Central banks' preferences and banking sector vulnerability

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Abstract

According to "Schwartz's conventional wisdom" and the so-called "divine coincidence", price stability should imply macroeconomic and financial stability. However, in light of the recent financial crisis, with monetary policy focussed on price stability, scholars have held that banking and financial risks were largely undressed. According to this alternative view, the belief in divine coincidence turns out to be benign neglect. The objective of this paper is to test Schwartz's hypothesis *vs* the benign neglect hypothesis. The priority assigned to the inflation goal is proxied by the central banks' conservatism (CBC) index proposed by Levieuge and Lucotte (2014b), here extended to a large sample of 73 countries from 1980 to 2012. Banking sector vulnerability is measured by six alternative indicators that are frequently employed in the literature on early warning systems. Our results indicate that differences in monetary policy preferences robustly explain cross-country differences in banking vulnerability and validate the benign neglect hypothesis, in that a higher level of CBC implies a more vulnerable banking sector.

JEL Codes: E3; E44; E52; E58.

Keywords: Central Banks' Preferences, Inflation Aversion, Banking Sector Vulnerability, Monetary Policy.

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1 Introduction

Since the 1980s, when the public authorities in industrialized countries entrusted newly independent central banks with disinflation policies, price stability has become the principal objective of monetary policy. The advent of the inflation targeting framework and the considerable support it has received among central bankers and academics can be viewed as the culmination of this orientation (King, 1997).

This top priority assigned to the control of inflation stems from the adherence of numerous economists and central bankers to Schwartz's "conventional wisdom" (Schwartz, 1995), according to which price stability implies macroeconomic and financial stability[1]. As a "divine coincidence", it was widely accepted that having a monetary policy focussed primarily on price stability would ensure output stability and maximum welfare, provided that distortions are composed solely of price rigidities (Woodford, 2003). The idea that price stability is a sufficient condition for guaranteeing financial stability was a leitmotiv in the 2000s. The conclusion of Bernanke and Gertler (1999, p.43) is representative of this perspective: "*Given a strong commitment to stabilizing expected inflation, it is neither necessary nor desirable for monetary policy to respond to changes in asset prices, except to the extent that they help to forecast inflationary or deflationary pressures*". The second part of this quote refers to the "Jackson Hole Consensus", according to which central banks should respond to financial developments only if they threaten price stability. In practice, this led most central banks to adopt a "cleaning up (the bust) afterwards" strategy, over the "leaning against the wind" strategy (White, 2009).

Certainly, a high level of inflation is not conducive to macroeconomic and financial stability. In some ways, by showing that high-inflation countries are more subject to financial crises, some empirical studies such as Hardy and Pazarbasioglu (1999), Demirgüç-Kunt and Detragiache (1998), Bordo and Wheelock (1998) and Bordo et al. (2001) are in accordance with Schwartz's conventional wisdom.

However, many recent financial crises were not preceded by periods of price instability (White, 2006). Typically, the recent financial crisis occurred in a context of the Great Moderation. This has shed some doubt on Schwartz's hypothesis and on the divine coincidence. A number of academics argue that with monetary policies focussed primarily on inflation, financial stability was largely undressed. In turn, financial instability has undermined macroeconomic stability, despite a low and stable inflation rate. According to this alternative view, the belief in divine coincidence has, in retrospect, been revealed to be benign neglect. For example, according to Whelan (2013, p.108): "*the crisis has weakened the case for central banks to be given a single, price-stability mandate and broadened the case for them to be given a wider set of primary goals that would include macroeconomic stability*". In the same vein, De Grauwe (2010, p.169) stated, "*by focusing almost exclusively on price stability, the ECB put too little emphasis on trying to clamp down on the emerging bubbles and the explosion of bank credit*". Similarly,

[1]Her main arguments are the following. Inflation creates uncertainty in that information contained in prices is confused. Thus, inflation distorts decisions regarding asset accumulation and affects the valuation of asset prices. Conversely, price stability promotes a sound, appropriate intertemporal allocation of resources and sound lending operations, as the balance sheet ratios and the valuation of borrowers' collateral are predictable.

according to the CIEPR (2011), "*central banks should go beyond their traditional emphasis on low inflation to adopt an explicit goal of financial stability [...]. The conventional approach fails to account adequately for financial-sector risk and is therefore too narrowly focused [...]. If this results in periods when, in the interests of financial stability, the central bank sets policies that could result in deviations from its inflation target, then so be it*". Finally, because of hysteresis effects, Blanchard et al. (2015, p.43) consider that "*monetary policy should react more strongly to output movements, relative to inflation. It also implies that stabilizing inflation is definitely not the optimal policy*". Ball (2015) shares the same opinion.

The issue of central banks' objectives has also been recently addressed by practitioners. For instance, regarding the inflation objective, Bayoumi et al. (2014, p.3) has stated: "*the crisis showed that it is not a sufficient condition for macro stability*"[2]. Mark Carney, the governor of the Bank of England, suggested in a speech in December 2012 that a nominal GDP target could have some advantages[3].

These assertions can find theoretical support. With simulations based on a New Keynesian DSGE model, Christiano et al. (2010) show that as inflation is stable during periods of stock market booms, while credit sharply increases, a central bank excessively focussed on inflation overlooks the financial imbalances that such a policy exacerbates. Furthermore, price stability is found to be insufficient for welfare maximization in the presence of financial distortions[4] (Bianchi, 2010; Lambertini et al., 2013). Financial stability should be a goal *per se* in this case. On political economic grounds, Berger and Kißmer (2013) demonstrate that the more independent the central banker is, the more likely it is that he refrains from implementing preemptive monetary tightening to ensure financial stability. The reason is that the objectives of price stability and financial stability are not necessarily complementary: preemptive increases in the interest rate lead independent central banks to suffer from an undershooting of the inflation target (its primary objective). Similarly, the simulations of Gadanecza et al. (2015), based on a stylized model, indicate that a greater focus on financial stability comes at the cost of greater inflation volatility.

Some empirical studies, like Di Noia and Di Giorgio (1999), Ioannidou (2005), Hasan and Mester (2008) and Chortareas et al. (2016), also suggest that price stability and financial stability are likely to be conflicting. As a result, countries whose central banks do not have banking supervisory duties have on average lower inflation rates. However, despite the context and the theoretical background calling into question Schwartz's conventional wisdom and the efficiency of policies inspired by the Jackson Hole Consensus, there is very little empirical research focusing on the relationship between price and financial stability. To the best of our knowledge, only Blot et al. (2015) frontally address the issue of the Schwartz's hypothesis. Using various empirical methods, they reject the hypothesis that price stability is positively correlated with financial stability. In this vein, two additional papers are worth being mentioned, in

[2]See also IMF (2015).

[3]Interestingly, the Fed adopted an explicit quantitative threshold value for the unemployment rate in December 2012.

[4]Blanchard and Gali (2007) already demonstrated that a trade-off between output and inflation emerges when rigidities other than price rigidities (such as real wage rigidities) are present.

that they assess the impact of the adoption of an inflation targeting framework on financial stability. Frappa and Mésonnier (2010) find that adopting such a framework has a positive, significant and robust effect on housing price growth. Analogously, Lin (2010) shows that it implies higher exchange rate volatility. If inflation targeting implies a narrower focus on the inflation stabilization objective, these two papers provide indirect evidence of a trade-off between inflation and financial stability.

The objective of the present paper is to complete this very limited literature by directly testing the Schwartz hypothesis *vs* the benign neglect hypothesis: does assigning a higher priority to inflation stabilization reduce or increase banking sector vulnerability? To this end, our empirical analysis is original in that it directly adresses the issue of complementary *vs* conflicting objectives, by using different methodologies, by including the global crisis years and by relying on a genuine measures of central banks' preferences.

The preference of central banks for price stability is proxied by the so-called $CONS$ index of central banks' conservatism (hereafter CBC), suggested by Levieuge and Lucotte (2014b) and based on the Taylor curve (Taylor, 1979). Regarding banking sector vulnerability, we consider six alternative measures that are widely used in the literature on early warning systems as determinants of financial crises[5]: credit volatility, credit-to-GDP gap, credit-to-deposit ratio, nonperforming loans, Z-score and capital-to-asset ratio. In short, they primarily concern the credit cycle and the structure of banks' balance sheets. Our results, based on a sample of 73 countries over the period 1980 - 2012, indicate that the degree of CBC robustly explains banking sector vulnerability, in line with the benign neglect hypothesis.

The remainder of this paper is organized as follows. Section 2 reviews the reasons why a monetary policy focussed primarily on price stability may undermine the stability of the banking system and thus may be conducive to financial and banking crises. Section 3 is dedicated to how we measure the central banks' preferences, relying on the $CONS$ index of CBC, that we extend to a broader set than that initially proposed by Levieuge & Lucotte (73 countries from 1980 to 2012 against only OECD countries from 1980 to 1998). Data for the dependent and control variables are also detailed in Section 3. Section 4 is devoted to the methodology that we implement and the results we obtain. Robustness checks are presented in Section 5. The implications and extensions of our results are discussed in the conclusion (Section 6).

2 Why might strong central bank preferences for price stability increase banking sector vulnerability?

The aim of this section is twofold. We first analyze why price stability is the main, even often the single, objective of central banks, over the output and the financial stability goals, while financial stability was their initial raison d'être. We identify *de jure* and *de facto* explanations. Then we review how strong preferences for price stability, namely a high degree of central bank conservatism (CBC), are conducive of benign neglect and banking sector vulnerability.

[5]See, for example, Giese et al. (2014) and Schularick and Taylor (2012).

First, priority assigned to the inflation stabilization objective and the underlying adherence to the "cleaning up afterwards" strategy stem from the institutional and legal arrangements that govern monetary policy. Preserving financial stability is often considered to be a concern for central banks, or even one of their main functions. This is mainly because they are responsible for the functioning of the payment system. However, according to the comprehensive survey led by de Haan and Oosterloo (2004) and the exhaustive report published by the BIS (2009), the objective(s) and powers of this financial stability function are not clearly and explicitly stated in law[6]. Less than half of the central banks' legal statutes contains explicit objectives relating to financial stability (see BIS, 2009, fig.2 p.21). However, even for those central banks, the objective of financial stability is not clear or broad-ranging. The understanding of what it entails is more diffuse. For instance, central banks are supposed to act in favour of "*promoting*" or "*contributing to*" financial stability. Certainly, such extra-statutory statements provide greater flexibility, but they also imply little commitment and responsibility (see details in BIS, 2009, tab.2 p.30). This contrasts with the clarity and accountability surrounding the objective of price stability, which is unsurprisingly found to be the dominant goal of central banks, according to the BIS (2009). Moreover, it appears that in most cases, price stability is a singular objective and superior to other objectives specified in the law. Therefore, while a central bank can be blamed for missing its price stability objective (e.g., having an inflation rate higher than a previously announced target), it is impossible to evaluate its performance in terms of financial stability in the absence of an explicit target.

A second and complementary explanation results from the fact that central bankers may be all the more reluctant to address financial imbalances in that monetary policy is not the most efficient tool to this end. As a blunt instrument, it not only affects the specific financial sector in which distortions have to be corrected but also many macroeconomic variables. Moreover, its impact on asset prices is uncertain. More generally, knowledge on financial stability is largely incomplete (definition, measure, adequate policies). Responding to financial developments may thus impede the credibility of the monetary authorities, who would pursue an uncertain goal while overlooking their dominant one (for which they are responsible). Even with an explicit dual mandate, the credibility of the central bank would be threatened because of a new time-inconsistency problem; according to Ueda and Valencia (2014), while *ex ante*, the monetary authorities choose the socially optimal level of inflation, *ex post* they are tempted to choose higher inflation to reduce the real value of private debt and to repair private balance sheets. Pursuing a objective of financial stability may even compromise the independence of the central bank (Cukierman, 2011). This incites the central banks to give priority to the inflation goal, over the financial stability issue.

These *de jure* and *de facto* arguments explain why financial stability[7] is not *per se* a priority for central banks. In such a context, four arguments explain how and why strong preferences

[6]Typically, According to the survey led by Koatter et al. (2014), more than 50% of the 47 central banks in their sample pursue a price stability objective. At the opposite, banking system stability is an objective for only 2 percent of them.

[7]Hereafter, "financial" and "banking" (vulnerability, stability, ...) are considered as synonym.

for price stability can lead to benign neglect and adversely affect the financial stability.

(i) Financial stability may be neglected because of price and financial cycle desynchronization. The business cycle and the financial cycle are not perfectly aligned (Borio, 2014). Thus, while bursting an asset price bubble would require tighter monetary policy, this may not necessarily be justified in terms of inflation, such as in the period 2002-2007. Given the aforementioned legal arrangements, central banks will give priority to the price stability objective and neglect financial imbalances in case of desynchronization. Moreover, the latter can be intensified by the so-called risk-taking channel of monetary policy.

(ii) Financial instability is exacerbated by the risk-taking channel of monetary policy in case of low inflation. The vast literature on the risk-taking channel argues that, when conducted regardless of any other objective than the inflation goal in a context of Great Moderation, monetary policy can be responsible for an increase in the systemic risk[8]. Indeed, prioritizing the inflation stabilization objective when the inflation rate is very low lead central banks to conduct loose monetary policies over a prolonged period. Such policies have been blamed for lowering risk perceptions and increasing risk tolerance, through several mechanisms, which include the following:

- A "search for yield" tendency, namely, to earn excess returns in a low interest rate environment, investment managers tend to engage in risky investment (Rajan, 2005);
- Banks' and firms' balance sheet effects that are at the heart of the financial accelerator and the bank capital channel theories (Ciccarelli et al., 2013; Adrian and Shin, 2010; Angeloni et al., 2015);
- The moral hazard stemming from the lenient management of previous crises, in line with the aforementioned "cleaning up strategy", which is itself dictated by the belief in the Schwartz hypothesis (Diamond and Rajan, 2012; Brunnermeier and Sannikov, 2014);
- The "paradox of credibility", according to which banks and the investors underestimate the risk because the risk-management ability is over-estimated after a long period of favourable outcomes (Thakor, 2015).

(iii) Financial stability suffers the consequences of conflict of objectives. While monetary policy is devoted to the price stability goal, other tools such as banking supervision and prudential policies are supposed to address financial stability. However, conflicts of objectives are frequent[9]. Ioannidou (2005) for example highlights the conflict between the monetary policy, which usually requires high real interest rates to fight inflation, and the regulatory /

[8]See, among others, Borio and Zhu (2012), Adrian and Shin (2010), Dell'Ariccia et al. (2014), Farhi and Tirole (2012), Dubecq et al. (2015), Ioannidou et al. (2015), Jiménez et al. (2014).

[9]Theoretical demonstrations and discussions on the trade-off between these two objectives are provided by Agur and Demertzis (2013), De Nicolo et al. (2010), Issing (2003), Badarau and Popescu (2014), Gali (2014), Beau et al. (2012), Angelini et al. (2012) and Laseen et al. (2015).

supervisory policy, which is concerned about the adverse effects of higher interest rate on the solvency of the banking sector. The risk-taking channel of monetary policy is another example of the external effects of one policy on the objective of the other. Similarly, macroprudential tools impact credit growth and external imbalances with consequences on aggregate demand and ultimately on inflation.

On the one hand, such conflicts imply a trade-off between the two objectives when they are both managed by a single institution. Examining the policy architecture of 35 countries, Chortareas et al. (2016) find that central banks serving both monetary and banking supervision functions are less conservative than those with a single price stability mandate. In this vein, Heller (1991), Goodhart and Schoenmaker (1993), Di Noia and Di Giorgio (1999) and Hasan and Mester (2008) unanimously find that countries whose central banks do not have supervisory duties have on average lower inflation rates. Similarly, Ioannidou (2005) finds when the Fed tightens monetary policy, it becomes less strict in bank supervision. One explanation is that the Fed compensates banks for the extra pressure it puts on them. As a result, strong preferences for fighting inflation tend to weaken the banking sector, even when the central bank has bank supervisory duties. Note that given the aforementioned legal context, not only central bank would prioritize the price stability objective in the event of a trade-off. But it may even be less prone to support the implementation of macroprudential frameworks that could conflict with their paramount inflation goal[10].

On the other hand, when the monetary and prudential policies are conducted by two distinct agencies, conflicts of objectives raise the risk of "push-me, pull-you" behavior between policymakers. Coordination and compromises are thus required. While the corresponding literature is far from being clear-cut on the optimal policy-mix to be implemented, it is at least obvious that the optimal equilibrium depends on the preferences of policymakers[11]. One can reasonably expect that the higher the CBC, the higher the externalities and spillovers of monetary policy and thus the higher the conflicts of objectives[12] (CIEPR, 2011). Through a contract theory model, Franck and Krausz (2008) demonstrate that under a sound (unstable) banking system, conservative parties with low inflation objectives find it appropriate to separate (to

[10]Things could change in the near future, as now central bankers know that they will have to implement unconventional monetary policies if the banking sector vulnerability is neglected.

[11]De Paoli and Paustian (2016) theoretically analyze the interactions between the monetary and macroprudential instruments, by considering cooperation *vs* non-cooperation between the two agencies, commitment *vs* discretion, different nature of shocks, and two different types of mandates (i.e. the way the social loss objective is shared between the two agencies). They notably find that higher conservatism is welfare improving. However, by definition, this result is limited to the discretionary case. Second, it relies on a singular definition of conservatism, viewed as "an increase in the relative concern for non-output-gap variations". If this is suited to monetary policy, it is debatable for the macroprundential policy (which is not responsible for the inflation bias for example). Last, the authors assume that the macroprudential authorities are not only made responsible for solving credit distortion but for stabilizing the output gap too. This additional objective is questionable, especially as it is at the origin of the coordination problems between authorities, which precisely disappear when "conservatism" increases. Indeed, when "conservatism" increases, each authority tends to have only one stabilization objective and one tool. This insures a perfect stabilization of each goal variable. Knowing that neglecting the output gap has no serious consequences, as this variable does not have an important weight in the social loss of New Keynesian models, welfare is thus optimized. Their result is by no means general.

[12]See for instance Smets (2014, p.266): "*Conflicts of interest of a 'push-me, pull-you' nature may arise when monetary and macroprudential policy instruments are used more aggressively, in opposite directions [...].*"

unify, respectively) the banking supervision and the conduct of monetary policy, to achieve their political platform. A way to interpret their conclusion consists in admitting that conflicts of objectives are less likely to occur under a sound banking system. On the contrary, in case of banking instability, a single agent is needed to internalize the external effects of both the banking supervision and the monetary policy.

(iv) More focus on output stabilization would imply more focus on the objective of financial stability. While inflation and financial stability are not necessarily two complementary goals, a central bank that is concerned with the output stability objective should also address financial developments. The reason is that asset price changes and financial shocks have an impact on economic activity. The channels are well known: wealth effects, the Tobin's Q channel, the financial accelerator mechanism, the bank capital channel and the exchange rate channel. In this vein, considering our sample of 73 countries from 1980 to 2012 (see *infra* for more details on the database), we essentially observe a positive and significant correlation between the variability of credit and the variance of output (close to 0.10), while the correlation between the variability of credit and the variance of inflation is not significantly different from zero. If central banks were more concerned with output stabilization, namely in case of "leaning against the wind" strategy, they would focus more on the financial stability objective. In other words, they would be more prone to follow a "leaning against the wind" strategy.

To this view, there is a trade-off between the pair output - credit stability on the one hand, and the stability of inflation on the other hand. By definition, this trade-off is represented by the Taylor curve. This is why it is natural to use the indicator of central banks' preferences suggested by Levieuge and Lucotte (2014b), which is precisely based on the Taylor curve. As mentioned above, former empirical studies rely on the level of the monetary policy instrument(s) or on the level of the inflation rate, as proxies for the stance of monetary policy. However, these levels do not necessarily represent the preferences of monetary authorities; they also reflect the shocks and the structure of the economies. Instead, we will use an indicator that is really representative of the relative preferences of central banks. The next section is precisely devoted to a comprehensive presentation of the data.

3 Data

To gauge the relationship between central banks' preferences and banking sector vulnerability, we use a large set of data from different sources. This section describes, in detail, the characteristics of and presents the theoretical justifications for the variables we use in this empirical analysis.

Measuring central banks' preferences The relative importance assigned to the objective of inflation stabilization (over any other objective) can be represented by and be deduced from the Taylor curve (Taylor, 1979), which represents the trade-off between price and output volatility. By extension, a high preference for the price stability goal coincides with the degree of

CBC in the sense of Rogoff (1985). Attempts to measure CBC are very scarce in the literature, inconvenient to expand in time and space, and often time-invariant and model-dependent. These caveats are circumvented by the recent $CONS$ indicator proposed by Levieuge and Lucotte (2014b), which we will expand in this paper. Based on the theoretical grounds of the Taylor curve, this index is intended to reveal monetary policy preferences in terms of inflation stabilization relative to output stabilization. It precisely relies on the empirical variances of inflation and the output gap, as detailed in Appendix 1.

As Levieuge and Lucotte (2014b) argue, the $CONS$ indicator has at least two main advantages. It is time-varying and model-independent. It does not impose any assumption concerning the monetary policy rule or strategy a central bank follows. Thus, it can assess the relative preferences of a central bank whatever the monetary regime in place. These features are particularly important for our study, as we consider countries that have heterogenous monetary policy practices and monetary policy strategies have changed substantially around the world in recent decades. For example, a growing number of industrialized and emerging economies have abandoned monetary targeting to adopt an inflation targeting framework. As shown in Levieuge and Lucotte (2014a), these changes affect the degree of CBC. Finally, while Levieuge and Lucotte (2014b) focus solely on the OECD countries from 1980 to 1998, we extend their index to a broader set of 73 countries, on an annual basis from 1980 to 2012, based on the empirical variances of output and inflation computed over five-year rolling windows. Note that the $CONS$ index lies between 0 and 1. The higher $CONS$ is, the more the central bank is considered conservative in the sense of Rogoff (1985), and vice versa. An immediate way to assess the relevance of this extension consists in examining the correlation between $CONS$ and the average inflation rate. Figure 3 in Appendix 1 indicates that except for the 1980s, the correlation is clearly negative.

Note that a movement in the $CONS$ index might not always reflect a conscious desire by the central bank to change its behaviour, namely, changes in preferences. In particular, such a shift may partly result from a combination of supply and demand shocks. These shocks are supposed to be addressed over the five-year rolling windows that we consider to compute $CONS$. Indeed, the main task of the central bank consists in responding to shocks to meet its objectives. Nevertheless, to be as rigorous as possible, supply and demand shocks will be taken into account as control variables (see details *infra*). Moreover, we will use an alternative measure of CBC, labelled $CONS\_W$, which is the $CONS$ index adjusted for demand and supply shocks. Details are provided in Appendix 1. While supply and demand shocks were expected to be particularly important in some (emerging) countries in our sample, $CONS$ and $CONS\_W$ are highly correlated, as we can see in figure 4 in Appendix 1.

The average values of $CONS$ and $CONS\_W$ by decades, for all the countries in our sample, are reported in table 9 in Appendix 2. Overall, we observe that central banks became more conservative from the 1980s to the 2000s. This is particularly striking for the OECD countries, for at least two reasons. First, over this period, a significant number of them had joined the European Monetary Union (EMU) with the prospect of adopting the Euro. This involved

reforms in central bank legislation by the Euro candidates and their rallying to the reputedly conservative Bundesbank's leadership (Siklos, 2002). This explains convergence towards more conservatism. Second, more than one-third of the OECD countries have adopted an inflation targeting regime since the early 1990s. This has increased their inflation aversion, as shown by Levieuge and Lucotte (2014a). In contrast, no clear trend emerges for non-OECD countries, in which preferences are heterogenous.

Measures of banking sector vulnerability As there is no universally accepted empirical measure of banking sector vulnerability, we employ six alternative variables commonly used in the literature.

First, a simple way of measuring the potential effect of benign neglect on financing conditions and financial instability more generally consists of focusing on credit volatility. In essence, the higher the credit volatility, the more unstable financing is for households and firms. This variable is calculated as a five-year moving variance on quarterly credit data, which stem from the International Monetary Fund's International Financial Statistics (IFS) database.

Our second measure is the credit-to-GDP gap. It is one of the most widely accepted proxies for banking and financial imbalances among policymakers and academics. It is intended to measure the size of the credit cycle - i.e., the deviations of credit from the "normal" range of historical experience - and then to capture excess credit growth. As argued by Minsky (1972) and Kindleberger (1978), credit booms tend to sow the seeds of crises. A number of empirical papers show that indicators of excess credit growth are efficient in providing a leading signal of banking distress (see, e.g., Giese et al., 2014; Schularick and Taylor, 2012; Borgy et al., 2009; Borio and Lowe, 2002, 2004). Specifically, Dell'Ariccia et al. (2012) find that one-third of credit booms are followed by crises and three-fifths are followed by a period of economic underperformance in the six years following the end of the boom. This empirical evidence certainly explains why the Basel Committee on Banking Supervision (BCBS) recommends the use of the credit-to-GDP gap as a benchmark for the activation and release of the countercyclical capital buffer. Concretely, we compute the credit-to-GDP gap as the difference between the credit-to-GDP ratio and its Hodrick-Prescott (HP) filter trend. Credit refers to the domestic loans provided by financial corporations to the household and private non-financial corporate sector. Data come from the World Bank's Global Financial Development (GFD) database.

The next four variables that we consider as proxies for banking sector vulnerability are taken from the GFD database. They concern the structure of banks' balance sheets. The first is the credit-to-deposit ratio. It measures the banking sector's funding stability. This ratio increases if credit creation is higher than deposit growth and decreases otherwise. Thus, a higher ratio indicates a greater amount of wholesale funding in the capital structure and is a signal of an excessive bank leverage. As shown by Stremmel and Zsámboki (2015), an increasing credit-to-deposit ratio positively contributes to the amplitude of the financial cycle. Regarding the 2007-2008 financial crisis, several recent papers indicate that the credit-to-deposit ratio is a good predictor of financial distress. For example, Caprio et al. (2014) show that the probability of suffering from the crisis in 2008 was larger for countries with higher levels of the credit-to-

deposit ratio. Ratnovski and Huang (2009) find that a large share of wholesale funding was the most robust predictor of distress for financial institutions during the crisis.

Next, we consider the ratio of nonperforming loans to total gross loans as an another indicator of banking sector vulnerability. This variable is used as a proxy for banks' asset quality and, more generally, as a proxy for banking system stability (Koatter et al., 2014). A higher value of this ratio indicates a degradation of the quality of the assets held by the banks in a given country. According to Cihák and Schaeck (2010), the proportion of nonperforming loans is also a good predictor of systemic banking vulnerabilities.

Then, we consider the Z-score, a measure that is widely used in the literature to capture the banking system's solvency (see, e.g., Beck et al., 2010; Laeven and Levine, 2009; Demirgüç-Kunt et al., 2008; Boyd and Runkle, 1993). It is based on a comparison between banks' buffers (capitalization and returns) and risks (volatility of returns). Formally, the Z-score is defined as $Z = (k + \mu)/\sigma$, where k is equity capital as a percentage of assets, μ is return as a percentage of assets, and σ is the standard deviation of return on assets as a proxy for return volatility. Because a bank becomes insolvent when its asset value drops below its debt value, the Z-score can be interpreted as the number of standard deviations that a bank's return must fall below its expected value to wipe out all equity in the bank and render it insolvent. The Z-score is inversely related to the probability of a bank's insolvency. As our empirical analysis is conducted at the country level, the Z-score can then be interpreted as the banking system's distance to default.

Our last measure of banking sector vulnerability is the bank capital-to-asset ratio. It measures the banking system's capitalization. A higher ratio indicates a more capitalized banking system. As a bank having higher capital provides a cushion against insolvency and better resilience to adverse shocks, this ratio can be viewed as an inverse proxy for banking system vulnerability (see, e.g., Beltratti and Stulz, 2012).

Note that the credit-to-deposit ratio, the capital-to-asset ratio and the share of nonperforming loans to total gross loans are variables that belong to the "financial soundness indicators" of the International Monetary Fund. Ultimately, using these six different indicators allows us to consider all aspects of banking sector vulnerabilities.

Control variables We also need to control for factors other than CBC that may impact banking sector vulnerabilities. There is no consensus in the empirical literature on the determinants of financial and banking imbalances. This difficulty is further compounded by the fact that our sample includes both industrialized and emerging countries, for which the sources of imbalances are not necessarily the same. Thus, following the literature on early warning indicators (see, e.g., Frankel and Saravelos, 2012), we consider a large range of structural, cyclical and regulatory control variables.

Specifically, the first set of variables is intended to control for the economic conditions and shocks that the banking sector faces. To this end, we identify demand and supply shocks by applying the decomposition scheme suggested by Blanchard and Quah (1989) and consider the variance of these shocks as control variables. Similarly to the inflation and output gap

volatilities used to compute the $CONS$ index, the variance of shocks is calculated over five-year rolling windows. As argued by Levieuge and Lucotte (2014b), it is also important to control for demand and supply shocks because they can impact the output gap and inflation variabilities, and thus the value of the $CONS$ index. Thus, by considering the variance of demand and supply shocks, we control for the fact that inflation and output gap volatilities do not necessarily reflect a conscious willingness by the central bank to prioritize inflation stabilization. In addition, to take into account the heterogeneity of country sample, we consider real GDP per capita as an indicator of the level of development. This variable is taken from the World Bank's World Development Indicators (WDI) database.

The second set of control variables is intended to capture the degree of banking competition because it can affect the risk-taking behaviour of financial intermediaries and, in turn, banking sector vulnerability. We measure the level of banking competition using two proxies commonly employed in the banking literature. The first is the Lerner index (Lerner, 1934), which measures the degree of market power of banks and is thus an inverse proxy for bank competition. A low value (the minimum is 0) indicates a high degree of competition, while a high value (the maximum is 1) indicates a lack of competition. The second proxy we consider is a measure of bank concentration. It corresponds to the assets of the three largest commercial banks as a share of total commercial banking assets. As with the Lerner index, bank concentration is an inverse proxy for competition because a concentrated market structure is expected to be associated with higher prices and profits, reflecting an uncompetitive context. These two variables are obtained from the GFD database. Despite the large number of studies devoted to the competition-stability nexus, the relationship between competition and bank risk-taking remains ambiguous. Under the "competition-fragility" view, bank competition is seen as detrimental to financial stability. Conversely, the "competition-stability" view rejects the competition-stability trade-off hypothesis and argues that market power increases bank portfolio risks[13].

Finally, we control for the regulation of the banking system and financial market. We consider an inverse proxy for the degree of financial regulation, which corresponds to the aggregate financial liberalization index defined by Abiad et al. (2010). It is obtained from their database of financial reforms. The index is normalized between 0 and 1, with 0 corresponding to a fully controlled financial system and 1 to a fully liberalized sector. A benefit of this indicator is that it captures the multi-dimensional nature of financial liberalization. To this end, the measure incorporates seven characteristics of the financial system, namely the credit and the interest rate controls, the reserve requirements, the existence of entry barriers and state participation in the banking market, the policies on securities markets and the restrictions on the capital account. Concerning the effect of financial liberalization on banking vulnerability, the results reported in the literature are ambiguous. In the seminal works of McKinnon (1973) and Shaw (1973), state intervention appears to reduce the efficiency of financial systems. More recently, empirical studies also contend that financial liberalization contributes to improving economic growth (see, for instance, Bekaert et al., 2005). However, as argued by Kaminsky and Reinhart

[13]See Beck (2008) for an overview of this debate.

(1999), lax banking regulation may lead to more risk-taking, which may in turn induce a higher degree of banking sector vulnerability. This view is empirically confirmed by Giannone et al. (2011), who show that the liberalization process in credit markets induced greater risk-taking behaviour. To have a complete picture of the degree of financial liberalization, we also consider a measure of financial openness using the Chinn-Ito index (Chinn and Ito, 2006, 2008). This index is a *de jure* measure of financial openness and assesses the extent of openness in capital account transactions. It is also normalized between 0 and 1, with the highest degree of financial openness corresponding to a value of 1 and the lowest to a value of 0. The expected impact of this variable on the vulnerability of the banking sector is uncertain. On the one hand, according to Abiad et al. (2007), greater financial openness allows investors to diversify their portfolios: this implies a longer investment horizon and reduces the risk of sudden stops, which may *per se* reduce banking vulnerability[14]. On the other hand, globally integrated financial systems are more exposed to international financial shocks and may experience more pronounced financial vulnerability (Giannone et al., 2011).

Under the benign neglect hypothesis, a positive relationship is expected between the banking sector vulnerability and the CBC ($CONS$ and $CONS\_W$). Specifically, the CBC indexes should be positively correlated with credit volatility, the credit-to-GDP gap, the credit-to-deposit ratio and the nonperforming loans ratio. Conversely, they should be negatively correlated with the Z-score and the capital-to-asset ratio. Figure 1 reports the mean value of our six measures of vulnerability for each quartile of the CBC indexes. As expected, we observe a positive correlation between the CBC indexes and the mean values of 1) credit volatility, 2) the credit-to-GDP gap, and 3) the credit-to-deposit ratio. Analogously, we see that higher degrees of conservatism are related to lower capital-to-asset ratios. Finally, the plots are less clear for the nonperforming loans ratio and the Z-score variable. Beyond these interesting simple correlations, the benign neglect *vs* Shwartz's hypotheses are examined in depth in the formal econometric analysis developed in the next section.

4 Methodology and results

This section presents the methodology and the results of our empirical analysis. Driven by data availability, the sample covers 73 countries, from 1980 to 2012[15]. To test the impact of central banks' preferences on banking sector vulnerability, namely, to test the benign neglect *vs* Schwartz's hypothesis, we run the following estimation:

$$Y_{i,t} = \alpha + \beta\, CBP_{i,t} + \gamma_1\, \sigma_{i,t} + \gamma_2\, X_{i,t-1} + \delta_i + \delta_t + \epsilon_{i,t} \tag{1}$$

where Y_{it} alternatively represents one of our six measures of banking sector vulnerability for country i at time t. $CBP_{i,t}$ is the indicator of central banks' preferences (namely $CONS$ or

[14]See also Abiad et al. (2009) and Calvo et al. (2008) for empirical evidence.

[15]See Appendix 2 for further details on the composition of our sample. Countries are excluded from the sample once they join a monetary union. This is the case for the members of the EMU, CEMAC, WAEMU and ECCU.

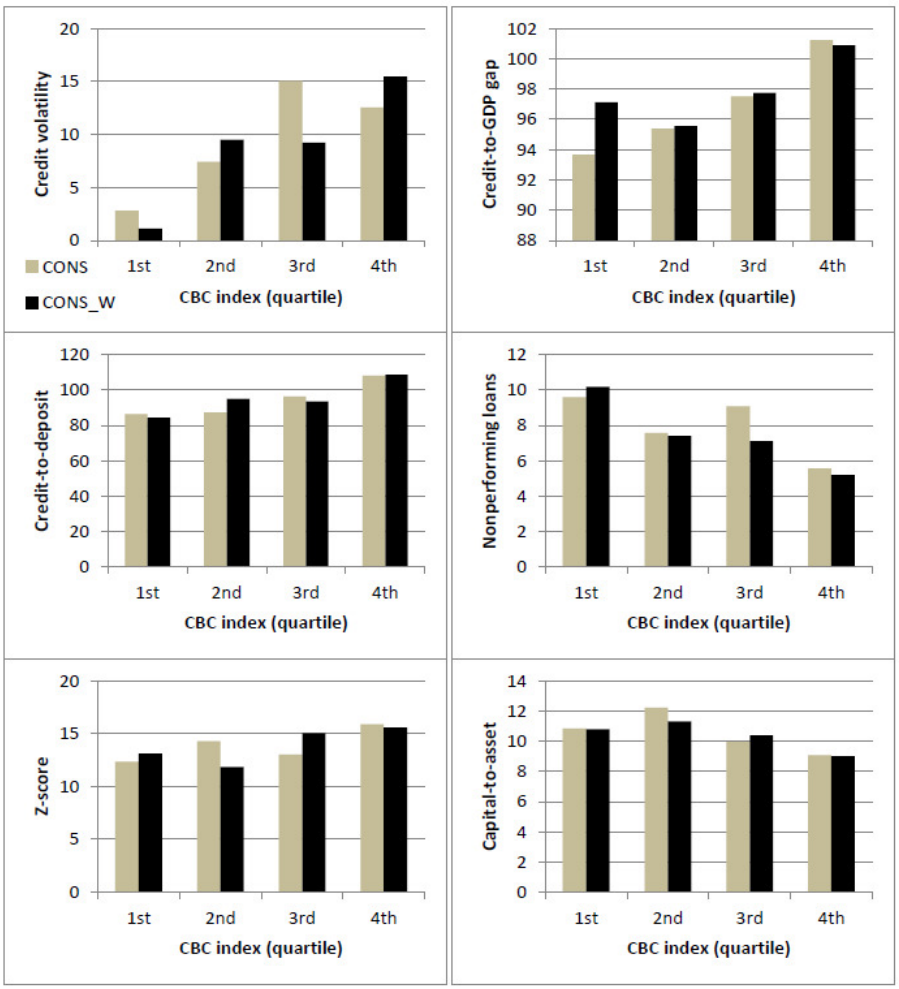

Figure 1: Central banks' preferences and banking sector vulnerability.

$CONS\_W$)[16], $\sigma_{i,t}$ is a vector containing the supply and demand shocks' variances, and $X_{i,t-1}$ is a vector that includes the other control variables, which are lagged to address potential endogeneity. Moreover, country fixed effects (δ_i) are included in equation (1) and intended to eliminate unobserved time-invariant heterogeneity at the country level. We also introduce time fixed effects (δ_t) to absorb the impact of global shocks that may affect all countries in sample, such as the subprime crisis. $\epsilon_{i,t}$ is the error term.

Throughout the study, we will be particularly interested in the sign and significance of β. For Y, measuring banking sector vulnerabilities, a positive β would validate the benign neglect hypothesis, while a negative one would support Schwartz's hypothesis. As the Z-score and capital-to-asset ratio are inverse proxies for banking vulnerabilities, the signs related to the alternative hypotheses are reversed.

Table 1 presents the results with credit volatility and the credit-to-GDP gap as endogenous variables. Table 2 reports results obtained with the credit-to-deposit ratio and the nonperforming loans to total gross loans ratio. Finally, table 3 refers to the results obtained with the Z-score and the capital-to-assets ratio as proxies for banking sector vulnerability. In each

[16] As mentioned above, $CONS$ and $CONS\_W$ are calculated using inflation and output gap volatilities computed over five-year rolling windows.

Table 1: CBC and banking sector vulnerability (credit volatility and credit-to-GDP gap)

Dependent variable	Credit volatility			Credit-to-GDP gap		
	(1)	(2)	(3)	(1)	(2)	(3)
CONS	21.876**	72.966***	48.586***	15.300***	15.405***	16.013***
	(11.009)	(23.357)	(15.776)	(2.715)	(3.604)	(5.822)
Variance of supply shocks	-2.497	-1.931	-4.512	0.845	-0.694	0.819
	(4.396)	(9.708)	(6.199)	(1.083)	(1.487)	(2.288)
Variance of demand shocks	6.219	8.396	4.528	-2.995***	-2.674**	-6.285***
	(4.200)	(8.444)	(6.371)	(1.033)	(1.306)	(2.351)
GDP per capita	-0.051	-0.192	-0.067	0.018	0.138***	0.456***
	(0.097)	(0.303)	(0.251)	(0.025)	(0.050)	(0.093)
Lerner index		-85.748**	-70.582***		20.855***	4.420
		(42.438)	(26.077)		(6.648)	(9.624)
Bank concentration		0.019	-0.255		-0.054	-0.130
		(0.347)	(0.247)		(0.057)	(0.091)
Financial openness			11.791			-0.477
			(26.484)			(9.774)
Financial liberalization			-245.911***			43.525
			(81.036)			(29.907)
Constant	3.171	-2.339	204.093**	20.089	-24.489***	-98.434***
	(50.881)	(46.411)	(81.070)	(13.857)	(7.368)	(29.920)
Observations	874	460	282	998	564	282
R-squared	0.047	0.074	0.140	0.144	0.229	0.242
Number of countries	73	55	43	73	56	43
CONS_W	27.396**	78.508***	52.334***	12.634***	13.129***	17.784***
	(10.764)	(24.142)	(16.250)	(2.682)	(3.713)	(5.993)
Variance of supply shocks	1.098	8.262	2.334	2.444**	1.103	3.138
	(4.672)	(10.039)	(6.471)	(1.153)	(1.541)	(2.386)
Variance of demand shocks	2.797	-3.101	-4.325	-4.763***	-4.696***	-9.254***
	(4.350)	(8.886)	(6.429)	(1.064)	(1.345)	(2.371)
GDP per capita	-0.056	-0.163	-0.033	0.026	0.145***	0.468***
	(0.096)	(0.303)	(0.251)	(0.025)	(0.051)	(0.093)
Lerner index		-75.460*	-67.923***		22.195***	5.290
		(42.305)	(26.006)		(6.703)	(9.590)
Bank concentration		0.079	-0.231		-0.050	-0.120
		(0.349)	(0.247)		(0.058)	(0.091)
Financial openness			10.248			-1.004
			(26.440)			(9.750)
Financial liberalization			-255.003***			40.725
			(80.583)			(29.717)
Constant	2.200	-12.063	206.214**	22.115	-23.759***	-98.405***
	(50.694)	(47.308)	(80.505)	(13.914)	(7.580)	(29.688)
Observations	874	460	282	998	564	282
R-squared	0.050	0.076	0.143	0.135	0.220	0.246
Number of countries	73	55	43	73	56	43

Notes: Standard errors are reported in parentheses. *, **, and *** denote significance at the 10%, 5% and 1% level, respectively.

Table 2: CBC and banking sector vulnerability (credit-to-deposit and nonperforming loans)

Dependent variable	Credit-to-deposit ratio			Nonperforming loans ratio		
	(1)	(2)	(3)	(1)	(2)	(3)
CONS	18.919***	30.933***	24.822***	6.539***	7.176***	3.528**
	(5.451)	(5.777)	(9.180)	(1.378)	(1.417)	(1.702)
Variance of supply shocks	-10.270***	-3.101	-3.135	0.705	1.124**	0.744
	(2.179)	(2.341)	(3.557)	(0.499)	(0.562)	(0.658)
Variance of demand shocks	-3.470*	-3.508	-5.792	2.354***	2.317***	1.565**
	(2.097)	(2.155)	(3.659)	(0.479)	(0.500)	(0.689)
GDP per capita	0.317***	0.258***	0.795***	0.082***	0.107***	0.090***
	(0.050)	(0.082)	(0.158)	(0.017)	(0.019)	(0.027)
Lerner index		19.817*	10.600		-9.347***	-4.308
		(10.640)	(15.472)		(2.526)	(2.820)
Bank concentration		-0.197**	-0.241		-0.012	0.063**
		(0.090)	(0.151)		(0.022)	(0.027)
Financial openness			-27.446*			-0.488
			(15.219)			(2.815)
Financial liberalization			100.466**			-21.858**
			(46.579)			(8.636)
Constant	23.120	61.077***	-64.114	-11.083***	-9.605***	7.161
	(26.760)	(11.710)	(46.604)	(2.634)	(2.960)	(8.654)
Observations	940	525	272	607	532	274
R-squared	0.150	0.229	0.226	0.303	0.349	0.501
Number of countries	72	55	42	65	54	41
CONS_W	13.406**	23.487***	25.105***	6.328***	6.398***	4.030**
	(5.359)	(5.965)	(9.391)	(1.409)	(1.468)	(1.752)
Variance of supply shocks	-8.614***	0.210	0.166	1.575***	1.984***	1.268*
	(2.302)	(2.432)	(3.720)	(0.525)	(0.584)	(0.689)
Variance of demand shocks	-5.529**	-7.639***	-10.146***	1.412***	1.354***	0.900
	(2.159)	(2.238)	(3.706)	(0.486)	(0.509)	(0.687)
GDP per capita	0.327***	0.266***	0.804***	0.084***	0.109***	0.093***
	(0.050)	(0.083)	(0.159)	(0.017)	(0.019)	(0.027)
Lerner index		22.433**	11.547		-8.770***	-4.139
		(10.845)	(15.475)		(2.551)	(2.814)
Bank concentration		-0.198**	-0.238		-0.009	0.065**
		(0.092)	(0.151)		(0.022)	(0.027)
Financial openness			-28.044*			-0.607
			(15.228)			(2.808)
Financial liberalization			95.086**			-22.520***
			(46.407)			(8.580)
Constant	27.201	66.386***	-59.657	-10.884***	-9.361***	7.113
	(26.802)	(12.060)	(46.197)	(2.642)	(3.025)	(8.583)
Observations	940	525	272	607	532	274
R-squared	0.144	0.207	0.225	0.300	0.340	0.504
Number of countries	72	55	42	65	54	41

Notes: Standard errors are reported in parentheses. *, **, and *** denote significance at the 10%, 5% and 1% level, respectively.

Table 3: CBC and banking sector vulnerability (Z-score and capital-to-asset)

Dependent variable	Z-score			Capital-to-asset ratio		
	(1)	(2)	(3)	(1)	(2)	(3)
CONS	-2.064**	-2.685**	-3.196*	-2.936***	-2.223***	-1.212
	(1.043)	(1.056)	(1.733)	(0.598)	(0.585)	(0.984)
Variance of supply shocks	0.575	0.406	-0.443	0.409*	0.176	-0.685*
	(0.408)	(0.431)	(0.681)	(0.211)	(0.227)	(0.388)
Variance of demand shocks	-0.745*	-0.999***	-1.714**	-0.588***	-0.728***	-0.994**
	(0.379)	(0.379)	(0.700)	(0.204)	(0.198)	(0.380)
GDP per capita	-0.039***	-0.045***	-0.055**	-0.013	-0.022***	-0.035**
	(0.014)	(0.015)	(0.028)	(0.008)	(0.008)	(0.017)
Lerner index		4.617**	2.338		2.291**	1.310
		(1.960)	(2.865)		(0.973)	(1.426)
Bank concentration		0.010	0.017		0.021**	0.051***
		(0.017)	(0.027)		(0.009)	(0.015)
Financial openness			1.177			-0.825
			(2.909)			(1.887)
Financial liberalization			-15.198*			-10.917*
			(8.902)			(5.697)
Constant	20.851***	20.666***	35.072***	12.779***	12.133***	21.611***
	(2.009)	(2.201)	(8.906)	(1.155)	(1.206)	(5.690)
Observations	633	577	282	457	429	187
R-squared	0.037	0.061	0.072	0.115	0.138	0.205
Number of countries	60	56	43	54	52	40
CONS_W	-2.455**	-3.019***	-3.564**	-3.096***	-2.354***	-1.028
	(1.043)	(1.079)	(1.786)	(0.614)	(0.608)	(1.088)
Variance of supply shocks	0.257	0.031	-0.908	-0.008	-0.128	-0.826**
	(0.425)	(0.444)	(0.711)	(0.218)	(0.231)	(0.394)
Variance of demand shocks	-0.413	-0.591	-1.120	-0.151	-0.396*	-0.814**
	(0.387)	(0.387)	(0.707)	(0.209)	(0.205)	(0.403)
GDP per capita	-0.040***	-0.047***	-0.057**	-0.014*	-0.023***	-0.035**
	(0.014)	(0.015)	(0.028)	(0.008)	(0.008)	(0.017)
Lerner index		4.278**	2.164		2.019**	1.261
		(1.963)	(2.859)		(0.978)	(1.431)
Bank concentration		0.008	0.015		0.020**	0.051***
		(0.017)	(0.027)		(0.009)	(0.015)
Financial openness			1.282			-0.915
			(2.906)			(1.902)
Financial liberalization			-14.645*			-10.661*
			(8.858)			(5.701)
Constant	21.208***	21.192***	35.085***	12.909***	12.306***	21.342***
	(2.017)	(2.244)	(8.849)	(1.159)	(1.219)	(5.746)
Observations	633	577	282	457	429	187
R-squared	0.040	0.063	0.074	0.117	0.139	0.201
Number of countries	60	56	43	54	52	40

Notes: Standard errors are reported in parentheses. *, **, and *** denote significance at the 10%, 5% and 1% level, respectively.

table, specification (1) includes $CONS$, the variances of macroeconomic shocks and the real GDP per capita as explanatory variables. Then, the specifications (2) and (3) successively include variables intended to control for banking competition/concentration and the financial environment, respectively. Banking competition and banking concentration are included simultaneously because many studies find no evidence that bank competitiveness measures are related to banking system concentration (e.g., Claessens and Laeven, 2004; Lapteacru, 2014)[17].

For all the specifications reported from table 1 to table 3, we find a robust relationship between the measure of inflation aversion of the central bank and the level of banking sector vulnerability. Excluding specification (3), with the capital-to-asset ratio as the endogenous variable, the coefficients associated with the two indexes of CBC are significant at the 5% level. A higher degree of CBC clearly entails higher banking sector vulnerability. Hence our results strongly support the benign neglect hypothesis. In other words, the more the central banks focus on the inflation goal, the more they neglect vulnerabilities in the banking sector, especially by enabling the amplification of credit cycles and the accumulation of an excessive and volatile amounts of credit (table 1) and by allowing banks' balance sheets to deteriorate (tables 2 and 3). Importantly, this result is robust despite a substantial change in sample size (from a maximum of 998 to a minimum of 187 observations) due to data availability once variables capturing the banking market structure and financial regulation are included.

Concerning specification (3), the non-significance of the coefficient related to the central banks' preferences when the capital-to-asset ratio is considered as dependent variable can be easily explained. Since the late 1980s, the Basel Committee on Banking Supervision (BCBS) has made recommendations on regulations on bank capital and leverage. The most striking example is the implementation in 1992 of the Cook ratio as an international norm on banks' capital. Such requirements were followed by many countries, irrespective of the preferences of their central banks. In our sample, no country has, on average, a capital-to-asset ratio below the reference value of 3%[18] (the norm recommended by the Basel III agreement, see BIS, 2014). This is the case for the 40 countries that remain once financial openness and regulation data are considered in specification (3). At a push, this variable does not constitute an indicator of banking sector vulnerability for these countries. This is why the capital-to-asset ratio is found to be less dependent on CBC than the other measures of banking sector vulnerability.

Moreover, the significance of the control variables depends on both the sample size and the choice of the dependent variable (particularly for the macroeconomic shocks). As highlighted above, the expected sign of banking competition is unclear. In most cases, when the Lerner coefficient is significant, competition between banks weakens the banking sector. Our result highlights the "competition-fragility" view mentioned above. This explanation is particularly relevant when we consider the Z-score as the endogenous variable, as one might expect that competition lessens the returns on assets for financial institutions. The coefficients associated

[17]See also Northcott (2004) for an overview of this debate.

[18]In the measure we used, the definition of banks' capital is broader than those adopted by the Basel Committee; however, the measure also underestimates banks' assets because, unlike in the Basel III agreement, it does not consider off-balance-sheet assets. Therefore, one can consider the 3% threshold more restrictive in the case of our measure.

with the concentration index lead to the same conclusion, except for the last column of table 3. A more concentrated banking market leads to a more stable financial sector. Next, the results for the financial liberalization indicators are mixed. When we consider the Z-score, the credit-to-deposit ratio and the capital-to-asset ratio, lax financial regulation induces more financial vulnerability, as in Kaminsky and Reinhart (1999) and Giannone et al. (2011). This explanation does not hold for credit volatility and the nonperforming loans ratio, the results for which are in line with Bekaert et al. (2005) and support the notion that financial liberalization improves the efficiency of the banking system. Finally, financial openness is only significant when we consider the credit-to-deposit ratio as endogenous variable. This suggests that this characteristic is not an important determinant of banking fragility. Overall, the signs associated with the control variables are consistent with the theoretical arguments raised in the literature.

5 Robustness checks

To enhance the credibility and plausibility of our previous findings, we supplement the empirical analysis by conducting several robustness checks. In particular, we assess whether the coefficients of equation (1) are sensitive to the set of control variables by considering some alternative or additional control variables. First, following Demirgüç-Kunt and Detragiache (1998), we replace demand and supply shocks with the annual growth rate of real GDP and the annual inflation rate. These two variables are taken from the WDI database. They constitute an alternative approach to capturing macroeconomic shocks that may adversely affect the economy and the banking system and, in turn, drive financial imbalances.

Second, we consider two alternative proxies for banking competition. Thus, we replace the Lerner index with the Boone index (Boone, 2008). As the Lerner index, the Boone index is a non-structural competition measure and is taken from the GFD database. It is based on the efficient structure hypothesis and on the idea that competition rewards efficiency. This means that an efficient firm will realize higher profits and gain a larger market share than a less-efficient firm. As shown theoretically in Boone (2008), this effect increases with the level of competition. As the industry becomes more competitive, given a certain level of efficiency of each individual bank, the profits of the more-efficient banks increase relative to those of the less-efficient bank counterparts. It is calculated as the elasticity of profits to marginal costs. An increase in the Boone indicator implies a deterioration of the competitive conduct of financial intermediaries. Despite the intensive academic debate between the proponents of the Lerner index and those of the Boone index (see, e.g., Schiersch and Schmidt-Ehmcke, 2011; Van Leuvensteijn, 2008), some recent empirical papers have applied the Boone indicator to banking markets (see, e.g., Schaeck and Cihák, 2014; Van Leuvensteijn et al., 2011). In the same way, we consider an alternative measure of bank concentration, defined as the assets of the five (instead of the three) largest commercial banks as a share of total commercial banking assets.

Third, we re-estimate our baseline model by replacing the aggregate financial liberalization index with two more specific proxies for banking regulation and supervision, also obtained from

the database of financial reforms developed by Abiad et al. (2010). The first proxy, which is a sub-component of the aggregate financial liberalization index, measures the degree of interest rate control. It takes values from 0 - corresponding to a situation in which both deposit rates and lending rates are fully repressed - to 4 - indicating a freely floating interest rate market. Although interest rate controls may result in lower bank risk taking, they could also restrict bank competition. According to the "competition-stability" view, such a policy is expected to be detrimental to financial stability. Ultimately, the expected sign of this variable is *a priori* unknown. The second proxy that we consider measures the conduct of prudential regulation and the level of banking supervision. It takes values from 0 to 6. However, contrary to the previous proxy, a higher value indicates greater supervision and regulation of the banking system. Thus, we expect a negative sign for this variable.

In the same vein, we also replace the financial liberalization index with a measure of *de jure* supervisory power to have a more complete picture of prudential regulation. This index is developed by Barth et al. (2004) and lies between 0 and 16. The expected sign of the variable is also negative, as a higher value implies greater supervisory power.

Alternatively to these indicators of banking regulation and supervision, we also consider a proxy for the quality of domestic institutions. This choice is driven by several considerations. As argued by Demirgüç-Kunt and Detragiache (1998), the quality of domestic institutions is highly related to the ability of the government to implement effective prudential supervision. Moreover, a weak institutional framework is expected to exacerbate financial fragility, as it provides limited judicial protection to creditors and shareholders (Shimpalee and Breuer, 2006). Specifically, we use the "Law and order" index compiled by the International Country Risk Guide (ICRG). This index lies between 0 and 6, with a higher value indicating better institutional quality. It has been widely used in the empirical literature devoted to financial fragility (see, e.g., Demirgüç-Kunt and Detragiache, 1998; Kaminsky and Schmukler, 2003; Francis, 2004).

Fourth and last, we test the robustness of our results with an additional control variable, namely capital flows, to capture *de facto* financial integration. Following Calvo et al. (2008), the measure of capital flows is calculated as the sum of FDI and portfolio investment, based on data constructed by Lane and Milesi-Ferretti (2007). While we used the Chinn-Ito index as a proxy for *de jure* financial openness in our baseline estimation, this test accounts for the *de jure* and the *de facto* dimensions of financial openness, simultaneously. As mentioned above, greater financial integration reduces the risk of sudden stops but also creates greater exposure to international financial shocks. The expected sign associated with both dimensions of financial openness is therefore uncertain.

The results of the corresponding robustness regressions are displayed in table 4 to table 6, still considering specifications (1) to (3). For parsimony, only the coefficients of $CONS$ (upper panel of the table) and $CONS\_W$ (lower panel) are reported.

Table 4: Robustness checks with credit volatility and the credit-to-GDP gap

Measure of Central Banks' preferences	*CONS*					
Dependent variable	Credit volatility			Credit-to-GDP gap		
	(1)	(2)	(3)	(1)	(2)	(3)
Alternative measures of shocks (a)	25.501**	93.713***	65.198***	15.143***	16.167***	19.067***
(GDP growth and inflation)	(9.950)	(23.658)	(16.913)	(2.464)	(3.648)	(5.967)
Alternative measure of competition (b)		73.083***	45.426**		19.807***	22.452***
(Boone index)		(24.734)	(17.893)		(3.459)	(5.449)
Alternative measure of concentration (c)		78.450***	51.007***		17.215***	17.605***
(assets of the five largest banks)		(24.606)	(16.519)		(3.719)	(5.978)
Alternative measure of liberalization 1 (d)			48.586***			16.013***
(credit controls)			(15.776)			(5.822)
Alternative measure of liberalization 2 (e)			54.945***			14.092**
(banking supervision)			(16.079)			(5.817)
Alternative measure of liberalization 3 (f)			48.586***			16.013***
(supervisor power index)			(15.776)			(5.822)
Alternative measure of liberalization 4 (g)			77.692***			11.983***
(law and order)			(24.155)			(3.648)
Adding measure of *de facto* financial			48.920***			15.895***
openness (h) (capital flows)			(15.944)			(5.822)
Measure of Central Banks' preferences	*CONS_W*					
Dependent variable	Credit volatility			Credit-to-GDP gap		
	(1)	(2)	(3)	(1)	(2)	(3)
Alternative measures of shocks (a)	26.484***	73.953***	51.960***	7.507***	8.332**	8.125
(GDP growth and inflation)	(10.071)	(23.776)	(16.391)	(2.512)	(3.603)	(6.151)
Alternative measure of competition (b)		85.838***	57.656***		17.133***	25.055***
(Boone index)		(25.631)	(18.695)		(3.574)	(5.705)
Alternative measure of concentration (c)		86.128***	53.473***		15.300***	18.307***
(assets of the five largest banks)		(25.602)	(17.011)		(3.857)	(6.158)
Alternative measure of liberalization 1 (d)			52.334***			17.784***
(credit controls)			(16.250)			(5.993)
Alternative measure of liberalization 2 (e)			56.729***			16.411***
(banking supervision)			(16.613)			(5.989)
Alternative measure of liberalization 3 (f)			52.334***			17.784***
(supervisor power index)			(16.250)			(5.993)
Alternative measure of liberalization 4 (g)			82.681***			9.789***
(law and order)			(24.943)			(3.707)
Adding measure of *de facto* financial			52.983***			17.458***
openness (h) (capital flows)			(16.487)			(6.020)

Notes: This table reports the estimated values of β in Eq. (1). Standard errors are reported in parentheses. *, **, and *** denote significance at the 10%, 5% and 1% level, respectively.
(a): we replace macroeconomic shocks with the annual growth rate of real GDP and the annual inflation rate.
(b) and (c): we replace the Lerner index with the Boone index and the three largest commercial banks with the assets of the five largest commercial banks, respectively. As the banking competition/concentration variables are excluded from the set of control variables in the first specification, we only present the estimated coefficients associated with the central bank's preferences indicator in specifications (2) and (3).
(d), (e), (f) and (g): we replace the financial liberalization variable with measures of credit controls, banking supervision, supervisor power and the quality of institutions (law and order), respectively. As the financial liberalization variable is only included in the set of control variables for the first specification, we only present the estimated coefficients associated with the central bank's preferences indicator in specification (3).
(h): we add a measure of capital flows, only in specification (3), to simultaneously include *de jure* and *de facto* indicators of financial openness.

Table 5: Robustness checks with the credit-to-deposit ratio and the nonperforming loans ratio

Measure of Central Banks' preferences	*CONS*					
Dependent variable	Credit-to-deposit ratio			Nonperforming loans ratio		
	(1)	(2)	(3)	(1)	(2)	(3)
Alternative measures of shocks (a)	16.654***	35.261***	31.385***	5.232***	6.214***	3.257*
(GDP growth and inflation)	(4.988)	(5.928)	(9.669)	(1.460)	(1.524)	(1.930)
Alternative measure of competition (b)		33.236***	29.544***		7.934***	4.678***
(Boone index)		(4.611)	(5.553)		(1.450)	(1.727)
Alternative measure of concentration (c)		30.815***	27.382***		7.635***	2.958*
(assets of the five largest banks)		(5.989)	(9.463)		(1.441)	(1.767)
Alternative measure of liberalization 1 (d)			24.822***			3.528**
(credit controls)			(9.180)			(1.702)
Alternative measure of liberalization 2 (e)			21.147**			4.134**
(banking supervision)			(9.227)			(1.724)
Alternative measure of liberalization 3 (f)			24.822***			3.528**
(supervisor power index)			(9.180)			(1.702)
Alternative measure of liberalization 4 (g)			27.204***			7.136***
(law and order)			(5.887)			(1.512)
Adding measure of de facto financial			24.264***			3.495**
openness (h) (capital flows)			(9.252)			(1.713)
Measure of Central Banks' preferences	*CONS_W*					
Dependent variable	Credit-to-deposit ratio			Nonperforming loans ratio		
	(1)	(2)	(3)	(1)	(2)	(3)
Alternative measures of shocks (a)	15.854***	19.449***	20.470**	5.403***	6.203***	2.666
(GDP growth and inflation)	(5.170)	(5.916)	(9.570)	(1.399)	(1.495)	(1.782)
Alternative measure of competition (b)		25.410***	30.019***		7.305***	5.068***
(Boone index)		(4.786)	(5.799)		(1.505)	(1.815)
Alternative measure of concentration (c)		23.377***	26.753***		7.091***	3.566*
(assets of the five largest banks)		(6.232)	(9.703)		(1.497)	(1.812)
Alternative measure of liberalization 1 (d)			25.105***			4.030**
(credit controls)			(9.391)			(1.752)
Alternative measure of liberalization 2 (e)			22.566**			4.434**
(banking supervision)			(9.441)			(1.779)
Alternative measure of liberalization 3 (f)			25.105***			4.030**
(supervisor power index)			(9.391)			(1.752)
Alternative measure of liberalization 4 (g)			18.981***			6.294***
(law and order)			(6.027)			(1.543)
Adding measure of de facto financial			24.272**			4.044**
openness (h) (capital flows)			(9.509)			(1.770)

Notes: This table reports the estimated values of β in Eq. (1). Standard errors are reported in parentheses. *, **, and *** denote significance at the 10%, 5% and 1% level, respectively.
(a): we replace macroeconomic shocks with the annual growth rate of real GDP and the annual inflation rate.
(b) and (c): we replace the Lerner index with the Boone index and the three largest commercial banks with the assets of the five largest commercial banks, respectively. As the banking competition/concentration variables are excluded from the set of control variables in the first specification, we only present the estimated coefficients associated with the central bank's preferences indicator in specifications (2) and (3).
(d), (e), (f) and (g): we replace the financial liberalization variable with measures of credit controls, banking supervision, supervisory power and quality of institutions (law and order), respectively. As the financial liberalization variable is only included in the set of control variables for the first specification, we only present the estimated coefficients associated with the central bank's preferences indicator in specification (3).
(h): we add a measure of capital flows, only in specification (3), to simultaneously include *de jure* and *de facto* indicators of financial openness.

Table 6: Robustness checks with the Z-score and the capital-to-asset ratio

Measure of Central Banks' preferences	*CONS*					
Dependent variable	Z-score			Capital-to-asset ratio		
	(1)	(2)	(3)	(1)	(2)	(3)
Alternative measures of shocks (a)	-1.848*	-2.004*	-1.790	-3.049***	-2.378***	-1.419
(GDP growth and inflation)	(1.008)	(1.023)	(1.686)	(0.720)	(0.732)	(1.103)
Alternative measure of competition (b)		-2.910***	-3.138*		-2.365***	-1.105
(Boone index)		(1.016)	(1.765)		(0.572)	(0.967)
Alternative measure of concentration (c)		-2.814***	-3.534**		-2.154***	-1.644*
(assets of the five largest banks)		(1.058)	(1.748)		(0.585)	(0.992)
Alternative measure of liberalization 1 (d)			-3.196*			-1.212
(credit controls)			(1.733)			(0.984)
Alternative measure of liberalization 2 (e)			-2.767			-0.930
(banking supervision)			(1.743)			(1.029)
Alternative measure of liberalization 3 (f)			-3.196*			-1.212
(supervisor power index)			(1.733)			(0.984)
Alternative measure of liberalization 4 (g)			-2.804**			-2.086***
(law and order)			(1.116)			(0.585)
Adding measure of de facto financial			-3.117*			-1.154
openness (h) (capital flows)			(1.732)			(0.985)
Measure of Central Banks' preferences	*CONS_W*					
Dependent variable	Z-score			Capital-to-asset ratio		
	(1)	(2)	(3)	(1)	(2)	(3)
Alternative measures of shocks (a)	-2.793***	-3.440***	-3.040*	-3.015***	-2.304***	-0.956
(GDP growth and inflation)	(1.018)	(1.067)	(1.783)	(0.599)	(0.598)	(1.062)
Alternative measure of competition (b)		-2.838***	-2.936		-2.573***	-1.182
(Boone index)		(1.040)	(1.860)		(0.593)	(1.068)
Alternative measure of concentration (c)		-3.113***	-3.938**		-2.157***	-1.329
(assets of the five largest banks)		(1.090)	(1.798)		(0.612)	(1.100)
Alternative measure of liberalization 1 (d)			-3.564**			-1.028
(credit controls)			(1.786)			(1.088)
Alternative measure of liberalization 2 (e)			-3.270*			-0.748
(banking supervision)			(1.797)			(1.141)
Alternative measure of liberalization 3 (f)			-3.564**			-1.028
(supervisor power index)			(1.786)			(1.088)
Alternative measure of liberalization 4 (g)			-3.094***			-2.084***
(law and order)			(1.128)			(0.601)
Adding measure of de facto financial			-3.515*			-0.995
openness (h) (capital flows)			(1.792)			(1.093)

Notes: This table reports the estimated values of β in Eq. (1). Standard errors are reported in parentheses. *, **, and *** denote significance at the 10%, 5% and 1% level, respectively.
(a): we replace macroeconomic shocks with the annual growth rate of real GDP and the annual inflation rate.
(b) and (c): we replace the Lerner index with the Boone index and the three largest commercial banks with the assets of the five largest commercial banks, respectively. As the banking competition/concentration variables are excluded from the set of control variables in the first specification, we only present the estimated coefficients associated with the central bank's preferences indicator in specifications (2) and (3).
(d), (e), (f) and (g): we replace the financial liberalization variable with measures of credit controls, banking supervision, supervisory power and quality of institutions (law and order), respectively. As the financial liberalization variable is only included in the set of control variables for the first specification, we only present the estimated coefficients associated with the central bank's preferences indicator in specification (3).
(h): we add a measure of capital flows, only in specification (3), to simultaneously include *de jure* and *de facto* indicators of financial openness.

First, we observe that the relationship between the $CONS$ index and the credit-to-GDP gap remains positive and statistically significant whatever the specification. This is also the case for credit volatility (table 4). This confirms the finding that a higher degree of CBC amplifies credit cycles. The results also confirm our previous findings for the credit-to-deposit and nonperforming loans to gross loans ratios (table 5). Whatever the specification, the parameter of interest remains positive and strongly significant. Our findings are also globally robust when the dependent variable is the Z-score (table 6): the impact of $CONS$ and $CONS\_W$ is still negative and significant, except in one case. Finally, the results for the capital-to-asset ratio are robust for specifications (1) and (2). The effect of central banks' preferences is often not statistically significant in specification (3), for the same reasons mentioned above.

Finally, one can argue that there might be a potential reverse causality from banking sector vulnerability to central banks' preferences. To address this potential endogeneity issue, we further consider an instrumental variable approach using the two-stage least squares (2SLS) estimator. Three instrumental variables are considered: the first lag of the CONS (or CONS_W) index, and two measures of central bank independence (CBI): the *de jure* index of CBI initially developed by Cukierman et al. (1992) and recently updated by Garriga (2016), and the *de facto* turnover rate of central bank governors. The latter is commonly used in the literature as an inverse proxy for CBI. It is viewed as more reliable when the rule of law is not strongly embedded in the political culture, as it is sometimes the case in some developing and emerging countries. It is computed over five-year rolling windows. Information on the term in office of central bank governors comes from Dreher et al. (2008).

Instrumental variables estimates for each measure of banking sector vulnerability and each specification are reported in tables 7 and 8. As above, to save space, we only report the coefficients for CONS and CONS_W. As we can see, while correcting for potential endogeneity the results are very similar to our previous findings. We still find a significant relationship between central banks' preferences and banking sector vulnerability. The effect of central banks' preferences appears to be even stronger than with the fixed-effects estimators. Note that the Hansen test p-values and the Cragg-Donald statistics indicate that our instruments are valid and not weak.

Hence, all of these additional results reinforce the finding that a high degree of CBC exacerbates the vulnerability of the banking sector, in line with the benign neglect hypothesis. There is no result supporting the alternative hypothesis.

Table 7: 2SLS results for credit volatility, credit-to-GDP gap and credit-to-deposit ratio

Dependent variable	Credit volatility					
	(1)	(2)	(3)	(1)	(2)	(3)
CONS	39.453*	127.286**	66.164*			
	(20.193)	(54.720)	(37.553)			
CONS_W				49.289**	163.217**	87.753**
				(23.268)	(70.843)	(43.453)
Observations	842	438	272	775	412	255
Number of countries	68	51	40	66	50	39
R-squared	0.046	0.069	0.138	0.048	0.053	0.122
Hansen J-OverID test [p-value]	0.741	0.389	0.128	0.758	0.594	0.371
Cragg-Donald Wald F Stat.	569.7	202.9	97.65	345.6	115.8	71.04
Stock & Yogo critical value (10%)	22.30	22.30	22.30	22.30	22.30	22.30
Dependent variable	Credit-to-GDP gap					
	(1)	(2)	(3)	(1)	(2)	(3)
CONS	14.246***	16.918***	16.096*			
	(3.503)	(4.776)	(8.361)			
CONS_W				10.024**	11.718**	22.668**
				(4.034)	(5.613)	(9.472)
Observations	958	538	272	892	513	255
Number of countries	69	52	40	68	52	39
R-squared	0.154	0.249	0.262	0.130	0.234	0.244
Hansen J-OverID test [p-value]	0.069	0.083	0.178	0.150	0.256	0.531
Cragg-Donald Wald F Stat.	740.2	319.6	97.65	446.5	196	71.04
Stock & Yogo critical value (10%)	22.30	22.30	22.30	22.30	22.30	22.30
Dependent variable	Credit-to-deposit ratio					
	(1)	(2)	(3)	(1)	(2)	(3)
CONS	17.365***	37.376***	32.260***			
	(5.097)	(6.640)	(8.872)			
CONS_W				11.408**	28.599***	39.855***
				(5.806)	(7.954)	(9.598)
Observations	902	500	262	837	475	245
Number of countries	68	51	39	67	51	38
R-squared	0.163	0.267	0.261	0.154	0.235	0.239
Hansen J-OverID test [p-value]	0.076	0.072	0.054	0.051	0.120	0.132
Cragg-Donald Wald F Stat.	656.2	269.8	96.99	395.2	163.2	71.07
Stock & Yogo critical value (10%)	22.30	22.30	22.30	22.30	22.30	22.30

Notes: This table reports the estimated values of β in Eq. (1). Standard errors are reported in parentheses. *, ** and *** denote significance at the 10%, 5% and 1% level, respectively.

Table 8: 2SLS results for nonperforming loans ratio, z-score and capital-to-asset ratio

Dependent variable	Nonperforming loans ratio					
	(1)	(2)	(3)	(1)	(2)	(3)
CONS	10.491***	10.372***	8.699***			
	(2.423)	(1.562)	(2.275)			
CONS_W				9.526***	9.840***	8.406***
				(2.606)	(1.918)	(2.616)
Observations	572	504	264	545	482	250
Number of countries	56	50	38	56	50	38
R-squared	0.298	0.349	0.481	0.318	0.368	0.468
Hansen J-OverID test [p-value]	0.583	0.794	0.843	0.311	0.624	0.658
Cragg-Donald Wald F Stat.	326.7	273.8	93.43	193.9	167.3	69.57
Stock & Yogo critical value (10%)	22.30	22.30	22.30	22.30	22.30	22.30
Dependent variable	Z-score					
	(1)	(2)	(3)	(1)	(2)	(3)
CONS	-1.886*	-2.466**	-2.240			
	(1.126)	(1.216)	(2.084)			
CONS_W				-2.216*	-2.914**	-2.441
				(1.343)	(1.453)	(2.376)
Observations	604	549	272	576	524	255
Number of countries	57	53	40	57	53	39
R-squared	0.032	0.061	0.081	0.030	0.053	0.083
Hansen J-OverID test [p-value]	0.409	0.622	0.670	0.345	0.537	0.470
Cragg-Donald Wald F Stat.	358.1	326.7	97.65	217.3	200.4	71.04
Stock & Yogo critical value (10%)	22.30	22.30	22.30	22.30	22.30	22.30
Dependent variable	Capital-to-asset ratio					
	(1)	(2)	(3)	(1)	(2)	(3)
CONS	-2.433***	-1.752**	-1.035			
	(0.913)	(0.880)	(1.226)			
CONS_W				-1.836**	-1.426	-0.860
				(0.912)	(0.873)	(1.409)
Observations	434	407	179	414	388	169
Number of countries	52	50	36	52	50	36
R-squared	0.136	0.157	0.218	0.130	0.159	0.271
Hansen J-OverID test [p-value]	0.231	0.232	0.406	0.279	0.312	0.314
Cragg-Donald Wald F Stat.	265.3	248.9	64.57	175.0	175.0	48.06
Stock & Yogo critical value (10%)	22.30	22.30	22.30	22.30	22.30	22.30

Notes: This table reports the estimated values of β in Eq. (1). Standard errors are reported in parentheses. *, ** and *** denote significance at the 10%, 5% and 1% level, respectively.

6 Conclusion

The dramatic recent crisis occurred in the context of the Great Moderation. This has shed doubt on the conventional wisdom of price stability guaranteeing macroeconomic and financial stability. An alternative view contends that with monetary policies focussed primarily on price stability, financial risks were largely undressed. The belief in the "divine coincidence" has, in retrospect, been revealed to be benign neglect. As a consequence, financial instability has undermined macroeconomic stability, despite low and stable inflation.

In this context, our paper is the first to directly address the link between the relative preferences of central banks for the inflation stabilization objective, namely their degree of conservatism, and banking sector vulnerability. In this respect, we tested the benign neglect *vs* Schwartz's hypothesis. Our results, based on a sample of 73 industrialized and emerging countries, indicate that differences in central banks' conservatism (CBC) robustly explain cross-country differences in banking vulnerability and unambiguously validate the benign neglect hypothesis.

On normative grounds, this result suggests two alternative recommendations. On the one hand, central bankers now know that it could be very costly to neglect financial and banking vulnerabilities. The costs of doing so is the renunciation of the usual monetary policy orthodoxy, once a dramatic crisis occurs, through the implementation of unconventional measures. This could lead central bankers to tolerate a dilution of their primary price stability objective, to devote greater attention to output and financial stability. This raises the issue of determining adequate instruments (in terms of number and assignment) to affect to these - sometimes conflicting - goals. To be fully efficient, this would also require formal reforms stating such additional objectives in law. Central banks would then officially be responsible for this goal.

On the other hand, if single mandates remain the rule, the implementation of an efficient macro-prudential policy may reduce the adverse effects of high CBC. Some efforts have been made in terms of prudential framework since 2008. However, it is certainly not *per se* a panacea because of the potential interferences concerning monetary policy. Indeed, monetary and macro-prudential policies can be complementary, but they can also compete with one another. Thus, they need to be coordinated. While the literature on this topic remains scarce, it is clear that the terms of the optimal coordination will depend on the preferences of the single (or various) authority (authorities) that is (are) responsible for the two goals. In particular, the central bank's conservatism would influence the terms of the coordination and the corresponding macroeconomic equilibrium. In this respect, our results call for an analysis of the occurrence of trade-offs, according to authorities' preferences and given different types of shocks[19]. A macroeconomic model with utility-based loss functions for both monetary and macro-prudential policies would be particularly suited to such an analysis. It would allow for the simultaneous identification of the relative preferences and the underlying structural "deep parameters" that contribute most to such conflicts.

While a higher level of CBC implies a more vulnerable banking sector, it is widely recog-

[19]The method suggested by Garcia et al. (2011), for example, is an interesting benchmark to this end.

nized that a highly inflationary context is not conducive to sound financial conditions. This suggests that an immediate extension of our results would consist in examining the existence of non-linearities in the link between CBC and banking sector vulnerability. Furthermore, our results suggest more fundamental extensions. One concerns the overall assessment of an excessively high degree of CBC. As shown in this paper, a conservative stance exacerbates banking vulnerabilities that are at the origin of banking and financial crises. This could be called the *ex ante* effect of CBC. Furthermore, one can expect that the degree of CBC also impacts the pace of economic recovery in the aftermath of a crisis. Indeed, a conservative central banker may be reluctant to deviate from its 'sacred' inflation objective to support the economy and the financial system once a financial crisis has occurred. At best, conservative monetary authorities would react too late[20]. This would be the *ex post* effect of CBC. Thus, an immediate extension of this paper would consist of investigating the impact of CBC on the severity and costs of banking and financial crises.

It is all the more important to assess whether CBC matters for the costs of crises, as the inflation targeting (IT) strategy has become very popular. While such a strategy can be followed in a flexible way (Svensson, 2002), it firmly places the inflation objective at the heart of the monetary policy arrangements (King, 1997; Bleich et al., 2012; Levieuge and Lucotte, 2014b). Thus far, there is no clear-cut conclusion on the performance of IT with respect to financial instability and the costs of crises[21]. One reason may be that beyond the focus on inflation, the IT strategy is accompanied by institutional, political, legal and practical reforms that are globally beneficial to macroeconomic and financial stability. In emerging countries in particular, these reforms could overcome the negative effect of greater conservatism, at least in the short run. This is less obvious for industrialized countries, in which the central banks' aversion to inflation is already high and inflation has been under control for almost 30 years. While controlling for the effects of institutional improvement is a difficult task, it would be interesting to re-examine the empirical literature on the performance of IT by considering the relationship among IT, CBC and financial (in)stability separately for developed and emerging countries.

[20]Such a view is supported, for example, by K. Whelan (2012, p.107-108): "*As I write, the US economy is growing and unemployment is falling. The Eurozone is in recession and unemployment is rising to record levels. Despite this, the Fed is holding short-term interest rates at zero while the ECB's policy rate is 75 basis points* [...]. *The Fed is promising to keep rates low for some time; the ECB is generally understood to want to raise rates if they observe any sign of an increase in inflation. This is what they have done twice during Europe's current economic crisis* [...]. *Similarly, in contrast the Fed's ongoing programme of large-scale bond purchases, the ECB's bond purchase programmes have been of a limited stop-start nature, with the not-yet-operational Outright Monetary Transaction (OMT) programme brought into being only when the very existence of the euro itself was under threat*".

[21]While some studies, such as Fazio et al. (2015), find IT not to be harmful to financial stability or growth, Petreski (2014) and Frappa and Mésonnier (2010) reach the opposite conclusion.

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Appendix 1 - Details on the $CONS$ index

Our measure of CBC relies on the method suggested by Levieuge and Lucotte (2014b) on the theoretical basis of the Taylor curve (Taylor, 1979). The latter, represented in figure 2 below, represents the standard trade-off between the variability of the inflation rate (σ_π^2) and the variability of the output gap (σ_y^2). Theoretically, any point on this curve is the result of an optimal monetary policy, given the structural model of the economy and the weight assigned to the objective of inflation stabilization. Then, the observed position of an economy on this curve reveals the central bank's preferences in terms of inflation stabilization relative to the output stabilization. While the first bisector corresponds to the case in which monetary authorities assign an equal weight to inflation and output variability in their loss function, a central bank is considered increasingly conservative as its corresponding point moves along the Taylor curve from the right to the left, that is, as inflation increasingly receives greater weight relative to output variability in its loss function. For example, point A in figure 2 illustrates the case in which the central bank is more adverse to inflation variability than at point B, while tolerating higher output variability. Point A then indicates a more conservative stance than point B.

Following this conceptual background, Levieuge and Lucotte (2014b) propose a new index, called $CONS$, which is based on the value of the angle of the straight line joining the origin and a given point on the Taylor Curve. Indeed, knowing the empirical volatilities of inflation and the output gap, that is, the adjacent and opposite sides, respectively, it is possible to calculate any angle value, following the usual trigonometric formula: $angle(\alpha) = atan(\sigma_y^2/\sigma_\pi^2) \times 180/pi$. Once rescaled to [0, 1], this angle measure constitutes a fair estimate of the relative degree of CBC, equivalent to the relative weight assigned to the inflation objective in a standard quadratic loss function. Thus, $CONS$ is defined as

$$CONS = \frac{1}{90}\left[atan\left(\frac{\sigma_y^2}{\sigma_\pi^2}\right) \times \frac{180}{pi}\right] \tag{2}$$

Levieuge and Lucotte (2014b) initially developed such a $CONS$ index for the OECD countries. As (σ_π^2) and (σ_y^2) are easily observable in any country, over any period, extending this

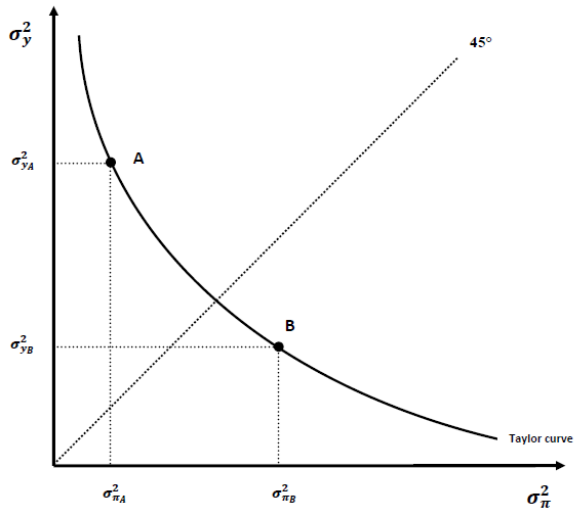

Figure 2: Preferences along the Taylor Curve

index to a broad set of countries is direct and simple. For the purposes of this paper, we have expanded the $CONS$ index to a large set of 73 countries from 1980 to 2012. $CONS$ is computed on an annual basis, with σ_π^2 and σ_y^2 computed over five-year rolling windows.

As highlighted by Levieuge and Lucotte (2014b), any change in $CONS$ can be the result of disturbances, outside the willingness of the central bank to change its preferences. This is potentially an important point to address, as our sample includes emerging countries that are known to be subject to shocks. In this respect, Levieuge and Lucotte (2014b) propose an alternative CBC indicator, labelled $CONS\_W$ ("W" for weighted), where the ratio σ_y^2/σ_π^2 in Equation (2) is weighted by the ratio of disturbances $\sigma_{\varepsilon y}^2/\sigma_{\varepsilon\pi}^2$. $\sigma_{\varepsilon y}^2$ and $\sigma_{\varepsilon\pi}^2$ are the variance of demand and supply shocks, respectively. They are identified from bivariate structural VAR models through the reliable decomposition scheme suggested by Blanchard and Quah (1989). Details are provided in Levieuge and Lucotte (2014b).

While prudence requires *a priori* to take cyclical shocks into account, figure 4 below shows that the (mean value of the) two measures are highly correlated.

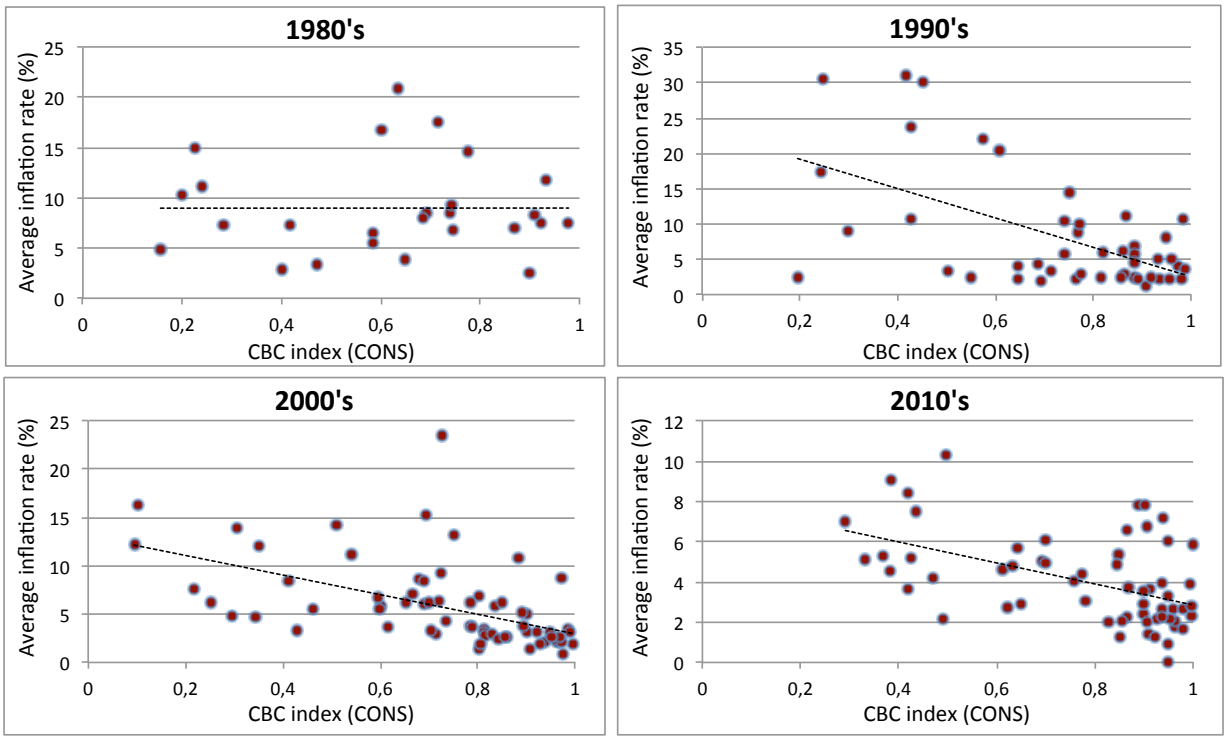

Figure 3: $CONS$ index and inflation (decade average)

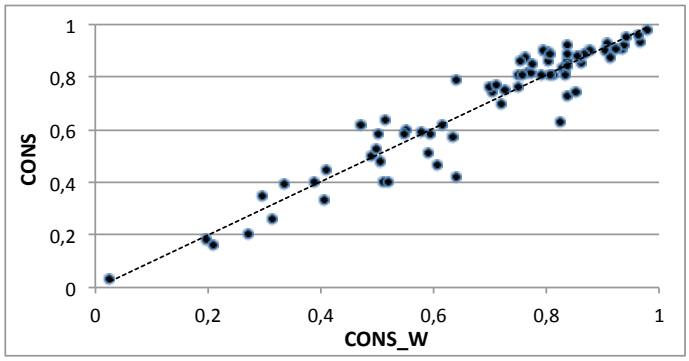

Figure 4: Correlation between $CONS$ and $CONS\_W$ (decade average)

Appendix 2 - Countries and average $CONS$ and $CONS\_W$

Table 9: Average $CONS$ and $CONS\_W$

Decade	1980's		1990's		2000's	
Country Name	$CONS$	$CONS\_W$	$CONS$	$CONS\_W$	$CONS$	$CONS\_W$
Algeria					0.405	0.335
Argentina			0.978		0.711	0.765
Armenia					0.836	0.920
Australia	0.740	0.823	0.816	0.756	0.951	0.942
Austria	0.649	0.763	0.886	0.938		
Bangladesh			0.741		0.601	0.615
Barbados	0.746	0.949	0.866	0.901	0.796	0.691
Belgium	0.156	0.167	0.646	0.768		
Bolivia			0.742	0.783	0.878	0.882
Botswana			0.984		0.965	0.932
Brazil			0.625	0.788	0.836	0.909
Bulgaria			0.412		0.658	0.791
Canada	0.584	0.830	0.893	0.805	0.941	0.945
Colombia			0.575		0.646	0.421
Costa Rica					0.829	0.835
Croatia					0.823	0.703
Czech Republic			0.951		0.818	0.730
Denmark	0.868	0.616	0.935	0.936	0.965	0.981
El Salvador			0.428	0.287	0.604	0.681
Estonia			0.450		0.751	0.741
Fiji	0.977	0.992	0.972	0.974	0.985	0.979
Finland	0.416	0.614	0.958	0.962		
France	0.284	0.167	0.695	0.723		
Georgia					0.754	0.864
Germany			0.872	0.929		
Guatemala					0.594	0.584
Hong Kong	0.922	0.983	0.885	0.905	0.918	0.890
Hungary					0.337	0.394
Iceland					0.750	0.806
Indonesia			0.751	0.775	0.404	0.384
Iran			0.429	0.310	0.692	0.765
Ireland	0.743	0.646	0.979	0.936		
Israel	0.802	0.939	0.866	0.801	0.996	0.994
Italy	0.239	0.313	0.647	0.672		
Jamaica					0.512	0.402
Japan	0.898	0.903	0.907	0.868	0.943	0.940
Jordan			0.933	0.930	0.861	0.900

Notes: The table provides the list of countries included in our sample and the ten-year average values of $CONS$ and $CONS\_W$ for each of them. The reported values of $CONS$ and $CONS\_W$ are not those used in the econometric analysis of the article and are only intended to provide an overview of central bank preferences country by country to the reader. Euro-area member states are considered until they join the European Monetary Union.

Table 9 (continued): Average $CONS$ and $CONS\_W$

Decade	1980's		1990's		2000's	
Country Name	$CONS$	$CONS\_W$	$CONS$	$CONS\_W$	$CONS$	$CONS\_W$
Kazakhstan			0.124		0.746	0.762
Korea, Rep.	0.693	0.904	0.885	0.894	0.922	0.886
Kyrgyz Republic					0.606	0.469
Latvia			0.561	0.379	0.847	0.890
Lithuania			0.574		0.839	0.862
Malawi	0.601	0.628	0.417	0.396	0.511	0.580
Malaysia			0.989	0.993	0.955	0.954
Mauritius					0.634	0.571
Mexico	0.806	0.884	0.609	0.733	0.908	0.883
Moldova					0.409	0.446
Morocco			0.884	0.867	0.927	0.879
Netherlands	0.400	0.472	0.552	0.544		
New Zealand			0.765	0.690	0.872	0.864
Nicaragua					0.591	0.509
Nigeria	0.634	0.689	0.245	0.231	0.094	0.066
Norway	0.911	0.914	0.919	0.959	0.974	0.965
Peru			0.474	0.417	0.973	0.970
Philippines	0.227	0.236	0.296	0.184	0.357	0.326
Poland					0.806	0.807
Portugal	0.715	0.795	0.818	0.856		
Romania					0.210	0.164
Russian Fed.			0.162		0.405	0.403
Slovak Republic			0.769		0.463	0.400
Slovenia					0.297	0.345
South Africa	0.775	0.630	0.774	0.679	0.655	0.734
Spain	0.200	0.212	0.688	0.780		
Sweden	0.684	0.573	0.714	0.701	0.898	0.939
Switzerland	0.472	0.451	0.857	0.906	0.970	0.977
Thailand			0.961		0.834	0.741
Trinidad and Tob.	0.934	0.897	0.859	0.918	0.780	0.771
Tunisia					0.726	0.748
Turkey			0.948	0.949	0.755	0.742
Ukraine					0.757	0.808
United Kingdom			0.504	0.463	0.829	0.901
United States	0.585	0.715	0.774	0.839	0.857	0.889
Zambia			0.026	0.029		

Notes: The table provides the list of countries included in our sample and the ten-year average values of $CONS$ and $CONS\_W$ for each of them. The reported values of $CONS$ and $CONS\_W$ are not those used in the econometric analysis of the article and are only intended to provide an overview of central bank preferences country by country to the reader. Euro-area member states are considered until they join the European Monetary Union.

Appendix 3 - Data : definitions, sources and correlation matrix

Table 10: Data: Definitions and sources

Variable	Definition	Source
Credit volatility	Indicator of credit dispersion computed with a five-year moving variance on quarterly total credit data. It is normalized to the mean of total credit in the same period.	IFS and authors' calculation
Credit-to-GDP gap	Difference in percentage between the domestic credit to private sector as a share of GDP and its long-term trend, obtained using an HP filter. Domestic credit to private sector refers to financial resources provided to the private sector. For some countries, it includes financial resources to public enterprises.	WDI and authors' calculation
Credit-to-deposit ratio	Financial resources provided to the private sector by domestic money banks as a share of total deposits.	GFD
Nonperforming loans to gross loans	Ratio of defaulting loans (payments of interest and principal past due by 90 days or more) to total gross loans (total value of loan portfolio). The loan amount recorded as nonperforming includes the gross value of the loan as recorded on the balance sheet, not just the amount that is overdue.	GFD
Z-score	Probability of default of a country's commercial banking system. Z-score compares the buffer of a country's commercial banking system (capitalization and returns) with the volatility of those returns.	GFD
Capital-to-assets ratio	Ratio of bank capital and reserves to total assets. Capital and reserves include funds contributed by owners, retained earnings, general and special reserves, provisions, and valuation adjustments. Capital includes tier-1 capital and total regulatory capital. Total assets include all nonfinancial and financial assets.	GFD

Table 10 (continued): Data : Definitions and sources

Variable	Definition	Source
Variance of supply shocks	Five-year rolling variances of supply shocks. Supply shocks are identified using the decomposition scheme suggested by Blanchard and Quah (1989) and by considering a bivariate structural VAR model.	Authors' calculation - see Appendix 1 for more details
Variance of demand shocks	Five-year rolling variances of demand shocks. Demand shocks are identified using the decomposition scheme suggested by Blanchard and Quah (1989) and by considering a bivariate structural VAR model.	Authors' calculation - see Appendix 1 for more details
Real GDP per capita	GDP in constant 2005 U.S. dollars divided by midyear population.	WDI
Lerner index	A measure of market power in the banking sector, calculated as the difference between output prices and marginal costs (relative to prices). An increase in the Lerner index indicates a deterioration of the competitive conduct of financial intermediaries.	GFD
Bank concentration	Assets of three largest commercial banks as a share of total commercial banking assets.	GFD
Financial openness	A *de jure* measure of financial openness based on the binary dummy variables that codify the tabulation of restrictions on cross-border financial transactions reported in the IMF's Annual Report on Exchange Arrangement and Exchange Restrictions. It ranges between 0 and 1. An increase in the index indicates a higher degree of financial openness.	Chinn and Ito (2006) and Chinn and Ito (2008)
Financial liberalization	An index measuring the degree of liberalization of the banking and financial sector. It ranges between 0 and 1, with 0 corresponding to a fully restricted financial system and 1 to a fully liberalized sector.	Abiad et al. (2010)

Table 10 (continued): Data : Definitions and sources

Variable	Definition	Source
Real GDP growth	Annual percentage growth rate of GDP in constant 2005 U.S. dollars.	WDI
Annual inflation rate	Annual percentage change in the consumer price index.	WDI
Boone index	A measure of the degree of competition based on profit efficiency in the banking market, calculated as the elasticity of profits to marginal costs. An increase in the Boone index indicates a deterioration of the competitive conduct of financial intermediaries.	GFD
Bank concentration (5 banks)	Assets of the five largest commercial banks as a share of total commercial banking assets.	GFD
Credit controls	An index measuring whether credits are administratively controlled, including whether certain sectors benefit from subsidized rates or minimum amounts of credit allocations or whether reserve requirements exist. It ranges between 0 and 4, with 0 corresponding to a fully restricted credit market and 4 to a fully liberalized market.	Abiad et al. (2010)
Banking supervision	An index measuring the degree of government intervention in terms of prudential regulation and banking supervision. It ranges between 0 and 6, with a higher value indicating greater supervision and regulation of the banking system.	Abiad et al. (2010)
Supervisory power index	A measure ranging between 0 and 16 of the extent to which official supervisory institutions have the authority to take specific actions to prevent and resolve banks' problems. A higher value indicates greater supervisory power.	Barth et al. (2004)
Law & Order	A measure of the strength and impartiality of the legal system and of the popular observance of law. This measure is commonly used in the literature as a proxy for institutional development. The index ranges between 0 and 6, with a higher value indicating greater institutional development.	ICRG
Capital flows	A *de facto* measure of financial openness computed as the sum of FDI and portfolio investment, asset and liability stocks, as a share of GDP. An increase in the capital flows indicates a higher degree of financial openness.	Lane and Milesi-Ferretti (2007) and authors' calculation

Table 11: Correlation matrix of explanatory variables

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$CONS$ (1)	1								
$CONS\_W$ (2)	0.9336*	1							
Variance of supply shocks (3)	-0.1140*	-0.2630*	1						
Variance of demand shocks (4)	-0.0578	0.1290*	0.2556*	1					
GDP per capita (5)	0.2919*	0.3187*	-0.0533	-0.0213	1				
Lerner index (6)	-0.0575	-0.0244	-0.1026*	0.0818*	-0.1349*	1			
Bank concentration (7)	0.1134*	0.0907*	0.0544	0.0112	0.2457*	0.0046	1		
Financial openness (8)	0.2569*	0.2743*	-0.1776*	-0.0945*	0.5300*	-0.0620*	0.1827*	1	
Financial liberalization (9)	0.2614*	0.2281*	-0.2395*	-0.3740*	0.5366*	-0.0125	0.2708*	0.7328*	1

Note: * denotes significance at the 5% level.