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Monetary Transmission via the Central Bank Balance Sheet

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This paper estimates the effects of unconventional monetary policies on consumer as well as asset price inflation, economic activity and bank lending at the hand of a VAR analysis, covering episodes of balance sheet policies of 9 countries over the last 20 years. While recent episodes of unconventional monetary policies have been extensively analysed, this paper reduces deficiencies about long-run implications following central bank balance sheet policies in Scandinavian countries, Australia in the 1990s and Japan in the early 2000s. Results of this study are that balance sheet policies, in response to a collapse of asset price bubbles, can ensure a short run stabilisation of economic activity but are not able to lift the economy out of the ensuing deflationary slump alone. Additionally, they do not pose severe problems associated with inflation, as laid out in several theories such as the static monetarist interpretation of the quantity theory of money, or towards newly created asset price bubbles.

Keywords: unconventional monetary policy, zero lower bound, money multiplier, VAR

JEL classification: C32, E31, E44, E51, E52, E58

I. Introduction

In general, the balance sheet of a central bank rises quite steadily in normal times through the growth of statutory reserves due to loan origination and higher money demand because of a growing economy. While most central banks target the interest rate as the crucial policy variable, the balance sheet size is a by-product of the undertaken operations to secure the inflation target via the calibration of the specific policy rate. But in recent years in response to the financial crisis of 2007/2008 this approach has changed. The size and composition of the central bank's balance sheet became an additional dimension of monetary policy conduct. With nominal interest rates approaching the zero lower bound, accompanied by a reduced effectiveness of the interest rate channel, central banks had to rely more and more on unconventional monetary policies to try maintain working transmission mechanisms. These so called balance sheet policies (BSPs) mainly affect the central bank's balance sheet through an intervention in private and public debt markets via refinancing or outright monetary operations (see Benford et al. (2009), BIS (2009)).

As stressed above, central banks' balance sheets usually have a steady and mostly stable growth path. In this paper the focus is on exceptional increases of the balance sheets in times of a financial crisis. The sudden increase—as defined in Borio and Disyatat (2009) as a rise of 30% or more in a span of less than two years—in response to an exogenous shock exposes the central banks with risks rarely faced in normal times.

The BSPs are mostly seen as essential to lean against the negative impacts of a financial crisis (see Bernanke (2009), Goodhardt and Ashworth (2012), IMF (2013d)). Since these actions are no standard measures of the central banks, little was (and still is) known about the effects they would entail, especially in the long run. Directly after the Lehman collapse in 2008, many central banks observed that standard monetary policy would rather soon be stretched to their limit, and become less effective in securing working transmission mechanisms. Depending on the country's respective situation and problems, specific measures were implemented. In most advanced economies central banks expanded their balance sheets quite substantially—as can be seen in figure 1—via either a buy-up of government securities, intervention in private debt markets, unconditional bank lending to commercial banks, or foreign exchange interventions to keep exchange rates stable.

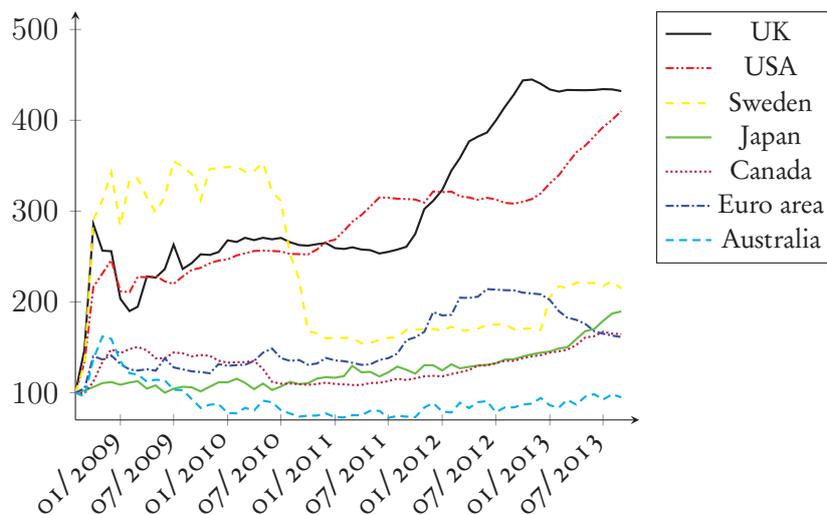


Figure 1: Size of the Central Banks Balance Sheets (08/2008 = 100). Sources: BoE, Fed, SRB, ECB, BoJ, BoC, RBA.

The implications of these unconventional monetary policies, and their effects on the transmission channels, and therefore the real economy, will be examined in this paper using a VAR approach. While the recent episodes of BSPs have been extensively analysed in the last years (see Chen et al. (2012), Gambacorta et al. (2012), IMF (2013e)), there are deficiencies in the literature—especially the empirical—about the Nordic Banking Crisis of the 1990s and long run effects of the BSPs on asset prices. These shall be reduced with this work.

The emphasis is on the consequences of an use of unconventional monetary policies on consumer and asset prices. Studies of the unconventional monetary period of Japan in the mid 2000s (e.g. Honda et al. (2007) and others) and about the recent Great Recession shall be compared with the results of this work while applying a VAR model. To assess the results, theoretical foundations about the various BSPs are given in the next chapter. Their effects on the transmission channels are discussed in chapter 3. These are linked to the empirical literature in chapter 4, to estimate their substance in explaining the current crisis. The empirical assessment follows in chapter 5—first on hand of stylised facts and then with a VAR model. The results are compared with other research on these topics and are discussed in the 6th chapter. Finally, chapter 7 concludes.

II. Theoretical Foundations

II.1. Effectiveness of Monetary Policy at the Zero Lower Bound

Situations like the observed after the Lehman collapse in 2008 are very rare. While there is literature about these episodes, examples, to derive specific policy procedures from, are hard to find. In response to the Great Depression scholars tried to find answers to the troubles. Especially Keynes and his successors shaped the discussion about the right policy descriptions after such a financial crisis. Standard IS/LM-Models analyse episodes like these under the special case of a liquidity trap. Since the LM-curve is flat in these instances, expansionary monetary policy becomes ineffective in raising economic activity, due to the perfect substitutability between bonds and cash at the lower bound of nominal interest rates. Furthermore, the interest rate cannot be lowered due to the binding zero lower bound, and therefore central banks are not able to stimulate the economy through the interest rate channel in these instances either (see Mankiw (2009)).

In New Keynesian models, monetary policy at the zero lower bound is mainly seen to have an effect on economic activity through increased inflation expectations. Since the aggregate demand function becomes positively sloping in these situations and nominal interest rates are tied to the zero lower bound, a further reduction of interest rates is barred, and therefore conventional monetary policy becomes ineffective (see Lambsdorff & Engelen (2007)). In these standard models the policy variable of the central bank is the interest rate—mostly via a Taylor rule. Therefore, forward guidance of the central bank to increase inflation expectations and thus lowering long-term real interest rates is seen as an effective tool to overcome the zero lower bound constraint (see Eggertson (2003)). New Keynesian models that explicitly incorporate quantitative measures as a central bank's policy tool see additional small positive effects of some form of quasi-debt management policy in lowering long-term real interest rates. While these policies can help overcome the zero lower bound constraint, the best way to stimulate the economy is

seen via positive aggregate demand shocks—that would be fiscal stimulus from the government (see Cúrdia and Woodford (2010)).

Mainly brought forward by Koo (2003, 2009, 2011), episodes like the Great Depression, Japan's Lost Decade, or the Great Recession after 2008 follow a distinct and unique pattern, unlike economic slowdowns observed during normal business cycle downswings. In what he calls "balance sheet recessions", monetary policy is unable to stimulate the economy and push it out of the deflationary environment. Koo sees the main reason for monetary policy ineffectiveness in weak credit demand because of deleveraging in the private sector after the collapse of an asset price bubble. He recommends countercyclical fiscal stimulus until private sector agents have cleaned up their balance sheets and loan demand picks up. Unlike other research (see Woodford (2012), Romer and Romer (2013)), he sees just little effects from forward guidance—that is the explicit communication of the future conduct of monetary policy.

Notably Eggertsson and Krugman (2012) expand a New Keynesian Model to account for the deleveraging in the private sector. They include debt constraints due to a hangover of excess debt after the collapse of an asset price bubble which restrains aggregate demand. Albeit they reiterate the notion that rising inflation expectations are key to overcome the zero lower bound, their main insight is on the front of fiscal policy. Monetary policy might just induce an incomplete expansion in their model, therefore fiscal policy will be most effective in increasing output through a temporary rise in government spending until the deleveraging process is finished. These conclusions are similar to the recommendations made by Koo (2009).

While these models mostly do not see a threat to inflation from expansionary monetary policies after a collapse of an asset price bubble, monetarist models postulate that an expansion of the monetary base always leads to an increasing price level, as Friedman (1970) notes: "Inflation is always and everywhere a monetary phenomenon". This view is based on the assumption that an expansion of the monetary base leads to a proportional increase in the money supply through a stable money multiplier, and in accord with the quantity theory to a higher price level. Hence, one should experience inflationary environments following expansionary monetary policy through the balance sheet, even in a liquidity trap. But as Teles and Uhlig (2010) observe that although the quantity theory seems to be valid, the relationship for low inflation countries is difficult to make (see also Gerlach (1995), De Grauwe and Polan (2005)). As it will be shown in this paper, when the economy is in a balance sheet recession and inflation rates are very low compared to normal standards, the relationships of the static money multiplier and quantity theory seem not to persist any longer.¹

¹Additionally, the observed BSPs can be seen to be of temporary nature. They are a reaction

II.2. Forms of Balance Sheet Policies

This paper uses the classification of BSPs brought forward by Borio and Disyatat (2009). They distinguish between quasi-debt management policy, credit policy, bank reserves policy and foreign exchange interventions as operations expanding the balance sheet of a central bank.² These are often undifferentiated labelled as quantitative easing (QE), but differ in many countries due to the country-specific issues.

The term quantitative easing is rightfully used in the context of a direct engagement by the central bank in public debt markets as a way to fulfil explicit targets for central bank reserves (see Ugai (2006))—as seen in Japan in the early 2000s—but is often identified with other unconventional operations by central banks as well. The main purpose of quasi-debt management policy is to flatten the yield curve through purchases of sovereign debt, and therefore an easing of the refinancing costs of the governments. This has to be seen divergent to debt monetisation through direct financing of newly issued government bonds, since quasi-debt management in the observed periods involves a purchase of already issued bonds on the secondary market.

The second form of BSPs is often entitled as credit easing (see Bernanke (2009)). In this case, central banks purchase private sector debt and securities to ease credit conditions for the private sector. Through this, financing conditions for the private sector can be improved, which helps to lower debt burdens after a negative financial shock. These policies were undertaken for instance by the Federal Reserve Bank of the United States (Fed) by buying mortgage backed securities (MBS) to halt the selloff in the housing markets (see Bernanke (2009)), the European Central Bank (ECB) via the Securities Market Program (SMP) (see ECB (2010)) and the Bank of England (BoE) via purchases of high-quality assets within the context of the Asset Purchase Facility (APF) (see BoE (2013)) after the Lehman collapse of 2008.

With bank reserves policies central banks aim to directly affect the quantity of reserves held by private banks at the central bank, and therefore supply the commercial banks with liquid assets. The objective is to boost money supply via increased reserves and preserve a well functioning interbank market. The ECB conducted bank reserves policy after the Lehman collapse by extending reserves to the banking sector directly via refinance operations to counter the breakdown of the interbank market (see ECB (2012)). Similar instruments were used by the Scandinavian central banks during the Nordic Banking Crisis of the 1990s (see Moe (2004)).

to market stress after a negative financial shock and not an attempt to significantly expand the monetary base permanently. Thus, an increase in inflation would be followed by an equal decrease after the unwinding of the BSPs in a strict monetarist framework.

²In the evaluation of BSPs in this paper permanent accumulations of assets by the central bank as a means to support the exchange rate through foreign exchange interventions will not be analysed.

These three forms of BSPs all have different targets. However, all types share the objective to lower yields for private and public agents, and reduce credit risks in the specific market segments. As a consequence, central banks remove risky assets from the private sector to help improve the private agent's balance sheets, relief them—at least temporarily—from the debt burden, preserve the functioning of financial markets and (hopefully) stabilise economic activity in the process.

II.3. Transmission Channels

Due to these operations the composition of the balance sheets of the central banks change, as the share of risky assets in the portfolios rises. Central banks are therefore prone to credit risks (see BIS (2009)). Through the increased balance sheet exposure they might be confronted with possible losses of credibility and independence (White (2012)). Despite these risks, the losses which could be faced due to non-action could potentially be quite high. In an environment where the interest rates—as seen in the recent financial crisis after the Lehman collapse in 2008—are near the zero lower bound, and traditional monetary policy through the interest rate channel is highly ineffective, central banks often have to restore financial market intermediation and provide additional monetary policy accommodation, even if it might have some negative drawbacks.

Monetary policy via the balance sheet works mainly through the different credit channels and the signalling channel. Other channels through which the BSPs have an impact on the economy can be the risk taking channel and the equity price channel (see Benford et al. (2009)).

To stimulate credit activities, central banks aim to affect the balance sheets of private agents through the substitution of private and public assets with central bank money. By exchanging risky with riskless assets in the private sector, and therefore a reduction of the risk premia, it is hoped that credit flows can be improved (see Bernanke (2009), Gagnon et al. (2011), Thornton (2012)). This balance sheet channel works mainly through portfolio balance effects, meaning that the quality of the borrowers' balance sheets are improved.

Via bank reserves policies, central banks provide reserves in larger quantities than the market participants would otherwise need due to the reserve requirements. Therefore, the increased precautionary demand for reserves, which is caused by doubt about counterparty solvency in the banking sector during a period of financial stress, can be met. Hence, credit supply, which could break down without the supporting measures, might be stabilised. The channel through which this policy can affect the economy is often referred to as the bank lending channel (see Bernanke & Gertler (1995)).

BSPs can also have effects on the perceived wealth of private sector agents. Through the change in the composition of their portfolios private sector agents perceive themselves as wealthier. This channel is often referred to as the equity price channel (see Brainard and Tobin (1968), Tobin (1969)). Coupled with lower interest rates and a shortage of assets relative to money this can lead to an increased risk-taking, and therefore to investments into riskier asset classes (see Borio & Zhu (2008)).

In recent years central banks have increasingly used the effectiveness of the expectations channel in combination with the various BSPs. Due to the BSPs and the perceived risks that could come with them, it is important for central banks to keep inflation expectations well anchored on the upper, as well as—and maybe especially—on the lower end. Thus, central banks try to steer inflation expectations (as seen from the Bank of Japan (BoJ) (2013)) and expectations about future economic conditions (by the implementation of the so called "Evans-Rule" (which states, that the federal funds rate is not to be raised, unless unemployment falls below 7.5%, as long as medium term inflation does not rise above 3%) by the Fed, as laid out in Evans (2011)) more and more through the use of specific communication strategies and forward guidance. With the use of these tools, central banks try to give market participants a clear roadmap for future policy and gain credibility (see Bauer and Rudebusch (2012), Krishnamurthy and Vissing-Jørgensen (2011) on this issue).

The effectiveness of the different transmission channels has been analysed in various theoretical models and empirical studies. Cúrdia and Woodford (2010) apply a New Keynesian model with central bank holdings of government debt as one policy variable to consider the implications of non-standard monetary policy measures at the zero lower bound. They show that especially quantitative easing—defined there as quasi-debt management policy—has no significant effect on aggregate demand at the zero lower bound. They rather see a role for direct credit policy targeted at asset purchases in the private sector as a tool for stabilisation policy working through the portfolio balance channel (see also Krishnamurthy and Vissing-Jørgensen (2013) in the same line of arguments).

Bernanke et al. (2004) study the effectiveness of non-standard monetary policy alternatives at the zero lower bound. They analyse financial market reactions to various policy announcements of the Fed regarding US Treasury securities, and find that the signalling channel might be most effective to lower longer-term yields at the zero lower bound, and therefore stimulate economic activity. Additionally they point out that direct asset purchases help affect the yields of the targeted assets most.

Clouse et al. (2000) analyse different options for central banks in low inflation environments when the economy approaches the zero lower bound. The authors use empirical evidence from the Great Depression and Japan, as well as theoretical deliberations to assess the impact of unconventional monetary policies in such

an environment. They find that an increase in the monetary base due to a purchase of assets—e.g. Treasury bills and bonds, or private sector securities—can increase aggregate demand by increasing liquidity in the targeted markets. But the authors identify considerable limitations regarding the effectiveness of these operations. They see notable uncertainty of responses of markets to these operations. Additionally they stress that underlying problems have to be tackled by specific operations which are best suited to address these issues directly.

III. Evidence on the Transmission Channels

Various scholars, politicians and the press note that the unconventional monetary policies might cause negative effects in the future. Since most of these policies do not belong to the standard measures of most central banks—at least in this size and length—they could entail undesired consequences. These concerns are mainly about higher inflation in consumer prices, financial market stability, distortions in financial markets and asset price bubbles (see Asness et al. (2010), Rajan (2013), White (2012)). In this section some reasoning behind these arguments will be given. The emphasis lies—as in the whole paper—on the concerns about inflation and asset price bubbles.

The biggest concern probably is on inflation in consumer prices. (Neo)-Classical and Monetarist scholars worry that an inflationary regime materialises in the future on the ground of the quantity theory of money and a stable money multiplier. Their reasoning implies a direct link between an expanded monetary base and a subsequent higher price level.³

The assumption that there is a direct causality in the money multiplier could be discarded, if the process of credit creation is clearly understood. Private banks do not *ex ante* depend on reserves in order to lend to the public, which could then give rise to higher price levels. In a fractional reserve banking system the causation does not go from the creation of bank reserves to credit expansion, but the other way around. If a bank extends a credit it acquires reserves afterwards, either on the interbank money market or, if banks cannot obtain funds there, through the standing facilities at the penalty rate whenever there is a shortage in the money market (see Carpenter and Demiralp (2012)). Therefore banks are never reserve constrained. As Dudley (2009) notes: "If banks want to expand credit and that drives up the demand for reserves, the Fed automatically meets that demand in its conduct of monetary policy. In terms of the ability to expand loans rapidly, it makes no difference whether the banks have lots of excess reserves or not." Hence, banks extend credits and acquire reserves afterwards to fulfil the average reserve requirement over the maintenance period (see also ECB (2012)).

³This notion is still frequently used in macroeconomic textbooks and the literature (see for example Freeman and Kydland (2000), Mankiw (2009), Meltzer (2010)).

The constraint that banks have is their internal risk calculus, which is based on the credit worthiness of the borrower, the cost of funding and capital requirements (see Georg and Pasche (2008), Singh and Stella (2012)). Central banks mainly manage the price at which lending is undertaken (i.e. the interest rate), but not directly the level. They cannot control lending activity directly on the upper end of the spectrum. But since commercial banks cannot lend their excess reserves directly to the non-bank public—as some commentators have suggested they should do—there is no direct additional credit expansion through the provision of excess reserves by the central bank (see again Singh and Stella (2012)). Hence, the money multiplier should be seen as an ex post identity and not as a rigid ex ante relationship.

On the ground of this reasoning, it is hard to see how an expansion of the monetary base alone via bank reserves can induce an inflationary regime through the bank lending channel.⁴ Evidently, broad money aggregates have not significantly risen in recent years.⁵ Ex ante money multipliers would be higher than the observed ex post ones. The drop of the money multipliers—especially in the USA and the UK—after the financial crisis of 2008 (and inversely the rise of the Japanese multiplier after the end of the first QE period in 2006) can be seen in figure 2:

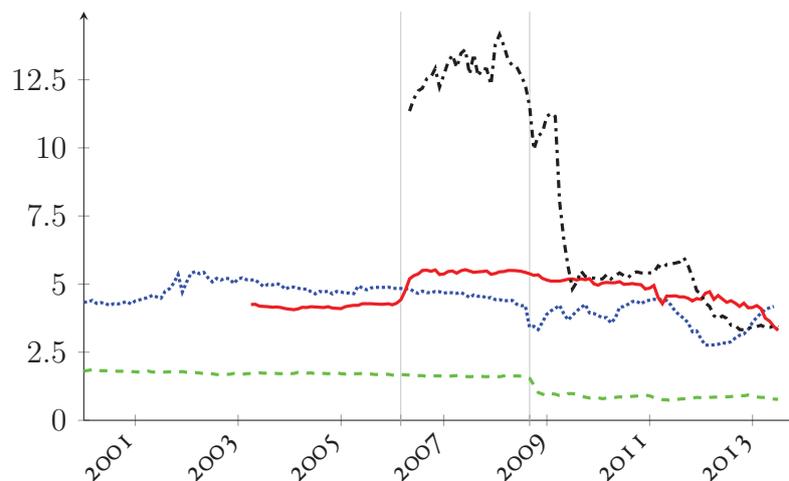


Figure 2: M1 Money Multipliers: Euro area (.....), Japan (—), USA (---), UK (-·-·-). The vertical lines indicate the end of the Japanese QE Period and the beginning of the BSP episode in 9/2008. Sources: BoE, BoJ, ECB, FRED.

⁴Especially neoclassical economists are opposed to this reasoning on the ground that higher individual savings in a recession represent loanable funds for the banking sector, which should increase lending. But as will be seen in the statistical analysis, bank lending does not pick up in a balance sheet recession due to the above mentioned constraints and the affirmation of the Paradox of Thrift (taking account of the fallacy of composition).

⁵That does not mean that the multipliers will stay negative at the margin. But until the private sector has not finished deleveraging extensive loan creation will probably not ensue. When the deleveraging is completed, normal credit demand should be restored, and marginal multipliers will become positive again.

Against the background of commodity and stock market rallies since 2012, the focus of many concerns is on equity prices. It is argued that central banks build up the next bubbles via their ultra-easy policies (see IMF (2013a), White (2012)). Through the provision of liquid assets, central banks try to reflate asset prices, and give investors more confidence going forward. Contrary to these concerns, it can be argued that the rising stock market prices are a welcome by-product of the BSPs at the hand of the central banks. With rising stock prices individuals feel wealthier, and might spend more money, which would help demand recover as the private sector is still deleveraging (see Benford et al. (2009), Borio and Disyatat (2009)). However, these asset price effects through the equity price channel probably do not have a strong effect on economic activity, as underlying fundamentals do not change substantially until there is a noticeable improvement of the real economy. Evidence suggests that the perceived wealth effects just have temporary effects on asset prices (see Bezemer (2012) and the following chapters).

In the analysis conducted in this paper the main focus lies on the effects of BSPs on consumer price inflation, lending and asset prices. As it could be seen in the theoretical part, BSPs do not automatically lead to a higher price level as stated in the mechanical interpretation of the quantity theory of money. The notion that BSPs stimulate lending has to be questioned as well. As shown for example in Koo (2011) for the case of Japan, BSPs are probably able to stabilise credit creation, but are not able to accelerate the private sector deleveraging as rapidly as it would be necessary to jump-start loan origination in the private sector. Regarding asset prices, it has to be distinguished which impact on rising stock markets can be attributed to the BSPs, and which stems from better economic performance and brighter expectations about the future path of the economy. The forgoing reflections will be examined on the hand of empirical analyses in the following chapters.

IV. Empirical Literature of Balance Sheet Policies

Since the empirical analysis in this paper is mainly conducted applying a VAR model, the focus shall be on similar studies. Most research in the VAR literature applies some form of interest rate or government bond spread to estimate the impact of the asset purchases on bond yields as a proxy for the policy instrument (see Baumeister and Benati (2010), IMF (2013e), Kamada and Sugo (2006), Smets and Peersman (2001)). Therefore, the effects on government bond spreads from unconventional monetary policies are well analysed in the literature. Chen et al. (2012) for example give an overview of various studies. A reduction of the 10-year Treasury yield after the large-scale asset purchases (LSAPs) in the USA after 2008 can be assessed in the literature, which range from a 15 to 107 basis point reduction, depending on the sample and method. However, because these implementations mainly go along with announcements by the central banks to keep policy rates low

for extended periods, the driving force behind the reductions could be seen in these commitments (see Woodford (2012)).

Since some central banks have approached—or came close to—the zero lower bound since 2008, the procedure changed in recent studies. Of late, measures of the monetary base or bank reserves are used as a reference for the monetary policy variable in VAR studies. Carpenter and Demiralp (2012) repeat the VAR analysis used by Bernanke and Blinder (1988) to estimate the relationship between reserves and loans to verify the notion of the money multiplier. They find no evidence for a relationship between changes in reserves and changes in lending, and therefore refuse the evidence on the bank lending channel and a static money multiplier.

Honda et al. (2007) focus on output and prices following an expansion of bank reserves. For this, they use the announced targets of the current account balances from the BoJ as a measure for the monetary expansion from 2001 to 2006 in Japan. While applying a three variable VAR model, they show that the monetary easing episode was effective in stabilising and slightly stimulating real economic activity, but they detect no significant effect on the inflation rate. Additionally, they extend the three variable VAR model by adding a financial variable. For the analysis with stock prices—as measured with the Nikkei Stock Average—they show a significant positive response for the first 6 months after the expansion of the current account balances.

A similar approach is used by Schenkelberg and Watzka (2011) who extend the analysis back to 1995, when the BoJ approached the zero lower bound with their overnight rate (known as the episode of the Japanese Zero Interest Rate Policy (ZIRP)). They find a statistically significant positive response of industrial production, but no effect on inflation after an expansion of the current account balances using a structural VAR model. Berkmen (2012) uses an analogous structural VAR model to analyse the monetary easing episodes in Japan ranging from 1998 to 2010. Comparable to other studies over this period, she finds a positive relationship between monetary easing and economic activity respective inflation, although the contribution of the monetary expansion to inflation is rather small.

Gambacorta et al. (2012) use a panel VAR analysis of recent BSPs in eight advanced economies after the Lehman collapse of 2008. They find a temporary rise in economic activity, which is significantly positive, and consumer prices, which is weaker and less persistent.

An analysis by Anderson et al. (2010) puts some focus on the experiences of Sweden and Finland in the 1990s. Their main result is that BSPs can lead to an increase in economic activity without causing inflation to rise, if the monetary authority credibly commits to reverse the expansion of the monetary base. They show that inflation expectations of the public remain well anchored during these periods of monetary easing.

V. Empirical Assessment

V.1. Stylised Facts

For long-run effects of unconventional monetary policies the experiences of Scandinavian countries from the banking crisis in the 1990s, and from Japan's and Australia's monetary easing periods are used as benchmarks (see figure 3).

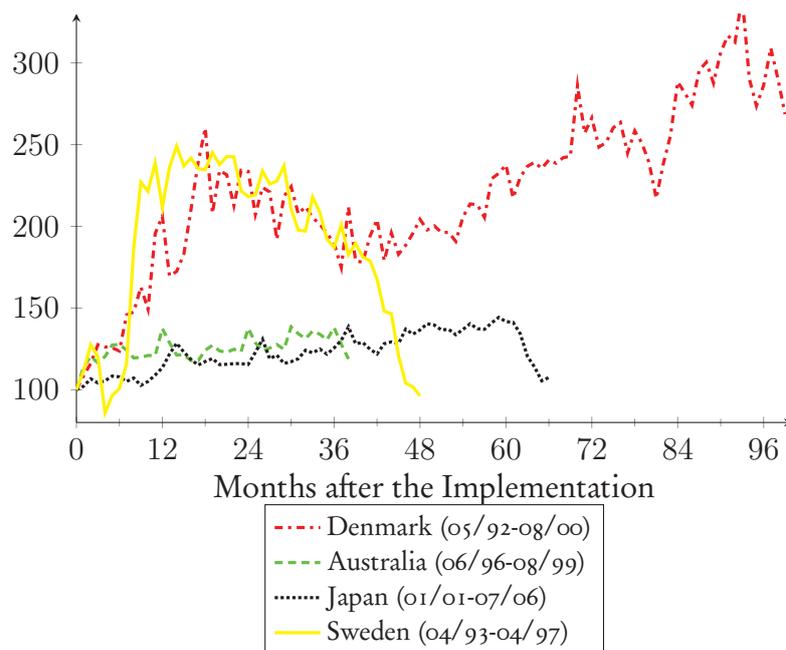


Figure 3: Size of Balance Sheets for the pre Lehman period (Starting Month of the Implementation = 100). Sources: Nationalbanken, RBA, BoJ, SRB.

During the late 1980s Sweden experienced a loan and real estate bubble, which burst in the end of the 1980s (see Englund (1999) and figure 4). In the beginning of the 1990s the Swedish government, through a guarantee of bank obligations, and the Riksbanken, through unconditional lending to the commercial banks, helped ease the burden on the stricken institutions (Moe et al. (2004)). Even though the Riksbanken expanded the balance sheet quite massively from 1993 on, there were no signs of runaway inflation. The inflation rate did not go above 3 percent for another decade (see figure 5). The stock market rebounded in the late 1990s (see figure 5), but this was mainly due to the dot-com bubble and the general favourable economic environment after the recovery from the crisis. Even though banks experienced a huge inflow into their current accounts held by the central bank during the monetary easing period, bank lending did just pick up after the reduction of the reserves and following the completion of the deleveraging of the private sector (see figure 5).

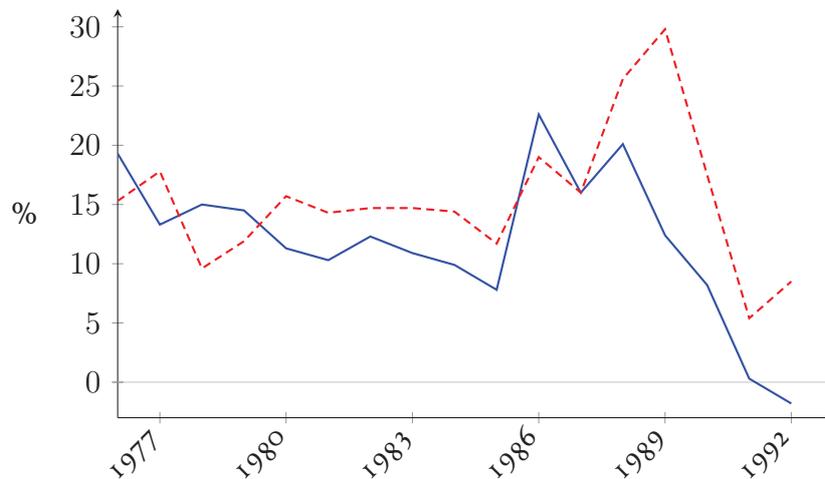


Figure 4: Credit growth (yoy change) to Households (—) and Non-financial Corporations (- - -) in Sweden. Source: SRB.

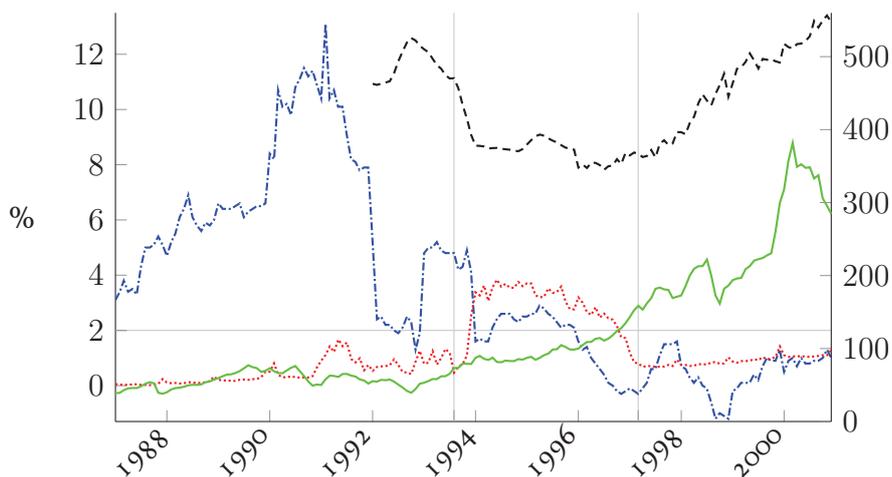


Figure 5: Statistics for Sweden: Inflation Rate (lhs) (- - -), Bank Lending (in bil. SEK) (rhs) (- - -), Monetary Base (in bil. SEK) (rhs) (· · · · ·), Affarsvarlden Index (Stock Market) (rhs) (—). The vertical lines indicate the beginning and end of the BSP episode. Sources: SCB, Affarsvarlden.

Similar events occurred in the other Scandinavian countries. In Denmark, the central bank responded with a huge increase in reserves starting in 1992 (see figure 6), which was unwound in the span of 6 months in the beginning of 2000 without much distortion for the economy. Quite the same patterns as in Sweden could be seen, as consumer price inflation did not go far above 3 percent until the summer of 2008 (see figure 6). Again similar to Sweden, the Fondsbørs stock market index saw a rise around 2000, but the subsequent fall almost revised the gains during the late 1990s, which is an indicator that the stock market was driven by the dot-com

bubble (see figure 6). Bank lending did not pick up until 2000, after the commercial banks repaired their balance sheets (see figure 6).

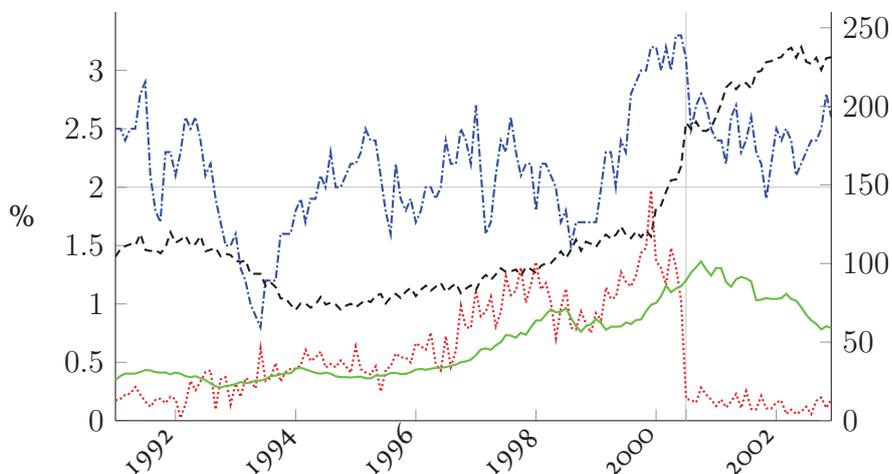


Figure 6: Statistics for Denmark: Inflation Rate (lhs) (---), Bank Lending (in bil. DKK) (rhs) (---), Reserve Balances (in bil. DKK) (rhs) (.....), Fondsbørs Indeks (Stock Market) (rhs) (—). The vertical line indicates the end of the BSP episode. Sources: IFS, Nationalbanken, Statistics Denmark.

Japan in the beginning of the 2000s might pose as the best analysed and most similar example for the aftermath of the current financial crisis, since it was, in difference to the Scandinavian countries, exposed to the zero lower bound, like most advanced economies today. The Bank of Japan responded to the collapse of the real estate bubble of the 1980s by lowering the interest rate to near zero in 1995 (see figure 7b). Since this measure did not seem to get the Japanese economy out of the deflationary slump, the BoJ implemented a quantitative easing strategy beginning in March 2001. This policy led to an almost doubling of the monetary base within two and a half years (see figure 7a). Several studies show a short stabilising effect on the economy right after the monetary easing was conducted by the Bank of Japan, but they also indicate that this effect was not lasting. The unconventional monetary policy was not able to jump-start the real economy (see figure 7b). On the other hand it did not have the negative effects on inflation, which have been feared by many. Japan remained stuck in a deflationary environment (see figure 7b). Recently the BoJ experienced some success in un-anchoring the low inflation expectations by credibly announcing a higher inflation target (2%, up from 1%) and implementing another round of quantitative, as well as qualitative easing.⁶ In the quantitative easing period of the early 2000s the Bank of Japan was not able to create a dynamic in credit markets. Bank lending could not even be held at the pre-crisis level, despite the massive expansion of the current accounts (see figure 7a).

⁶As defined by the BoJ (2013) as an expansion of the monetary base and a change of the composition of the balance sheet by purchasing Japanese government bonds and exchange-traded funds.

As it is shown in figure 7a, the quantitative easing policy in Japan might have raised stock market prices quite substantially in the mid-2000s, but this rise came after a decrease in 2001, which was mainly due to the collapse of the dot-com bubble and the falling economic activities after 9/11.

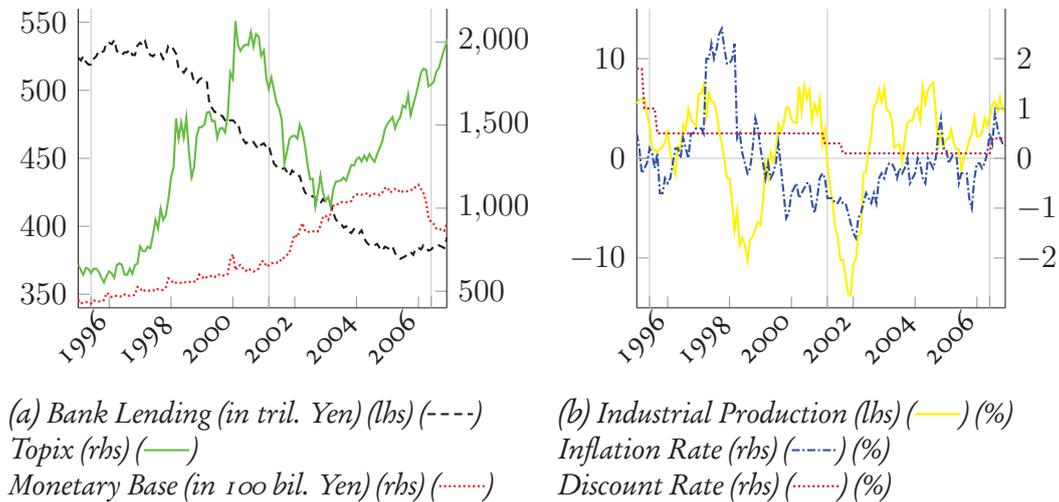


Figure 7: Statistics for Japan. The vertical lines indicate the beginning of the ZIRP in 06/1995, the implementation of the QE in 03/2001 and the end in 06/2006. Source: BoJ.

The increase in the monetary base in Australia in 1996 was due to the conduct of exchange settlements responding to financial stress in south east Asian economies prior to the Asian financial crisis of 1997. The Reserve Bank of Australia (RBA) increased the Exchange Settlement Accounts in July and August of 1996 by 6 billion AUD, stemming almost equally from purchases of Australian government securities and foreign exchange holdings. Not surprisingly due to the type of the purchase, inflation did not rise in response to these operations (see figure 8). The high inflation in late 2000 and early 2001 are a reflection of a newly introduced tax system in 2000 and higher import prices for fuel and food, and not a product of the BSPs (see RBA (2001); this is also evidenced by the drop in early 2001 after the short pickup). There is also no substantial upwards deviation of the stock market and bank lending above the trend as there might be expected following an increase of the monetary base of 30% in two months (see figure 8). Although economic activity picked up following the BSPs (see figure 8), it cannot be concluded here, if this increase is caused by the BSPs, or stems from other factors.

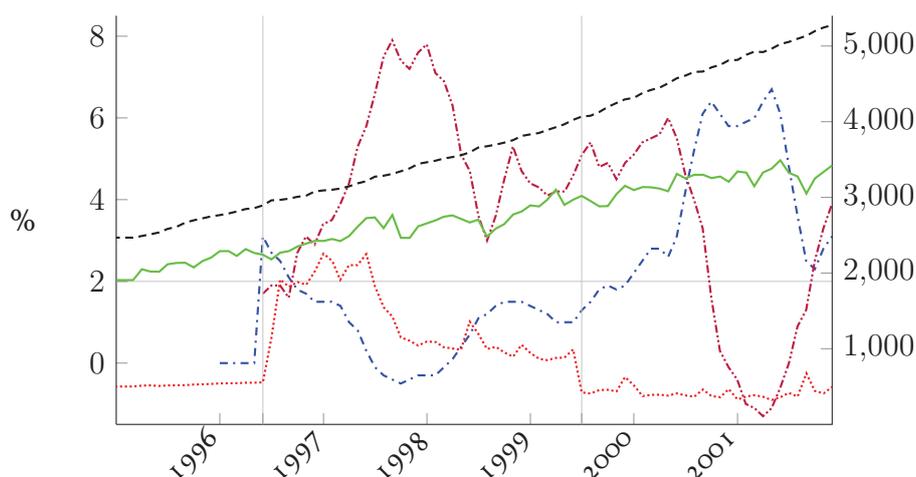


Figure 8: Statistics for Australia: Inflation Rate (interpolated from quarterly data) (lhs) (---), Index of Economic Activity (lhs) (-.-.-), Bank Lending (in 100 mil. AUD) (rhs) (....), Reserve Balances (in 10 mil. AUD) (rhs) (.....), All Ordinaires Index (rhs) (—). The vertical lines indicate the beginning and end of the BSP episode. Sources: IFS, RBA, Westpac.

The episodes after 2008 are characterised by deflationary tendencies, anaemic bank lending, mainly flat economic activity and a rebounding in stock markets well after the initial crisis was over.⁷ Due to these similarities, the events especially in Sweden, Denmark and Japan pose as an example for the long-run implications to what happened around the world after the Lehman collapse. The stylised facts show similar trends in inflation, stock markets and lending patterns for the countries after central banks engaged in the various forms of BSPs. Specifically, consumer price inflation does not rise, bank lending does not pick up, it rather shrinks, and stock market increases probably do not have their origin in the balance sheet policies of the central banks. The results from the stylised facts are analysed and reviewed using a VAR model on different countries in the next chapter.

V.2. VAR Analysis

V.2.1. Specification

Although the drawbacks of VAR models are well known, a five variable reduced-form VAR model shall be estimated here, to assess the effects of the BSPs on inflation, economic activity, bank lending and stock markets, and to underscore the

⁷An in-depth analysis of the BSPs in the other countries of the sample will not be conducted here. For further analysis see for example Borio and Disyatat (2009), IMF (2013d), Joyce et al. (2012), Kapetanios et al. (2012), Stone et al. (2011).

theoretical foundations. It is determined by:

$$y_t = a_1 y_{t-1} + \dots + a_p y_{t-p} + e_t \quad (1)$$

where y_t is a vector of endogenous variables at time t , a_p is the matrix of autoregressive coefficients of the lagged values y_{t-p} with p as the number of lags, and e_t is a vector of the residuals.⁸

The lag length is set to 2 months, which is consistent with the literature. Additionally, lag-length criteria were applied as verification and yielded the same results for most samples.⁹ For the impulse response functions the Cholesky decomposition is used. This is the most common identification scheme in the VAR literature, and also recommended by various authors (see for example Hamilton (1994)).

V.2.2. Variables

The frequency of the data is monthly. The sample period depends on the different countries and regions.¹⁰ The vector of endogenous variables y_t contains the following variables: To assess the monetary shock, the size of the current account balances (CAB) is taken, since these are the main policy target for most central banks conducting BSPs (in case of credit easing indirectly through the size of the asset purchases). Output is measured as the index of industrial production (IIP). The measurement for prices is the core consumer price index (CCPI), which is not used by all central banks as the crucial variable for measuring inflation, but is used here as to not distort the results through exogenous shocks in highly volatile commodity prices.¹¹ To estimate credit market conditions aggregate bank lending to the private sector is applied. For asset prices, the broad stock market indices of the respective countries and regions are employed. All data is expressed in log-levels.

For an analysis of the long run effects, especially on the stock markets, the observation period for the countries pre-Lehman, and Canada and Sweden starting in 2008

⁸An alternative SVAR model could have been applied here, but was not chosen since many theoretical assumptions which are valid in non-crisis times might not apply in a balance sheet recession. Therefore, these restrictions might have not produced sound results.

⁹For some countries lag lengths of one period are recommended as root tests gave caution to instability issues while using two periods as lags. But since these could not be observed in the data, two lags are incorporated for the dataset to be consistent (with the exception for Australia after 2008, where one lag is used). For some countries lag lengths of three and six months were suggested. These did not essentially change the results for the samples, but jagged lines are visible, suggesting that the number of parameters to be estimated is too large relative to the number of observations.

¹⁰For the VAR approach there are 12 episodes of BSPs in 9 countries and regions identified. For some countries certain data is not available, therefore the VAR model had to be reduced in these instances. A detailed listing of the variables and countries is given in the Data Appendix.

¹¹For some countries the CCPI could not be obtained, instead headline inflation was used. All other models are also checked using headline inflation measures and yielded similar results.

was extended for at least one year after the unwinding of the BSPs. Through this it is possible to control for the equity price channel, which is estimated to have a longer lagging time horizon. For the other countries and regions the last period for which the whole dataset was available is applied.

V.2.3. Results

From the theoretical and empirical literature it can be expected that the BSPs might stimulate economic activity through the various channels. It can also be assumed that inflation as well as stock prices might react slightly positive. In addition, the level of bank lending probably does not change substantially.

Appendix 1 to 4 displays selected impulse response functions from the sample. They show a one-standard-deviation shock to each variable. Appendix 1 represents the response of inflation to an expansion of the current account balances, while the following three figures show the responses of the IIP, bank lending and the stock markets to a monetary policy shock respectively. The solid lines represent the estimates of the impulse response functions, while the dotted lines mark the plus/minus two standard deviations (i.e. the confidence bands).

Additional tests are conducted. Lag length criteria are used to determine the lag lengths (see chapter 5.2.1). Granger causality tests gave no indication that one variable forecasts another for the whole sample (i.e. they do not Granger-cause each other). As mentioned earlier, root tests indicated possible instability issues in some cases, but these could not be observed in the final outputs, since the standard deviation bands do not drift apart extremely with a longer time horizon. Ultimately, variance decomposition is attributed to indicate the relative importance of each innovation in influencing the other variables in the model. The focus in the following analysis lies on the crucial results from the impulse response analysis, that is why a detailed interpretation of the additional tests will be left out.

For almost every sample there appear quite the same patterns. Inflation does not increase substantially following the BSPs. In cases where inflation rises (for example in the United States) it can be attributed to reflation effects after the drop in the inflation rate directly after the respective onset of the crisis. But these increases do not result in an un-anchoring of inflation, since inflation rates remain at, around, or even under the target rates for all countries well after the conduct of the BSPs, and therefore—if at all—just make up for the below target inflation directly after the crisis. Industrial production is just stimulated for a short period of time and this effect is not lasting. Stock markets react primarily slightly positive, but just after an initial fall. Additionally, bank lending does not pick up, it rather shrinks. These findings are mostly in accord with results from other VAR studies like Honda et al.

(2007), Schenkelberg and Watzka (2011) and Ugai (2006) on Japan, and Gambacorta et al. (2012) for the recent episodes.¹²

The results of the VAR analysis in this paper are quite similar to the above mentioned research on the Japanese monetary easing period in the mid 2000s. In the first quantitative easing period from 2001 to 2006 inflation and bank lending shrink in response to the monetary policy shock.¹³ In contrast, economic performance is elevated, but just after sinking for the first 4 months. The Topix stock market index is positively responding to a monetary policy shock, too. Using the variance decomposition, these movements are attributed to the BSPs to just a small amount, except for bank lending, where the contribution is about 20 percent.

In the Nordic countries in the 1990s the pattern is quite the same. After the bursting housing bubbles the BSPs were just able to stabilise the economy at the previous path, but gave no significant rise to inflation or bank lending. Although inflation picks up in Denmark in response to the BSPs, the contribution of the increase of the reserves is not very high (less than 10 percent). Despite rising stock markets in the end of the 1990s, this was probably not due to the BSPs in any large extend, but rather because of improved economic conditions and the dot-com bubble (stock markets even fell in response to the monetary policy shock in Sweden). The variance decomposition confirms these findings for Denmark, since the BSPs have just a small (20 percent) influence in explaining the stock market rise.¹⁴

Australia represents quite the same picture for the period in the late 1990s. Industrial production and bank lending remain flat following the monetary policy shock. Although the All Ordinaries Index reacts positive in the first 9 Months after the shock, this is not statistically significant and not lasting. Inflation could not be incorporated into the model, but core inflation remained between two and three percent—well under the rates in the 1980s and early 1990s—during and after the unconventional monetary policy period.

New Zealand is kind of a special case in the sample, since their increase in the monetary base stems from a rise of the statutory reserve requirement, and was not following a financial shock (see Nield (2008)). Nevertheless it is incorporated into

¹²Caution remains, since the VAR model incorporates just 5 variables. Therefore variables that were left out could have contributed to the patterns (for example fiscal policy shocks to industrial production). The reasoning for the incorporation of these particular variables is explained by the effects of monetary policy through the applicable transmission mechanisms on these specific measures as laid out in chapter 2. Variables like the exchange rate or interest rates could have also been incorporated into the model, but these are already extensively analysed in the literature (see chapter 4).

¹³Again, see Appendix 1-4 for the impulse response functions discussed in this chapter.

¹⁴The influence of the dot-com bubble can be seen especially in the Copenhagen Stock Exchange Index, which afterwards reversed to a level which is compliant with a growth pattern comparable to the pre BSP episode and the pre-bubble expansion.

the sample, since it shows how such an increase might lead to a higher price level following the static interpretation of the money multiplier and the quantity theory of money. But there is no evidence for this. Inflation reacts negatively at first, but then rises slightly after around two years after the shock, and not statistically significant and as drastic as the Monetarist Theory would expect.¹⁵ Bank lending picks up during the period after the implementation of the extended reserves policy.¹⁶ Again, this rise is also not as drastic as would be assumed following the quadrupling of the monetary base in one and a half years from mid 2005 to the end of 2006. Stock prices also go up following the monetary shock, but this can again be attributed to other factors, as the variance decomposition just devotes a low impact to the expansion of the reserves in increasing the stock market.

The findings for the countries and the Euro area post Lehman are mostly the same as for the pre-Lehman period countries. Inflation, industrial production and bank lending remain mostly flat or fall, and the monetary policy shock has just a clear positive impact on stock markets in the United States and the United Kingdom.

In general the BSPs cannot induce a fast and long lasting economic recovery, do not create inflationary regimes and do not spur bank lending in a way which would be in line with the static, *ex ante* money multiplier theory. In some cases, there seem to be some short run contributions to growth, but these are not lasting. A direct and immediate reaction of stock market prices cannot be observed either, and the rise seems to be attributed to the low level from which the stock markets started, since the BSPs are implemented just after the beginning of the respective financial collapses.¹⁷ Furthermore, the variance decomposition analysis shows that the longer run effects on stock markets are mostly due to better economic outlooks after some years, rather due to the BSPs directly.¹⁸

¹⁵Caution remains with the inflation data for New Zealand, since it was not possible to incorporate CCPI data, and New Zealand—as a small open economy—is especially prone to currency revaluation and inflationary shocks from commodity markets. Evidently, inflation rates rose quite significantly during the commodity price booms in the second halves of 2008 and 2011.

¹⁶It would be a puzzle, if the increase would stem from the higher reserves directly, since the increase in the reserve requirements does not enable private banks to undertake more lending activities directly, but can be explained by higher liquidity in the banking sector. Evidently, the variance decomposition reveals that the rise in lending is mainly due to a higher stock market and does not stem to a high proportion from the increased reserves. But since the model for New Zealand is not completely specified, it cannot be said, if the rise in the stock market might stem from higher economic growth, or other contributing variables.

¹⁷Data for the post Lehman countries for example starts in September of 2008, where the stock markets already dropped quite substantially.

¹⁸Similar results were obtained when the findings were also crosschecked with different stock market indices in countries where there is more than one leading indicator and data was available (i.e. in the USA additionally to the Dow Jones Industrial Index the Standard and Poor's 500 and the NASDAQ, in Japan additionally to the TOPIX the NIKKEI 225 and in Sweden additionally to the Affarsvarlden Index the OMX Stockholm 30 Index).

V.2.4. Model extensions

Even though it was established in the theoretical part that there is no direct causal relationship between the extension of current account balances and the money supply, the VAR model is extended using broad money measures—mostly M_3 —as a further variable for several samples.

Although the impulse response functions predominantly indicate a positive impact to the money aggregate from an extension of the current accounts (and therefore a seemingly validation of the quantity theory), this conclusion would just be built on a statistical relationship, and not on a sound and consistent interpretation of the money creation process as laid out in chapter 3. The expansion of excess reserves by the central banks during the observed crises do not result in an increase of the monetary aggregate per se, but is just to be seen as a statistical lock step without theoretical causation.

Broad money aggregates have—almost always, even in recessions—a positive growth trend, because of increasing loan origination and/or longer term refinancing of the banks from the private sector. As a consequence the impulse response functions show a positive relationship when—like in the observed episodes—the central banks expand their current account balances. While the majority of the broad money aggregate growth rates experienced reductions in the aftermath of the respective crises, they were (at least to a certain extend) reflat while the central banks still expanded their balance sheets. But this growth pick-up occurred because of a nearly normalisation of credit growth after the immediate crisis was over and just coincides with the expansion of the central bank reserves (see for example figure 5 and 6 on Sweden and Denmark). Therefore, to justify the quantity theory on the notion of the aforementioned statistical analysis would be erroneous.

The interpretation used here can also be verified while applying Granger causality tests. These show that broad money aggregates are not caused by the monetary base respectively current account balances, but (if at all) the other way around (see appendix 5 for the results using one lag). Growth in the broad money aggregates therefore entails a rise in base money respectively the current accounts. Even though this approach is strictly speaking not quite correct, since an expansion of broad money requires just an increase in statutory reserves and not necessarily total reserves, it is applied here anyway to refute the notion that an increase of the monetary base does cause an increase in the money supply. This refutation can be verified on the hand of the Granger causality tests. The null hypotheses cannot be rejected in all these instances for the current account balances (except for the Euro area), but can primarily be rejected for M_3/M_2 at a high significance level—which means that M_3/M_2 Granger causes M_0 respectively the current accounts.

VI. Discussion

The basic conclusions from the theoretical analysis are supported by the empirical findings. We do not see inflationary regimes after the introduction of the BSPs and no de-anchoring of inflation expectations (see also Anderson et al. (2010), Assenmacher (2013), IMF (2013b) on this issue). Inflationary pressure from the quasi-debt management policies cannot be observed, since the bond purchases are mostly conducted to affect yield curves, and do not finance additional and excessive government spending, like it was for example the case in the Weimar Republic or in Zimbabwe in the late 2000s. Additionally, since the private sector is mostly still deleveraging during the periods of the implementation of the BSPs, credit expansion is not fuelled by the oversupply of bank reserves, and therefore inflationary pressures through the bank lending channel do not ensue. Although credit standards by commercial banks have been tightened in recent years, there seems to be evidence that the constraint in a balance sheet recession is mainly on the side of the borrowers (see ECB (2013), Zoli (2013)). These results go along with research by Koo (2011) that the sluggish credit expansion in the Great Depression and Japan's Lost Decade were mainly a borrower's side problem due to on-going deleveraging, and is akin to a situation after a Minsky moment (1992). In addition to a lack of borrowers, banks are not willing—and sometimes not able—to lend, because they are reducing their assets in response to equity losses after the crisis, to meet regulatory capital requirements. In recent cases it seems that the newly implemented Basel III framework exacerbates this problem, since banks that are already low on equity have to reduce their share of liabilities even more (see European Banking Authority (2013)).

It is argued here that equity market increases do not have their sole—and likely not their main—origin in the BSPs. A high ratio of the increased stock market prices might probably be attributed to a rebounding after the initial drop in the stock markets. Additionally, higher expectations of future net cash flow because of better economic conditions and higher corporate profits well after the acute crisis is over may be a reason for the rise after the initial acute crisis is over.¹⁹ The other main driver behind rising equity market prices could be seen in a shortage of investment opportunities with a sizeable return. In a time where households and companies reduce debt, which they inherited before the financial crisis, and therefore banks cannot find willing borrowers to channel their excess savings to, these funds have to find other investment opportunities—the so called "search for yield". Since not many investments are seen as safe and profitable directly after a financial crisis, funds flow into the bond markets of sovereign currency issuers like the US and UK, or perceived safe havens as Germany, into asset markets (especially

¹⁹This can be verified by the price-earnings ratios of the respective stock markets. They are not that unusually elevated in recent years that they would give rise to concerns of excessive bubbles (see Dobbs et al. (2013)).

housing markets in big, vibrant cities), into commodities like gold, silver or copper, or, as mentioned, stocks. Some analysts see a shortage of safe assets and high-quality collateral—amplified by the buy-up of government debt from the central banks, and therefore even less remaining safe assets for the general public—as causes for rising asset prices (see Credit Suisse (2011), Gourinchas and Jeanne (2012), Stella and Singh (2012)). Especially the rise in sovereign bond yields in the USA and Japan in June 2013 might be attributed to a shortage of tradable government securities due to the huge market share which the Fed and the BoJ purchase each month.

This view seems to be validated by a recent correction in these markets on the background of better looking economic conditions since the 2nd half of 2012. With a recent pick-up in growth, falling unemployment—except for the Euro area—and more confidence from investors, safeguard and speculative assets like gold, oil, food and even government bond prices of perceived safe havens have fallen to levels which far more seem to reflect underlying fundamentals. These upward movements can be seen as not very harmful for the real economy as long as these book values are not created by excessive leverage (see Allen and Gale (2007)). This seems not to be the case in recent years, and therefore the elevated prices are not seen as a concern for excessive bubbles which could harm the financial system and especially the real economy.

As is shown above, it is difficult for central banks to directly support asset prices as a way to accelerate the deleveraging in the private sector. Therefore the equity price channel seems to not be very efficient as a way to boost economic recovery after a balance sheet recession, since the underlying fundamentals of the assets do not increase drastically just by inducing BSPs.²⁰ Even if underlying fundamentals would increase, it is not evident that households do increase consumption immediately. The general process of deleveraging might proceed faster, but a direct impact might not materialise. This view seems to be validated by the empirical assessment conducted in chapter 5, that the increase of stock markets is mainly a product of better underlying economic fundamentals after the acute crisis is over.

Furthermore, the BSPs seem not to be able to induce growth momentums through the aforementioned other channels in these instances. They are able to eliminate some segmentation in the targeted markets, and therefore help lessen the drop in economic activity, but cannot generate growth dynamics on their own (see Del Negro et al. (2011)). Additionally to the low influence on the real economy, the longer they are implemented, the lower are the marginal returns of an extended implementation (see Goodhardt and Ashworth (2012) on this issue). Unconventional monetary policy might not be as ineffective as Koo (2009) and others are stressing, since the expectations channel seems to work quite well after a financial crisis (see

²⁰Central banks would have to conduct massive purchases of private sector assets to have a huge impact on prices. This could impair their credibility and trustworthiness by loading further risks onto their balance sheets (see Orphanides (2004)).

Cúrdia and Woodford (2010), Eggertson (2003), and Krugman (2000)), but growth momentums cannot be created by it alone.

Even if the BSPs have quite positive effects in stabilising the economy directly after a financial crash, other measures that increase aggregate demand and speed up the deleveraging—like a fast restructuring of the commercial banks as seen in Scandinavia in the 1990s—might seem more appropriate to induce a faster recovery of the economy (see Borio et al. (2010), Joyce et al. (2012), Palley (2011)). A good example of the reduced effectiveness of the transmission channels of monetary policy during a balance sheet recession can be seen in the Great Depression of the 1930s. Even then, when the banking sector was afloat with funds in the market from the central bank, banks could not be tempted to extend loans due to the ongoing deleveraging (see Friedman and Schwartz (1963)). Only the implementation of the New Deal in the United States and the war mobilization of Germany brought the respective economies back on a growth path by offsetting the reduction of private demand with an expansionary fiscal policy (see Koo (2009)). Evidently, like then, countries which conducted the biggest stimulus packages after the Lehman collapse came out faster of the recession and did not experience huge and lasting slowdowns in growth like the countries who conducted drastic austerity measures (like France and Great Britain then and the Southern European crisis countries today) (see Blanchard and Leigh (2013), De Grauwe and Ji (2012), IMF (2013c), Wren-Lewis (2011)).

VII. Concluding Remarks

The implementation of BSPs and therefore an injection of central bank money at or near zero interest rates seem to be quite ineffective in comparison to other measures in the long run. There appear to be short stabilisation effects directly after a financial crash, but further injections after the acute crisis is over seem to have diminishing returns and impose higher risks as longer as they are conducted (see Goodhardt and Ashworth (2012), Koo (2013)).

The main results of this paper are seen in an impairment of the notions that expansionary unconventional monetary policies will always and everywhere induce inflationary regimes. In all samples, inflation does not rise above the central bank targets, due to an underutilisation of capacity in the depressed economies. Although the static money multiplier interpretation might still be valid in the long-run, at least as a tautological formula, the interpretation that inflation is fuelled by an increase in base money, irrespective of what form and under which circumstances, can be discarded. Other factors than a simple increase in base money or the size of excess reserves play a far bigger role in affecting inflation rates. Additionally, central banks were able to anchor inflation expectations quite successfully in the last couple of decades (see IMF (2013b)). Hence, there are only minimal risks to

inflationary regimes while conducting temporary balance sheet policies in times of a crisis.

Additional inflationary pressures from low interest rates and the BSPs cannot be observed through the bank lending channel, too. Huge credit acceleration after a financial crash cannot be seen in the data.²¹ As was outlined in the paper, commercial banks have other constraints than central bank reserves which play a far more crucial role in determining credit extension. A fast restructuring of the stricken institutions—like in Sweden in the 1990s—and direct credit policy might get the economy out of a balance sheet recession quicker, while simultaneously increase bank lending, than standard quasi-debt management policy, which is mainly an asset swap for the public (see also Krishnamurthy and Vissing-Jorgensen (2013)).

Additionally, it can be argued that the increases in stock markets do not stem directly from the BSPs. Some rise can be attributed to it, but as is argued before, more weight has to be put on better economic conditions, a catch-up effect after the initial losses after a financial crisis and a shortage of other investment opportunities due to an overhang of savings relative to investment.²² When one looks at the underlying price-earnings ratios of listed companies this picture seems to be validated, as these are not unusually high following the recent BSPs.

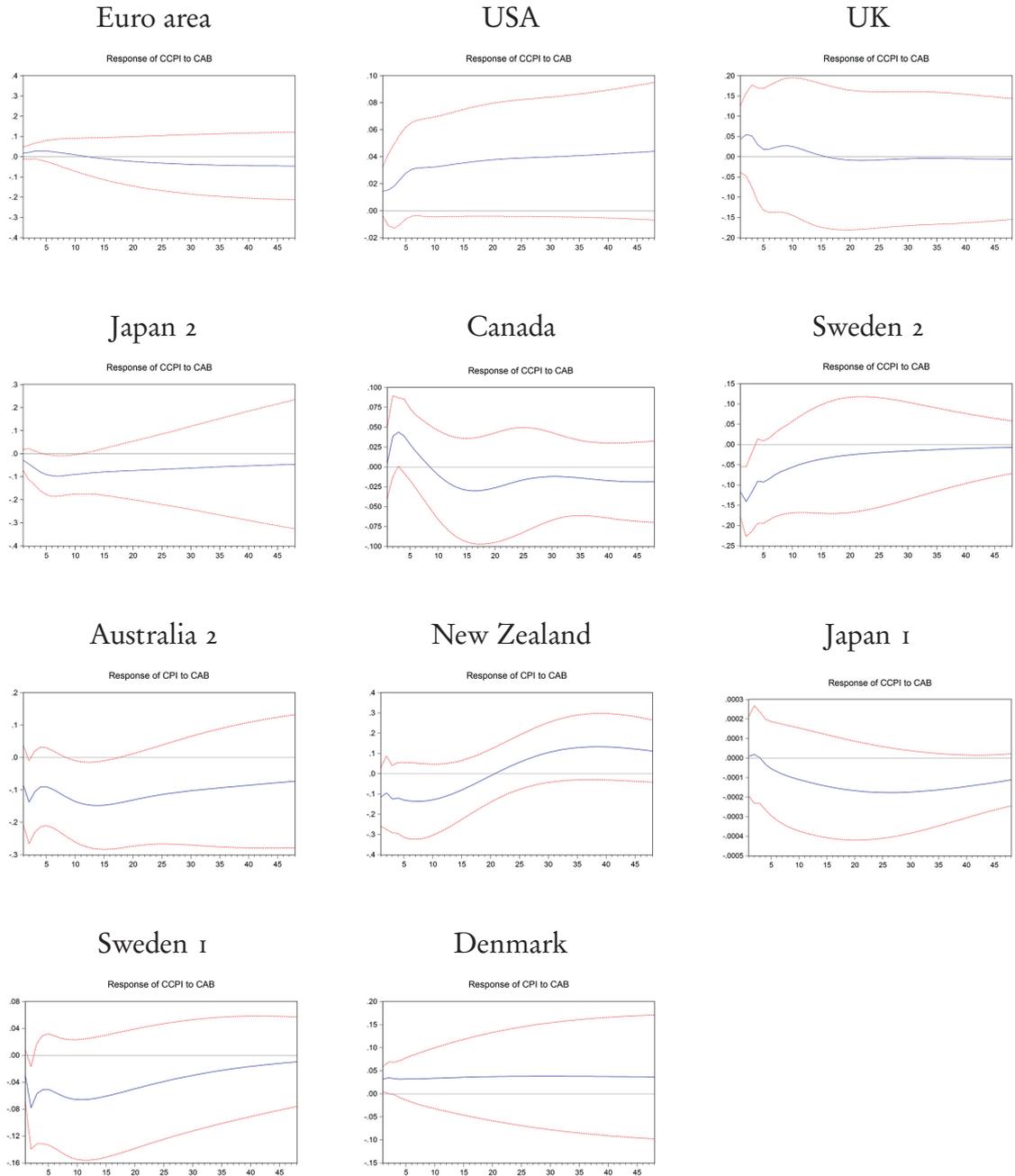
To sum up, BSPs are effective as an immediate response to a financial crash following excessive loan origination and a burst of asset price bubbles. They can contribute towards a crisis resolution, but are exposed to diminishing returns. Therefore it is advisable to counteract the underlying economic problems with better suited measures, while still maintaining a reasonable level of specifically targeted monetary policy accommodation in specific markets or market segments to ease the deleveraging process.

²¹Therefore, financial market distortions due to an inducement of an exceptional increase in unprofitable investments because of the low interest rate environment seem to not be a concern, since there is already a tendency for underinvestment in a balance sheet recession.

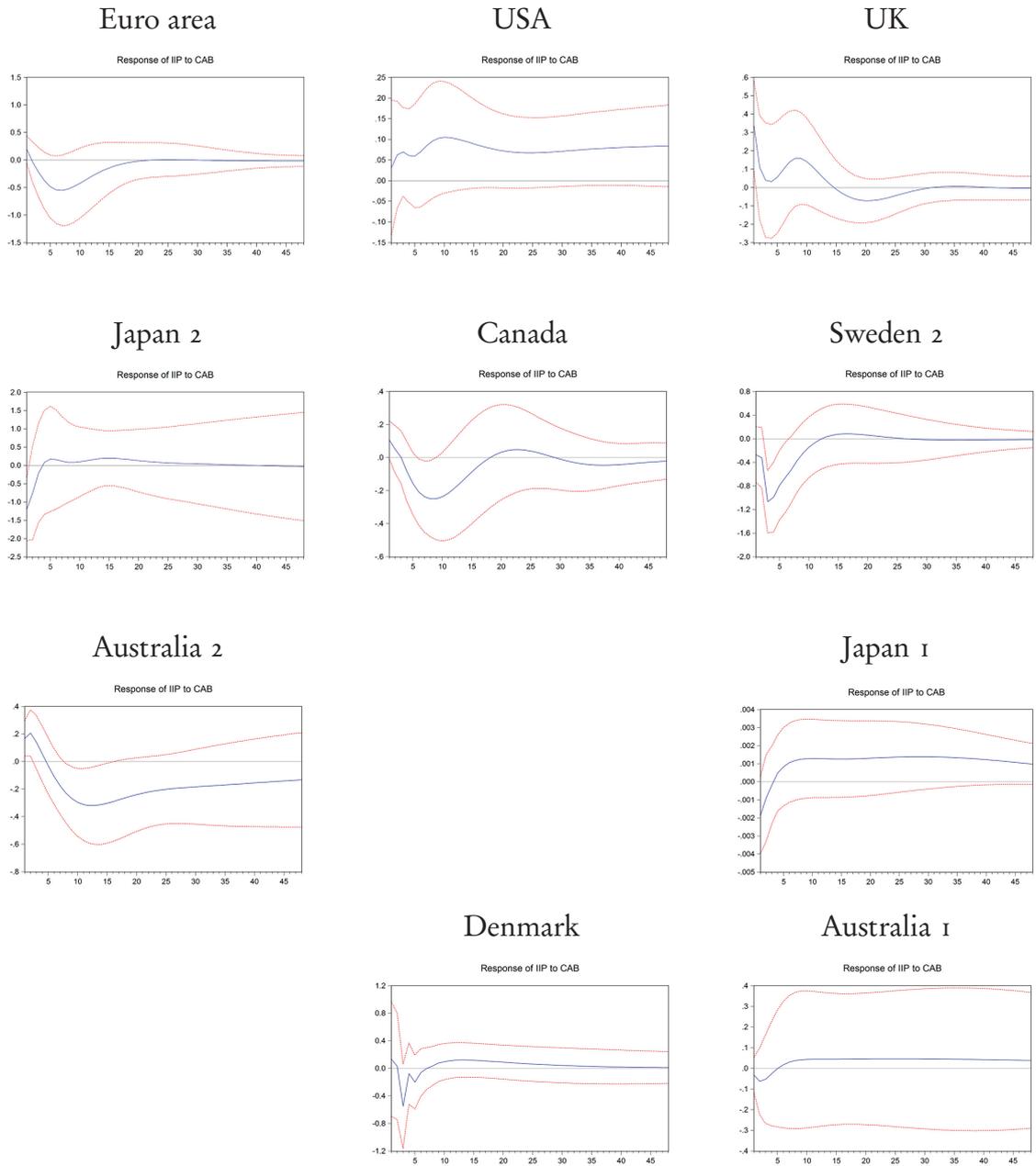
²²Additionally, it is not reasonable to assume that the business models of most real economy companies are broken after bursting asset price bubbles and their aftermath. In most cases companies just face inadequate demand, stemming from the strong deleveraging of the private sector (as shown in Koo (2009)).

VIII. Appendix

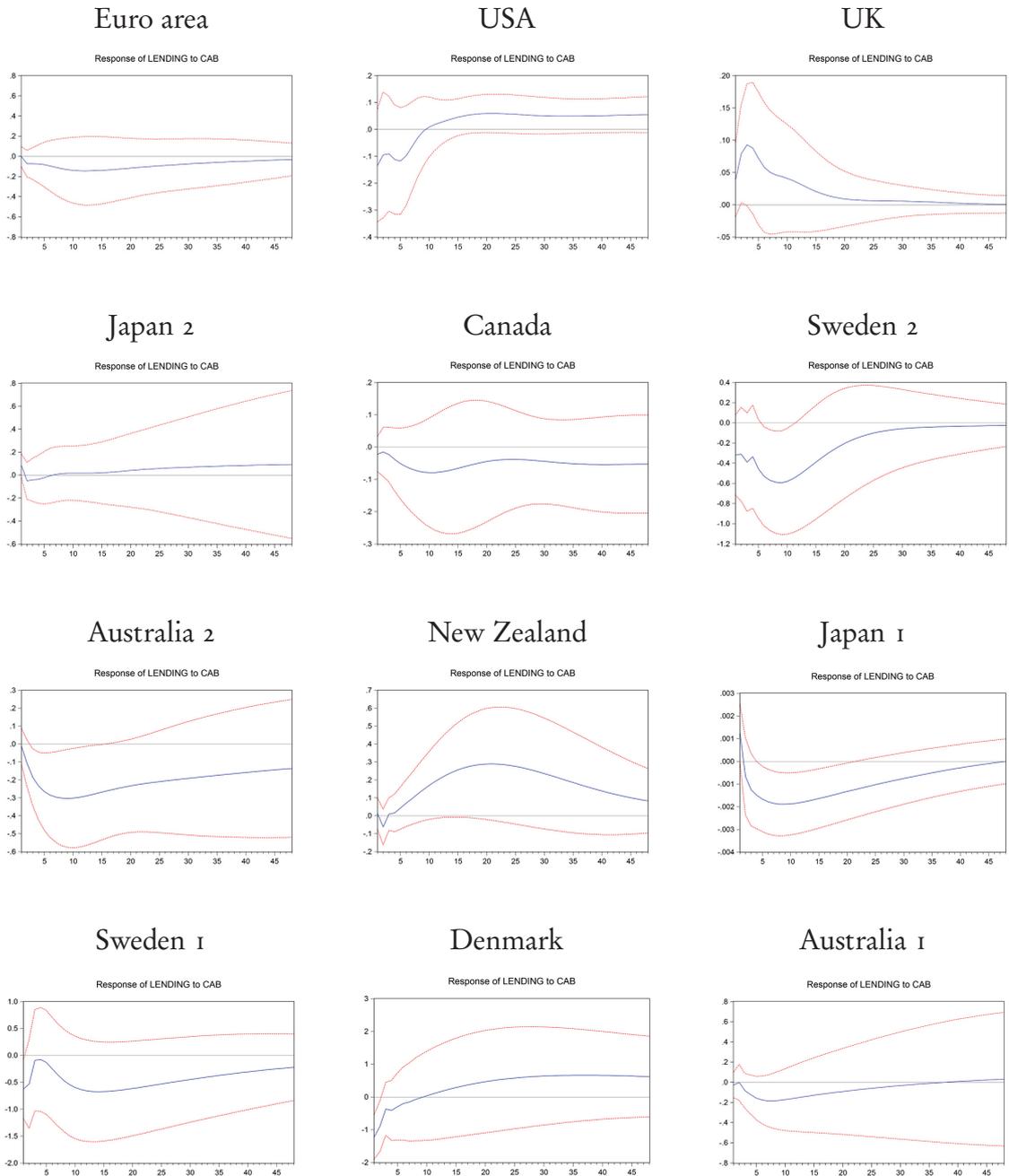
Appendix 1: Reaction of Inflation to a Monetary Policy Shock



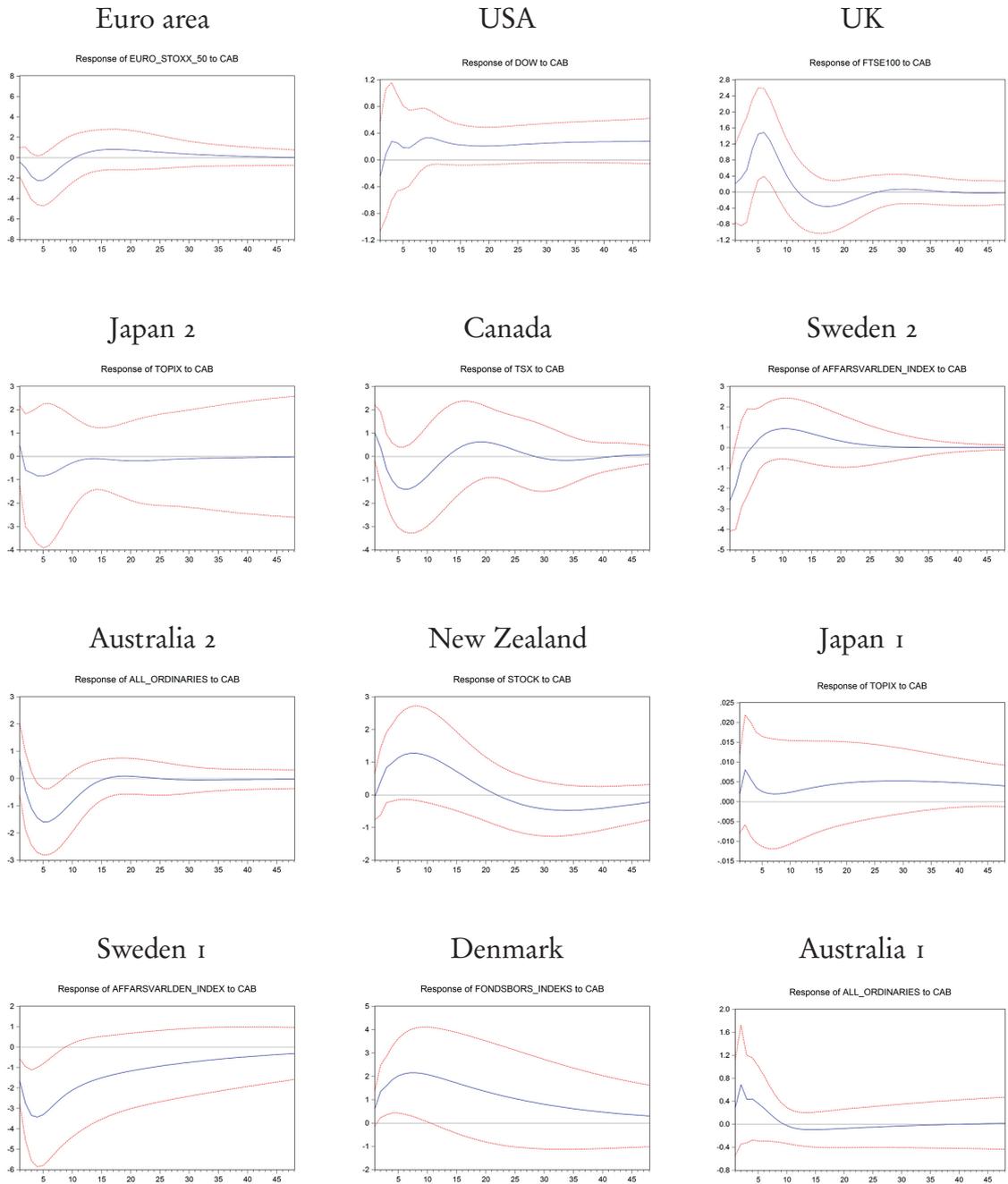
Appendix 2: Reaction of Industrial Production to a Monetary Policy Shock



Appendix 3: Reaction of Bank Lending to a Monetary Policy Shock



Appendix 4: Reaction of Stock Markets to a Monetary Policy Shock



Appendix 5: Granger Causality Tests

Causation between Mo and M₃/M₂

	<i>Null Hypothesis</i>	<i>Obs.</i>	<i>F-Stat.</i>	<i>Prob.</i>
Euro area	M ₃ does not Granger Cause Mo	56	2,06094	0,1570
	Mo does not Granger Cause M ₃		3,58313	0,0638
USA	M ₃ does not Granger Cause Mo	58	24,8695	0,0003
	Mo does not Granger Cause M ₃		0,11972	0,7307
UK	M ₃ does not Granger Cause Mo	59	4,30740	0,0426
	Mo does not Granger Cause M ₃		2,95851	0,0909
Japan 2	M ₃ does not Granger Cause Mo	57	0,38502	0,5375
	Mo does not Granger Cause M ₃		1,93316	0,1701
Sweden 2	M ₃ does not Granger Cause Mo	39	13,3935	0,0008
	Mo does not Granger Cause M ₃		1,47676	0,2322
Australia 2	M ₃ does not Granger Cause Mo	27	2,12258	0,1581
	Mo does not Granger Cause M ₃		0,00957	0,9229
New Zealand	M ₃ does not Granger Cause Mo	92	0,77935	0,3797
	Mo does not Granger Cause M ₃		0,94945	0,3325
Japan 1	M ₃ does not Granger Cause Mo	56	6,72077	0,0123
	Mo does not Granger Cause M ₃		0,05457	0,8162
Denmark	M ₃ does not Granger Cause Mo	119	0,20511	0,6515
	Mo does not Granger Cause M ₃		0,39095	0,5330
Australia 1	M ₃ does not Granger Cause Mo	54	22,2794	0,0000
	Mo does not Granger Cause M ₃		2,16651	0,1472

Causation between current account balances (CAB) and M₃/M₂

	<i>Null Hypothesis</i>	<i>Obs.</i>	<i>F-Stat..</i>	<i>Prob.</i>
Euro area	M ₃ does not Granger Cause CAB	56	1,20665	0,2770
	CAB does not Granger Cause M ₃		3,56309	0,0646
USA	M ₂ does not Granger Cause CAB	58	43,4645	0,0000
	CAB does not Granger Cause M ₂		1,35154	0,2500
UK	M ₃ does not Granger Cause CAB	59	2,84191	0,0974
	CAB does not Granger Cause M ₃		2,69112	0,1065
Japan 2	M ₃ does not Granger Cause CAB	57	3,13578	0,0822
	CAB does not Granger Cause M ₃		1,66923	0,2019
Sweden 2	M ₃ does not Granger Cause CAB	39	44,3916	0,0000
	CAB does not Granger Cause M ₃		0,24609	0,6229
Australia 2	M ₃ does not Granger Cause CAB	27	1,56059	0,2236
	CAB does not Granger Cause M ₃		0,00709	0,9336
New Zealand	M ₃ does not Granger Cause CAB	92	2,26094	0,1362
	CAB does not Granger Cause M ₃		0,02209	0,8822
Japan 1	M ₃ does not Granger Cause CAB	56	3,14899	0,0817
	CAB does not Granger Cause M ₃		0,24542	0,6224
Denmark	M ₃ does not Granger Cause CAB	119	0,02846	0,08663
	CAB does not Granger Cause M ₃		0,00616	0,9376
Australia 1	M ₃ does not Granger Cause CAB	54	20,6755	0,0000
	CAB does not Granger Cause M ₃		0,38971	0,5352

IX. Data Appendix

Country	Variable	Description	Source
Euro area	CAB	Mo less Currency in Circulation	ECB
	CCPI	CoreCPI (Index 2005 = 100, seasonally adjusted)	ECB
	Lending	Loans to Euro Area Residents excl. Gov.	ECB
	IIP	Index of Industrial Production (Index 2010 = 100, seasonally adjusted)	ECB
	Stoxx50	Euro Stoxx 50 Index (Index 1991 = 100; EoP)	Stoxx.com
USA	M3	M3	ECB
	CAB	Total Reserves of Depository Institutions	FRED
	CCPI	CoreCPI (Index 1984 = 100, seasonally adjusted)	FRED
	Lending	Loans and Leases in Bank Credit	FRED
	IIP	Index of Industrial Production (Index 2007 = 100, seasonally adjusted)	FRED
UK	Dow	Dow Jones Industrial Average	FRED
	M2	M2	FRED
	CAB	Reserve Balance Liabilities	BoE
	CCPI	Core CPI (Index 2005 = 100, seasonally adjusted)	ONS
	Lending	Net Lending to Individuals (excl. Student Loans)	BoE
Japan	IIP	Index of Industrial Production (Index 2009 = 100, seasonally adjusted)	ONS
	FTSE100	Financial Times Stock Index 100 (Index 2005 = 100)	Eurostat
	M3	M3	BoE
	CAB	Current Account Balances	BoJ
	CCPI	Core CPI (Index 2010 = 100, seasonally adjusted)	eStat
Canada	Lending	Loans and Discounts (excl. Shinkin Banks)	BoJ
	IIP	Index of Industrial Production (Index 2005 = 100, seasonally adjusted)	IFS
	Topix	Tokyo Stock Price Index (Index 1968 = 100)	Tokyo SE
	M3	M3	BoJ
	CAB	Mo less Currency in Circulation	CANSIM
Sweden	CCPI	Core CPI (Index 2002 = 100, seasonally adjusted)	CANSIM
	Lending	Domestic Credit	BoC
	IPI	Industrial Production Index (Index 2002 = 100, seasonally adjusted)	CANSIM
	TSX	TSX Composite (Index 1975 = 1000)	BoC
	CAB	Mo less Currency in Circulation	SCB
Denmark	CCPI	Core CPI (Index 1987 = 100, seasonally adjusted)	SCB
	Lending	Bank Lending to Swedish non-Corporations (Interpolated from 1992-1995 using Catmull-spline)	SCB
	IIP	Index of Industrial Production (Index 2010 = 100, seasonally adjusted)	SCB
	Affarsvarlden Index	Affarsvarlden Index (Index 1995 = 100)	Affarsvarlden
	CAB	Mo less Currency in Circulation	IFS + Nationalbanken
Australia	CPI	CPI (Index 2000 = 100, seasonally adjusted)	Statistics Denmark
	Lending	Bank Lending to non-financial Corporations	Nationalbanken
	IIP	Index of Industrial Production (Index 2005 = 100, seasonally adjusted)	IFS
	Fondsbors Indeks	Københavns Fondsbors Indeks (Index 2005 = 100)	Eurostat
	CAB	Monetary Base less Currency on Issue	RBA
New Zealand	CPI	Inflation Gauge Index (Index 2002 = 100, seasonally adjusted)	TD-MI
	Lending	Loans and Advances by Banks	RBA
	IIP	Index of Economic Activity (Index 1980 = 100, seasonally adjusted)	Westpac
	All Ordinaries	All Ordinaries Index (Index 1980 = 100)	RBA
	CAB	Current Accounts	RBNZ
New Zealand	CPI	CPI (Index 2006 = 1000, seasonally adjusted)	Stats New Zealand
	Lending	Private Sector Credit	RBNZ
	Stock	All Share Price Index (Index 1986 = 1000)	RBNZ

Data Samples

Country	Start Date	End Date	Country	Start Date	End Date
Euro area	09/2008	05/2013	Sweden 1	08/1993	12/1998
USA	09/2008	07/2013	Sweden 2	09/2008	12/2011
UK	09/2008	08/2013	Denmark	01/1992	12/2001
Japan 1	03/2001	12/2007	Australia 1	06/1996	12/2000
Japan 2	09/2008	05/2013	Australia 2	09/2008	12/2010
Canada	01/2009	12/2011	New Zealand	06/2005	02/2013

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