Optimal Monetary Policy during Boom-Bust Cycles: The Impact of Globalization

Rolf Knütter (Corresponding author)
Department of Economics, University of Hagen, Universitaetsstrasse 41, 58084 Hagen, Germany
Tel: 49-2331-987-2587 E-mail: rolf.knuetter@fernuni-hagen.de

Helmut Wagner
Department of Economics, University of Hagen, Universitaetsstrasse 41, 58084 Hagen, Germany
Tel: 49-2331-987-2640 E-mail: helmut.wagner@fernuni-hagen.de

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Abstract

During boom-bust cycles in asset prices, monetary policy has the choice between two strategies: the proactive strategy of curbing asset price inflation and preventing a bust-induced credit crunch and the reactive strategy of loosening monetary policy conditions during the boom phase. We show that globalization makes the reactive strategy the favorable option in all situations, relatively to the proactive strategy. However, when employing an absolute comparison of calculating both strategies' losses, the proactive strategy is the optimal choice in exceptional circumstances.

Keywords: Monetary Policy, Asset Prices, Credit Crunch, Boom-Bust Cycles, Globalization, Phillips Curve, Demand Curve.

1. Introduction

It has been shown that, in general, 'benign neglect' is not a sensible option for monetary policymakers during boom-bust cycles in asset prices (see Berger, Kißmer and Wagner 2007). In this paper, we consider explicitly a small open economy model in the sense of Clarida et al. (2001) and analyze the effects of globalization on the policy trade-off between the proactive and the reactive stance. In our model, globalization is captured by the degree of openness and affects both the supply and the demand side of the economy: it leads to a flatter Phillips curve and to a flatter IS curve. Both results are supported by empirical and theoretical evidence (Note 1). Moreover, there is widespread evidence for an increase in both trade and financial openness (see for example IMF 2002).

We show that this leads to two contrary effects: The "Phillips curve effect" is favoring a proactive strategy and the "IS curve effect" is favoring a reactive strategy. Allowing for both effects, there is no unambiguous analytical result. However, we demonstrate in numerical simulations that a reactive strategy is the optimal choice in relative terms. Comparing both strategies' losses it turns out that only in exceptional situations the proactive strategy is the favorable monetary policy stance.

The remainder of the paper is structured as follows. In section 2, evidence of the impact of globalization on the Phillips curve and the IS curve is presented. In section 3 the model is analyzed. The numerical simulation is employed in section 4. Section 5 concludes.

2. How Globalization Affects the Phillips Curve and the IS Curve

2.1 The Phillips Curve

Several reasons have been listed regarding the growing theoretical and empirical evidence for a flatter Phillips curve, in particular lower trend inflation, higher credibility of monetary policy, and globalization. It should be noted that these reasons are not mutually exclusive. Rather, they are possibly interlinked and may even amplify one another. However, in this paper we focus solely on globalization, which itself offers a variety of channels: Price-setting behavior, higher competition in markets for goods, services and factors, and a higher degree of openness. Here, we focus on globalization captured by a higher degree of openness.

There are various models which study the impact of the degree of openness on the slope of the Phillips curve. In a New Keynesian model with Calvo price setting, Galí and Monacelli (2005) show that increased trade openness curbs the terms of trade-adjustment necessary for absorbing a shift in domestic output. Increased openness therefore lowers the impact of domestic output on marginal costs and inflation, and makes domestic inflation more sensitive to world output, resulting in a flatter Phillips curve. Razin and Loungani (2005a), (2005b) analyze the impact of both more trade and more financial openness on the Phillips curve trade-off. They show that the opening of an economy to international trade in goods is inversely related to the slope of a New Keynesian Phillips curve.

2.2 The IS Curve

The slope of the IS curve did not get so much attention as the slope of the Phillips curve. There may be several reasons for this, one of them being the lack of empirical evidence, and another that only supply shocks usually generate a trade-off for monetary policy. However, the IS curve can also be important for the conduct of monetary policy. In this paper, we consider this case. Focusing on the trade-off central banks face during asset price boom-bust cycles, we show that changes in the slope of the IS curve have important implications for the central bank's decision to act proactively or reactively.

The discussion of a possible change of the IS curve can be related to two channels:

- The ability of monetary policy to influence the domestic real interest rate (Note 2),
- The interest rate elasticity of demand.

Regarding the first channel, the empirical evidence is mixed. Whereas Yellen (2006) argues that monetary policy has even gained effectiveness during the past few years, some authors, however, e.g. Boivin and Giannoni (2008), find that some variables, in particular long term interest rates and prices, display more correlation with global forces. This is supported by tentative empirical evidence for a weakened link between the short term rate of central banks and long term rates ("conundrum", see Greenspan 2005, Note 3). Furthermore, there is evidence that national bond yields are increasingly determined by global factors, see Giannone, Lenza and Reichlin (2007). In addition, U.S., German and Japanese bond yields have had a very high degree of synchronization during the last years (Ferguson et al. 2007). Rogoff (2006) argues that increasing financial integration has already led to a vanishing of the influence central banks have on medium and long term real interest rates. Wu (2006) stresses that the ability of central banks to affect long term interest rates may have weakened. Some authors see the "global saving glut" (cf. Bernanke 2005), which holds real interest rates down, and higher real and monetary stability (low inflation) during the last decades as main reasons. Wu (2006) argues that globalization has led to a higher interest elasticity of bond demand. In consequence, monetary policy has lost some of its influence on aggregate demand. Finally, Gnan and Valderrama (2006) stress that monetary policy has lost effectiveness in influencing inflation through the demand channel.

However, far more interesting for our analysis is the second channel. This channel concentrates on structural estimates of the slope of the IS curve since we assume, according to the standard workhorse model of monetary policy – the New Keynesian framework – that central banks are still able to set the domestic real interest rate. As already mentioned, the empirical evidence is rare (see Fuhrer and Rudebusch 2004 and Yogo 2004). Bilbiie and Straub (2008) present some evidence for a change in the slope of the Euler equation. They employ structural break tests and find an endogenous breakpoint in the interval 1979-1982. The estimated aggregate intertemporal substitution after 1982 is consistent with economic theory, whereas the values in the pre-1979 phase have the wrong sign. The authors show that the sign can change when they allow for asset market participation: if the share of asset holders switches from a low to a high value, the sign changes into the right direction (positive). Therefore, Bilbiie and Straub (2008) find at least an increase in the slope of the IS curve (corresponding to a flatter IS curve when written like in section 3).

As shown in several theoretical models, economies with a higher degree of openness are characterized by a higher interest elasticity of demand due to the influence of exchange rates and the terms of trade (see Galí and Monacelli 2005, Clarida et al. 2002). Hence, in this paper we suppose that globalization is affecting the economy through the second channel. In our model, an increasing degree of openness leads directly to a higher sensitivity of aggregate demand to real interest rate changes, which in turn decreases the slope of the IS curve, since an interest rate hike is associated with higher output losses than before. Hence, we argue that globalization leads to a flatter IS curve.

Summarizing, there are several theoretical and empirical reasons for a flatter Phillips curve and a flatter IS curve. Furthermore, we listed theoretical reasons for an inverse impact of the degree of openness on the slope of both curves. Empirical evidence for a higher degree of openness can be found abundantly, for instance in IMF (2002) and Alesina et al. (2000). Hence, there is evidence for a flatter Phillips curve and for a flatter IS curve due to globalization. Changes in the structure of the Phillips curve are important for the conduct of monetary policy, for example for the behavior of central banks during boom-bust cycles on asset markets, as shown by Berger, Kißmer and Knütter (2007). Furthermore, the IS curve is important for the policy choice during boom periods as well. Hence, we concentrate on the question of how a flatter Phillips curve and a flatter IS curve influence the central bank's decision to respond to boom-bust cycles, which is, considering the subprime and financial crisis 2007-2009, a very important area for both researchers and policymakers.

3. The Model

Our model is related to Bordo and Jeanne (2002) and Berger, Kißmer and Wagner (2007). We extend their analysis to a small open economy setup along the lines of Clarida et al. (2001) in order to study explicitly the effects of globalization (Note 4).

To better illustrate the boom-bust cycle we consider three periods. In period 1, the boom period, firms contract debt to finance the acquisition of a productive asset. Firms need this asset for production, but it may also serve as collateral in the second period. Policymakers have to decide which strategy to choose. In period 1, future asset prices are still unknown. In period 2, an asset price bust (associated with a steep drop in collateral) may or may not occur. Firms only get new credit if the required credit remains below the real value of their collateral less the debt burden from period 1. In period 3, the economy moves into a new steady state.

The equations are the well-known New Keynesian forward looking IS and Phillips curve equations, and the Fisher equation:

$$x_t = E_t x_{t+1} - \frac{1+w}{\sigma}(rr_t - rr^*) \tag{1}$$

$$\pi_t = \beta E_t \pi_{t+1} + \kappa_w x_t + u_t \tag{2}$$

$$rr_t = r_t - E_t \pi_{t+1} \tag{3}$$

with
$$w = \gamma(\sigma\eta - 1)(2-\gamma)$$
$$\kappa_w = \delta\left(\frac{\sigma}{1+w} + \phi\right)$$
and $t = 1, 2, 3$

The IS curve equation (1) relates the current output gap x_t to the expected future output gap $E_t x_{t+1}$ and the real interest rate rr_t. The parameter rr^* is defined as the domestic real interest rate that would prevail in the absence of shocks. We assume rr^* to be exogenous in our model (see Knütter and Wagner 2008 for further explanation). The elasticity of aggregate demand concerning changes of the real interest rate is given by $(1+w)/\sigma$ with σ as the coefficient of the relative risk aversion. The degree of openness γ is defined as the share of foreign goods consumed by domestic households. As only consumption goods are produced and traded, we are able to equate the empirical measure of the degree of trade openness with the degree of openness in our model in an analogous way. Globalization - captured by an increase in the degree of openness γ - leads to a higher interest elasticity of demand. This is the standard result in (New Keynesian) small open economy models (see for example Clarida et al. 2002 and Galí and Monacelli 2005). The output effect of monetary policy is greater in open economies since the effect of expansive monetary policy is amplified through the depreciation of the exchange rate, which in turn boosts exports and domestic output in addition to the (positive) output effect of monetary policy. According to Clarida et al. (2001), restrictive monetary policy is followed by a depreciation of the terms of trade and the expenditure-switching effect on demand is captured by the parameter w in the interest sensitivity of x_t. This effect amplifies the overall impact on demand if $\sigma\eta > 1$ (implying $w > 0$) as seems empirically reasonable (cf. Clarida et al. 2001). Then, it is evident that globalization (captured by a higher degree of openness γ and hence a higher w) induces a higher interest elasticity of demand and hence a flattening of the IS curve.

The New Keynesian Phillips curve (2) with its slope κ_w relates current inflation π_t to expected future inflation $E_t \pi_{t+1}$, the output gap x_t and a financial shock u_t. The parameter ϕ is the inverse of the labor-supply elasticity, η the elasticity of substitution between home and foreign goods, β the discount factor and δ the degree of price stickiness. Globalization – captured by a higher degree of openness γ and hence a higher w – induces a flattening of the Phillips curve. The financial shock of the supply side is associated with a possible credit crunch (Note 5). Since firms can only borrow against collateral (assets), a steep fall in asset prices induces a sharp decrease of firms' collateral, resulting in some firms' net worth being too small to get further credit. These firms must stop their production. Hence, a collateral-induced credit crunch leads to a decline in economic activity.

The Fisher equation (3) makes the real interest equal to the difference of nominal interest rate r_t and the expected next period's inflation. Policymakers can influence the real interest rate by variations of their policy instrument r_t.

The financial shock u_t can only occur in period 2 and is defined as

$$u_t = \begin{cases} 0 & in\ \ t \neq 2 \\ 0 & in\ \ t = 2 \quad if\ no\ credit\ crunch \\ \varepsilon > 0 & in\ \ t = 2 \quad if\ credit\ crunch \end{cases} \tag{4}$$

where ε is the extent of a credit crunch (Note 6). The financial shock u_t is not entirely exogenous. We assume that firms' debt burden is smaller the higher the real interest rate in the first period. Hence, the probability of a collateral-induced credit crunch in the second period can be written as

$$\mu \equiv prob(u_2 = \varepsilon \mid rr_1) = \begin{cases} 0 & if \quad rr_1 \geq \underline{rr} > rr^* \\ 0 < \mu < 1 & if \quad rr_1 < \underline{rr} \end{cases} \tag{5}$$

where $\underline{rr}$ denotes the minimum real interest rate which is necessary to completely eliminate the probability of a future credit crunch. If $rr_1 > \underline{rr}$, the debt burden from period 1 will always be low relative to the value of firm's collateral. Hence, the probability of a credit crunch depends on the real interest rate chosen by the central bank.

Welfare is measured by the intertemporal (V_t) and period (L_t) loss function:

$$V_t = E\left(\sum_{t=1}^{3} \beta^{t-1} L_t\right) \tag{6}$$

$$L_t = \pi_t^2 + \lambda x_t^2 \tag{7}$$

The period loss function (7) is quadratic in inflation and the output gap, where the parameter λ measures the relative weight that central bankers attach to the output gap. Equations (6) and (7) are related to an inflation-targeting regime. Note that $\lambda > 0$ $(\lambda = 0)$ is associated with a regime of flexible (strict) inflation targeting (see Svensson 2003).

3.1 The Reactive Policy

When adopting a reactive policy strategy, a credit crunch in period 2 may occur. If it does not occur, the flex-price equilibrium can be achieved. However, in the case of a credit crunch, central bankers will have to trade off inflation against output losses:

$$\pi_2^{REA} = \lambda \varepsilon / \Delta \tag{8}$$

$$x_2^{REA} = -\kappa_w \varepsilon / \Delta \tag{9}$$

with $\Delta = \lambda + \kappa_w^2$.

Furthermore, the expected losses in the second period are positive due to the strictly positive $(\mu > 0)$ probability of a credit crunch under the reactive strategy:

$$E(L_2^{REA}) = \mu \lambda \varepsilon^2 / \Delta \tag{10}$$

Additionally, in period 1 forward-looking agents will allow for the possibility of a credit crunch, and the expected future stabilization policy reacting to this credit crunch in their expectations. These expectations enter the current inflation rate and the current output gap, so that central bankers have to respond to them by setting their policy instrument r_t in a way that the first period's real interest rate falls below the flex-price equilibrium level rr^*:

$$\pi_1^{REA} = \beta \mu \varepsilon \left(\lambda / \Delta\right)^2 \tag{11}$$

$$x_1^{REA} = -\kappa_w \beta \lambda \mu \varepsilon / \Delta^2 \tag{12}$$

$$rr_1^{REA} = rr^* - \frac{\left[\lambda\left(1-\beta\right) + \kappa_w^{\ 2}\right] \sigma \kappa_w \mu \varepsilon}{(1+w)\Delta^2} \tag{13}$$

Hence, the losses of the reactive strategy in period 1 are positive:

$$L_1^{REA} = \left(\beta \mu \varepsilon\right)^2 \left(\lambda / \Delta\right)^3 \tag{14}$$

For an overview of all results see Table 1.

3.2 The Proactive Policy

Proactive policymakers attain the solution without a credit crunch in the period 2. However, in order to avoid a credit crunch in period 2, policymakers must choose for rr_1 a value of $\underline{rr}$, inducing inflation and the output gap to fall below their target values during the boom phase, which leads to positive losses in period 1:

$$\pi_1^{PRO} = -\frac{1+w}{\sigma}\kappa_w z \tag{15}$$

$$x_1^{PRO} = -\frac{1+w}{\sigma} z \tag{16}$$

$$L_1^{PRO} = \left(\frac{1+w}{\sigma}\right)^2 z^2 \Delta \tag{17}$$

with $z = \underline{rr} - rr^* > 0$.

The value of z can be understood as the insurance premium of the proactive strategy. For an overview of all results see Table 2.

3.3 The Optimal Policy Choice

The losses are

$$\text{(Reactive)} \qquad V^{REA} = \left(\beta\lambda\mu\varepsilon^2 / \Delta\right) + \left(\beta\mu\varepsilon\right)^2 \left(\lambda / \Delta\right)^3 \tag{18}$$

$$\text{(Proactive)} \qquad V^{PRO} = \left(\frac{1+w}{\sigma}\right)^2 z^2 \Delta \tag{19}$$

Both strategies may emerge to be the optimal policy. Formally, the proactive policy is optimal if $V^{PRO} < V^{REA}$, which is the case if condition (20) is fulfilled.

$$\underline{rr} < \overline{rr} = rr^* + \frac{\sigma\varepsilon}{(1+w)\Delta}\sqrt{\beta\lambda\mu\left[1 + \beta\mu\left(\lambda/\Delta\right)^2\right]} \tag{20}$$

In equation (20) $\overline{rr}$ is defined as the maximum level of the real interest rate that central bankers are willing to endure in order to avoid a credit crunch. If this threshold value is larger than $\underline{rr}$, monetary policymakers will choose the proactive strategy.

The smaller slope of the Phillips curve κ_w increases $\overline{rr}$, therefore favoring the proactive strategy (Note 7). In contrast, the flattening of the IS curve has a negative effect on $\overline{rr}$, hence favoring the reactive strategy. Allowing for both effects simultaneously, there is no unambiguous analytical result. Thus, the model is calibrated in section 4.

4. Numerical Simulation and Results

4.1 Main Result (Relative comparison)

As can be clearly seen from figure 1, for the chosen baseline parameter values (see Table 3) the threshold value $\overline{rr}$ is decreasing with a higher degree of openness, thus favoring the reactive strategy.

The reason is that with globalization the sensitivity with which aggregate demand reacts to real interest rate changes is increasing. Since the proactive strategy is characterized by an interest rate hike in the boom period, it is now associated with higher losses than before due to inflation and output diverging from equilibrium to a larger extent. The more open the economy the stronger is the demand effect – hence the larger the losses of the proactive strategy relative to the reactive strategy.

In order to test for robustness, a wide range of parameter values is used (see Knütter and Wagner 2008 for further explanation). Additionally, we choose different values for μ and ε. The results are robust to <u>all</u> parameter variations. Hence, the result of our analysis is that globalization makes the reactive strategy the more favorable choice in relative terms.

4.2 Further Results (Absolute comparison)

In this case the losses of both strategies have to be compared, using again the parameter values and now additionally varying z. As can be seen from figure 2, already for a relative low insurance premium z of 10 % the proactive strategy is associated with higher losses than the reactive strategy. We use the following values for z: 10 %, 20 % and 100 %. The losses of both strategies increase with a higher degree of openness, but to a lesser extent for the reactive strategy. Hence, for the baseline parameter values the reactive strategy is still the favorable policy outcome. Again, the result is robust to all variations of parameter values.

Yet, there might be exceptional circumstances favoring the proactive strategy, according to Rudebusch (2005) who distinguishes between standard policy and bubble policy. The reactive policy can be seen as the standard case prevalent in most situations, contrary to the proactive stance, which might be the optimal choice in exceptional circumstances (e.g. the financial crisis 2007-2009). These circumstances may arise when the probability of a credit crunch (μ) and the extent of a credit crunch (ε) are very high. If we use considerably higher values for μ (between 0.2 and 0.5) and ε (between 0.1 and 0.4) than above, a different picture may emerge. Figure 3 clearly shows that in the case of μ=0.4 and ε=0.3 and using the baseline values the proactive strategy is the optimal choice in absolute terms, especially for relatively low values of the insurance premium (z = 10 %, 20 %). Hence, the proactive strategy can dominate the reactive strategy in exceptional circumstances.

5. Conclusion

We show that the incorporation of the supply and demand effects of globalization leads to two contrary channels: A flatter Phillips curve favors the proactive policy, and a flatter IS curve effect broadens the case for the reactive strategy. Using numerical simulations and comparing both strategies in a relative way, we show that the reactive strategy is the favorable option. This result remains valid for all parameter combinations when comparing the losses of both strategies. Only in the exceptional circumstances of a very high probability of a credit crunch and a very high extent of a credit crunch it may be optimal to adhere to the proactive strategy.

References

Adrian, T., Moench, E. & Shin, H. S. (2010). Macro Risk Premium and Intermediary Balance Sheet Quantities, Staff Report No. 428, Federal Reserve Bank of New York.

Alesina, A., Spolaore, E. & Wacziarg, R. (2000). Economic Integration and Political Disintegration. *American Economic Review*, 90, 1276-1296.

Bean, C. R. (2004). Asset Prices, Financial Instability, and Monetary Policy. *American Economic Review Papers and Proceedings*, 94, 14-18.

Berger, W., Kißmer, F. & Wagner, H. (2007). Monetary Policy and Asset Prices: More Bad News for 'Benign Neglect'. *International Finance*, 10, 1-20.

Berger, W., Kißmer, F. & Knütter, R. (2007). Monetary Policy and Asset Prices: The Impact of Globalization on Monetary Policy Trade-Offs. In: A. N. Kendall (Eds.), *International Business and Finance Issues* (pp. 133-148), New York 2007.

Bernanke, B. S. (2005). The Global Saving Glut and the U. S. Current Account Deficit. Remarks at the Sandridge Lecture, Virginia Association of Economics, Richmond, Virginia, March 10, 2005.

Bilbiie, F. O. & Straub, R. (2008). Changes in Output Euler Equation and Asset Markets Participation, submitted.

Boivin, J. & Giannoni, M. P. (2006). Has Monetary Policy Become More Effective? *The Review of Economics and Statistics*, 88, 445-462.

Boivin, J. & Giannoni, M. P. (2008). Global Forces and Monetary Policy Effectiveness. NBER Working Paper No. 13736, National Bureau of Economic Research.

Bordo, M. D. & Jeanne, O. (2002). Boom-Busts in Asset Prices, Economic Instability, and Monetary Policy. NBER Working Paper No. 8966, National Bureau of Economic Research, Washington DC.

Borio, C. & Filardo, A. (2007). Globalisation and Inflation: New Cross-Country Evidence On the Global Determinants of Domestic Inflation. BIS Working Paper No. 227, Bank for International Settlements.

Clarida, R., Galí, J. & Gertler, M. (2001). Optimal Monetary Policy in Open versus Closed Economies: An Integrated Approach. *American Economic Review Papers and Proceedings*, 91, 248-252.

Clarida, R., Galí, J. & Gertler, M. (2002). A Simple Framework For International Monetary Policy Analysis. *Journal Of Monetary Economics*, 49, 879-904.

Cúrdia, V. & Woodford, M. (2009). Credit Spreads and Monetary Policy. Paper prepared for the FRB-JMCB research conference "Financial Markets and Monetary Policy", Washington, DC, June 4-5, 2009.

Ferguson, R., Hartmann, P., Panetta, F. & Portes, R. (2007). International Financial Stability. Draft Report prepared for ICMB Conference, Geneva, 3-4th May.

Fuhrer, J. C. & Rudebusch, G. D. (2004). Estimating the Euler Equation for Output. *Journal of Monetary Economics*, 51, 1133-1153.

Galí, J. & Monacelli, T. (2005). Monetary Policy and Exchange Rate Volatility in a Small Open Economy. *Review of Economic Studies*, 72, 707-734.

Giannone, D., Lenza, M. and Reichlin, L. (2007). The Equilibrium Level of the World Real Interest Rate. Paper presented at the First Annual Risk Management Institute Research Conference "Capital Flows and Asset Price: The International Dimension of Risk", Singapore 6-7 July.

Gnan, E. & Valderrama, M. T. (2006). Globalization, Inflation and Monetary Policy. In: Monetary Policy & The Economy Q03/06, 37-54, Oesterreichische Nationalbank.

Greenspan, A. (2005). Testimony Before the Committee on Banking, Housing and Urban Affairs. U.S. Senate, February 16, 2005.

IMF. (2002). Trade and Financial Integration, Chapter III, World Economic Outlook, September 2002, 108-146, International Monetary Fund.

IMF. (2006). How Has Globalization Affected Inflation? Chapter III, World Economic Outlook, April 2006, 97-134, International Monetary Fund.

Khan, H. (2005). Price-Setting Behaviour, Competition and Mark-Up Shocks in the New-Keynesian Model, *Economics Letters*, 87, 329-335.

Knütter, R. & Wagner, H. (2008) Globalization and Asset Prices: Which Trade-Offs Do Central Banks Face in Small Open Economies?, Discussion Paper No. 433, Department of Economics, University of Hagen, December 2008.

Razin, A. & Loungani, P. (2005a). Globalization and Disinflation: The Efficiency Channel. CEPR Discussion Paper No. 4895.

Razin, A. & Loungani, P. (2005b). Globalization and Inflation-Output Tradeoffs. NBER Working Paper No. 11641, National Bureau Of Economic Research.

Razin, A. & Yuen, C. W. (2002). The 'New Keynesian' Phillips Curve: Closed Economy Versus Open Economy. *Economics Letters*, 75, 1-9.

Rogoff, K. (2006). Impact of Globalization on Monetary Policy. Paper prepared for Symposium sponsored by the Federal Reserve Bank of Kansas City on "The New Economic Geography: Effects and Policy Implications", Jackson Hole, Wyoming, August 24-26, 2006.

Rudebusch, G. D. (2005). Monetary Policy and Asset Price Bubbles, FRBSF Economic Letter No. 2005-18, Federal Reserve Bank of San Francisco, San Francisco.

Smets, F. & Wouters, R. (2007). Shocks and Frictions in U.S. Business Cycles – A Bayesian DSGE Approach, *American Economic Review*, 97, 586-606.

Wu, T. (2006). Globalization´s Effect on Interest Rates and the Yield Curve. Economic Letter No. 9/1, Federal Reserve Bank of Dallas.

Yellen, J. L. (2006). Monetary Policy in a Global Environment. Speech at the Euro and the Dollar in a Globalized Economy Conference U. C. Santa Cruz, Santa Cruz, CA, May 27 2006.

Yogo, M. (2004). Estimating the Elasticity of Intertemporal Substitution When Instruments Are Weak. *The Review of Economics and Statistics*, 86, 797-810.

Notes

Note 1. For theoretical evidence see for example Razin and Yuen (2002), Khan (2005), for empirical evidence see for example IMF (2006) and Borio and Filardo (2007) regarding traditional Phillips curves and Boivin and Giannoni (2006) and Smets and Wouters (2007) for Phillips curves in New Keynesian general equilibrium models. The latter report on a larger interval between price changes that corresponds to a smaller slope of the Phillips curve.

Note 2. Hence, the question: is the domestic real interest rate no longer set by domestic monetary policy, but rather by a world interest rate because of complete financial integration?

Note 3. During the period June 2004 to July 2006 the Fed raised the funds rate from 1% to 5.25%. At the same time, the long term interest rates, which normally should have increased as well, did not increase as much as they used to do and even declined in 2004 and 2005.

Note 4. For a more lenghty description of the model, see Knütter and Wagner (2008), and Bordo and Jeanne (2002) for the microeconomics of the lending and the borrowing decisions of households and firms. See also Bean (2004) who studies the impact of a credit crunch in a New Keynesian model and, like in this paper, not explicitly assumes asset prices, but rather let them move "in sympathy with investment and borrowing".

Note 5. The financial shock in equation (2) can be interpreted as a cost-push-shock. This is supported by Cúrdia and Woodford (2009). In their model, a negative financial shock leads to higher costs of intermediation between borrowers and savers, inducing an increase in the credit spread. In the New Keynesian Phillips curve, the credit frictions have cost-push effects since the real resource cost of loan origination and monitoring and the measure of inefficiency of financial intermediation are part of the New Keynesian Phillips curve and are positively related to inflation. Furthermore, Adrian et al. (2010) analyze the meaning of financial intermediaries for macroeconomic fluctuations. They extend the basic New Keynesian model by adding the macro risk premium to the Phillips curve. Focusing on the effects of financial frictions on credit supply, they show that a higher risk premium has cost-push effects.

Note 6. It can be imagined that the extent of credit crunch is measured in output losses, since the financial shock induces a fall in production.

Note 7. It can be shown that an endogenous output weight (positively related to the slope of the Phillips curve) does not change our results.

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Table 1. Reactive Policy

Reactive Policy		
t = 1	t = 2	t = 3
$r_1^{REA} = rr^* + \frac{\left[\left(\lambda(1+w)-\kappa_w\sigma\right)\Delta+\beta\lambda\kappa_w\sigma\right]\mu\varepsilon}{(1+w)\Delta^2}$ $rr_1^{REA} = rr^* - \frac{\left[\lambda\left(1-\beta\right)+\kappa_w{}^2\right]\sigma\kappa_w\mu\varepsilon}{(1+w)\Delta^2}$	*Crisis (Note 1)* $r_2^{REA} = rr_2^{REA} = rr^* - \frac{\sigma\varepsilon(\psi\Delta-\kappa_w)}{(1+w)\Delta}$ *no crisis* $r_2^{REA} = rr_2^{REA} = rr^*$	$r_3^{REA} = rr_3^{REA} = rr^*$
$\pi_1^{REA} = \beta\mu\varepsilon\left(\lambda/\Delta\right)^2$ $x_1^{REA} = -\kappa_w\beta\lambda\mu\varepsilon/\Delta^2$	*crisis* $\pi_2^{REA} = \lambda\varepsilon/\Delta$ $x_2^{REA} = -\kappa_w\varepsilon/\Delta$ *no crisis* $\pi_2^{REA} = x_2^{REA} = 0$	$\pi_3^{REA} = x_3^{REA} = 0$
$L_1^{REA} = \left(\beta\mu\varepsilon\right)^2\left(\lambda/\Delta\right)^3$	*crisis* $L_2^{REA} = \lambda\varepsilon^2/\Delta$ *no crisis* $L_2^{REA} = 0$ *Expected losses* $E(L_2^{REA}) = \mu\lambda\varepsilon^2/\Delta$	$L_3^{REA} = 0$

With $\Delta = \lambda + \kappa_w^2$.

Note: We assume that $\psi > 1/\kappa_w$ so that the optimal monetary policy response to a credit crunch in period 2 unambiguously consists in an interest rate reduction. Thus, we follow Berger, Kißmer and Wagner (2007) in assuming the policy response to a crisis to be more plausible than in the model of Bordo and Jeanne (2002) who suppose the central bank being restrictive in the face of a bust because the resulting credit crunch reduces supply without affecting demand. In this respect, our result is more in line with empirical evidence that asset price busts tend to be deflationary.

Table 2. Proactive Policy

Proactive Policy		
t = 1	t = 2	t = 3
$r_1^{PRO} = rr_1^{PRO} = \underline{rr}$	$r_2^{PRO} = rr_2^{PRO} = rr^*$	$r_3^{PRO} = rr_3^{PRO} = rr^*$
$\pi_1^{PRO} = -\frac{1+w}{\sigma}\kappa_w z$ $x_1^{PRO} = -\frac{1+w}{\sigma} z$	$\pi_2^{PRO} = x_2^{PRO} = 0$	$\pi_3^{PRO} = x_3^{PRO} = 0$
$L_1^{PRO} = \left(\frac{1+w}{\sigma}\right)^2 z^2 \Delta$	$L_2^{PRO} = 0$	$L_3^{PRO} = 0$

with $z = \underline{rr} - rr^* > 0$ and $\Delta = \lambda + \kappa_w^2$.

Table 3. Parameter Values

Parameter	Low value	High value	Baseline value
β	0.99	0.99	0.99
σ	1.1	2	1.5
δ	0.052	0.17	0.08583
λ	0.05	1	0.25
ϕ	3	10	5
η	1	10	5
μ	0.01	0.2	0.1
ε	0.01	0.2	0.1

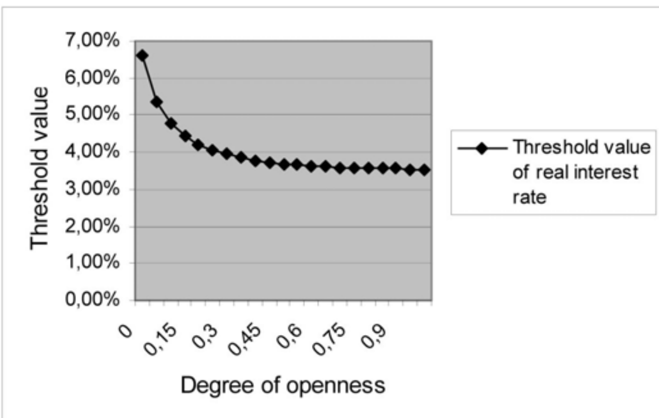

Figure 1. Threshold value of real interest rate in dependence of the degree of openness

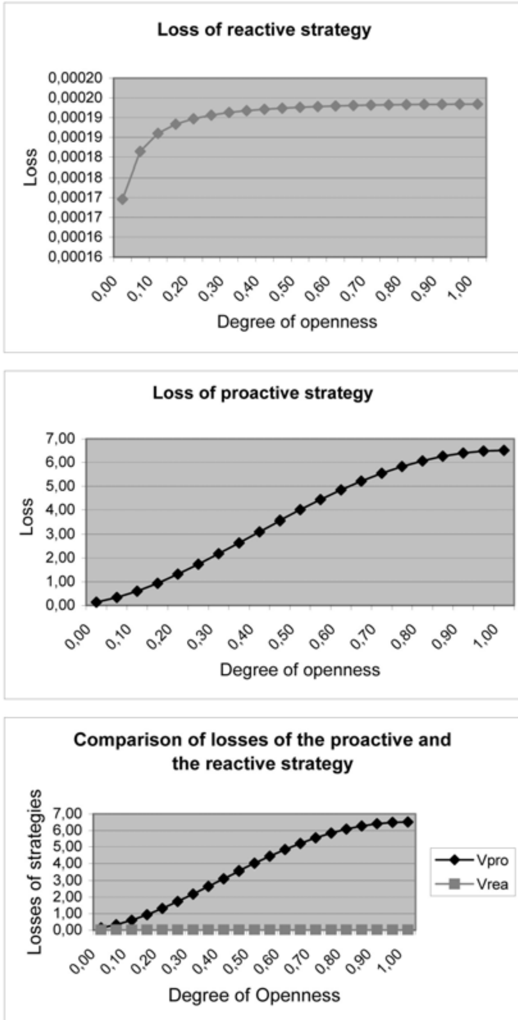

Figure 2. Comparison of losses of the proactive and the reactive strategy

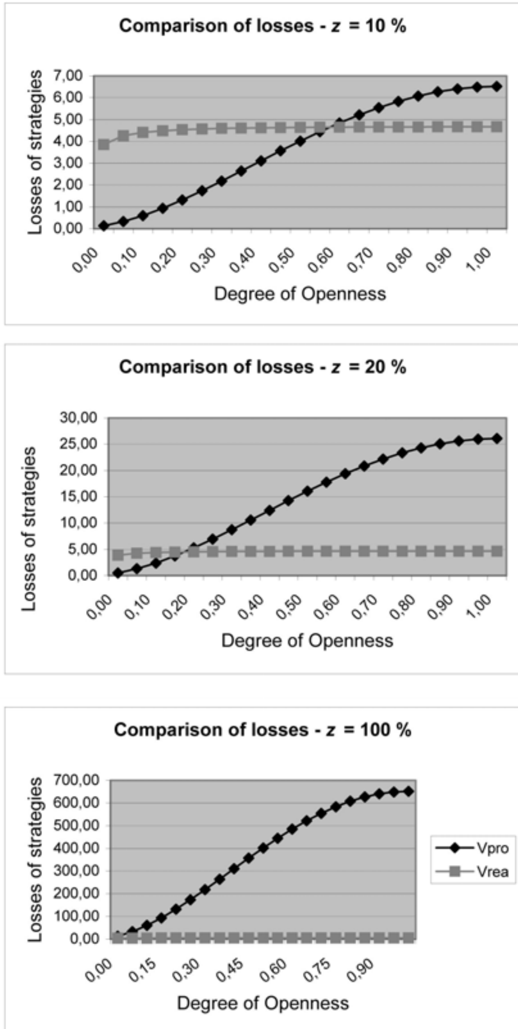

Figure 3. Comparison of losses of the proactive and the reactive strategy in exceptional circumstances