Central Bank Independence and Financial Stability: A Tale of Perfect Harmony?

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Abstract

In this paper we show that the degree of central bank independence (CBI) influences the optimal choice of monetary policy strategy during potentially unsustainable asset price booms. We assume that central bankers have to choose between a policy that preemptively raises short-term real interest rates in the boom phase to prevent the build-up of a financial market crisis scenario and the cleaning-up strategy that ignores its impact on the likelihood of a future crisis. We find that the more independent central bankers are, the more likely it is that they refrain from implementing preemptive monetary tightening to maintain financial stability. These results stand in sharp contrast with the seemingly predominant view that CBI fosters financial stability. The intuition underlying these results is that a preemptive interest rate hike gives rise to, among other things, a lower inflation rate in the boom period. Whether this disinflation creates additional costs or benefits depends on the degree of CBI. It can benefit dependent central bankers who otherwise would suffer from a higher inflation bias; however, for independent central bankers, this disinflation leads to an undesirable undershooting of their inflation target.

Keywords: monetary policy, asset price bust, central bank independence, cleaning-up, pre-emptive tightening

JEL Codes: E52, E58, E44

1 Introduction

The two decades prior to the most recent global financial crisis saw the emergence of a new consensus about monetary policy that highlighted, among other things, the importance of central bank independence (hereafter, CBI) and the affirmation of price stability as a mandated goal for monetary policy. This consensus view is not only well documented in mountains of academic literature but also corresponds to the remarkable changes in monetary policy practices that took place in many countries during that time. Since the late 1980s, many central banks have achieved more independent status, and the related revisions of the central bank laws generally have led to a greater emphasis on price stability.

Economic theory suggests that CBI, coupled with an explicit mandate for maintaining price stability, offers an institutional device for realizing the social benefits associated with low and stable inflation rates. In addition, a large body of empirical studies provides evidence that these benefits of CBI come about without apparent costs, such as a deterioration of real macroeconomic performance (e.g., increased output volatility, reduced economic growth). Moreover, it has even been claimed that CBI does not only help assure price stability but also fosters financial stability (e.g., Bernanke 2010a; Arnone et al. 2009). Former conventional wisdom (i.e. prior to the recent global financial crisis) stressed that at least in the long run, no trade-off between price stability and financial stability existed. At first glance then, it might seem reasonable to expect a double dividend: those institutional changes that have helped achieve low and stable inflation rates seem conducive to a stable financial system as well.

In sharp contrast to the voluminous literature on the relationships between CBI and inflation, a still scarce, albeit burgeoning, research stream attends to the impact of CBI on financial

stability.[1] Čihák (2010) argues that insulating monetary policy from political pressures implies that central bankers are less constrained from acting preemptively to prevent financial crises. He also presents some preliminary empirical findings that support the view that CBI fosters financial stability. Using a sample of yearly data for 79 countries between 1970 and 1999, García Herrero and Del Río (2003) provide evidence that higher values of CBI indicators are associated with a lower likelihood of a banking crisis. Relying on a broader set of financial instability indicators and a sample of 80 countries between 1985 and 2005 Klomp and de Haan (2009) also find a negative relation between CBI and financial instability.

However, such tentative findings regarding the link between CBI and financial stability should surprise those observers who recognize that both the recent global financial crisis and the Wall Street crash at the end of the 1920s, which led to the Great Depression, occurred during periods in which CBI had been comparatively high for an extended time. Thus in an analysis of historical experiences, Bordo (2010) cannot arrive at a clear-cut conclusion. However, he emphasizes that the U.S. Federal Reserve Bank's policy during the interwar period indicates that CBI can be harmful for financial stability if monetary policy is based on a flawed policy doctrine. Furthermore, insofar as CBI contributes to a high degree of monetary policy credibility and thus the existence of a low inflation environment, it may create the so-called paradox of credibility. According to Borio and Lowe (2002), a credible low inflation policy reduces the probability that investors and financial institutions assign to the occurrence of a future economic downturn and encourage them to engage in further borrowing and lending, respectively, thus driving up asset prices and private indebtedness. A

[1] Since the outburst of the recent financial crisis, intensive debate has also raged about the reverse causality, namely, how financial instability affects or should affect the (optimal) degree of CBI (e.g., Goodhart (2010), Blinder (2010), Bordo (2010) and Cukierman (2011a, b)). Alesina and Stella (2011) point out that the crisis has shaken the foundations of economists' knowledge about monetary policy so profoundly that many questions about the conduct and institutional design of monetary policy, which once were regarded as consensual, are back on the agenda. Raising the normative question of how the optimal degree of CBI is determined has a long tradition in the literature since the seminal work by Rogoff (1985). However, doing this in a financial crisis context is beyond the scope of this paper.

credible monetary policy could therefore render the financial system, paradoxically, more vulnerable to adverse economic shocks.[2]

In this paper we analyze the nexus between CBI and financial stability and ask how the policy chosen in the run-up to an asset price bust depends on the degree of central bank independence. To do that we modify an otherwise standard New Keynesian model by integrating the degree of CBI – in dependence on political pressure –and the possibility of a financial crisis. To the best of our knowledge, this work belongs to the first attempts to model the impact of CBI on financial stability. We show that policymakers' optimal choice between a policy that preemptively raises short-term real interest rates in the boom phase to prevent the build-up of a financial market crisis scenario and the cleaning-up strategy that ignores its impact on the likelihood of a future crisis inter alia depends on the degree of CBI. In particular, our model results stand in sharp contrast to the view that CBI fosters financial stability. The intuition underlying this result is that safeguarding financial stability through a preemptive interest rate hike not only leads to output gap losses but also gives rise to lower inflation rates in the boom period. This can be beneficial for politically dependent central bankers, who must follow less hawkish anti-inflation policies than actually warranted by their own policy objectives. For independent central bankers the decrease in inflation only gives rise to additional costs because inflation gets driven away from its target. Therefore, the more independent central bankers are, the lesser their willingness is to prevent the occurrence of a future financial crisis.

[2] Bean et al. (2010) provide some evidence that the reduction in macroeconomic volatility has been an important factor for explaining real credit growth, as well as real house price growth in the United States and United Kingdom during the period (2002–2005) prior to the outburst of the recent financial crisis. They support the view that a more credible monetary policy contributed to the "Great Moderation" and potentially added to an unsustainable asset price boom through this indirect channel.

We further show that if the cleaning-up strategy is chosen, it does not imply that central bankers should stay passive and view a potential detrimental asset price boom with benign neglect, as was apparently favored until the recent crisis by politicians and academics alike (e.g., Greenspan 2002, Posen 2006). As also suggested by Berger and Kißmer (2008) and Gruen et al. (2005) in a different set-up the optimal cleaning-up approach involves a preemptive loosening of monetary policy when central bankers confront a looming asset price bust in an attempt to accommodate the progressive deterioration of expectations before the crisis or overcome time lags in monetary policy transmission, respectively. Hence, our model suggests another important policy conclusion: Central bankers' willingness to adopt a leaning-*with*-the-wind strategy during asset price booms is higher when the degree of CBI is greater.

Our approach relates to the literature that deals with the hotly debated question of the extent to which, and how, monetary policymakers should adjust interest rates when they observe rapidly rising asset prices. Prior to the recent financial crisis, the conventional wisdom regarded interest rate policy as an overly blunt tool to deal effectively with asset price boom-and-bust cycles. The best monetary policy could do instead was to mitigate the adverse effects on inflation and the output gap after the bubbles burst ("clean-up").[3] Recently, sparked at least partially by the global financial crisis and its severe economic repercussions, this consensus has started to falter (White (2009)). Studies such as Bordo and Jeanne (2002), Gruen et al. (2005), Berger et al. (2007) and Woodford (2012) stress that under certain circumstances monetary policymakers should be ready to act preemptively to prevent future financial crises.[4] Similar to our paper these studies show that the optimal policy response to an asset price boom depends 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

[3] See, e.g., Bernanke and Gertler (1999, 2001), Greenspan (2002) and Posen (2006).
[4] In contrast with prior studies, these contributions model the build-up of a financial crisis scenario as an endogenous process that partly depends on monetary policy.

(2002)), the extent of private sector's forward-looking behavior (Berger et al. (2007)), the time lags of monetary policy (Gruen et al. (2005)) or the availability of other macro-prudential policy tools (Woodford (2012)). None of these studies, however, considers the nexus between CBI and financial stability and its interplay with the optimal monetary policy response in times of financial crises.[5]

The remainder of this paper is organized as follows. A stylized New Keynesian model that allows for financial shocks and integrates CBI will be presented in section 2. We analyze the links among monetary policy, financial stability, and CBI in section 3. Section 4 details the optimal monetary policy choice if and when an asset price boom may turn to bust, as well as its dependence on the degree of CBI. Section 5 concludes.

2 The Model

2.1 Output, Inflation and Crisis Probability

The two building blocks of our model are given in Equations (1) and (2).

$$\pi_t = E_t\pi_{t+1} + \alpha \cdot x_t + v_t \qquad \alpha > 0. \tag{1}$$

$$x_t = E_t x_{t+1} - \frac{1}{\sigma}\cdot\left(i_t - E_t\pi_{t+1} - r^*\right) \qquad r^*, \sigma > 0 \qquad t = 1, 2, 3. \tag{2}$$

The forward-looking Phillips Curve (Equation (1)) relates current inflation π_t to expected next-period inflation $E_t\pi_{t+1}$ and the current output gap x_t.[6] We augment the Phillips Curve by

[5] Somewhat related to our study is the work by Bensaid and Jeanne (2000), who employ a second-generation model of currency crises to show that delegating monetary policy to an independent central banker does not prevent self-fulfilling currency crises from occurring and can even make them more costly to the government.

[6] As explained below, our model allows for an inflation bias due to political pressures on central bankers. For convenience, we assume that price setters do not discount the future; thus we can set the discount factor in front of the expected next-period inflation equal to unity. Otherwise, incorporating price setters' time preference

adding a random disturbance (v_t) that we interpret as a shock emanating from the financial sector (see below). The IS-relationship (Equation (2)) links the current output gap to the expected future output gap $E_t x_{t+1}$ and the deviation of the real interest rate ($r_t = i_t - E_t\pi_{t+1}$) from its equilibrium value r*.

We consider an economy that exists for three periods. In period 1, asset prices are driven up. Along the lines of Bordo and Jeanne (2002), we assume that firms borrow funds to invest in a productive asset that also may be used as collateral for new borrowing in subsequent periods. However, in period 2 a financial shock or a collateral bust, respectively, can occur. Depending on the occurrence and strength of a potential asset price bust, as well as the firms' leverage, the future price of the collateral may be too low compared with the firms' future debt burden (i.e., required new credit must remain below the market value of their collateral, minus the ex post debt burden). In this case firms cannot receive further credit and must cease their operations. We label this shortage in credit a "credit crunch". The supply-side effects of a credit crunch are captured by v_t. In period 3, no further shocks can occur, and the economy moves to a new steady state.

The shock v_t is assumed to follow the simplest possible distribution.

$$(3) \qquad v_t = \begin{cases} 0 & \text{in} \quad t \neq 2 \\ 0 & \text{in} \quad t = 2 \quad \text{if} \quad \text{no credit crunch} \\ \varepsilon > 0 & \text{in} \quad t = 2 \quad \text{if} \quad \text{credit crunch} \end{cases}.$$

introduces a long-run trade-off between inflation and output. However, according to Clarida et al. (1999) and Goodfriend and King (1997), this trade-off is small and negligible at reasonable parameter values.

In contrast with conventional models, a key feature of our model is that v_t is not an entirely exogenous shock. A credit crunch can only occur if the debt burden in the corporate sector exceeds a certain threshold. In other words, firms' leverage relates positively to the probability that a collateral bust will result in a credit crunch. Debt accumulation, however, depends on the real costs of debt ($r_1 = i_1 - E_1\pi_2$), which can be influenced by policymakers through variations in the first-period nominal interest rate i_1.[7] Formally, the probability μ of the occurrence of a collateral-induced credit crunch in period 2 is contingent on the policy choice in the first (boom) period and can be written as

$$(4) \qquad \mu = \text{prob}\,(v_2 = \varepsilon |\, i_1 - E_1\pi_2) = \begin{cases} 0 & \text{if} \quad i_1 - E_1\pi_2 \geq \underline{r} > r^* \\ 0 < \mu < 1 & \text{if} \quad i_1 - E_1\pi_2 < \underline{r} \end{cases}$$

where $\underline{r}$ denotes the minimum real interest rate required to completely forestall a future credit crunch. If the real interest rate is set to equal at least $\underline{r}$ in period 1, the previously accumulated debt burden in the corporate sector will always be low relative to the value of the collateral that firms can offer. In this case financial stability is maintained.[8] For $r_1 < \underline{r}$ policymakers must stand ready to clean up the fallout should a crunch occur.

[7] In a similar vein Woodford (2012) allows for endogenous financial distortions in a New Keynesian model with credit frictions. He assumes that monetary policy can influence financial stability indirectly through its impact on the output gap. A higher output gap is assumed to increase the leverage in the financial sector and thus the probability of a financial crisis.

[8] Admittedly, the representation of the (elusive) concept of financial stability in our model does not cover all its various features but is very focused. For an overview of alternative definitions of financial stability, see Allen and Wood (2006).

2.2 Introducing Central Bank Independence

Policymakers are assumed to minimize the intertemporal loss function V in Equation (5)

$$(5) \qquad V = E\left(\sum_{t=1}^{3} \beta^{t-1} L_t\right)$$

where L_t represents the instantaneous loss function that monetary policymakers strive to minimize. Similar to Cukierman (1992) and Eijffinger and Hoeberichts (1998, 2008) we measure the extent of political pressure imposed on central bankers through different degrees of CBI. In particular, we assume that L_t is a weighted average of the loss functions of two authorities: the government's loss function L_t^G and the central bank's own loss function L_t^{CB}.

$$(6) \qquad L_t = \gamma \cdot L_t^{CB} + (1-\gamma) \cdot L_t^G \qquad \text{where } 0 \le \gamma \le 1 .$$

In Equation (6), the parameter γ represents the degree of CBI, where a higher (lower) value of γ corresponds to a higher (lower) degree of CBI. For example, if γ equals unity, central bankers are completely insulated from political pressure and are therefore granted full independence. Generally, a higher (lower) value of γ in the range between 0 and 1 corresponds to a higher (lower) degree of CBI.

As in the seminal work about the classic inflationary bias problem (e.g., Barro and Gordon (1983) and Rogoff (1985)), we allow for the possibility that the socially optimal output level (k) exceeds its natural rate level, due to the presence of distortional taxes or imperfect competition. In accordance with this strand of literature, we assume that the social loss function coincides with the government's loss function L_t^G, as given by Equation (7).

(7) $L_t^G = \pi_t^2 + \lambda \cdot (x_t - k)^2$ where $k > 0$ and $\lambda \geq 0$.

As is well known, and will be demonstrated in our model below, the presence of an overly ambitious output target (k) in the policymaker's loss function gives rise to an inflation bias, that is, unnecessary inflation that is not accompanied by any benefit in the output gap target. Delegating monetary policy to an independent central bank often has been regarded as an institutional device to reduce the welfare costs associated with overly high inflation rates (inflation bias). In our interpretation, delegation of monetary policy to an independent central bank means that society (government) sets forth the monetary policy objectives in a central bank law, but the central bank is free to decide how to achieve the mandated objectives (operational independence). Against the background of the aforementioned development toward a greater emphasis on price stability, we assume that the mandated policy objectives do not include an overly ambitious output target. Central bankers' losses L_t^{CB} are quadratic in the inflation rate, and the output gap as given in Equation (8).

(8) $L_t^{CB} = \pi_t^2 + \lambda \cdot x_t^2$ where $\lambda \geq 0$.

If central bankers are endowed with full independence (i.e., $\gamma = 1$), then L_t^{CB} will coincide with L_t, and no inflation bias will occur. However, rather than focusing exclusively on the case $\gamma = 1$, we allow for the possibility that the government interferes in monetary policymaking (i.e., if $\gamma < 1$). Several reasons can explain why the loss function L_t that effectively determines monetary policy might deviate from central bankers' loss function L_t^{CB}. First, empirical studies that deal with the measurement of CBI provide evidence that there still are differences in the degree of CBI across countries, notwithstanding the global trend toward higher CBI (e.g., Cukierman (2008) and Arnone et al. (2009)). Second, measuring CBI often

means interpreting and scoring the de jure degree of CBI. However, what matters is central bankers' actual behavior. Both the "true" monetary policy goals and the actual degree of CBI are influenced by not only legal regulations but also various informal factors, such as political pressure. A simple translation from de jure to actual CBI does not seem to exist (cf. Cukierman (1992, 2008), Siklos (2008) and Acemoglu et al. (2008)).

Since the seminal work by Rogoff (1985) the concepts of central bank independence and central bankers' conservatism are considered as tightly intertwined. Unlike our approach, Rogoff assumes that even an independent central banker aims at an overly ambitious output target but places less weight (smaller λ) on output stability than does the government. In Rogoff's work, the conservative central banker is endowed with full independence. However, along the lines of Svensson (2002), we interpret the development towards greater emphasis on price stability in central bank statutes and greater legal independence of central banks not as an increase in weight-conservatism but as a better understanding of suitable monetary policy goals. The latter implies the absence of a mandated overly ambitious output target.

Our model follows the studies by Cukierman (1992) and Eijffinger and Hoeberichts (1998, 2008) in distinguishing between CBI and central bank conservatism but in contrast to them we do not assume that political pressure leads to a distortion of the "effective" relative weight that the central bank places on inflation stabilization versus output stabilization. In our approach, political pressure aims to get monetary policymakers to pursue an overly ambitious output target,[9] so in our model, granting central bankers full independence eliminates the

[9] This can be easily seen after substituting Equations (7) and (8) into Equation (6), such that L_t can be written $L_t = L_t^{CB} - 2 \cdot (1-\gamma) \cdot \lambda \cdot k \cdot (x_t - (k/2))$. The first term on the right is identical to the central banker's mandated loss function. If there is no full CBI (i.e., $\gamma < 1$), there is another term which relates monetary policymakers' losses linearly and inversely to the output gap (x_t). The weight of this term is positively dependent on the extent of political pressures ($1 - \gamma$), the relative weight placed on the output objective (λ), and the government's output target (k). Political pressure thus influences the central bank's desire for output expansion, and not the relative

inflation bias.[10]

3 CBI, (Dis-)Inflation and Financial Stability

3.1 Period 3: The New Steady State

We proceed by looking at each period in turn, starting with the last, period 3.[11] In this period the economy returns to its steady state, and no further shock can occur, irrespective of the policy chosen in the previous periods. With an optimal interest rate setting in period 3, inflation and the output gap take on the values described in Equations (9) and (10)

(9) $\pi_3 = (1-\gamma)\cdot(\lambda/\alpha)\cdot k\,.$

(10) $x_3 = 0\,.$

Equations (9) and (10) clearly demonstrate the classic inflation bias problem of discretionary monetary policy, due to the problem of time inconsistency. The presence of the government's overly ambitious output target (k) leads to inflation, though there are no gains from a higher output. In our model, however, the inflation bias is not only dependent on $k > 0$ (and $\lambda > 0$) but is directly linked to the degree of CBI. If central bankers are completely insulated from political pressures (i.e., $\gamma = 1$), monetary policy does not suffer from too high inflation, because private agents know that central bankers will not try to push the output gap above zero. In general and all other things being equal, the higher the degree of CBI (γ), the lower is the inflation bias.

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weight (λ) that the central bank attaches to output gap stabilization. The last term in the bracket (i.e., k/2) is an irrelevant constant. Walsh (2003) and Faust and Svensson (2000) similarly assume that political pressure influences the effective output target but not the relative weight that policymakers place on output stabilization.

[10] Hence our approach is also in line with McCallum (1995) and Blinder (1998), who deny that independent central bankers pursue overly ambitious output targets. However, in our stylized New Keynesian model, full CBI does not eliminate the problem of time inconsistency. Discretionary policymaking still suffers from the stabilization bias (see e.g., Clarida et al. (1999)).

[11] The model is solved by backward induction. With the assumption that no further shocks can occur in $t > 2$, the model's terminal conditions $E_3\pi_4 = \pi_3$ and $E_3x_4 = x_3$ are used to solve for the model's third period.

3.2 Period 2: Minimizing Losses in the Bust Period

Second-period outcomes depend on policy decisions in the first period. If policymakers pursue the leaning-against-the-wind policy, they eliminate the possibility of a credit crunch, which means financial stability is maintained in the second period. With preemptive monetary tightening (i.e., an interest rate hike) during the boom phase, policymakers can move inflation and the output gap to their steady state values already in the second period.

(11) $\pi_2^{TT} = (1-\gamma)\cdot(\lambda/\alpha)\cdot k$.

(12) $x_2^{TT} = 0$.

If however policymakers decide not to contain the accumulation of debt in period 1 (i.e., they choose the cleaning-up approach), a credit crunch may or may not occur in the second period. Should no credit crunch occur ($v_2 = 0$), policymakers can realize the same allocation as under the leaning-against-the-wind approach. However, with a strictly positive probability (μ), a financial crisis ($v_2 = \varepsilon$) can occur in period 2. In this crisis scenario, a perfect stabilization of both inflation and output is no longer feasible. Should a crisis occur, policymakers must trade off inflation against output losses, as can be seen in Equations (13b) and (14b).[12]

(13a) $\pi_2^{CU}(v_2 = 0) = (1-\gamma)\cdot(\lambda/\alpha)\cdot k$.

(13b) $\pi_2^{CU}(v_2 = \varepsilon) = (1-\gamma)\cdot(\lambda/\alpha)\cdot k + (\lambda/\Delta)\cdot\varepsilon$.

(14a) $x_2^{CU}(v_2 = 0) = 0$.

(14b) $x_2^{CU}(v_2 = \varepsilon) = -(\alpha/\Delta)\cdot\varepsilon$,

where $\Delta = \lambda + \alpha^2$.

[12] Incorporating additional demand-side effects of an asset price bust would give rise to a more plausible transmission mechanism (see, e.g., Berger et al. (2007) who also allow for the potential impact of financial sector shocks on aggregate demand in a similar model). However, our results remain valid even if we take the demand-side effects of an asset price bust into account. It is well known that, according to the New Keynesian model, policymakers can effectively stabilize demand shocks if the interest rate does not hit the zero lower bound. A stabilization dilemma for the policymaker arises from Phillips curve effects. Therefore, neither the inflation rate nor the output gap would be affected by a demand shock. For simplicity, we therefore focus exclusively on the supply side.

In the second period, the leaning-against-the-wind policy is associated with smaller expected deviations of both target variables from their target value than the cleaning-up approach. Therefore, expected losses in the second period are unambiguously smaller for a leaning-against-the-wind policy compared with the cleaning-up strategy.

3.3 Period 1: Adapting the Monetary Policy Stance in the Boom Period

These benefits of the leaning-against-the-wind policy are not free though. In period 1, policymakers must pay an "insurance premium" to avoid the potential occurrence of a later financial crisis. To ensure that firms' leverage still remains sustainable in the second period, policymakers must preemptively set the short-term real interest rate to equal at least the minimum required level $\underline{r} > r^*$. If policymakers choose to lean against the wind of soaring asset prices, they cannot reach the steady-state solution already during period 1.[13]

(15) $\pi_1^{TT} = (1-\gamma)\cdot(\lambda/\alpha)\cdot k - \alpha\cdot(z/\sigma)$.

(16) $x_1^{TT} = -(z/\sigma)$, where $z = \underline{r} - r^* > 0$.

An important characteristic of the results under a leaning-against-the wind-policy emerges from (15) and (16). As expected, a monetary tightening leads to lower inflation and a recession. The drop in output unambiguously increases policymakers' losses associated with a preemptive interest hike; that is, it increases the 'insurance premium'. However, the direction in which a fall in inflation affects policymakers' losses depends on the degree of CBI. For high degrees of CBI, the inflation bias is already low. Thus, if the interest rate hike leads to

[13] A typical argument against the leaning-against-the-wind policy is the unavailability of necessary information. Recent papers however show that financial indicators (especially credit aggregates) may provide useful information for monetary policymakers, see e.g., Schularick and Taylor (2009) and Alessi and Detken (2011). Alessi and Detken even conclude that "(…) *the often claimed unavailability of timely warning indicators is unlikely to be a major hindrance for 'leaning against the wind' type of policies, if the latter would be deemed desirable by policy makers*."(Alessi and Detken (2011), p. 532).

deflation, the deviation of inflation from its target level may increase rather than decrease. This can easily be seen by considering the extreme case of full independence given by $\gamma = 1$. If central bankers are completely insulated from political pressures, leaning-against-the-wind drives inflation away from its target level. In contrast, if $\gamma < 1$, inflation may or may not come closer to its target level when policymakers tighten monetary policy to curb the asset price boom.

The cleaning-up approach, as the alternative policy option available to monetary policymakers, has widely been interpreted as a policy that views a potentially unsustainable asset price boom with 'benign neglect'.[14] However, refraining from curbing an asset price boom does not imply that policymakers should stay passive during the boom phase. A key distinguishing feature of the New Keynesian approach is the forward-looking nature of agents' expectations. As soon as agents understand that a credit crunch might occur, they will integrate this possibility, along with the monetary policy reaction, in their expectations. This forward-looking character of the model is responsible for the immediate (i.e., period 1) impact of a possible credit crunch in the future (period 2). Policymakers are therefore forced to adjust the current interest rate to contain the adverse effects from this expectation channel.[15] In particular, policymakers need to decrease the short-run real interest rate and thus have to implement a preemptive monetary loosening.

$$(17) \qquad r_1^{CU} = r^* - \sigma \cdot \left(\alpha / \Delta\right)^2 \cdot \alpha \cdot \mu \cdot \varepsilon \qquad \text{where } \Delta = \lambda + \alpha^2 .$$

[14] See, e.g., Greenspan (2002) and Bordo and Jeanne (2002).
[15] Berger et al. (2007) and Berger and Kißmer (2008) stress the importance of this expectation channel for the optimal cleaning-up strategy.

The reason why the policymaker loosens monetary policy ("*lean with the wind*") by pushing the short-run real interest rate below its steady state value r* is to avoid a (more) severe recession. This "*fear of recession*" rests on households' optimal consumption path (which features a smoothing effect across time) that will be adapted immediately if a crisis is expected in the future. Hence, in contrast with the 'benign neglect view' the optimal cleaning-up strategy involves a preemptive leaning-*with*-the-wind policy and cannot be equated with an asymmetric monetary policy response during asset price boom-and-busts cycles.[16]

The leaning-with-the-wind property of the optimal cleaning-up strategy would also prevail if the model allowed for a richer representation of the transmission channel for the credit crunch. As discussed briefly above (see footnote 11) any demand-side effects of the credit crunch could be perfectly stabilized through appropriate interest rate movements so that the output gap and inflation rate in the bust period would still be given by equations (13a) to (14b). Therefore, forward-looking expectations in the boom period would not be influenced by the potential occurrence of a demand shock and still require the policymaker to lean with the wind by setting the interest rate according to equation (17). Our result of two distinct policy strategies with distinctive interest rate policies would not change.

First-period inflation and the output gap under the cleaning-up approach are given by Equations (18) and (19).

$$(18) \qquad \pi_1^{CU} = (1-\gamma)\cdot(\lambda/\alpha)\cdot k + (\lambda/\Delta)^2\cdot\mu\cdot\varepsilon\,.$$

$$(19) \qquad x_1^{CU} = -(\alpha\cdot\lambda/\Delta^2)\cdot\mu\cdot\varepsilon\,.$$

[16] A "fear of recession" can even lead to a leaning-with-the-wind policy if the private sector displays purely backward-looking expectations as shown by Gruen et al. (2005). In their model central bankers are forward-looking and start to ease monetary policy well before the bust owing to time lags in the transmission of monetary policy to the real economy. Detken and Smets (2004) provide empirical evidence that monetary policy during asset price booms that are followed by severe recessions is indeed typically quite expansionary.

The economic outcome therefore changes not only if and when a crisis hits but also in the periods before. A possible future financial crisis does not give rise to economic costs only when it occurs. Inflation already increases during the first period since the Calvo price setting behavior implies that some firms can adjust prices in the boom period and do so by taking their expected future profits into account. As an expansionary monetary policy in the future would push up their marginal costs and thus squeeze their profit margins they will adjust prices upwards immediately. Furthermore, as households prefer a stable path of consumption they try to smooth consumption over the cycle and thus contribute to an economic slowdown already before the outbreak of the financial crisis.[17] In contrast with the leaning-against-the-wind policy, the cleaning-up approach implies that in the boom period both target variables are unambiguously driven (further) away from their target levels, irrespective of the degree of CBI.

4 Leaning Against or With the Wind: Does CBI Make a Difference?

In the boom period policymakers must choose between a policy of preemptive tightening and the cleaning-up strategy. As discussed above, the essence of the preemptive leaning-against-the-wind policy is to maintain financial stability; the cleaning-up strategy instead takes the probability of a future crisis as given. Understood correctly, this approach implies a leaning-with-the-wind policy during an asset price boom and not, as has often been suggested, a policy of benign neglect toward rising asset prices. In short, the question in the boom period is whether policymakers should lean preemptively *against* or *with* the wind when they observe a

[17] In their comprehensive analysis of financial and banking crises after World War II in industrialized countries Reinhart and Rogoff (2008) point out that the economic slowing down prior to the crisis as reflected in equation (19) is a typical crisis feature. Output growth before the outbreak of the crisis follows an inverted v-shape with the peak well before the onset of the crisis. They also point out that the US subprime crisis followed the same pattern. Bordo et al. (2001) review financial crises of the last 120 years and point out that crises often occur in recessions and significantly add to their severity.

potentially unsustainable asset price boom. Next, how does the degree of CBI influences policymakers' optimal choice between these basic policy options?

The optimal policy can be derived by comparing the intertemporal loss functions V^{TT} and V^{CU}. Tedious but straightforward algebra shows that policymakers will lean *against* the wind if condition (20) is fulfilled.

$$(20) \qquad \underline{r} < r^* + \frac{\sigma \cdot \varepsilon}{\Delta} \cdot \sqrt{\mu \cdot \lambda \cdot \left[\left(\beta + \mu \cdot \frac{\lambda^2}{\Delta^2} \right) + \frac{2 \cdot k \cdot (1-\gamma)}{\alpha \cdot \varepsilon} \cdot (\beta \cdot \Delta + \lambda) \right]}, \qquad \text{where } \Delta = \lambda + \alpha^2 .$$

As noted previously, $\underline{r}$ is the minimum level of the real interest rate required to forestall a financial crisis. It is the measure against which policymakers compare the maximum level of the real interest rate they are willing to accept to avoid a financial crisis (i.e., the right side of inequality (20)). If the latter is larger than the former, adopting a leaning-against-the-wind policy is associated with comparatively smaller losses than the cleaning-up approach, i.e. the condition $V^{TT} < V^{CU}$ is fulfilled.

Intuitively, policymakers' willingness to lean against the wind increases in the probability of a credit crunch (μ) and the extent of the asset price bust (ε) but decreases in the degree of time preference (i.e., a fall in β), as well as the sensitivity with which output reacts to interest rate changes ($1/\sigma$) and inflation to output changes (α).

The impact of both k and γ on the optimal policy choice deserves special attention. An increase in government's output target k inter alia increases central bankers' willingness to prevent financial crises, provided they are not endowed with full independence. As explained

above, the degree of CBI measured by γ can take on values in the range between 0 (no CBI) and 1 (full CBI). Equation (20) implies that a higher degree of CBI decreases policymakers' willingness to adopt the leaning-against-the-wind strategy. The higher the degree of CBI (the higher γ), the lower is the maximum level of the real interest rate that policymakers are willing to accept to avoid a future financial crisis. In other words, policymakers' willingness to implement a preemptive loosening (i.e., follow the cleaning-up approach) in the boom period is stronger with a higher degree of CBI. Because financial instability can be ruled out completely only if policymakers lean against the wind, a higher degree of CBI has an adverse effect on financial stability.

To shed light on the intuition underlying these results, we take a closer look at the costs and benefits associated with the implementation of the leaning-against-the-wind policy. As explained above, a preemptive interest rate hike not only causes immediate output gap losses but also brings about a lower inflation rate in the boom period. This disinflation can be beneficial for dependent central bankers who are subject to political influence and therefore suffer from an overly high inflation rate. If the inflation bias is high compared with the disinflation induced by a preemptive monetary tightening, the inflation rate comes closer to its target level. The inflation bias is greater when the government's output target k is greater and the degree of CBI (γ) is lower. In the inflationary case (i.e., in case of a comparatively high inflation bias), the emerging disinflation lowers the 'insurance premium' that policymakers need to pay to maintain financial stability. However, if the resulting disinflation implies that first-period inflation will undershoot its target value, implementing a leaning-against-the-wind policy might increase the squared deviations from the inflation target. This is the case if the resulting deflation is higher in absolute value than the otherwise prevailing inflation rate.

Therefore, the costs of a leaning-against-the-wind policy depend positively on the degree of CBI and inversely on the government's output target. In contrast, the benefits of the leaning-against-the-wind strategy are completely unrelated to the degree of CBI or the government's output target, respectively. In our model, these benefits arise from avoiding a potential collateral-induced credit crunch in the future. From Equations (13b), (14b), (17), and (18), it follows that the expected adverse effects of a credit crunch ε depend on neither γ nor k. This feature of our model solution reflects our assumption that political pressures might influence policymakers' effective output target but not the relative weight λ that central bankers place on the output gap versus inflation stabilization.

In short, at high degrees of CBI, the emerging disinflation under a preemptive tightening does not necessarily contribute to price stability during the boom period. While dependent central bankers may regard a leaning-against-the-wind policy as an option to reduce the inflation bias further, independent central bankers may eschew the threatening deflation.[18] In this narrow sense, independent central bankers face a trade-off between price stability and financial stability. It is not a trade-off between overly *high* inflation and financial instability but rather between the costs of an overly *low* inflation rate and the expected costs of a financial crisis. [19]

[18] This "fear of deflation" is key for our result that independent central banks are less likely to choose the pre-emptive tightening policy. Arguably, this fear was an important element in the Fed's decision during the mid-2000s not to increase interest rates more rapidly despite an excessive housing price boom (see Bernanke (2010b) and Woodford (2012)).

[19] Cukierman (1992) examines a trade-off between overly high inflation and financial instability. According to his view central bankers' concern for financial stability gives rise to an inflation bias. Unlike our approach, Cukierman incorporates financial stability as an additional policy objective in central bankers' loss function. More important, a key distinction to our model lies in his assumption regarding the relationship between the monetary policy stance and the likelihood of a financial crisis. In contrast with our assumption that an overly low, short-term real interest rate boosts the private sector's indebtedness during an asset price boom and thus may increase the likelihood of a future financial crisis, Cukierman assumes that a low interest rate fosters high profits in the banking sector, which reduces the banking system's vulnerability to adverse shocks. Therefore, according to Cukierman, high levels of interest rates, necessary to contain inflation, increase the likelihood of a banking crisis.

In analyzing the nexus between financial stability and CBI we admittedly abstracted from some of the problems that policymakers have been facing in the recent crisis and assumed, e.g., a stable and well-known monetary transmission mechanism. The introduction of uncertainty concerning the monetary transmission would affect both strategies so that it is not clear ex-ante whether and how the balance between the leaning-against and the leaning-with-the-wind strategy would be impacted (a more rigorous analysis thereof seems to be a promising avenue for future research). On the one hand, central bankers may be unsure about the extent of the pre-emptive interest rate hike that is necessary for containing an asset price boom or a credit boom, respectively. On the other hand, our model might also overestimate the policymaker's ability to mitigate the consequences of the fall-out after a bust. Woodford (2012) recently stressed that central banks' unprecedented "cleaning up" efforts after the recent financial crisis did not prevent a sharp decrease in economic activity worldwide. As White (2009) points out, changes in the monetary transmission seem to have weakened the effectiveness of monetary policy to bring about recovery in the recent past.[20]

Moreover, the ability of the central bank to clean up after the bust can be heavily constrained by the zero lower bound (ZLB).[21] Central banks worldwide, including the U.S. Federal Reserve, the Bank of England , the Swiss National Bank, and the Swedish Riksbank, have been trapped in this situation for some time. These difficulties have prompted central banks to take recourse to unconventional measures, such as quantitative easing. However, the long-

[20] One might argue that both monetary policy options are subject to parameter uncertainty and "Brainard's conservatism principle" should therefore lead policymakers to more cautious policies (Brainard (1967)). One needs to bear in mind, however, that the Brainard principle is not generally valid but sensitive to the exact form of uncertainty. More recent literature has provided examples that parameter uncertainty might even call for more aggressive interest rate movements than in the absence of uncertainty (see, e.g., Söderström (2002)). Furthermore, the robust control literature has also recently provided a rationale for aggressive policy reactions to prevent worst-case scenarios (see, e.g., Giannoni (2002)).

[21] Chung et al. (2011) provide evidence that the magnitude and duration of the ZLB constraint encountered in the recent crisis in the United States and other countries came as a surprise to both policymakers and academics.

term consequences and risks of these (unconventional) policy measures remain largely unclear and much disputed.

5 Conclusion

The recent financial crisis seems not only to have given rise to doubts about the optimal monetary strategy but also sparked a debate about the interplay between CBI and financial stability. We contribute to the still relatively small but burgeoning strand of literature that deals with the question of whether CBI fosters financial stability. To do that we modify a simple New Keynesian model to allow for different degrees of CBI and political pressure on monetary policymakers. Within this framework, we analyze the effects of CBI on monetary policymakers' willingness to avoid a financial crisis and maintain financial stability.

We assume that policymakers can choose between the leaning-against-the-wind policy that preemptively raises short-term real interest rates in the boom phase to prevent the build-up of a financial market crisis scenario and the cleaning-up strategy that ignores its impact on the likelihood of a future crisis. The view that CBI not only contributes to price stability but also fosters financial stability is not supported by our analysis. On the contrary, we find that the more independent central bankers are, the more likely they are to choose the cleaning-up approach and thus refrain from eliminating the risk of potentially severe financial instability in the future. The disinflation associated with a preemptive interest rate hike in the boom period can be beneficial for dependent central bankers who are subject to political pressure and therefore suffer from an overly high inflation rate. Relatively independent central banks, however, suffer from deflation (or, more generally, from an undershooting of the inflation target) if they adopt the leaning-against-the-wind policy to maintain financial stability. Given

a relatively high degree of CBI, a preemptive monetary tightening can drive inflation too far away from its target level.

Our model thus predicts that inter alia, relatively independent central bankers are more likely to adopt the cleaning-up strategy than their more dependent counterparts. We also show that the cleaning-up approach should not to be equated with a 'benign neglect' view on soaring asset prices, i.e. staying inactive during the boom. If policymakers decide to adopt the cleaning-up approach, they need to be ready to lean *with* the wind, i.e. initiate a preemptive monetary loosening already during the boom phase, when agents' expectations start to deteriorate.

Several interesting and promising avenues for future research on the basis of our findings can be envisaged such as extending, or rather reversing, this paper's research question and investigating in addition how financial instability affects the optimal degree of CBI. More sophisticated means of government interventions or escape clauses, respectively, could be considered. For example, Cukierman (2011b) discusses the impact of financial instability on the optimal degree of CBI. He proposes that central bankers should decide alone about monetary policy in normal times. However, when in extreme circumstances such as financial crises central bankers are forced to implement substantial quasi-fiscal operations, monetary policy should be determined jointly by the central bankers and political authorities. The precise circumstances that trigger government interventions should be formulated in advance. We expect that the proposed escape clauses could affect central bankers' optimal policy already in the run-up to potential financial crises. If one assumes that otherwise independent central bankers are not indifferent about the degree of CBI, the threat of government

interference, should a severe financial crisis occur, may increase central bankers' willingness to lean *against* the wind during boom periods.[22]

[22] Lohmann (1992) makes a similar point in the classical flexibility versus credibility debate. Extending Rogoff's (1985) analysis, Lohmann shows that the government should retain the option of overruling the "conservative" central banker when very large supply shocks occur. In equilibrium, however, the "conservative" central banker is never overruled, because she prefers to react more strongly to very large shocks than to small shocks to prevent government interference. Alesina and Stella (2011) link this approach to the highly topical debate about the independence of the Fed, which broke out in the aftermath of the global financial crisis.

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