Interest rates close to zero, post-crisis restructuring and natural interest rate

Piotr Cizkowicz and Andrzej Rzonca

Warsaw School of Economics, Department of International Comparative Studies

December 2011

Interest rates close to zero, post-crisis restructuring and natural interest rate

Piotr Ciżkowicz* Andrzej Rzońca**

Abstract

Central banks seem not to account for the influence of interest rates close to zero on the natural interest rate *after* the bursting of the asset bubble which triggered financial crisis. We claim that this omission may have deleterious consequences. Should interest rates close to zero persistently decrease natural interest rates, that would mean fall in TFP growth and more limited central bank's capacity to influence aggregate demand and price dynamics. We explain that interest rates close to zero may persistently reduce the natural interest rate because in economy requiring post-crisis restructuring they impede that process and facilitate forbearance lending, which crowds viable economic agents out of credit through a number of channels. To reduce these risks central bank could voluntarily set the lower bound for interest rates cuts at, say, 2%. The bound appropriate for a given economy should be a function of its growth and interest rates in the pre-crisis period. We argue that irrespective of central bank's credibility such a change in the monetary policy conducting in economies requiring post-crisis restructuring would bring better outcomes than keeping there interest rates close to zero.

Keywords

interest rates close to zero, new Keynesian analytical framework, restructuring, credit

JEL classification: E51, E58, G34

* Warsaw School of Economics, pcizko@sgh.waw.pl,

** Monetary Policy Council in the National Bank of Poland, Warsaw School of Economics, andrzej.rzonca@nbp.pl

1. Introduction

This article analyses a possible influence of keeping the interest rates close to zero on the natural interest rate *after* the bursting of the asset bubble which triggered financial crisis. Thus, it is focused on economies requiring post-crisis restructuring.

Section 2 identifies the adverse effects which could be brought about by a persistent fall in the natural interest rates. Section 3 explains why the interest rates close to zero may lead to such a fall. Section 4 shows when it is likely to occur. Section 5 outlines some guidelines for the monetary policy *after* the bursting of the asset bubble. Section 6 concludes.

2. Potential consequences of interest rates close to zero

During the current crisis all the major central banks lowered their interest rates to the level close to zero. Such a response to the crisis has been expected to reduce the risk of deflation which could limit monetary policy capacity to influence aggregate demand and price dynamics. It has also been justified by a weakening of the transmission mechanism (see, e.g. IMF, 2010.) In the standard new Keynesian (NK) analytical framework used by the central banks (see, e.g. Christiano, Trabandt and Walentin, 2011 or Walsh, 2009), these conditions may be illustrated, firstly, as an exogenous, transitory fall in r_t^n, and secondly, as a change in σ in the expectational IS curve (equation 1) or in ρ or κ in the NK Philips curve (equation 2.)

$$x_t = E_t x_{t+1} - \left(\frac{1}{\sigma}\right)\left(i_t - E_t \pi_{t+1} - r_t^n = -\left(\frac{1}{\sigma}\right)\sum_{k=0}^{\infty} E_t\left(i_{t+k} - E_t \pi_{t+k+1} - r_{t+k}^n\right)\right) \quad (1)$$

$$\pi_t - \pi^T = \beta E_t\left(\pi_{t+1} - \pi^T\right) + \kappa x_t + e_t \quad (2)$$

where:

- x_t – output gap;
- i_t – interest rate;
- π_t – inflation;
- π^T – inflation target;
- r_t^n – natural real interest rate;
- e_t – cost shock

However, major central banks' actions seem not to have accounted for the fact that interest rates close to zero may consolidate low level of r_t^n after its decline caused by the crisis or postpone its return to the pre-crisis level, if economy hit by the crisis requires restructuring. In the standard analytical framework changes in r_t^n result (mainly) from exogenous disturbances – in growth in TFP (g_t), and in households' preferences with regard to consumption and labor supply.

$$r_t^n = \rho + \frac{\sigma(1+\eta)}{1+\sigma}(1-\rho)g_t \tag{2.8}$$

where:

- $\rho = -ln\beta$

Our estimates, based on Kalman filter[1], of r_t^n for Japan indicate that its average level decreased from 2.1% in the years 1980Q1-1993Q2 to 0.8% in the following years, in which interest rates have been close to zero.[2] The fall in r_t^n after the asset bubble bursting has turned

[1] Kalman filter has been used to estimate r_t^n for example by Laubach and Williams (2001) and Brzoza-Brzezina (2006.) This approach is based on estimation of two equations model of the form:

(1) $\Delta \pi_t = \alpha_1 \Delta \pi_{t-1} + \alpha_2 (i_{t-1} - E_{t-1}\pi_t - r_{t-1}^n) + \varepsilon_{1,t}$

(2) $r_t^n = \beta_1 + \beta_2 r_{t-1}^n + \varepsilon_{2,t}$

We used quarterly data covering the period 1980Q1 – 2011Q2 for Japan and, because of restricted availability of inflation expectations, 1987Q2 - 2011Q2 for Sweden. Detailed results are available upon request.

[2] We consider interest rates lower than 2% as interest rates close to zero. 2% is a level below which they did not fell until recently in the UK, for which time series reaching the seventeenth century is available (Bullard, 2010).

out to be highly persistent. This persistence can hardly be explained by the financial crisis itself. It is worth remarking that in Sweden, which at the beginning of the 1990s experienced financial crisis of similar depth[3], r_t^n sharply decreased at its onset, but returned fairly quickly to the average level of 2%. This development was accompanied by the reduction of policy rate from 10% in 1990Q1 to 4.5% in 1994Q1 followed by its increase to 7.5% in 1995Q3.

(Figure 1.)

(Figure 2.)

Interest rates close to zero would have 3 negative effects should they persistently decrease r_t^n.

- They would mean weaker growth. It is unlikely that they could reduce r_t^n in other way than by curbing g_t (see equation 3 and section 3.)
- They would weaken the impact of interest rate reduction on x_t and π_t (see equations 1 and 2). This weakening of the transmission mechanism is consistent with the empirical analysis of the consequences of the crises (see, e.g. the IMF, 2010), but, in this case, it would be the *effect* of aggressive cuts in i_t, generally considered an appropriate response to such weakening.
- They would limit the central bank's capacity to influence x_t and π_t in a longer term. The decline in r_t^n would reduce the difference in price dynamics between two steady states, determined by the Fisher equation and the Taylor's rule (see, e.g. Bullard, 2010). This difference is equal to the sum of r_t^n and π^T. One may also show that a decline in r_t^n would

[3] In Sweden, in contrast to Japan, there was no substantial fall in share prices, since before the crisis they had not considerably increased. But the scale of both the increase in property prices before the crisis, and their decline during the first two years after the crisis was much larger in Sweden than in Japan (although it should be noted that in Japan this fall was continued in the next several years, and was particularly strong in the case of commercial real estate, especially in major cities; see e.g., Hoshi and Kashyap, 2004.) Credit to the private sector to GDP ratio was growing faster before the crisis in Sweden than in Japan (although its level in Sweden remained lower than in Japan.) Finally, in Sweden, unlike in Japan, there was a currency crisis. Currency crises are usually associated with particularly high costs immediately after their occurrence (see, e.g. Cecchetti et al, 2009.)

increase the inflation rate at which the central bank loses the ability to pursue an active policy understood as cutting the nominal interest rate to a scale larger than the expected decline in inflation (see figure 3.)

(Figure 3.)

3. Impact on restructuring

Interest rates close to zero may weaken g_t and – as a result – reduce r_t^n because they impede restructuring, i.e. the key process in a post-crisis economy. In particular, they lower exit rates, lock assets in their current uses, and weaken incentives to improve productivity in low-productivity businesses. We discuss these effects in a more detailed way below.

Although as a result of the bubble bursting the value of many assets falls below the debt incurred for their purchase, these assets may not change hands provided they generate income in excess of debt service costs. Interest rates close to zero mean that even if a particular economic agent will never be capable of repaying borrowed principal, she is able to pay interest. Rolling loans over in the case of borrowers who, when faced with interest rates markedly above zero, would not be able even to repay the interest, allows banks to avoid the write-off of non-performing loans (NPLs); as a result, it improves, technically, their profits and capital position. As regards the non-financial sectors, the results of loans 'evergreening' are impeded flows of the production factors and dwindling informative value of asset prices. Some economists (Kobayashi, 2000) also point to the fact that forbearance lending increases uncertainty, which may incite enterprises to postpone the execution of new projects and discourage them from specializing.

To allow *Ponzi finance* borrowers to join the group of *speculative finance* (Minsky, 1986), their newly incurred loans should have as short maturity as possible. Shortening debt maturity enables interest payments to get close to zero.[4] Yet, it means also lower stability of debt financing which undermines debtors' incentives to undertake corrective measures. These incentives are weak anyway due to debtors' awareness of banks having an interest in rolling loans over, regardless of the debtor's financial condition. Debtors facing financial problems cease to perceive the possibility of banks' withdrawing from financing as a real threat. They consider such withdrawal as a function of variables beyond their control, such as, for example, banks' capital or interest rate level. As a result, contrary to what is suggested by the standard literature (see, e.g. Flannery, 1994), banks do not increase their control over debtors' behavior by shortening debt maturity.

In the case of Japan where interest rates have been close to zero since 1993[5], there is a multitude of evidence to support deterioration in distortions on factor markets (see, e.g. Nakakuki et al., 2004), forbearance lending (see, e.g. Peek and Rosengren, 2005 or Kobayashi at al, 2002), decline in the informative effectiveness of the asset markets (see, e.g. Hamao et al., 2007), and shortening of loan maturities (see, e.g. Smith, 2003). Yet, if these phenomena have ever been associated with zero interest rates, this has been limited to isolated hints.

For restructuring to be impeded, interest rates need not fall close to zero (although interest rates close to zero have obviously the strongest negative impact on restructuring.) It is enough

[4] Granting loans with variable interest rate without changing their maturity would have the same effect. Yet, the chances of loan maturity not being shortened seems unlikely given high uncertainty about borrowers' ability to repay loans at normal interest rate level.
[5] Formally, Bank of Japan introduced a policy of zero interest rates on February 12th, 1999. However, in practice, according to the definition adopted in this article, interest rates were kept close to zero since September 21st, 1993. Bank of Japan reduced then the discount rate below 2% (to 1.75%), earlier, i.e. on February 4th, 1993, equating it with the pre-crisis minimum (2.5%). Since the summer of 1995 it has been kept below 0.5%.

that they go back down to a level similar to that which sparked the crisis by enabling agents incapable of regular-term loan repayment to take out loans.

As the interest rates which triggered the crisis may differ across countries, this level should also be different. It should be higher in countries reporting a rapid growth in the pre-crisis period and lower in countries reporting a weak growth (see equation 3).

4. Impact on credit (and on other sources of external financing)

Impeded restructuring do not necessarily have to decrease g_t and r_t^n, provided two conditions are met:

- the entry rate and productivity growth in viable enterprises depend upon loan availability, and
- interest rates close to zero are capable of increasing the flow of new credit to viable economic agents during the crisis.

In the simplest NK analytical framework there is no role for credit. However, during the current crisis, central banks have intensified efforts to assign credit an important function in their analytical framework. Credit has gained this function due to various financial frictions (financial accelerator, collateral constraints, capital requirements) introduced into the NK analytical framework. Introduction of these frictions has modified the expectational IS curve, which may have the following form (see, e.g. Christiano, Trabandt and Walentin, 2011 or Walsh, 2009.)

$$x_t = E_t x_{t+1} - \left(\frac{1}{\sigma}\right)\left(i_t - E_t \pi_{t+1} - r_t^n\right) - \gamma_1 i_t - \gamma_2 \psi_t \qquad (4)$$

where:

ψ_t – measure of financial frictions.

Such a modification may serve (see equation 4.) and indeed, have served (see, e.g. BIS, 2010) as an additional argument in favor of maintaining interest rates close to zero during the crisis. Yet, it does not accounts for the fact that interest rates close to zero in economies requiring post crisis restructuring may lead to forbearance lending. Forbearance lending may in turn enhance financial frictions and, as a result, curb the credit flow reaching viable economic agents via at least seven mechanisms.

- First, banks may create the image of agents applying for a loan on the basis of non-restructured loan portfolio.
- Second, the fact that a particular agent has recourse to borrowing may cease to bring "relationship" benefit (see, e.g. Kashyap, Stein and Wilcox, 1993, or Oliner and Rudebush, 1995); on the contrary, it may signal financial problems.
- Third, the more serious the problem of undisclosed NPLs, the larger (and the more expensive) the scope of information which should be examined by banks prior to granting a loan. They may have to monitor not only potential borrowers but also their partners, and partners of their partners, etc. (Caballero and Simsek, 2009). At the same time, the absence of a considerable risk of competitors taking over financing of a profitable project and the possibility of earning on liabilities thanks to various charges enable banks to postpone costly state verification.
- Fourth, banks uncertain of the current value of their loan portfolios may not be able to determine the scale of lending growth not posing a risk of capital requirements' breach.
- Fifth, enterprises which take advantage of forbearance lending may, by underpricing their products and putting an upward pressure on wages, reduce the profitability of other

companies (Caballero et al., 2006). Lower profits, in turn, diminish enterprises' ability to repay loans and their propensity to take out loans.

- Sixth, an unrestructured loan portfolio may be an obstacle for banks to gain access to new capital, without which no increase in lending is possible. These difficulties may also affect sound banks as an issue of new shares might be perceived as a sign that the issuing bank has not restructured its loan portfolio. Lack of access to new capital enhances, in turn, incentives to 'evergreen' loans, as 'evergreening' helps to meet capital requirements.
- Seventh, delays in loan restructuring may urge banks to increase their liquid reserves and purchase 'safe' assets: treasury bonds, foreign assets and commodities[6]. Another stimulus inducing banks to build up liquid reserves and purchase bonds is connected with banks' limited access to new capital and the method of calculating capital adequacy ratio. The reason behind increasing liquid reserves are also zero profits on sharing liquidity (cf., e.g. McKinnon, 2011) and the possibility to earn on liabilities.

The first, the second, the third, the fourth, the sixth and the seventh channel adversely affect credit supply. The second and the fifth channel reduce demand for credit.

The second, the third, the fifth and the seventh channel may also limit the use of other sources of external financing than credit in economies requiring post-crisis restructuring.

- Amidst the difficulties in the assessment of their financial situation, enterprises may be stigmatized for applying for any external funding.
- Not only banks, but also investors are forced to examine an extended set of information before taking a decision on financing a particular project if there exists a major risk that its completion might be threatened by the changing environment.

[6] Commodities, in a given commodity market, have uniform characteristics and are consumed during the production process, which makes their resale a certain option, and, in the case of most countries, have prices which do not depend on their economic situation.

- Decline in the corporate sector's profitability resulting from propping up bankrupt companies, limits the sector's ability to repay loans and its propensity not only to take out loans but to incur any liabilities.
- Delays in loan restructuring may incite not only banks but also other investors, including foreign ones, to purchase safe assets.

All four channels may particularly strongly affect equity finance (cf., e.g. Myers and Majluf, 1984).

There is ample evidence of crowding viable enterprises out of credit in Japan after the bursting of the asset bubble (see, e.g. Ahearne and Shinada, 2004, Caballero et al, 2006, Hosono and Sakuragawa, 2003). Moreover, these enterprises have not substituted bonds for credit. The share of bonds in total debt has fallen not only in the Japanese enterprises with low return on assets but also in the enterprises with high ROA (see, e.g. Peek and Rosengren, 2005.) Lastly, the access to equity finance has also considerably narrowed (see, e.g. Hamao et al., 2007.)

5. Some guidelines for monetary policy after the bursting of the asset bubble

It is all too easy to find studies (see, e.g. Eggertsson and Woodford, 2003) showing that zero lower bound should not deprive central banks of the capacity to stabilize economy provided that they can credibly commit to keep i_{t+j} at low level for a sufficiently long period (see equation 1.) However, using the same logic, one may claim that keeping interest rates low but clearly above zero (at, say, 2%) should not deprive central banks of that capacity either. Yet, such a policy should not entail as large risk of consolidating the low level of r_t^n or of

postponing its return to the pre-crisis level as the policy of keeping interest rates close to zero in economy requiring post-crisis restructuring.

A reduction of that risk could allow central bank establishing a less distant horizon of the return to the pre-crisis rule in the monetary policy than otherwise, which would increase the chances that its commitment will be considered credible. The less distant the horizon of the return to the pre-crisis rule, the easier the persuasion of economic agents that central bank will accept an economic boom, once the economy recovers after the crisis (see equations 1. and 2.), as well as that the *exceptionally* low level of interest rates is truly *exceptional*[7].

The established horizon of the return to the pre-crisis rule would be less distant in the case of keeping interest rates at, say, 2% than at the level close to zero, if interest rates close to zero had sufficiently strong or persistent negative impact on r_t^n (see equation 1.) Our estimates of r_t^n for Japan (see section 2.) as well as the comparison of the average length of period preceding the return of growth after financial crisis to its pre-crisis rate (3 years; see IMF, 2009) with the length of that period for Japan (no return so far) suggests that this negative impact may be both strong and persistent in economy requiring post-crisis restructuring.

Surprisingly little empirical research has been devoted to effects of crises on the perception of central banks. From existing studies (see Gros and Roth, 2010), one may conclude that crises have strong negative impact on credibility of central banks. If economic agents believe that the central bank is responsible for the crisis, they may come to the conclusion that its actions will lead to another crisis and the slump of aggregate demand. The impact of interest rate cuts on the aggregate demand will then be weakened or neutralized by the downward revision of

[7] Schmitt-Grohe and Uribe (2010) show that this latter meaning of the credible commitment with regard to future policy is crucial for central bank's ability to influence price dynamics, and McKinnon (2011) explains why it is important for speeding up the closing of negative output gap.

aggregate demand expectations. In such an environment, central bank's decision to keep interest rates low but clearly above zero (at, say, 2%) would also be less risky than to keep them close to zero. In both cases interest rates cuts may fail in stimulating aggregate demand, but the former policy would bear more limited risk of impeding restructuring than the latter.

Since interest rates impeding restructuring may differ across countries (see section 3.), there in no unique level at which central bank should set a voluntary bound for interest rates cuts. This bound should be a function of economic growth and interest rates in the pre-crisis period.

The lower bound clearly above zero should be applied also in other economies, but for other reason, discussed elsewhere (see, e.g., Giavazzi and Giovannini, 2010, Hoenig, 2010 or Taylor, 2009). In their case central bank should avoid extremely low interest rates so as not to inflate asset bubble, whose bursting could trigger financial crisis.

5. Conclusions

During the current crisis all the major central banks lowered their interest rates close to zero. Such a policy action has been fully justified by the NK analytical framework. However, at its current stage of development the NK analytical framework abstracts from the possible impact of interest rates close to zero on the natural interest rate *after* the bursting of the asset bubble which triggered financial crisis.

Monetary policy failing to account for its impact on inflation expectations led to stagflation in the 1970s. The omission of monetary policy impact on the natural interest rate in economies requiring post-crisis restructuring, may bring no less deleterious consequences: fall in TFP

growth and more limited central bank's capacity to influence aggregate demand and price dynamics.

Interest rates close to zero may persistently reduce the natural interest rate in economies requiring post-crisis restructuring because they impede this process. Namely, they decrease the exit rate, hamper the flow of production factors between enterprises and weaken the incentives to improve productivity in low-productivity businesses. The impeded restructuring would not result in the natural interest rate fall if its negative impact on TFP growth was offset (or outweighed) by the positive effects of the credit flow reaching viable enterprises. Yet forbearance lending facilitated by the interest rate close to zero may actually crowd viable economic agents out of credit through a number of channels.

To reduce these risks central bank in economy requiring post-crisis restructuring could voluntarily set the lower bound for interest rates cuts at, say, 2%. The actual bound should be set at a level related to growth and interest rates in the pre-crisis period. Irrespective of central bank's credibility, such a change in the monetary policy conducting should bring better outcomes than keeping interest rates close to zero.

Acknowledgments

We would like to thank Leszek Balcerowicz and Roger Myerson for their helpful comments on the early version of this paper. The usual caveats apply.

References:

Ahearne, A. G., Shinada, N. (2004), "Zombie Firms and Economic Stagnation In Japan". *Paper presented at the conference "Macro/Financial Issues and International Economic Relations: Policy Options for Japan and the United States" at University of Michigan, Ann Arbor, October 22-23.*

BIS (2010) *80th Annual Report. 1 April 2009 – 31 March 2010*. Basel: Bank For International Settlements, June 28

Brzoza-Brzezina, M. (2006) "The information content of the natural rate of interest". *Economics of Transition* 14(2): 391-412.

Bullard, J. (2010) "Seven Faces of "The Peril"". *Federal Reserve Bank of St. Louis Review* 92(5): 339-352

Caballero, R. J., Simsek, A. (2009) "Complexity and Financial Panics". *NBER Working Paper* 14997

Caballero, R., Hoshi, T., Kashyap, A. K. (2006) "Zombie Lending and Depressed Restructuring in Japan" *NBER Working Paper* 12129

Cecchetti S., Kohler M., Upper C. (2009) "Financial Crises and Economic Activity". *Paper prepared for Federal Reserve Bank of Kansas City Symposium at Jackson Hole*

Christiano, L. J., Trabandt, M., Walentin, K. (2011) *DSGE Models for Monetary Policy Analysis.* in: *Monetary Economics. Volume 3A.* (Friedman. B. M., Woodford, M., eds.) Amsterdam, London, San Diego: Elsevier B.V.

Clarida, R., Gali, J., Gertler, M. (1999) "The Science of Monetary Policy: A New Keynesian Perspective". *NBER Working Paper* 7147

Eggertsson G. B., Woodford M. (2003) “The Zero Bound in Interest Rates abd Optimal Monetary Policy” *Brookings Papers on Economic Activity* 1: 139-233

Flannery M. J. (1994) “Debt Maturity and the Deadweight Cost of Leverage: Optimally Financing Banking Firms”. *American Economic Review* 84: 320-331

Giavazzi, F., Giovannini, A. (2010), “Central Banks and the Financial System”. *NBER Working Paper* 16228

Gros, D., Roth, F. (2010) “The financial crisis and citizen trust in the European Central Bank”. *CEPS Working Document* 334

Hamao, Y., Mei, J., Xu, Y. (2007) “Unique Symptoms of Japanese Stagnation: An Equity Market Perspective”. *Journal of Money, Credit and Banking. 39(4)*: 901-923

Hoenig, T. M. (2010) “The High Cost of Exceptionally Low Rates”. *Bartlesville Federal Reserve Forum, June 3*

Hoshi, T., Kashyap, A. K. (2004) “Japan’s Financial Crisis and Economic Stagnation”. *Journal of Economic Perspectives* 18 (1): 3-26

Hosono, K., Sakuragawa, M. (2003) “Soft Budget Problems in the Japanese Credit Market”. *Nagoya City University Discussion Papers in Economics* 345

IMF (2009) *What’s the Damage? Medium-term Output Dynamics After Financial Crises*, in: *World Economic Outlook. Sustaining the Recovery.* (IMF) Washington D.C.: IMF

IMF (2010) *Central Banking Lessons from the Crisis.* Washington D.C.: IMF

Kashyap, A. K., Stein, J. C., Wilcox, D. W. (1993) “Monetary Policy and Credit Conditions: Evidence from the Composition of External Finance”. *American Economic Review* 83(1): 78-98

Kobayashi, K. (2000) “Debt Overhang as a Delayed Penalty”. *MITI/RI Discussion Paper* DOF35

Kobayashi, K., Saita, Y., Sekine, T. (2002) “Forbearance Lending: A Case for Japanese Firms”. *Monetary and Economic Studies* 21(2): 69-92

Laubach, T., Williams, J.C. (2001) “Measuring the Natural Rate of Interest”. *Federal Reserve Board Finance and Economics Discussion Series* 2001-56

McKinnon R. I. (2011) “Beggar-thy-neighbor interest rate policies”. *Journal of Policy Modeling* 33(5): 759-775

Minsky, H. P. (1986) *Stabilizing an Unstable Economy*. New Haven, London: Yale University Press

Myers S., Majluf, N. S. (1984) “Corporate Financing and Investment Decisions when Firms have Information that Investors Do Not Have”. *Journal of Financial Economics*13(2): 187-221

Nakakuki, M., Otani, A., Shiratsuka, S. (2004) “Distortions in factor markets and structural adjustments in the economy”. *Monetary and Economic Studies* 22(2): 71-100

Oliner, S. D., Rudebusch, G. (1995) “Is There a Bank Credit Channel for Monetary Policy?” *FRBSF Economic Review* 1: 3-20

Peek, J., Rosengren, E. (2005) “Unnatural selection: perverse incentives and the misallocation of credit in Japan” *American Economic Review* 95(4): 1144-1166

Schmitt-Grohe, S., Uribe, M. (2010) “Liquidity Traps: An Interest-Rate-Based Exit Strategy”. *NBER Working Paper* 16514

Smith, D. C. (2003) “Loans to Japanese Borrowers”. *Journal of Japanese and International Economies* 17(3): 283-304

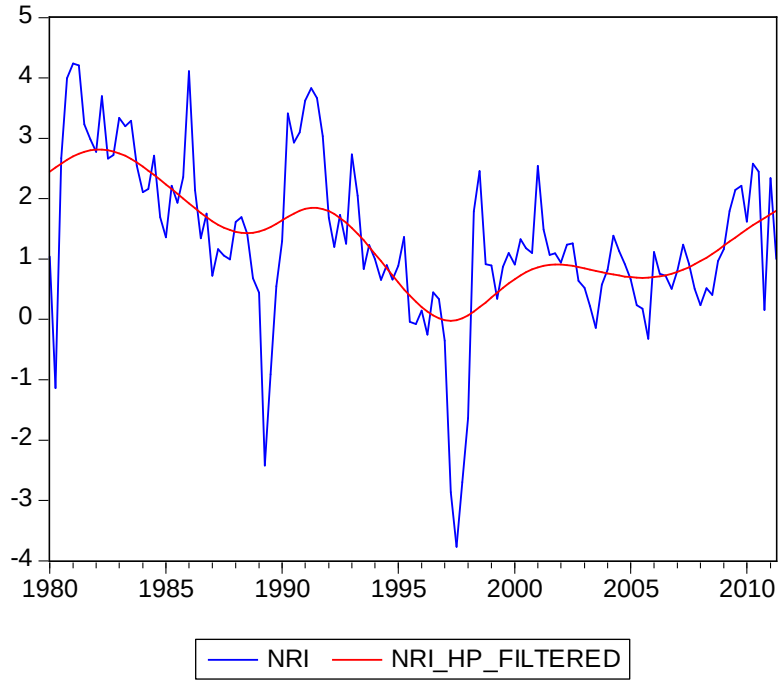
Taylor J. (2009) *Getting Off Track: How Government Actions and Interventions Caused, Prolonged, and Worsened the Financial Crisis.* Stanford: Hoover Press

Walsh, C. E. (2003) *Monetary Theory and Policy*. Cambridge and London: The MIT Press

Walsh, C. E. (2009) “Using monetary policy to stabilize economic activity”. *Paper prepared for the Jackson Hole Symposium on Financial Stability and Macroeconomic Policy*

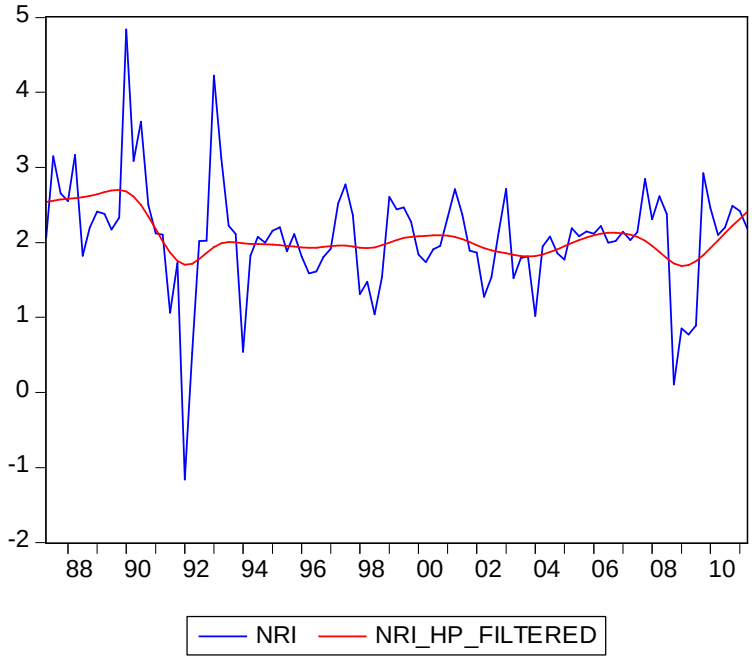
Woodford, M. (2003) *Interest and Prices*. Princeton: Princeton University Press

Figure.1 Natural Rate of Interest in Japan (1980-2011)



Source: own calculations based on ReutersEcowin data

Figure.2 Natural Rate of Interest in Sweden (1987-2011)



Source: Own calculations based on ReutersEcowin data

Figure 3. Interest rates and inflation