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Monetary Policy and Asset Prices: The Impact of Globalization on Monetary Policy Trade-Offs

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Abstract

This paper studies the nexus between globalization and the optimal monetary policy response to asset prices. Employing a modified New Keynesian sticky price model we explore how the slope of the Phillips curve influences the monetary policy trade-offs that policymakers face in the presence of boom-bust cycles in asset markets. Basically, policymakers can choose between a pro-active policy that raises short term real interest rates during an asset price boom to prevent the build-up of a financial market crisis scenario and a reactive policy that ignores its impact on the likelihood of a future crisis. We show that a globalization-induced flattening of the Phillips curve raises the maximum level of the real interest rate that central bankers are willing to endure in order to avoid a future financial market crisis. Thus, globalization makes the pro-active strategy a more favorable policy option.

Keywords: Monetary policy, asset prices, credit crunch, boom-bust cycles, globalization, Phillips curve.

JEL Codes: E52, E58, E44, F41

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1. Introduction

To what extent, and how, should monetary policymakers adjust interest rates when they observe rapidly rising asset prices? Should monetary policymakers adopt a pro-active policy that raises short term real interest rates during an asset price boom to prevent the build-up of a financial market crisis scenario, or should they follow a reactive policy that ignores its impact on the likelihood of a future downward financial cascade? A pre-emptive interest rate hike may involve unnecessary high welfare losses in terms of too low inflation and output losses during the boom-phase, while a reactive strategy may be associated with a bust-induced economic recession in the aftermath of the boom.

During the last decade, academic research has devoted considerable efforts to exploring this monetary policy trade-off.[1] Early contributions often expressed general skepticism about both the feasibility and the desirability of the pre-emptive monetary policy strategy (Bernanke and Gertler (1999, 2001), Greenspan (2002)). More recent studies, however, emphasize that there is no clear-cut answer to the optimal policy choice. Rather, the optimal policy response to an asset price boom may depend in a complex way on various economic determinants, such as the probability of a bust-induced credit crunch and the degree of 'market exuberance' (Bordo and Jeanne (2002a, b)), the extent of the private sector's forward-looking behavior (Berger, Kißmer and Wagner (2007)) or the time lags of monetary policy (Gruen, Plumb and Stone (2005)).

In this paper we focus on the question whether and how the ongoing process of economic integration, usually labeled as globalization, affects policymakers' optimal choice between a pro-active and reactive policy strategy. Recently, a lively debate about the impact of globalization on monetary policy has evolved. In particular, the apparently increased importance of global factors for domestic inflation has received much attention among policymakers and academics.[2] Tentative empirical evidence supports the view that globalization reduces the response of domestic inflation to domestic output, and hence contributes to a flattening of the short-run output-inflation trade-off (Helbling et al. (2006),

[1] Bernanke and Gertler (1999, 2001), Cecchetti et al. (2000), Cecchetti, Genberg and Wadhwani (2003), Kent and Lowe (1997), Bordo and Jeanne (2002a, b), Filardo (2003), Gruen, Plumb and Stone (2005), Berger, Kißmer and Wagner (2007). See also the recent discussion between Roubini (2006) and Posen (2006).

[2] Greenspan (2005), Bernanke (2007), Rogoff (2003, 2006), Wagner (2002), Ball (2006), Razin and Loungani (2005a, b), Helbling et al. (2006), Borio and Filardo (2006), Bean (2006a, b) and Yellen (2006).

Borio and Filardo (2006), Loungani et. al (2001)).[3] Recent theoretical analyses of the Open-Economy New Keynesian Phillips curve also suggest that globalization induces a flattening of the Phillips curve (Galí and Monacelli (2005), Razin and Yuen (2002)). The slope of the Phillips curve, however, is a key factor that central bankers should take into account when they decide on their optimal response to rising asset prices (see, e.g., Bordo and Jeanne (2002a, b) and Berger, Kißmer and Wagner (2007)). Building on this work, we study the nexus between globalization and the optimal monetary reaction to boom-bust cycles in asset prices.

The remainder of the paper is structured as follows. In the second section we briefly survey the recent discussion on globalization-induced flattening of the Phillips curve. In section three we explore how the slope of the Phillips curve influences the policymaker's choice between a pro-active and a reactive policy in a New Keynesian model that has been modified to allow for financial market shocks and collateral constraints. Following Bordo and Jeanne (2002a, b), we stress that an asset price bust may lead to a fall in output by generating a credit crunch. We show that a flattening of the Phillips curve raises the maximum level of the real interest rate that central bankers are willing to endure in order to avoid a future financial market crisis. Thus, globalization makes the pro-active strategy a more favorable policy option. There are mainly two reasons for this result. First, a flattening of the Phillips curve reduces the welfare losses of a pro-active interest rate hike because the related output losses induce a smaller deviation of inflation from its target level during the boom phase. Second, the smaller the slope of the Phillips-curve the higher are the expected losses of a reactive policy strategy. The intuition underlying this second reason is that a bust-induced credit crunch triggers a negative supply effect. Given a flattening of the Phillips curve, it is more costly to get inflation back to its target level. In section four we conclude.

2. Globalization and the Phillips Curve

It has often been claimed that the increased growth of international trade in goods, services and financial assets, coupled with increased competition in product and factor markets, has provided favorable tailwinds that have made it easier for central banks to hold inflation down

[3] Cf. Bean (2006a, b) and Yellen (2006). However, it should be mentioned that these findings are in sharp contrast to the earlier studies of Romer (1993) and Rogoff (2003). Ball (2006) regards the empirical evidence of a flatter Phillips curve as robust. But he disputes that globalization is the right explanation.

during the last two decades. Rogoff (2003, 2006) emphasizes that increased competition in goods and factor markets weakens the power of domestic firms and unions and contributes to greater price and wage flexibility. In Rogoff's view, fiercer competition not only reduces the natural rate of unemployment but also steepens the output-inflation trade-off. Both effects lower the severity of the dynamic inconsistency problem and may contribute to a lower inflation bias.[4] However, the view that globalization makes the Phillips curve steeper has recently been challenged on theoretical and empirical grounds:

Theoretical considerations

In sharp contrast to what Rogoff (2003, 2006) suggests, other theoretical studies argue that increased global competition may reduce price and wage flexibility and therefore flatten rather than steepen the Phillips curve. An increase in the degree of competition among firms suggests that they face a more elastic demand curve and have less scope to pass through increasing wage costs when domestic unemployment falls (Yellen 2006, Helbling et al. 2006). In a similar vein, Borio and Filardo (2006) emphasize that globalization reduces the response of inflation to domestic output but amplifies the impact of global output on domestic inflation because firms increasingly compete in global markets. Thus, the impact of increased global competition among firms on the slope of the Phillips curve is not as clear as Rogoff's studies might suggest.

Khan (2005) stresses the importance of firms' price setting behavior. In a New Keynesian model of monopolistic competition, the impact of intensified competition between firms on the degree of price flexibility depends on whether firms are assumed to behave according to Rotemberg's (1982) or to Calvo's (1983) model of price adjustment. In the former model, increased competition, captured by a larger elasticity of demand, increases price flexibility. Rotemberg's model implies that the optimal price adjustment decreases in the degree of competition among firms. Hence, under the assumed quadratic costs of price adjustment, price flexibility becomes relatively cheaper when competition increases. In contrast to that, under Calvo's staggered price adjustment more intense competition reduces price flexibility, provided that strategic complementarity in price setting prevails.[5] The intuition for the latter

[4] Romer (1993), too, stresses that more trade openness increases the slope of the Phillips curve. See also Ball (2006) and Wagner (2002) on how globalization may affect monetary policy.

[5] Woodford (2003) emphasizes that the degree of strategic complementarity in price setting is a key parameter in determining the slope of the New Keynesian Phillips curve. Strategic complementarity refers to the interaction between price setters on the macroeconomic level. It implies that a firm's optimal product price increases when other firms raise their prices. Given Calvo's price adjustment, the higher the degree of strategic complementarity

result is that in Calvo's model firms' price setting decisions also depend on concerns about their market shares. An increased elasticity of demand implies that firms may hesitate to raise prices in order to avoid losing market shares. Hence, given segmented factor and goods markets (i.e. strategic complementarity), enhanced competition among firms decreases price flexibility and gives rise to a flattening of the Phillips curve (Khan (2005)).

Furthermore, globalization may also affect the slope of the Phillips curve through the related increase in the degree of openness. Employing Calvo's staggered price setting in a New Keynesian model, Galí and Monacelli (2005) show that increased trade openness, captured through a decline of the home bias in consumption, dampens the terms of trade-adjustment required for bolstering a shift in domestic output. Thus, the impact of domestic output on marginal costs and inflation is reduced by increased openness. Therefore, domestic inflation is more sensitive to world output, implying a flatter Phillips curve.[6] Moreover, Razin and Yuen (2002) show in a similar model that more financial openness and higher capital mobility makes it easier for households to smooth their consumption over time. This increases the effective intertemporal elasticity of substitution of consumption, thus raising the degree of strategic complementarity in price setting. As consumption becomes less sensitive to changes in domestic output, inflation responds less sensitively to output. Again, the outcomes are higher price inflexibility and a flatter Phillips curve. Razin and Loungani (2005a, b) examine the impact of both more trade and more financial openness on the Phillips curve trade-off. They show that the slope of a New Keynesian Phillips curve becomes smaller when an economy opens up to international trade in goods. Moreover, for reasons already explained in Razin and Yuen (2002) the Phillips curve flattens even more when the economy additionally opens up to the international financial markets.[7]

It has also been argued that globalization may enhance the opportunity for firms producing in global markets to substitute imports for domestic output (Yellen 2006). This raises global competition between workers and reduces their scope to claim higher wages when domestic

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the higher is inertia. Since only a subset of all firms is able to adjust their prices, even flexible-price suppliers change prices relatively less in response to disturbances. See also Khan (2005) and Woodford (2003).

[6] This result therefore stands in sharp contrast to Romer's early study (1993), which stresses that more trade openness causes a steeper Phillips curve.

[7] Razin and Loungani (2005a, b) point out that a flatter Phillips curve does not necessarily contradict the view that globalization may have contributed to lower inflation. In a microfounded New Keynesian model they show that the relative weight a central bank optimally has to put on price stability is inversely related to the slope of the Phillips curve. Although the globalization-induced flattening of the inflation-output trade-off increases central bankers' incentives to inflate, the increased importance of price stability relative to output stability reduces the inflation bias. Woodford (2003) clarifies how the relative weights on inflation and output stability appearing in a standard quadratic loss function depend on structural parameters.

demand increases. Thus, globalization may reduce wage flexibility and may contribute to a flatter Phillips curve (Bean 2006a, b).

Empirical Evidence

Some recent studies support the view that globalization has contributed to a flattening of the Phillips curve. Borio and Filardo (2006) show for 16 countries and the Euro area in the period 1985-2005 that the impact of global capacity on inflation increases and the importance of domestic capacity simultaneously declines. In a similar vein, Helbling et al. (2006) provide evidence for selected advanced economies that the impact of domestic conditions on inflation has weakened over the past decades. This in turn points to a higher impact of foreign factors. The study suggests that trade openness is the essential factor behind the decreased sensitivity of inflation to domestic conditions. In addition, Helbling et al. (2006) show that the fall in real import prices is a key factor for inflation development over several years. In a study for the U.S. economy, Gamber and Hung (2001) analyzed the impact of globalization on inflation in the 1990s. They found that globalization and excess foreign capacity can explain the increasing impact of foreign conditions on domestic inflation during the last years.[8] Ciccarelli and Mojon (2005) show for 22 industrialized countries (time period: 1960-2003) that inflation is characterized by a common factor across countries that is responsible for nearly 70 % of inflation variance. Thus, there is some evidence supporting the 'new view' that globalization contributes to a smaller response of inflation to domestic output.

As mentioned above, globalization-induced higher competition among firms may lead to less scope for firms to raise their prices. Both Bean (2006a) and Yellen (2006) point out that this not only implies a reduction of the average values of mark-ups. Rather, more global competition should lead to a greater countercyclicality of mark-ups and thus reduce the slope of the Phillips curve. This is consistent with the findings of Batini et al. (2005). Furthermore, Khan (2005) estimates the slope of the Phillips curve for several countries. He provides evidence that more intense competition among firms contributed to a flattening of the inflation-output trade-off in the 1990s.

Loungani et al. (2001) analyze the link between capital mobility and the output-inflation trade-off. Using IMF data they find a strongly positive correlation between capital controls and the slope of the Phillips curve. In accordance with Razin and Yuen (2002), this means

[8] In contrast, Tootell (1998) does not find any relationship between foreign utilization and U.S. inflation.

that an economy with a small degree of capital controls should have a relatively flat Phillips curve.

To sum up, theoretical considerations and tentative empirical evidence both support the view that globalization has flattened the short-run output-inflation trade-off. In the next section we show how this globalization-induced impact on the Phillips curve may influence a second trade-off that an asset price boom gives rise to.

3. Globalization and the Optimal Monetary Response to Asset Price Booms

How does the globalization-induced flattening of the Phillips curve affect monetary policy? Academic literature has so far highlighted the role of globalization for inflation. In contrast, we focus on the optimal monetary response to asset price booms. Our model allows for an endogenous financial market shock along the lines of Bordo and Jeanne (2002a, b). In contrast to Bordo and Jeanne, we explicitly employ a standard forward-looking New Keynesian Phillips curve based on Calvo's (1983) staggered price adjustment. As aforementioned, this price setting behavior is consistent with a globalization-induced flattening of the Phillips curve.[9]

3.1. The Model

We consider an economy where policymakers face rapidly rising asset prices. Central bankers are assumed to have a choice between two main policy options. They can either adopt a pro-active policy or alternatively a reactive policy. By choosing a pro-active interest rate hike central bankers aim at reducing the risk of a future bust-induced credit crunch. Adopting a reactive policy means that monetary policymakers ignore their influence on the likelihood of a future credit crunch. Instead, they concentrate on mitigating the consequences of an expected or an actual crisis if and when it occurs.

[9] Following Rogoff (2003) we focus on the impact of globalization on the slope of the Phillips curve in a stylized macroeconomic model without explaining the details of its open economy microfoundation. In contrast to Rogoff (2003), who employs a standard Barro-Gordon-model, we consider a standard New Keynesian model. However, as shown by Clarida, Galí and Gertler (2001) the simple work-horse closed-economy model is isomorphic to the New Keynesian model of a small open economy under certain conditions, i.e. the closed-economy IS and Phillips curve equations have the same general form as their counterparts in a small open-economy model.

The model describes an economy that exists for three periods.[10] Period 1 is the boom period. Firms issue debt to finance the purchase of a productive asset. Firms need this asset to be able to produce, but it may also serve as collateral in the second period. Policymakers must also choose their policy strategy. However, in period 1 future asset prices, or the future prices of collaterals respectively, are unknown. In period 2, an asset price bust coupled with a precipitous drop in collateral values may or may not occur. Firms can only obtain further credit if the required new credit remains below the real value of their collateral minus the ex post debt burden. Hence, the credit constraint that firms face is directly linked to asset prices. In period 3, the economy moves into a new steady state.

Our stylized macroeconomic model is given by equations (1) to (3).

$$\pi_t = \beta E_t \pi_{t+1} + \alpha x_t + v_t \tag{1}$$

$$x_t = E_t x_{t+1} - (r_t - r^*)/\sigma \tag{2}$$

$$r_t = i_t - E_t \pi_{t+1} \qquad t = 1, 2, 3 \tag{3}$$

The New Keynesian Phillips curve (1) relates current inflation π_t to expected future inflation $E_t\pi_{t+1}$, the current output gap x_t, and a financial shock v_t (see below). Both parameters α and β are positive, with agents' discount factor β satisfying $0 \leq \beta \leq 1$. The impact of expected future inflation on current inflation is rooted in the assumption that firms set prices in a staggered fashion à la Calvo (1983). When firms decide about their optimal prices they must be concerned about future inflation, because they may be unable to reset their prices for several periods. The slope of the Phillips curve α determines how inflation responds to output gap changes. The larger is α the more flexible are prices. For reasons explained above in section 2 we will later assume that globalization induces a reduction in α.

[10] The model is laid out in more detail in Berger and Kißmer (2007) and Berger, Kißmer and Wagner (2007). Our model is related to Bordo and Jeanne (2002a, b). But we focus exclusively on macroeconomic effects and on macroeconomic policy. Readers who are interested in the microeconomics of the lending and borrowing decisions of households and firms and the microeconomic foundations of the collateral-induced credit crunch are therefore referred to their work.

The forward-looking IS equation (2) makes the current output gap dependent on the expected future output gap $E_t x_{t+1}$ and the real interest rate r_t. The parameter r* is defined as the real interest rate that would prevail in the absence of shocks.[11] The parameter $\sigma > 0$ is related to the intertemporal elasticity of substitution of consumption. The smaller is σ, the larger is the decline in aggregate demand that a given rise in the real interest rate causes.[12] The Fisher equation (3) makes the real interest equal to the difference of nominal interest rate i_t and the expected next period's inflation. Policymakers can influence the real interest rate by variations of their policy instrument i_t.

Following Bordo and Jeanne (2002a, b) we focus on the supply-side effects of a collateral induced credit crunch. In our model, a precipitous fall in asset prices is associated with a sharp shrinkage of firms' collateral bases, implying that some firms' net worth may become too small to obtain further credit. Firms that suffer from a credit crunch must stop producing goods. Hence, the macroeconomic result of a collateral-induced credit crunch is a decline in economic activity. To examine the policy trade-off presented by an asset price boom we employ the simplest possible distribution for v_t. The financial shock can only occur in the middle period 2, so that the distribution of v_t can be defined as

$$(4) \qquad v_t = \begin{cases} 0 & \text{in} \quad t \neq 2 \\ 0 & \text{in} \quad t = 2 \quad \text{if} \quad \text{no credit crunch} \\ \varepsilon > 0 & \text{in} \quad t = 2 \quad \text{if} \quad \text{credit crunch} \end{cases}$$

In contrast to conventional models, v_t is not entirely exogenous. Rather we assume that central bankers can affect the probability that a credit crunch will occur in the second period through the choice of their policy strategy in the first period. For given asset prices in the second period, the probability of a credit crunch depends on the difference between the size of firms' collateral base and their debt burden. The higher the debt burden the more likely it is that an asset price bust results in a credit crunch. Hence, through variations in the first-period nominal interest rate i_1 policymakers are able to influence the first period's real interest rate

[11] Since there is no growth, r* is constant across the periods.
[12] We abstract from the "usual" demand and supply shocks. In order to sharpen our results we focus exclusively on the financial shock, v_t (see equation (1)). Including the usual demand and supply shocks would complicate the derivation of the optimal monetary policy without changing the results qualitatively.

and thus the costs associated with a given debt burden. We assume that firms' debt burden is smaller the higher the real interest rate in the first period. Formally, the probability of a collateral-induced credit crunch in the second period can be written as

$$(5) \qquad \mu = \text{prob}(v_2 = \varepsilon \mid r_1) = \begin{cases} 0 & \text{if} \quad r_1 \geq \underline{r} > r^* \\ 0 < \mu < 1 & \text{if} \quad r_1 < \underline{r} \end{cases}$$

where $\underline{r}$ denotes the minimum real interest rate required to completely eliminate the probability of a future credit crunch as explained above. If the first period's real interest rate exceeds $\underline{r}$, the debt burden accumulated so far in the corporate sector will always be low relative to the value of the collateral that firms can offer.

Policymakers are assumed to minimize an intertemporal loss function V where L_t represents instantaneous periodical losses.

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

$$(7) \qquad L_t = \pi_t^2 + \lambda x_t^2 .$$

As usual, the standard loss function L_t is quadratic in inflation and the output gap, where the parameter λ measures the relative weight that central bankers assign to output gap stability.[13] We follow Svensson (2004) and associate (6) and (7) with an inflation-targeting regime. If $\lambda > 0$ ($\lambda = 0$) then a regime of flexible (strict) inflation targeting is said to prevail.

[13] Woodford (2003) and Rotemberg and Woodford (1997) show that L can be derived as an approximation of households' period utility losses that result from deviations from the non-stochastic steady state allocation.

3.2 The Policy Trade-Off

Suppose that policymakers are currently observing an exceptional asset price boom. Should they immediately raise the interest rate in order to prevent a future financial crisis? This pro-active strategy may involve unnecessary high losses during the boom period, as the first period's output and inflation may fall sharply below their target values. Alternatively, policymakers may choose not to incur these costs and adopt the reactive policy strategy. However, if a future crisis occurs, policymakers will be unable to stabilize both inflation and the output gap at the same time. Furthermore, under a reactive strategy a looming asset price bust may even cause current losses through its impact on the private sector's forward-looking expectations. When deciding about the optimal response to an asset price boom policymakers compare the expected losses that are associated with both policy strategies. To examine the optimal policy choice we have to evaluate expected losses under both regimes.

3.2.1 The Reactive Policy

By adopting a reactive policy strategy, policymakers take the probability of a future credit crunch as given and stabilize the consequences of actual or expected shocks if and when they occur.

We can solve the model through standard backward induction. In period 3 no shocks can occur and the economy moves into a new steady state. As there is no real growth and the steady state lasts forever, we make use of the terminal condition $E_3\pi_4 = 0$. Furthermore, we assume discretionary policymaking, implying that central bankers are not committed to react to the previous period's shocks. In period 3, policymakers thus set the interest rate equal to the equilibrium value r*. Given $i_3 = r_3 = r^*$, output and inflation coincide with the target values. Hence, the third period's expected losses are zero. (see Table 1 below).

In period 2, however, a credit crunch may or may not occur under a reactive policy. If a credit crunch does not occur, policymakers will be able to fully stabilize the economy. Then, the second period's equilibrium mimics the steady state solution. In contrast to this favorable case, the policymakers' optimal interest rate policy will have to trade off inflation against

output losses if a credit crunch occurs.[14] The optimal monetary stabilization policy then results in an increase in inflation and a decrease in output (see Table 1). Since the credit crunch does not have any demand-side effects in our model, a falling supply meets an unchanged demand, so that inflation immediately increases. The expected loss in the second period is strictly positive, since the probability of a credit crunch is strictly positive ($\mu > 0$) under the reactive strategy (see Table 1).

Table 1

Reactive Policy		
t = 1	**t = 2**	**t = 3**
$i_1^{REA} = r^* + \left[(\lambda - \alpha\sigma)\Delta + \beta\lambda\alpha\sigma\right]\mu\varepsilon / \Delta^2$ $r_1^{REA} = r^* - \left[\lambda(1-\beta) + \alpha^2\right]\alpha\lambda\mu\varepsilon / \Delta^2$	*crisis* $i_2^{REA} = r_2^{REA} = r^* + \alpha\sigma\varepsilon / \Delta$ *no crisis* $i_2^{REA} = r_2^{REA} = r^*$	$i_3^{REA} = r_3^{REA} = r^*$
$\pi_1^{REA} = \beta\mu\varepsilon(\lambda / \Delta)^2$ $x_1^{REA} = -\beta\alpha\lambda\mu\varepsilon / \Delta^2$	*crisis* $\pi_2^{REA} = \lambda\varepsilon / \Delta$ $x_2^{REA} = -\alpha\varepsilon / \Delta$ *no crisis* $\pi_2^{REA} = x_2^{REA} = 0$	$\pi_3^{REA} = x_3^{REA} = 0$
$L_1^{REA} = (\beta\mu\varepsilon)^2(\lambda / \Delta)^3$	*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 $\Delta = \lambda + \alpha^2$.

In period 1, forward-looking agents will incorporate the possibility of a credit crunch, and the expected future monetary policy in response to such a credit crunch, in their expectations. As these expectations feed into the current inflation rate and the current output gap, policymakers

[14] Some readers may regard an increase in second period's interest rate (see Table 1) as a counter-intuitive policy reaction to the occurrence of a credit crunch. Note, however, that this reflects an easing of monetary policy: In case of a credit crunch, the interest rate hike would not be strong enough to prevent inflation in the second period. As already mentioned by Bordo and Jeanne (2002a) and shown by Berger, Kißmer and Wagner (2007), integrating the demand-side effects of a credit crunch in the model (i.e. modeling a credit crunch as the simultaneous occurrence of a negative supply and demand shock) would make the model more consistent with the evidence that a credit crunch is typically followed by a decrease in interest rates. However, the results of this paper remain valid even when the demand side effects of an asset price bust are taken into account (see ibid.). For simplification, we therefore exclusively focus on the supply side here.

are forced to respond to the deterioration of agents' expectations by setting their policy instrument so that the first period's real interest rate falls below the flex-price equilibrium level r*. Although reactive central bankers do not try to lean against the wind of a future credit crunch, the expectations channel prevents them from maintaining the flex-price equilibrium during the boom phase.

Thus, allowing for forward-looking expectations has two main implications for the optimal design of a reactive policy strategy. First, in general a reactive strategy deviates from a policy of benign neglect towards asset price booms. Our interpretation of a reactive strategy is very much in line with the conventional view that an optimal reactive policy involves a timely adjustment of monetary policy if an asset price boom signals current or future changes in the target variables, inflation and the output gap.[15] This is in sharp contrast to Bordo and Jeanne (2002a, b) and Greenspan (2002), who interpret the optimal reactive strategy as an asymmetric policy that only reacts in the aftermath of a boom when and if a bust occurs. Second, according to our model the optimal reactive policy response implies that central bankers adopt a leaning-with-the-wind strategy that causes a decline in the real interest rate during the boom period. Berger and Kißmer (2007) show that this interpretation of a reactive strategy is consistent with both the tentative empirical evidence on central banks' interest rate setting during asset price booms and with central bankers' rhetoric.[16]

3.2.2 The Pro-active Policy

By adopting a pro-active strategy monetary policymakers aim at avoiding a future credit crunch in the first place. Following Bordo and Jeanne (2002a, b), we assume that policymakers know how much to raise the first period's interest rate in order to prevent a future financial crisis.[17]

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[15] Hence, the reactive strategy might be regarded as the 'standard policy' under flexible inflation targeting. Cf. Rudebusch (2005) who introduces the term 'standard policy' to describe central bankers' conventional response to asset price booms. See also Bean (2003).

[16] Central bankers routinely emphasize that they do not try to influence the probability of a boom-bust cycle. Borio and Lowe (2003) as well as Detken and Smets (2004) provide evidence that monetary policy has been relatively loose during high-cost asset price booms.

[17] Obviously, this is a heroic assumption. Opponents of a pro-active strategy often emphasize that the link between monetary policy instruments and the probability of a future financial crises is unknown to central bankers (Greenspan (2002)).

Starting with the third period we can easily see that there are no differences to the reactive policy case. For reasons explained above, policymakers again set the real interest rate at r*, implying that inflation and output gap equal their target values. In contrast to reactive policymakers, pro-active central bankers will be able to attain this favorable solution in the second period as well, since a credit crunch cannot occur under a pro-active policy regime (see Table 2). However, the insurance premium for this kind of monetary risk management has to be paid during the boom period. Policymakers have to set the first period's interest rates equal to $\underline{r}$, implying that inflation and the output gap fall below their target values during the boom phase.

Table 2

Pro-active Policy		
t = 1	**t = 2**	**t = 3**
$i_1^{PRO} = r_1^{PRO} = \underline{r}$	$i_2^{PRO} = r_2^{PRO} = r^*$	$i_3^{PRO} = r_3^{PRO} = r^*$
$\pi_1^{PRO} = -\alpha z / \sigma$ $x_1^{PRO} = -z / \sigma$	$\pi_2^{PRO} = x_2^{PRO} = 0$	$\pi_3^{PRO} = x_3^{PRO} = 0$
$L_1^{PRO} = \Delta (z / \sigma)^2$	$L_2^{PRO} = 0$	$L_3^{PRO} = 0$

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

To sum up, the main difference between a reactive policy and a pro-active policy is not the timing of the policy response but the direction in which the real interest rate is moved during asset price booms. Adopting a pro-active policy means that policymakers have to lean against the wind by raising the real interest rate during the boom phase. In contrast to this, under a reactive policy the optimal response follows a leaning-with-the-wind strategy inducing a decline of the real interest rate in the boom period.

3.2.3 The Optimal Policy Choice and the Impact of Globalization

The policy rule that governs the optimal choice of the monetary policy strategy can now be derived. From our results presented in Table 1 and 2 above, it follows that

$$(8) \qquad V^{REA} = \left(\beta\lambda\mu\varepsilon^2/\Delta\right) + \left(\beta\mu\varepsilon\right)^2\left(\lambda/\Delta\right)^3 \qquad \text{(Reactive)}$$

$$(9) \qquad V^{PRO} = \Delta(z/\sigma)^2 \quad \text{with } z = \underline{r} - r^* > 0. \qquad \text{(Pro-active)}$$

In general, both strategies may turn out to be the optimal policy response to an asset price boom. Formally, the pro-active policy is optimal if $V^{PRO} < V^{REA}$, which is the case if condition (10) is fulfilled.

$$(10) \qquad \underline{r} < \bar{r} = r^* + \frac{\sigma\varepsilon}{\Delta}\sqrt{\beta\lambda\mu\left[1+\beta\mu\left(\lambda/\Delta\right)^2\right]} \text{ with } \Delta = \lambda + \alpha^2$$

where $\bar{r}$ is defined as the maximum level of the real interest rate that central bankers are willing to endure in order to avoid a future credit crunch. If this threshold value is larger than the real interest rate required to avoid a credit crunch $\underline{r}$, monetary policymakers will pay the insurance premium and choose the pro-active strategy.

Our model implies that adopting a pro-active policy tends to be the optimal choice if the probability of a credit crunch (μ) and the extent of the asset price bust (ε) are comparatively large. In contrast, policymakers' willingness to act pro-actively decreases in the degree of time preference (i.e. a fall in β), as well as in the sensitivity with which aggregate demand reacts to real interest rate changes ($1/\sigma$).

The impact of a change in the slope of the Phillips curve α on the optimal policy choice deserves closer attention. As explained in section 2, globalization is assumed to give rise to a less sensitive response of inflation to output gap changes. However, it can easily be seen in (10) that a smaller inflation-output trade-off (a smaller α) increases the threshold value $\bar{r}$. Thus, our model implies that globalization may increase policymakers' incentives to adopt a pro-active strategy. There are two main reasons for this result. First, a smaller slope of the

Phillips curve reduces the losses that are associated with a pro-active strategy. As the pro-active policy involves an interest rate hike during the boom period, the output gap will immediately fall. However, the smaller the slope of the Phillips curve the smaller is the impact of a given recession on the current inflation rate (see Table 2). Second, expected losses that are associated with the reactive policy depend inversely on the slope of the Phillips curve (see Table 1). The intuition for this result is that a bust-induced credit crunch impacts the economy through the supply side. If a credit crunch occurs, reactive policymakers have to trade-off inflation against output. Given a flattening of the Phillips curve it is more costly to get inflation back to its target level. However, not only will the second period's expected losses rise. Since agents are forward-looking, the potential deterioration of macroeconomic stability affects the first period's inflation and output gap through the expectations channel. Hence, reactive policymakers are already confronted with increasing losses during the boom period. All in all it becomes clear that a globalization induced flattening of the Phillips curve unambiguously increases policymakers' willingness to adopt a pro-active policy strategy.

However, it might be objected that a flattening of the Phillips curve trade-off gives rise to a change in the relative weight that central bankers optimally assign to output gap stability. Woodford (2003) stresses the endogeneity of λ in a fully microfounded New Keynesian approach.[18] He shows that λ can be expressed as the ratio between the slope of the Phillips curve α and the price elasticity of demand θ faced by individual firms, i.e. $\lambda = \alpha/\theta$. It follows that for a given θ a smaller α should make central banks more conservative.[19] However, although the impact of more conservatism on the optimal policy choice between the pro-active and the reactive strategy is ambiguous, it can be shown that a simultaneous reduction in λ and α unambiguously increases the threshold value $\bar{r}$ in (10). Thus, our main result would remain valid even if we had allowed for the endogeneity of λ.

[18] See also Razin and Yuen (2002), Razin and Loungani (2005a, b).

[19] Furthermore, as already explained in section 2 and in Khan (2005), more intense competition between firms might be captured by a higher elasticity of demand θ. Moreover, an increase in θ raises the strategic complementarity in price setting and leads to a decline in α. Hence, a globalization induced increase in competition unambiguously lowers the relative weight λ that a central bank should put on stabilizing the output gap. See also Razin and Loungani (2005a, b) who stress that central bankers should put more weight on price stability when the economy opens up to international trade in goods and capital. Probably, this endogeneity of policy objectives partly explains the worldwide trend to grant central banks more independence as well as the greater emphasis that has recently been placed on price stability as a goal of monetary policy.

4. Conclusions

Recently, the academic literature has provided tentative empirical evidence that globalization has contributed to a flattening of the short-run inflation-output trade-off. Furthermore, theoretical studies emphasize various channels through which globalization may affect the slope of the Phillips curve. In New Keynesian approaches, a more intense global competition between firms as well as greater capital mobility can be considered as the key factors behind the apparent flattening of the Phillips curve.

In this paper, we examine the consequences of a flatter Phillips curve for the optimal monetary policy response to an asset price boom. We assume that policymakers have a choice between adopting a pro-active policy that aims at avoiding a future financial crisis by raising interest rates already during the boom phase and adopting a reactive policy that does not try to influence the probability of a boom-bust cycle. Employing a forward-looking New Keynesian macroeconomic model, modified to allow for a collateral-induced credit crunch, we show that a weaker response of inflation to the output gap increases the incentives of monetary policymakers to adopt a pro-active policy strategy. A smaller slope of the Phillips curves implies smaller losses of the pro-active strategy, while at the same time it increases the losses that are associated with the alternative reactive policy strategy.

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