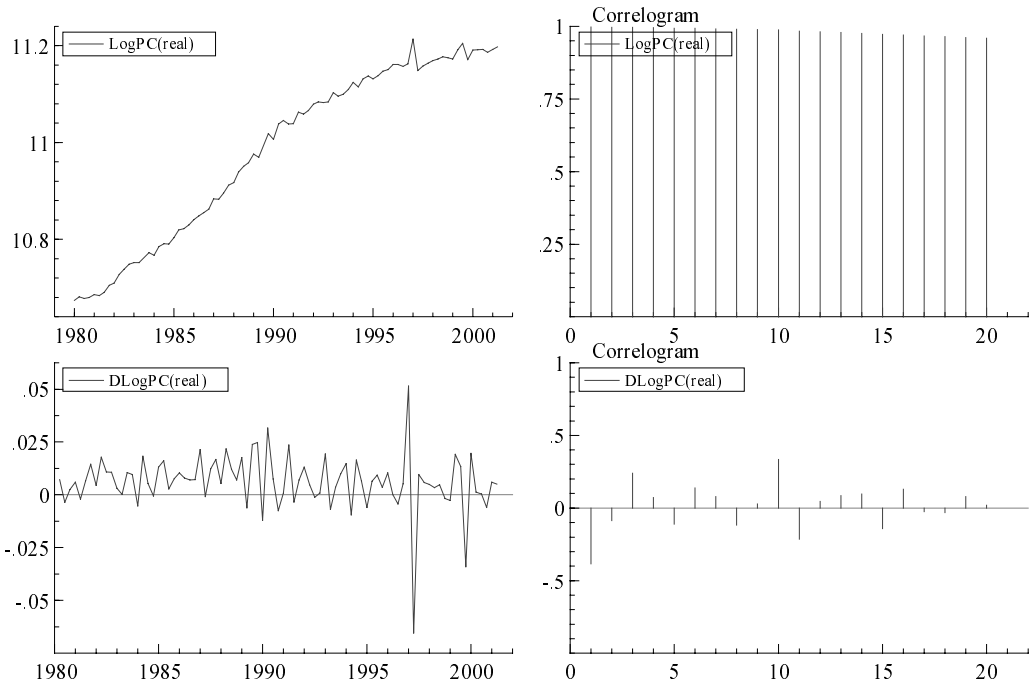
$$C_{Tt} = \frac{\tau E_t}{P_{Tt}} \quad \text{and} \quad C_{Nt} = \frac{(1-\tau)E_t}{P_{Nt}},$$

which can be substituted in the maximisation problem to get

$$C_{Tt}^{\tau} C_{Nt}^{1-\tau} = \frac{\tau^{\tau}(1-\tau)^{1-\tau} E_t}{P_{Tt}^{\tau} P_{Nt}^{1-\tau}}.$$

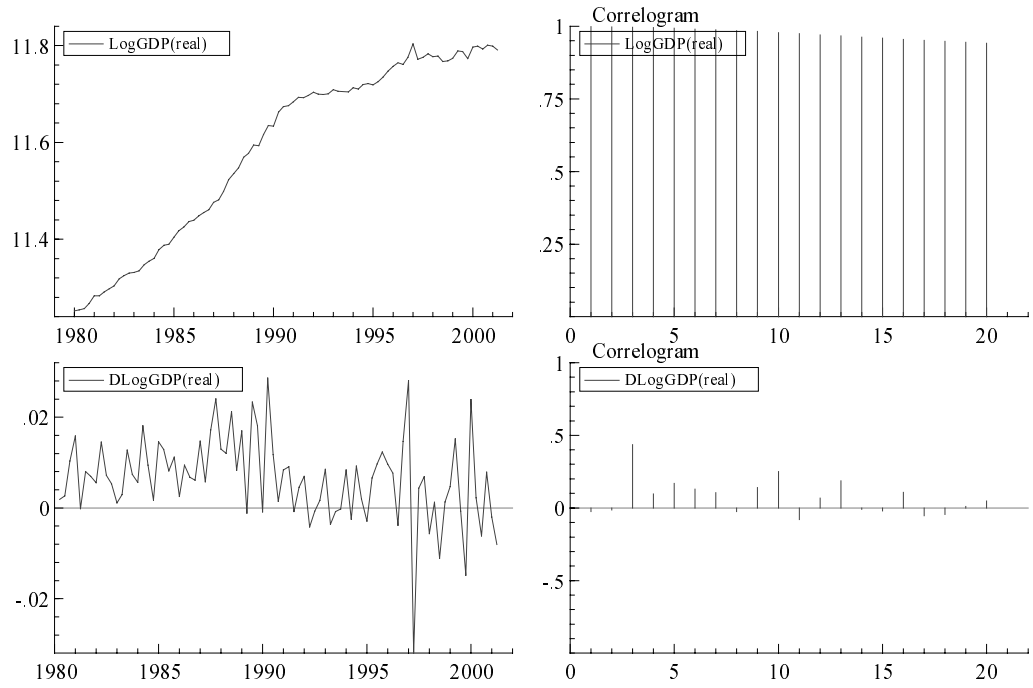
Since $C_{Tt}^{\tau} C_{Nt}^{1-\tau} \equiv C_t$ and $P_{Tt}^{\tau} P_{Nt}^{1-\tau} \equiv P_t$, using private final consumption expenditure to estimate the equilibrium real interest rate is consistent with open economy.

Figure B.2 **Logarithmic private consumption and first difference**



Sources: Economic and Social Research Institute, Stamp calculations.

Figure B.3 **Logarithmic GDP and first difference**



Sources: Econmic and Social Research Institute, Stamp calculations.

Table B.2 **Two private consumption models**

Model for logarithmic private consumption	Level: stochastic Slope: stochastic Seasonal: trigonometric	Level: stochastic Slope: stochastic Seasonal: no seasonal
Estimation sample	1980Q1–2001Q2	1980Q1–2001Q2
Convergence	Very strong in 17 iterations	Strong in 100 iterations
Summary statistics		
Std.Error	0.011275	0.011210
Normality	30.414	41.489
H(27)/H(28)	3.6318	3.9980
r(1)	–0.018545	–0.038540
r(9)/r(8)	0.023825	–0.15737
DW	2.0314	2.0725
Q(9,6)/Q(8,6) [p-value]	8.8392 [0.1828]	8.4890 [0.2044]
Goodness-of-fit results for residual LogPC		
Prediction error variance (p.e.v.)	0.000127	0.000126
Prediction error mean deviation (m.d)	0.000091	0.000085
Ratio p.e.v./m.d in squares	1.252198	1.383464
Coefficient of determination (R2)	0.995951	0.995997
… based on differences (RD2)	0.282004	0.290191
… based on diff around seas mean (RS2)	0.263464	0.271862
Information criterion of Akaike (AIC)	–8.784326	–8.888817
… of Schwartz (Bayes) (BIC)	–8.556015	–8.774662
$E(C_{t+1}/C_t)$	0.99962907	0.99962907
Max δ for negative real interest rate	0.037	0.037

Table B.3 **Two GDP models**

Model for logarithmic GDP (real)	Level: stochastic Slope: stochastic Seasonal: trigonometric	Level: stochastic Slope: stochastic Seasonal: no seasonal
Estimation sample	1980Q1–2001Q2	1980Q1–2001Q2
Intervention	1997Q1	1997Q1
Convergence	Very strong in 13 iterations	Very strong in 14 iterations
Summary statistics		
Std.Error	0.0074361	0.0074263
Normality	0.34186	0.20066
H(27)	1.9708	2.8791
R(1)	0.020851	0.023059
R(9)/r(8)	–0.12600	–0.12180
DW	1.9258	1.9249
Q(9,6)/Q(8,6) [p-value]	8.8756 [0.1807]	7.9503 [0.2418]
Goodness-of-fit results for residual LogPC		
Prediction error variance (p.e.v.)	0.000055	0.000055
Prediction error mean deviation (m.d)	0.000044	0.000044
Ratio p.e.v./m.d in squares	0.989737	1.009984
Coefficient of determination (R2)	0.998350	0.998354
… based on differences (RD2)	0.357984	0.359671
… based on diff around seas mean (RS2)	0.342086	0.343816
Information criterion of Akaike (AIC)	–9.593511	–9.689167
… of Schwartz (Bayes) (BIC)	–9.336661	–9.546472
$E(Y_{t+1}/Y_t)$	1.0030	1.0030
Max δ for negative real interest rate	–0.29	–0.29

Table B.4 **Model of differencial GDP**

Model for differentiated logarithmic GDP (real)	Level: stochastic Slope: no slope Seasonal: no seasonal
Estimation sample	1980Q2–2001Q2
Intervention	1997Q2
Convergence	Very strong in 2 iterations
Summary statistics	
Std.Error	0.0080885
Normality[1]	2.0367
H(28)	3.7160
r(1)	–0.074726
r(8)	–0.061535
DW	2.1260
Q(8,7) [p-value]	10.777 [0.1486]
Goodness-of-fit results for residual LogCPI	
Prediction error variance (p.e.v)[6]	0.000065
Prediction error mean deviation (m.d)	0.000051
Ratio p.e.v./m.d in squares	1.041529
Coefficient of determination (r2)	0.240387
… based on differences (RD2)	0.627909
… based on diff around seas mean (RS2)	0.616885
Information criterion of Akaike (AIC)	–9.564030
… of Schwartz (Bayes) (BIC)	–9.477819
$E(Y_{t+1}/Y_t)$	1.00126
Max δ for a negative real interest rate	–0.0006

Table B.5 **Maximum δ for a negative equilibrium real interest rate**

Quarter	$E(C_{t+1}/C_t)$[7]	Max δ (%)	$E(Y_{t+1}/Y_t)$[8]	Max δ (%)	$E(C_{t+1}/C_t)$[9]	Max δ (%)
1997Q1	0.9797	2.07	0.9843	1.60	1.0026	$\delta < 0$
1997Q2	1.0329	$\delta < 0$	1.0060	$\delta < 0$	1.0184	$\delta < 0$
1997Q3	1.0166	$\delta < 0$	1.0034	$\delta < 0$	1.0073	$\delta < 0$
1997Q4	1.0080	$\delta < 0$	1.0027	$\delta < 0$	1.0018	$\delta < 0$
1998Q1	1.0013	$\delta < 0$	1.0044	$\delta < 0$	1.0017	$\delta < 0$
1998Q2	1.0000	0.00	1.0022	$\delta < 0$	1.0008	$\delta < 0$
1998Q3	0.9986	0.14	1.0024	$\delta < 0$	1.0024	$\delta < 0$
1998Q4	1.0020	$\delta < 0$	0.9985	0.15	0.9977	0.24
1999Q1	1.0026	$\delta < 0$	0.9976	0.24	0.9948	0.52
1999Q2	0.9921	0.79	0.9980	0.20	0.9956	0.44
1999Q3	0.9908	0.93	1.0032	$\delta < 0$	1.0028	$\delta < 0$
1999Q4	1.0184	$\delta < 0$	1.0051	$\delta < 0$	1.0071	$\delta < 0$
2000Q1	1.0003	$\delta < 0$	0.9981	0.19	0.9961	0.39
2000Q2	1.0018	$\delta < 0$	1.0034	$\delta < 0$	1.0026	$\delta < 0$
2000Q3	1.0027	$\delta < 0$	1.0055	$\delta < 0$	1.0067	$\delta < 0$
2000Q4	1.0077	$\delta < 0$	1.0024	$\delta < 0$	1.0035	$\delta < 0$
2001Q1	1.0014	$\delta < 0$	1.0035	$\delta < 0$	1.0032	$\delta < 0$
2001Q2	0.9996	0.04	1.0030	$\delta < 0$	1.0030	$\delta < 0$

[7]The model used for forecasts: level = stochastic, slope = stochastic and seasonal = trigonometric.
[8]The model used for forecasts: level = stochastic, slope = stochastic and seasonal = no seasonal.
[9]The model used for forecasts: level = stochastic, slope = stochastic and seasonal = trigonometric.

Figure B.4 **The quality of private consumption forecasts**

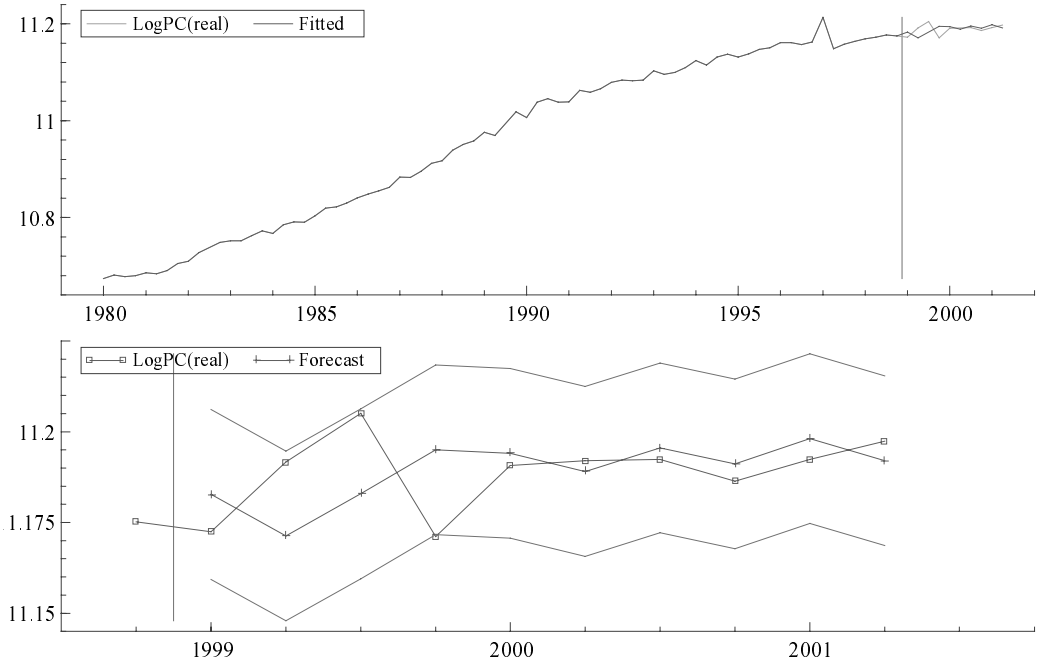


Figure B.5 **The quality of GDP forecasts**