PRELIMINARY DRAFT
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HOW SHOULD CENTRAL BANK BE DESIGNED TO ACHIEVE FINANCIAL STABILITY

Alicia García-Herrero[1]

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Abstract

This paper assesses how the design of the central bank may affect financial instability. Different dimensions of financial instability are considered, such as housing and stock market bubbles, banking sector fragility or crisis events. As for the central bank, it looks into the way monetary policy is designed, in terms of objectives, operational targets and degree of independence, as well as other potential central bank functions, such as the payment systems, lender of last resort or the supervision of the financial system. Based on a cross section of 60 countries, the paper's empirical results show that more independent and focused central banks tend to be less prone to financial instability. This evidence supports the idea of synergies between price and financial stability, at least in terms of the central bank design.

JEL Classification: E52, E44, G21

Key words: Monetary policy design, monetary policy objectives, monetary policy strategy, financial stability, banking crisis.

[1] Alicia Garcia-Herrero is affiliated with the Bank of International Settlements; she can be contacted at alicia.garcia-herrero@bis.org. The opinions expressed in this article are those of the authors and not necessarily of the institutions they are affiliated with. I thank Pedro del Rio for a permanent exchange of views on this topic and Andrea Tesei and Gert Schnabel for their excellent research assistance.

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Introduction

As every other institution, central banks evolve over time but very slowly. The high inflation environment of the eighties led central banks to focus on price stability, which implied redefining central bank objectives, as well as their monetary policy strategy and instruments. More recently, an increasing number of banking crises as well as housing and stock market bubbles have turned central banks' attention towards financial stability.

In fact, more and more central banks acknowledge, at least *de facto* if not *de iure*, that both price and financial stability are their major objectives. However, the set of strategies and instruments with which central banks conduct monetary policy are generally chosen on the basis of their usefulness to achieve price stability only. In addition, there is a growing trend for central banks to focus more narrowly on monetary policy leaving other functions, such as financial regulation and supervision but also the operation of the payment system, outside their realm. Even the lender of last resort function (LOLR) is, in many central banks, being limited to very specific circumstances.

While a wealth of economic literature has been devoted to how central banks should be designed to achieve price stability –starting with the literature on central bank independence – much less is known about their optimal design to achieve financial stability. The design of the central bank, however, could be relevant in as far as the central bank is the major institution influencing financial conditions and the functioning of the financial system as a whole. More generally, there is growing consensus that institutional design is key for economic growth and financial development.[2]

How the design of the central bank – and in particular monetary policy – can influence financial stability relates to the question of whether synergies – or a trade-off - exist between price stability and financial stability. If there were synergies, one should not be surprised to find that the design of the central bank which better contributes to price stability also fosters

[2] For a description of the role of central banks in financial stability across regimes see Borio and Lowe (2002).

financial stability.[3] However, if there was a trade-off, central banks might need to introduce a more flexible design with different –but complementary - instruments to achieve their two major goals.

Against this background, this paper assesses empirically whether the design of the central bank affects financial stability and in which way. Several dimensions of financial instability will be considered (from asset price bubbles to bank fragility or major crisis events) and also different aspects of central bank design related to monetary policy and to other central bank functions, such as the payments system or the involvement of the central bank in banking regulation and supervision.

This paper contributes to the literature on the relation between monetary policy and financial stability by exploring empirically, for a large number of countries, how central bank design may influence financial instability and in which way. While the results are still very preliminary and based on scarce data, they point to more independent and focused central banks being less prone to financial instability. This evidence supports the idea that synergies exist between price and financial stability at least in terms of the central bank design.

A historical overview of central banks and financial stability

Practically since their creation, monetary authorities have been concerned with financial stability[4]; that is since they undertook the issuance of money as paper currency, replacing previously metallic currencies. It further developed when bank deposits grew as a substantial share of the money stock. With the creation of a public institution as monetary authority (in the nineteenth century in Europe and early in the twentieth century in the US), the issuance of high-powered money was essentially related to stability and efficiency needs. The stability issue arose because the previous situation of private issuers of banknotes, being profit maximizers, had incentives to print more notes than they could back with holdings of hold or silver. The efficiency issue was due to very high transaction and information costs entailed by the co-existence of many different private monies. [5]

The combination of the central bank monopoly in issuing “final” money and the participation of commercial banks in the money-creation process resulted in the involvement of central banks in financial stability. This is because central banks became the bank of other banks, by facilitating the settlement of interbank payments through rediscounting of commercial banks’ assets and the collection of reserves. In addition, since commercial bank money progressively developed into a large share of the money, the value of money again became dependent on the creditworthiness of commercial banks. In sum, the concern of central banks for the orderly functioning of the banking system arose from the need to maintain the value of money as a public good.

Since then, there have been several combinations of monetary and financial regimes and none has been fully successful at achieving both price and financial stability, at least in a liberalized financial system. Under the gold standard, there was a single anchor, gold convertibility, which aimed both at monetary and financial stability. Concerning the latter, financial institutions had to ensure they could always mobilize gold (or assets convertible into gold) to redeem their liabilities. The system, though, did not prevent waves of excessive expansion, followed by instability and bust. The interwar periods saw the replacement of the

[3] For a discussion on this issue, see García-Herrero and del Rio (2005).

[4] Thornton (1802) described de role of the Bank of England in financial stability.

[5] This paragraph draws from Padoa-Schioppa (2002).

discipline of the gold standard with fiat money standards. This led to a closer identification of monetary policy with the objective of price stability. But, at the same time, it loosened the constraints on credit expansion putting financial stability at stake. In fact, during the episodes of financial crises of the early 1930s, most countries introduced strict regulations for commercial banking and, sometimes for other financial activities. After the Second World War, the Bretton Woods system was a de facto dollar standard. Given the experience of the interwar period, strict controls were introduced on several domestic and international financial transactions. They system delivered price stability, as long as the US authorities were able to keep inflationary forces under control. It also delivered financial stability to some extent but at the heavy cost of inefficiencies in intermediation and misallocation of resources. This because of the very many controls introduced. The floating exchange rate regimes which followed the Bretton Woods system searched for alternative monetary anchors and for a means of disciplining the financial system within a more liberal environment. The approach followed included separating both objectives. For the pursuit of price stability, central banks have been given narrower objectives and more independence, in most cases. In fact, price stability has become the overriding objective of monetary authorities in many countries. As regards the strategy to achieve this goal, monetary targeting was the first choice in many cases although small open economies used exchange rate anchors. More recently, inflation targeting has been increasingly used. As for financial stability, prudential supervision was strengthened.[6]

This does not mean, however, that financial stability is no longer a concern of the central banks. First of all, financial and monetary stability are clearly intertwined. It is true that there is no yet consensus on how that relation is defined but nobody doubts that they are close phenomena. Second, many central banks still have financial stability as a separate explicit, or implicit, objective.

An operational definition of financial stability

Financial stability is an elusive concept to define, as proven by the fact that the opposite concept, financial instability, is much more often used.

The available definitions of financial stability are very general and hard to operationalize. A first example is that of Haldane, Hoggarth and Saporta (2001), which relates to the optimality of a saving-investment plan. Deviations from the optimal saving-investment plan may arise because of inefficiencies in the functioning of the financial system or from instabilities in the face of shocks. In the same line, Crockett (1997) defines financial stability as the absence of stresses that have the potential to cause measurable economic harm beyond a strictly limited group of customers and counterparties. Finally, Padoa-Schioppa (2002) understands financial stability as a condition where the financial system is able to withstand shocks without giving way to cumulative processes which impairs the allocation of savings to investment opportunities and the processing of payments in the economy.

The difficulty in coming up with a working definition of financial stability has led the literature to focus on financial instability. Even financial instability is not a well-defined concept. In fact, at least three major dimensions can be found in the literature: asset price volatility, financial fragility and banking crises.

Financial instability is often used synonymously to asset price volatility, which takes prices far away from their fundamental level, finally reversing suddenly and producing a “crash”

[6] This paragraph draws from Crockett (2000)

(Bernanke and Gertler (2000) and Crockett (2000)). The advantage of this definition is that it can be easily computed. The caveat, though, is that volatility is not necessarily bad for the functioning of financial markets. In fact, sound markets can have high volatility in asset prices without producing any major failure and, even if failures occurred, they would only constitute a problem if they had systemic consequences.

Moving away from the concept of volatility, a different dimension of financial instability is financial fragility. Bernanke and Gertler (1990) define it as a situation in which potential borrowers have low wealth relative to the size of their projects. Such a low insider's stake increases the agency problems and exacerbates frictions in the credit market. While probably more akin to the concept of financial instability, the problem with this definition is its measurement.

A third dimension of financial instability is based on extreme realizations, namely crises. Many different definitions of financial crisis exist. A very broad one is that of Mishkin (1996), where a financial crisis is a disruption to financial markets in which adverse selection and moral hazard become much worse, so that financial markets are unable to efficiently channel funds to those who have the most productive investment opportunities. Bordo *et al*. (1995) provide a much narrower definition in which a real – as opposed to pseudo – financial crisis is a flight to cash because of the perception that no institution will supply the necessary liquidity. These different definitions reflect the opposing theories concerning the causes of financial crises: asymmetric information in the former and monetary developments in the latter. In any case, both definitions include the danger of a failure of financial and/or non-financial firms.

While the identification of extreme events is probably easier than that of financial fragility, still such events may be very different in nature. In fact, banking crises can in some cases imply large deposit runs while in others deposit are stable but most of the asset side of the banks' balance sheet is non-performing. The existing surveys of banking crises put together all such different aspects of a banking crisis and consider an event as such in which at least one of those different aspects occur. As an example, Caprio and Klingebiel (1997), define a banking crisis as a situation where actual or incipient bank runs or failures lead to suspend the internal convertibility of their liabilities or force the government to intervene to avert this by replacing a significant share of the banks' capital. Gupta (1996), in turn, describes a banking crisis as a situation in which a significant group of financial institutions have liabilities exceeding the market value of their assets, leading to portfolio shifts or to deposit runs and/or the collapse of financial institutions and/or government intervention. Under such circumstances, an increase in the share of non-performing loans, an increase in financial losses, and a decrease in the value of the bank's investments cause solvency problems and may lead to liquidations, mergers and restructuring of the banking system. More recently, the IMF (1998) has coined a broad definition of banking crisis, in which actual or potential bank runs or failures induce banks to suspend the internal convertibility of their liabilities or which compel the government to extend assistance to banks on a large scale. All the different kinds of banking crises which are reflected in these definitions are summarized in a binary variable, which takes the value of one when the crisis occurs and which is constructed with the help of cross-country surveys (Lindgreen *et al*. (1996), Caprio and Klingebiel (2003)).

Central bank design and financial stability

While it is widely accept that the central bank is an important institution for ensuring financial stability, much less is known as to how it should be designed to achieve that goal.

If we first look into the central bank's most important function, namely monetary policy, its objectives are generally price stability and also output or employment stabilization for those central banks with broader objectives. In particular, it is well documented that a high degree

of central bank independence and an explicit mandate to restrain inflation are important institutional devices to ensure price stability (Berger, Haan and Eijffinger (2001)). The choice among different intermediate targets (i.e., monetary policy strategies) is less clear even for price stability and output stabilization although inflation targeting is receiving increasing support.[7]

There are many ways in which the design of monetary policy, in terms of objectives and intermediate targets, can affect financial stability. If it leads to a too lax monetary policy, inflation will tend to be more volatile and probably also asset prices. In addition, positive inflation surprises redistribute real wealth from lenders to borrowers and negative inflation surprises have the opposite effect. The latter kind of redistribution may provoke bankruptcy, with serious implications for the quality of banks' loans. In addition, a very tight monetary policy leading to very low inflation levels and, thereby, very low interest rates, makes cash holdings more attractive than interest-bearing bank deposits. This may induce disintermediation and, thereby, financial instability. On the other hand, if a tight monetary policy does not manage to bring down inflation and real interest rates remain high, financial stability might be at risk. Sharp increases in real interest rates may also have adverse effects on the balance sheets of banks and even bring about a credit crunch.

All in all, the implications of monetary policy design for financial stability seem to depend on which on the kind of relation between the two; that is whether there are synergies, or rather a trade-off - between them. If price and financial stability were complementary, one would expect the monetary policy design which better helps achieve price stability (namely, narrow central bank objectives and central bank independence) to also foster financial stability. However, if there were a trade-off, the situation could be the opposite or, at least it would be much harder to establish an *a-priori* on the impact of central bank design on financial stability.

Among the arguments for a trade-off, Mishkin (1996) argues that high level of interest rates, necessary to control inflation, negatively affect banks' balance sheets and firms' net financial worth, especially if they attract capital inflows. This is because capital inflows contribute to over-borrowing and increase credit risk, and may lead to currency mismatches if foreign capital flows are converted into domestic-currency denominated loans. Cukierman (1992) states that inflation control may require fast and substantial increases in interest rates, which banks generally cannot pass as quickly to their assets as to their liabilities. This increases interest rate mismatches and, thus, market risk. Another type of trade-off stems from too low inflation or deflation, which reduces banks' profit margins and, by damaging borrowers (and not lenders as inflation) increases the amount of non performing loans in banks' balance sheets (Fisher (1933)).

Among the arguments for synergies between price and financial stability, Schwartz (1995), states that credibly maintained prices provide the economy with an environment of predictable interest rates, leading to a lower risk of interest rate mismatches, minimizing the inflation risk premium in long-term interest rates and, thus, contributing to financial soundness. From this strong view of synergies, where price stability is practically considered a sufficient condition for financial stability, some more cautious supporters of the "synergies" view argue that price stability is a necessary condition for financial stability but not a sufficient one (Padoa-Schioppa (2002) and Issing (2003)).

The central bank performs other functions, in addition to monetary policy, which are closely related to the functioning of the financial markets and, as such, could have a bearing on financial instability. First, central banks are providers of immediate liquidity to financial

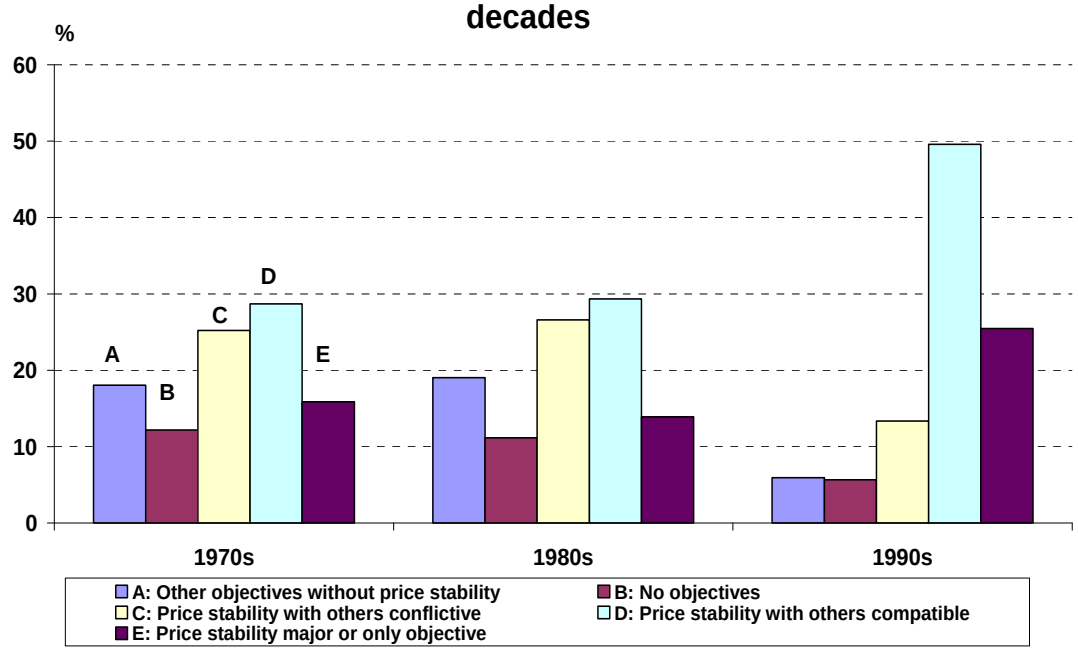
[7] In terms of macroeconomic performance, however, it is hard to argue that inflation targeting is clearly superior (Ball and Sheridan 2003).

institutions. Second, they are generally responsible for the smooth functioning of the payment system.[8] Third, central banks are in many cases in charge of regulating and supervising the financial system.

The central bank objectives and the way to achieve them – the monetary policy strategy – are crucial elements of the monetary policy design, determining the focus of the central bank and the stance of its monetary policy. We shall, thus, concentrate on these two aspects in our empirical study. Another important aspect is the degree of central bank independence, which clearly influences how much room central banks have to stick to their objectives.

Since their creation, central banks have moved back and forth in the objectives they have targeted. In the last decade, the trend has been to narrow down the central bank objectives to a single one, price stability, or at least to a set of objectives considered to be compatible with price stability (Figure 1). However, many other situations still exist: some central banks aim at price stability together with other – in principle non-compatible – objectives; others do not mention price stability in their list of objectives or do not have clearly specified objectives at all.

Figure 1: Distribution of central bank objectives by decades



As regards the choice of the monetary policy strategy, there is a wealth of literature on the advantages and disadvantages of each strategy for achieving price stability but no clear consensus on which one is preferred given certain central bank objectives. Furthermore, no evidence exists on how it may affect financial stability. While the choice of the monetary strategy will mainly depend on its relation with the central bank's main objective (on the basis that one instrument should serve one objective), it is still interesting to know whether there are any spillovers from the choice of the strategy towards financial stability.

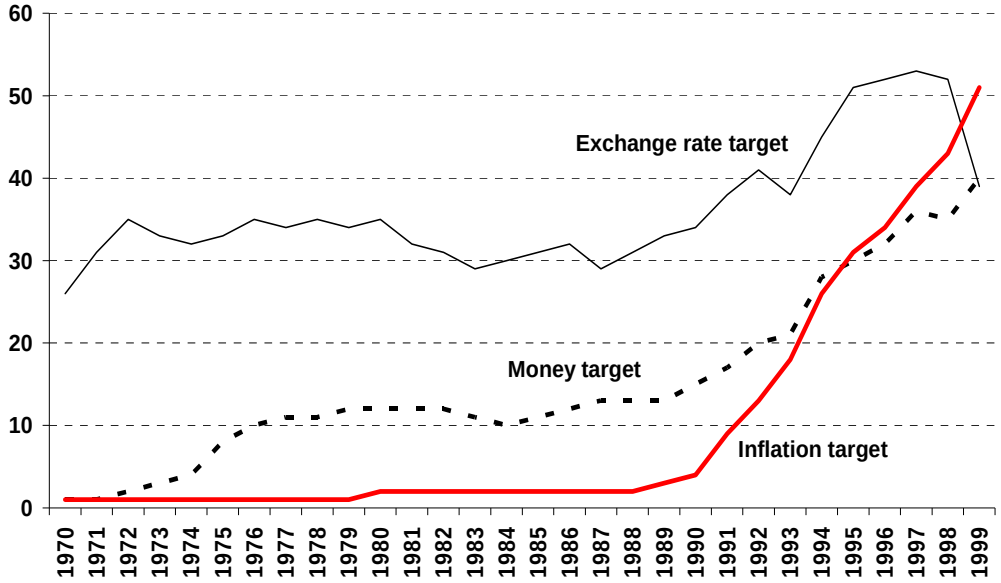
When compared with the central bank objectives, the ways in which the monetary policy strategy can affect financial stability are less clear-cut, although some argue that it should

[8] Padoa-Schioppa (2002) argues that financial stability considerations are taken into account when designing the central bank objectives and strategy.

have an impact (Padoa-Schioppa (2002) and Mahadeva and Sterne (2000)). Perhaps the most debated case is the exchange-rate based strategy. Domaç and Martinez Pería (2000) find that fixed exchange rate regimes, and implicitly an exchange rate-based monetary strategy, are preferred to reduce the likelihood of banking crises among developing countries. However, Eichengreen (1998) argues that whether fixed or floating exchange rate regimes reduce the probability of banking crises depends on the source of disturbances. If the threat to the stability of the banking system comes from outside, there is a case for exchange rate flexibility (which may translate into a monetary or inflation targeting in terms of the monetary policy strategy). Instead, if the threat comes from inside (i.e., erratic monetary policies at home), an exchange rate anchor is a better strategy. Finally, Eichengreen and Arteta (2000) also find mixed results. In sum, there is hardly any *a priori* on which strategy can better contribute to financial stability[9].

A historical overview of the monetary policy strategies shows that the number of central banks with direct inflation targeting strategies has surged from close to zero at the end of the 1980s to over 50 today (Figure 2). The number of central banks targeting a monetary aggregate has also grown albeit less rapidly; they are nearly 40 today. It is important to note that many of the central banks targeting money have an additional target in their monetary policy strategy, usually inflation targeting. The most obvious cases are the twelve euro countries, included separately in our exercise. On the contrary, central banks with an exchange rate anchor are less than 40 today from over 50 in the mid 1990s. This corresponds with a certain degree of disenchantment with fixed exchange rates, after the Mexican and Asian crises. The information available also shows that there is a growing number of central banks with more than one target in its monetary policy strategy. This could be understood as a growing preference for flexibility in the conduct of monetary policy.

Figure 2: Evolution of monetary policy strategies
(number of countries)



[9] It should be noted that exchange rate targets are considered less flexible, in as far as they are generally single targets, not coupled with money or inflation targets (Mahadeva and Sterne (2000)).

Central bank independence is also important in as far as it can influence the central bank's behavior. In fact, if a central bank is not independent, the government will probably determine its objectives and could even influence the way central banks perform other functions, (such as the lender of last resort), especially in circumstances of stress. The *a priori* for the impact of central bank independence on financial stability should, therefore, follow the same reasoning as for the central bank objectives. If synergies exist, a high degree of central bank independence, should not only foster price stability (as Alesina and Summers (1993) show), but also contribute to financial stability.

There are other functions the central bank may be responsible and that are related to financial stability. These include the involvement of the central bank in the payment system and its LOLR functions. In addition, some central banks are in charge of financial regulation and supervision and sometimes even of the setting up and/or oversight of the deposit insurance scheme (DIS), if not formally informally.

The payment system is an important vehicle to transmit the unsoundness of a particular financial institution to others. In addition, a malfunctioning of the payment system can cause disruption and, eventually, financial instability.[10] A central bank can oversee, operate and provide settlement guarantee and/or intraday liquidity. While the economic literature generally argues that the central bank's involvement in the oversight of the payment system contributes to financial soundness (BIS 2000), there is no consensus regarding the need for the central bank to be involved operationally. Goodhart and Schönmaker (1993) opine that there is no need for the central bank to run the payment system, as long as it can obtain sufficient information with real-time monitoring to oversee financial institutions; in addition, too large an involvement of the central bank could create moral hazard. In contrast, Summers (1991) argues in favour of an active role for the central bank in operating large value payment systems, because of the systemic risk involved, so that a safety net exists in case of malfunctioning of the system. More recently, the Core Principles for Systemically Important Payments Systems (2001) developed by the BIS offer broad guidance as to which should the responsibilities of a central bank be in the area of payments. At the minimum, it could be argued that the central bank's involvement in the payment system should be beneficial for financial stability when the private sector is not ready to take that task.

The central bank LOLR functions are generally considered useful to avoid systemic banking crisis but at the risk of creating moral hazard. Bagehot's basic principles are generally considered the benchmark for the extent of the LOLR, namely that only solvent (although illiquid) institutions should have the right to receive funds. From that benchmark, a more free-market view, such as that of Humphrey (1975), would argue that the importance of the central bank's LOLR function today is limited by the development of the interbank market. On the contrary, a more activist view is that of Goodhart 1987, De Cecco 1999 and He 2000, who advocate temporary central bank assistance even to insolvent banks on the basis that it is impossible to distinguish between insolvency and illiquidity in a short period of time. All in all, how broad the central bank LOLR functions should be seems very much related to the trade-off between bank stability and increasing moral hazard.

Finally, there is growing literature on where the regulation and supervision of the banking system should be located. This comes hand in hand with the trend towards moving prudential regulation and supervision outside the central bank and, in some cases, to consolidate it with the regulation and supervision of other financial institutions. Most of the literature, though, focuses on what is the most appropriate institutional arrangement for bank supervision in terms economic performance (Heller, 1991 and Goodhardt and Schönmaker,

[10] Cuadro, García-Herrero and Gallego (2003) analyze empirically the relation between the payment system and the development of the financial system.

1993) and only few in terms of the efficiency of the regulation and supervision and/or the reduction of bank unsoundness (Di Noia and Di Giorgio, 1999). The arguments in favor of placing supervision at the central bank are several. First, there are efficiency gains due to the strong complementarities between the personnel needed for the two functions (Beaufort Wijnholds an Hoogduin, 1994) and the type of information needed (Goodhart 2000, Mishkin 1992, and Peek et al., 1999). The latter is confirmed in Sinclair's questionnaire (2000), where supervisory data was the one ranked highest by central bankers for its usefulness to avoid financial distress. Second, co-ordination is much easier in several fronts: (i) between monetary policy and supervision (especially important if there are trade-offs rather than synergies between price and financial stability, which makes the consideration of financial stability factors warranted when conducting monetary policy); (ii) between the payment systems and supervision, since the operation and/or oversight of the payment systems gives useful information on the banks' market and liquidity risks while the supervisory information helps distinguish among banks which want access to intraday (and especially overnight) credit (Bernanke, 2001 and Goodhart, 2000); (iii) and the LOLR and supervision, since an in-depth knowledge of the banks' situation coming from banks' inspections, helps the central bank to distinguish between insolvent and illiquid institutions when injecting liquidity (Goodhart 2000). Finally, in line with the argument made by Hutchison and McDill (1999) for the LOLR, a sufficiently independent central bank is more likely to apply purely professional considerations in supervisory functions, including the closure versus the bailout of insolvent institutions, than would another institution closer to the political establishment (Bruno 1994). On the other side of the argument, placing supervision at the central bank increases the temptation of central bankers to compromise their monetary policy objectives for bank soundness reasons. This situation may occur not only in the case of a trade-off between price and financial stability, as previously mentioned, but also because the cyclical effects of micro (regulatory) and macro (monetary) policies tend to conflict (Goodhart and Schönmaker, 1993). Additionally, the financial system is moving towards an always weaker demarcation between the different financial intermediaries, which makes consolidated financial supervision more warranted. The central bank has much less of a comparative advantage for consolidated supervision (Goodhart 2000).

In the same way as the LOLR, the DIS is another important safety net for the financial system. The central bank is likely to influence the way it is set up and perhaps even oversee it. The existing literature finds that having a DIS reduces the likelihood of a crisis as long as it is explicit and limited and the institutional and regulatory environment is sound (Cull et al., 2000; and Demirgüc-Kunt and Kane, 2001). However, a DIS may increase the probability of banking crises, particularly if unlimited or implicit (Demirguc-Kunt and Detragiache, 1998).

Empirical results

Although the issue of this paper is complex and cannot be summarized in a regression, it seems interesting to see whether there is a common pattern in terms of the relation between central bank design and financial stability. This section briefly sets out the methodology for the empirical analysis, then the variable definition and the data used and, finally, the results obtained.

Methodology

We use cross-section analysis to study the question of interest, namely whether central bank design affects the likelihood of a country's becoming financially unstable either because of a crisis, a high degree of bank fragility or an asset bubble. The reasons why we opt for a cross section are twofold: First, institutional design is known rarely over time, and this is also the case of the central bank. Second, data availability is scarce. In fact, for many of the central bank functions analyzed, we can only have a snapshot of the situation but not the changes overt time.[11]

We, thus, use ordinary least square estimation but take to precautionary measures. An important issue is heteroschedasticity since very different countries (industrial and emerging) are included in our sample. We, thus, prefer to regress with robust standard errors. Another potential problem is endogeneity and, more specifically reverse causality. In fact, financial instability could be behind the design of the central banks, specially the LOLR but not only. There are very few things one can do to tackle endogeneity with a cross-section. The best one is probably to make sure that the data for the regressors has a time frame before that of the dependent variable. Data on central bank design is, thus, chosen before 1997 (and whenever possible as an average of as many years as data is available until 1996) and that of financial instability episodes after that date. [12] Finally collinearity could be an issue looking at some of the bi-variate correlations (Table 2 in Appendix). This is why –together with the limited number of observations – we focus on each of the central bank's function at each time and only take one control variable per regression.

Variable choice and data sources

In order to be as comprehensive as possible, five different dimensions of financial instability are considered in this paper: (i) the occurrence of a systemic banking crisis; (ii) a summary

[11] Time-variant data does exist for the monetary-related functions included in the paper. The results are generally consistent with the ones found her with a cross section. See García-Herrero and del Rio (2005) for further details.

[12] The possibility of reverse causality is somehow muted by previous findings in the literature. In particular, García Herrero (1997a) and Martinez Pería (2000) find empirical evidence that money demand is stable in the long run in countries having experienced systemic banking crises. García Herrero (1997a) also reviews seven case studies regarding the impact of banking crises on monetary policy, which includes the strategy and instruments, and reports that banking crises do not necessarily lead to substantial changes in the monetary policy design.

measure of bank fragility; (iii) housing bubbles; (iv) stock market bubbles; and, more generally, (v) asset price bubbles.

To account for systemic banking crises, existing surveys of crisis events with a large country coverage are used, namely those of Caprio and Klingebiel (2003) and Domaç and Martinez Pería (2000). This implies defining a banking crisis as the situation when a large part of the banking system is affected by the crisis, in terms of the number of banks, the share of assets or the amount of bank capital lost. Potential inconsistencies between the two surveys are checked for and, if they exist, other sources (such as IMF staff reports and financial news) are consulted to determine whether a country underwent a crisis. Table 1 in the Appendix shows the main statistics of each of the variables included and Table 3 (column 1) lists the countries which have undergone a systemic banking crisis since 1997 from the group included in our empirical analysis.

The second dimension of financial instability used n this empirical analysis is that of bank fragility. This is understood as a summary measure of the asset quality, profitability and efficiency of a country's banking system. Such measure is obtained using principle components.[13] Asset quality is proxied by the share of non performing loans to total loans drawn of a country's banking system during the period 1997 to 1999. This data is drawn from the Barth, Caprio and Levine (2002). Bank profitability is measured with the net interest margin in the same period and is drawn from the World Bank's Financial Structure Dataset. Bank efficiency by overhead costs to total assets and comes from the same source. Table 1 (column 2) in the Appendix shows the countries for which a summary measure of bank fragility is available.

The third dimension of financial instability is that of asset bubbles. Housing and stock market bubbles are analyzed separately since they may affect countries very differently depending on the distribution of household wealth. A housing bubble is proxied by a dummy variable which takes the value of one when housing prices are at least 5% above their trend since 1997 onwards years or so, and takes the value of zero otherwise.[14] In the same way, a stock market bubble is proxied by a dummy which takes the value of one when each country's main stock market index is at least 5% above its trend since 1997.

Finally, we use housing and stock market price developments together to come up with a more general measure of asset price bubbles. This is possible in as far as housing and stock market prices tend to move together for practically all countries in our sample. Since we do not know the distribution of household wealth, we opt for taking the average growth in stock and housing prices and translating them into a dummy which takes the value of 1 when such average price rises by at least 5% since 1997.

We now move to the variables chosen to account for the central bank design. The design of monetary policy is summarized in three indicators: the central bank objectives, the operational target (or monetary policy strategy) and the degree of central bank independence. Objectives are those which appear in the central bank law and do not necessarily coincide with the real ones, nor even with the final outcomes. In other words, a central bank may have the overriding objective of achieving price stability but still focus on

[13] The idea behind principle components is using a restricted set of variables, j, to describe other variables, k, where the j variables are a subset of the k ones (j < k). The subset of j variables (the principal components) is computed as linear combinations of the original k variables. Among the j principal components, there is one which best explains the variance of the original variables; this is the one with the highest eigenvalue, which should account for at least 50% of the variance (Jackson 1991).

[14] We follow Borio and Lowe (2002), who also take differences from trend. A more simple way is that of Kaminsky and Reinhart (1999) who take the differences from the mean.

employment and growth; and even it did not, it might still not manage to deliver stable prices. This could be related to its degree of independence – which we shall take into account in this study – but also to other factors, including the central bank institutional capability to achieve its objectives. We, thus, take existing information on declared central bank objectives –*de iure* - from different surveys, mainly Cukierman *et al*. (1992), Cukierman, Webb and Neyapti (1992), Cukierman, Miller and Neyapti (2002), and Mahadeva and Sterne (2000). Following their methodology, we construct an index, which takes a larger value the more narrowly the central bank statutory objectives focus on price stability. More specifically, it takes the value of 1 when price (or currency) stability is stated to be the only, or the main, goal. It takes the value of 0.75 when the price stability objective is accompanied by – in principle non-conflicting – objectives, such as financial stability. It takes the value of 0.50 when price stability goes together with others – in principle conflicting – objectives, such as economic growth and/or employment creation. In particular, this is the case when objectives such as employment or growth are stated separately without being qualified by statements such as "without prejudice to monetary or price stability". Finally, the index takes the value of 0.25 when there are no statutory objectives and 0 when there are statutory objectives but none of the existing goals is price stability[15]. Figure 3 (upper panel) shows the number of countries for each kind of objective (from narrower to broader).

The second variable accounts for the choice of intermediate target to achieve the central bank objectives. There are three major monetary policy strategies: exchange rate targeting, monetary targeting and direct inflation targeting. Three dummy variables are created, one for each strategy, which take the value of one when the central bank uses that specific strategy and zero otherwise. It should be noted that these dummies are not mutually excludable since there are countries whose central banks use two different monetary strategies in parallel. To construct these dummies, we use information on the monetary policy strategies of 94 central banks from a survey carried out by the Bank of England in 1999 (Mahadeva and Sterne (2000)). We complement the data with information from other sources. Regarding the exchange rate strategy, we use existing classifications of exchange rate regimes, namely, Reinhart and Rogoff (2002), Berg *et al.* (2002) and Kuttner and Posen (2001), to extract those countries which had exchange rate anchors during the 30 year period of interest for us. Data for monetary and direct inflation targeting are complemented with information in Kuttner and Posen (2001) and Carare and Stone (2003). Figure 3 (lower panel) shows how many countries use each of the three types of monetary policy strategies.

In order to take into account the degree of independence of the central bank, we include an index which measures to what extent the central banks are legally independent according to their charters, following the approach of Cukierman *et al.* (1992). This variable goes from 0 (least independent) to 1 (most independent) and is taken from Cukierman *et al.* (1992), for the 1970s and 1980s, and from Mahadeva and Sterne (2000) and Cukierman *et al*.[16] (2002) for the 1990s. Although many other indexes exist, these have been chosen because they cover the largest number of countries for the largest time frame and also because they are very similar in their construction[17]. In fact, both Cukierman *et al*. (1992 and 2002) and Mahadeva and Sterne (2000) clusters include the appointment, dismissal and term of office of Governor, the independence in policy formulation, the limitations in lending to the government, and the central bank objectives, as components of their central bank

[16] This is only available for transition countries.

[17] The construction of central bank independence indices differs widely. Mangano (1998) compares the Cukierman index and the Grilli-Masciandaro-Tabellini index and concludes that 45% of the criteria are not regarded as relevant in the second.

independence index. Figure 3 (middle panel) shows the distribution of countries according to their degree of central bank independence (from lower to higher).

Figure 3

Inflation focus, central bank independence and monetary policy strategy

Number of central banks (vertical axis)

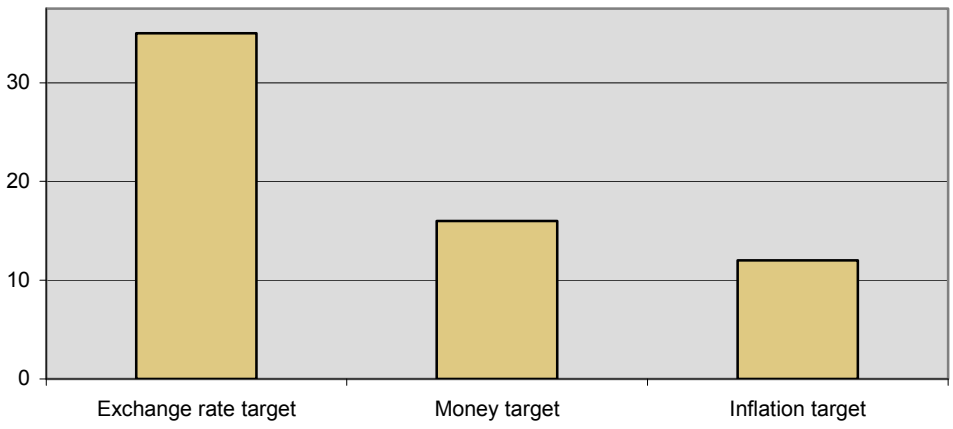
Price-stability oriented objectives [1]

Error! Not a valid link.

Central Bank Independence[1]

n**Error! Not a valid link.**

Monetary Policy Strategy



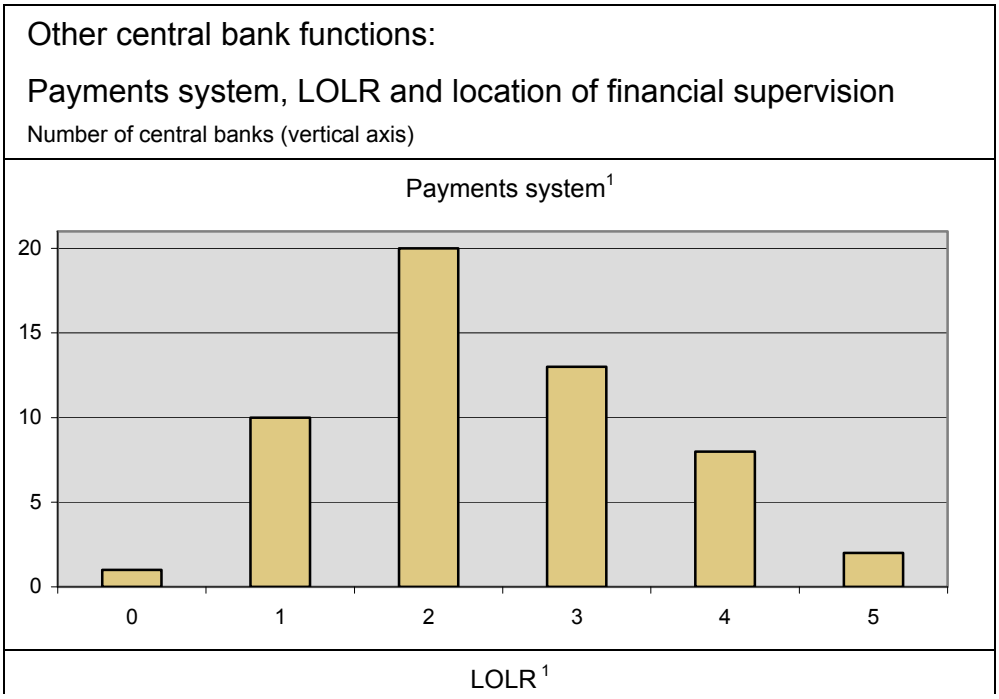
[1] A larger number on the horizontal axis indicate narrower central bank objectives (i.e., more inflation focus) and more central bank independence, respectively. Graph 1

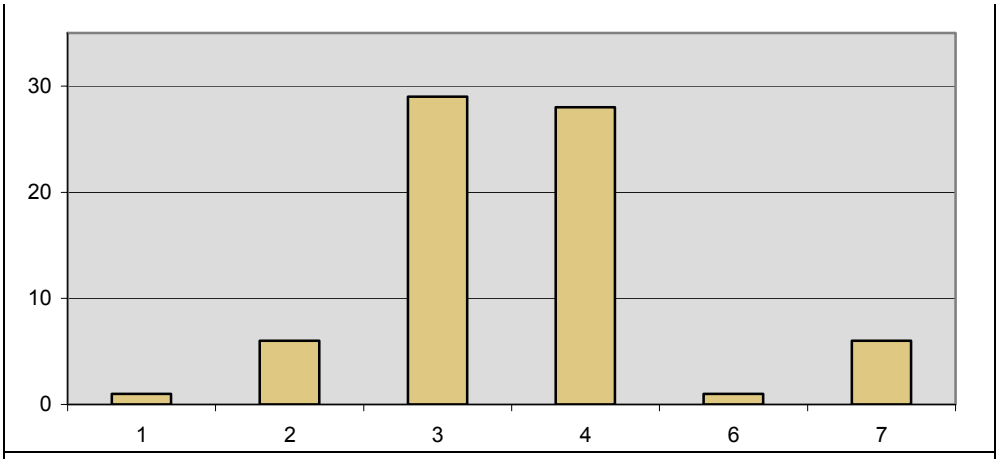
We now move to other central bank functions other than monetary policy. The first one is the payments system, which can have two main dimensions: the central bank's direct operation of the payment system and its oversight. In order to measure these two aspects to the maximum extent possible given the available data, we choose five potential roles which the central bank may play, namely: (i) the formal oversight of the system, (ii) the informal one, (iii) the direct operation of the payment system, (iv) the coverage of credit and liquidity risks through the extension of intraday credit into overnight credit, and/or (v) the guarantee of settlement failure. We, then, summarize this information in an index ranging from 0 to 5; where 0 means no involvement and 5 implies the maximum involvement possible. Data is mostly drawn from a survey in Fry et al. (1999) but also from Fry (1996) and published FSSAs from the IMF and the World Bank and own calculations from websites for several countries. Figure 4 (upper panel) indicates the central bank's degree of involvement in the payment system and for how many countries.

The extent of the central bank LOLR also differs from country to country. When broad, the central bank's mandate envisages liquidity injections even to insolvent institutions (and not only to illiquid ones). The other extreme is when the central bank cannot inject liquidity to single institutions. We, thus, define our LOLR variable as taking the value of 0 in the latter case, 1 when central banks can give funds to single illiquid institutions, and 2 when even allowed to inject to insolvent institutions. The main source of this data can be found in Sinclair (2000) and FSSAs from the IMF and the World Bank, and Jácome (2001) for some Latin American countries. Figure 4 (middle panel) shows how many central banks have narrow –as opposed to broader - LOLR functions.

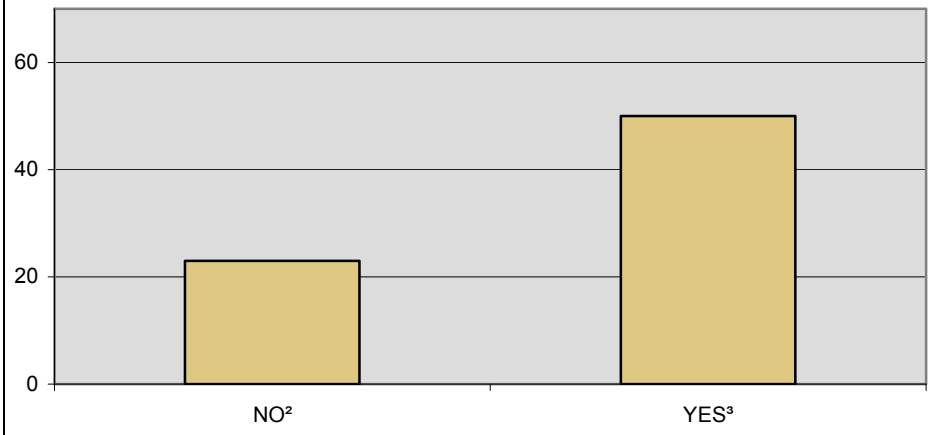
Finally, another financial-stability related function that the central bank may have is regulating and supervising the banking system. The survey conducted by Tuya and Zamalloa (1994) on whether it is the central bank or a separate agency to conduct bank regulation and supervision is used as data source. Figure 4 (lower panel) shows the number of countries under either of the two arrangements.

Graph 2





Responsibility for financial regulation and supervision



[1] A higher number on the horizontal axis indicates a larger involvement of the central bank in the payments system or a wider LOLR facility, respectively. [2] Separate supervisory authority. [3] supervision conducted by the central bank. Graph 2

The last institutional feature which could be related – at least indirectly- to the central bank is the DIS. This variable is a dummy which takes the value 1 for countries where there is an explicit deposit insurance system, since the year of its enactment until 1996, and 0 otherwise. It is drawn from a World Bank database compiled by Demirgürç-Kunt and Sabaci (2002).

Finally, two macroeconomic variables are considered as controls for the regressions**:** real GDP growth, from the IMF International Financial Statistics, and real GDP per capita in US dollar, from the World Bank World Tables[18].

Results

The first set of results explores the relation between central bank design and the likelihood of a banking crisis. Apart from the importance of such extreme events, in terms of the costs of financial instability, this set of regressions is also the most reliable in as far as they include data for as many as 60 countries.

[18] The EBRD Transition Report is used for some transition countries

Each central bank-related variable is analyzed separately and only one control is added, namely economic growth, to maximize the degrees of freedom. Robustness tests are conducted with different macroeconomic controls.

The most important finding is that the design of monetary policy significantly affects financial stability. More specifically, countries whose central banks have a price-stability oriented mandate have a significantly lower probability of suffering from a banking crisis (Table 1, column 1). The result holds even when including the monetary policy strategy as well (Table 1, column 4).

In the same way, more independent central banks are associated with a significantly lower likelihood of suffering a banking crisis (Table 1, column 2). As for the monetary policy strategy, monetary targeting is found significant in reducing the probability of a banking crisis (Table 1, column 3) but the result does not hold when the central bank orientation towards price stability is included as an additional variable (Table 1, column 4)

Finally, other central bank functions which in principle could have seemed more closely associated with financial stability, such as the LOLR or the central bank's involvement in the payments system, do not have a significant impact on the likelihood of a banking crisis.

Table 1

Central bank design and the banking crises						
Regression Number	*1*	*2*	*3*	*4*	*5*	*6*
Monetary policy design						
Price-stability oriented objectives	-1.88*** (0.00)			-1.78** (0.14)	0.82 (0.42)	0.45 (0.65)
CB independence		-2.76*** (0.00)				
Exchange rate targeting			-0.91 (0.90)	0.82 (0.43)		
Money targeting			-2.28** (0.05)	-1.99 (0.12)		
Inflation targeting			-1.33 (0.28)	-0.69 (0.60)		
Other CB functions						
Payment System					-0.43 (0.21)	
LOLR Summary						-0.33 (0.13)
Bank supervision						
Deposit Insurance						
Controls						
Real GDP growth	-0.09 (0.13)	-0.02 (0.97)	0.13 (0.30)	-0.07 (0.56)	0.68** (0.04)	-0.07 (0.28)
	Obs 60	Obs 60	Obs 60	Obs 60	Obs 43	Obs 60

Logit estimation

*** stands for 99% significance level; ** stands for 95% significance level and * stands for 90% significance level.

Standard deviation in brackets

The second set of results explores the relation between central bank design and bank fragility, defined as a summary measure of asset quality, profitability and efficiency. As before each central bank-related variable is analyzed separately but in this case we can also include the location of financial regulation and supervision and the existence of a DIS. Again, only one control is included, namely GDP per capita although robustness tests are conducted with other controls.

As was the case for banking crisis, the design of monetary policy significantly affects the degree of bank fragility. More specifically, countries whose central banks have a price-stability oriented mandate are associated with less fragile banking systems in a statistically significant way (Table 2, column 1). The result holds even when including the monetary policy strategy as well (Table 2, column 4).

The result for central bank independence is again the same as before: countries with more independent central banks tend to have less fragile banking systems. (Table 2, column 2). In turn, the choice of monetary policy strategy yields different results: exchange rate targeting is

significantly associated with more fragile banking systems but only when the central bank objectives are controlled for (Table 2, column 4). Monetary and inflation targeting are now indifferent choices.

As regards other central bank functions, a large involvement of the central bank in the payment systems seems to be counterproductive as it is significantly associated with higher bank fragility (Table 2, column 5). On the contrary, its role in the LOLR and bank supervision does not seem to matter (Table 2, column 6 and 7, respectively). Finally, the existence of an explicit DIS is also found significantly associated with more bank fragility (Table 2, column 8). All in all, the results for the payments system and the DIS would point to moral hazard considerations being important.

Table 2

Central bank design and bank fragility

Regression Number	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*
Monetary policy design								
Price-stability oriented objectives	-1.08*** (0.00)			-1.58*** (0.00)	0.35 (0.42)	0.86 (0.11)	1.14** (0.02)	1.06*** (0.00)
CB independence		-1.09** (0.04)						
Exchange rate targeting			0.45 (0.20)	0.89*** (0.00)				
Money targeting			-0.36 (0.38)	0.22 (0.55)				
Inflation targeting			0.21 (0.63)	0.32 (0.41)				
Other CB functions								
Payment System					-0.27** (0.03)			
LOLR Summary						-0.52 (0.59)		
Bank supervision							0.05 (0.88)	
Deposit Insurance								-1.05*** (0.01)
Controls								
GDP per capita	≈0*** (0.00)	≈0*** (0.00)	≈0 (0.21)	≈0*** (0.00)	≈0*** (0.00)	≈0*** (0.00)	≈0*** (0.00)	≈0*** (0.00)
	Obs 49	Obs 49	Obs 49	Obs 49	Obs 36	Obs 49	Obs 49	Obs 49

OLS estimation
*** stands for 99% significance level; ** stands for 95% significance level and * stands for 90% significance level.
Standard deviation in brackets

The results for housing bubbles are similar to previous ones although less reliable in as far as there are few observations. The design of monetary policy significantly affects the degree of bank fragility. In fact, central banks with a narrow mandate, i.e., oriented towards price stability, have a significantly lower likelihood of suffering from a housing bubble (Table 3, column 1). The same is true for a higher degree of central bank independence (Table 4, column 2). The monetary policy strategy does not seem to play a role: monetary targeting reduces the likelihood of a housing bubble even when the central bank objectives are included as an additional regressor (Table 4, columns 3 and 4).

As regards other central bank functions, a large involvement of the central bank in the payment systems and wide LOLR functions increase the likelihood of a housing bubble (Table 4, columns 5 and 6, respectively). Instead, who is in charge of bank supervision and the existence of a DIS are not found significant.

Table 3

Central bank design and housing bubbles

Regression Number	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*
Monetary policy design								
Price-stability oriented objectives	-2.06** (0.03)			1.78 (0.25)	1.08 (0.45)	0.15 (0.91)	1.71* (0.08)	2.28** (0.03)
CB independence		-2.50*** (0.01)						
Exchange rate targeting			-0.09 (0.89)	0.82 (0.49)				
Money targeting			-2.28*** (0.01)	-1.99** (0.04)				
Inflation targeting			-1.33 (0.27)	-0.69 (0.52)				
Other CB functions								
Payment System					-1.10*** (0.01)			
LOLR Summary						-0.67** (0.05)		
Bank supervision							-1.46 (0.13)	
Deposit Insurance								0.25 (0.71)
Controls								
Real GDP growth	0.23 (0.15)	0.33** (0.04)	0.13 (0.26)	0.23 (0.23)	0.68** (0.03)	0.37** (0.02)	0.37** (0.04)	0.24 (0.14)
	Obs 28	Obs 28	Obs 28	Obs 28	Obs 23	Obs 28	Obs 28	Obs 28

Logit estimation

*** stands for 99% significance level; ** stands for 95% significance level and * stands for 90% significance level.

Standard deviation in brackets

The fourth set of results, which concentrate on stock price bubbles, should be taken with great care because of the very low number of available observations. As before, central banks with a narrow mandate have a significantly lower likelihood of suffering from a stock market bubble (Table 4, column 1) but the result do not hold when including the monetary policy strategy as additional variable (Table 4, column 4). Also the result for central bank independence is in line with previous ones as more independent central banks are less subject to housing bubbles (Table 3, column 2). The monetary policy strategy, however, does not seem relevant this time.

Finally, larger LOLR functions seem to help in this case (Table 4, column 6) while the central bank's involvement in the payments system nor bank supervision are not found significant. The same is true for the existence of a DIS.

Table 4

Central bank design and stock market bubbles

Regression Number	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*
Monetary policy design								
Price-stability oriented objectives	-3.04* (0.10)			2.06 (0.41)	4.14 (0.21)	2.41 (0.30)	3.04* (0.09)	4.04 (0.24)
CB independence		-5.06** (0.02)						
Exchange rate targeting			1.75 (0.16)	1.50 (0.32)				
Money targeting			1.15 (0.24)	0.64 (0.58)				
Inflation targeting			-0.35 (0.76)	-0.40 (0.74)				
Other CB functions								
Payment System					-0.62 (0.29)			
LOLR Summary						1.13** (0.03)		
Bank supervision							-0.03 (0.97)	
Deposit Insurance								-1.09 (0.55)
Controls								
Real GDP growth	-1.56* (0.06)	-2.45*** (0.00)	-1.10 (0.09	-1.71*** (0.01)	-1.26 (0.23)	-3.18*** (0.01)	-1.56* (0.07)	-1.56 (0.12)
	Obs: 23	Obs: 23	Obs: 23	Obs: 23	Obs: 19	Obs: 23	Obs: 23	Obs: 23

Logit estimation

*** stands for 99% significance level; ** stands for 95% significance level and * stands for 90% significance level.

Standard deviation in brackets

Finally, when taking into account the joint evolution of housing and stock market prices, we still find some evidence that countries with price-stability oriented central banks perform better. The small number of observations and the fact that we do not know what is the composition of household wealth, in terms of residential property or stocks, make these results less reliable than the previous ones.

Table 5

Central bank design and asset price bubbles

Regression Number	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*
Monetary policy design								
Price-stability oriented objectives	1.26 (0.14)			-3.06** (0.03)	-0.40 (0.79)	0.77 (0.48)	1.16 (0.18)	0.69 (0.65)
CB independence		1.37 (0.18)						
Exchange rate targeting			0.07 (0.91)	1.49 (0.19)				
Money targeting			-0.18 (0.83)	0.78 (0.56)				
Inflation targeting			0.62 (0.57)	1.30 (0.19)				
Other CB functions								
Payment System					-0.49 (0.21)			
LOLR Summary						-0.15 (0.65)		
Bank supervision							-0.90 (0.48)	
Deposit Insurance								-1.95 (0.11)
Controls								
Real GDP growth	-0.07 (0.66)	-0.03 (0.86)	-0.28 (0.13)	-0.16 (0.35)	0.01 (0.62)	-0.04 (0.81)	0.01 (0.94)	-0.21 (0.26)
	Obs: 23	Obs: 23	Obs: 23	Obs: 23	Obs: 19	Obs: 23	Obs: 23	Obs: 23

Logit estimation

*** stands for 99% significance level; ** stands for 95% significance level and * stands for 90% significance level.

Standard deviation in brackets

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Conclusions

This paper explores the nexus between monetary and financial stability and, in particular whether synergies or a trade-off exist, looking into a specific question, namely how the design of the central bank may affects financial stability. Several dimensions of financial instability are considered, namely banking crisis, bank fragility, housing bubbles and stock market bubbles.

Within the design of the central bank, monetary policy-related aspects are explored, such as the central bank objectives, the degree of independence and the choice of the monetary policy strategy. In addition, other central bank functions which may be potentially relevant for financial stability are analyzed, namely its involvement in the payments system, the LOLR and the central bank responsibility for banking regulation and supervision.

While the results are still very preliminary and based on scarce data, they point to more independent and focused central banks being less prone to financial instability. This is generally true for all dimensions of financial instability included in this paper (Table 6). In the same vein, more independent central banks are found to be less prone to any of the dimensions of financial instability analyzed here. The evidence is more mixed for the choice of monetary strategy; if anything monetary targeting seems to perform better and exchange rate targeting worse.

Finally, the evidence for other central bank functions is not so robust for all specifications. When significant, however, it basically follows the same line as the monetary policy functions: a more focused central bank is generally associated with less financial instability in its different forms.

All in all, the empirical evidence from this paper supports the idea of synergies between price and financial stability, at least in terms of the central bank design. This also implies that not too large trade-offs should exist in the central bank design, particularly that of monetary policy.

Albeit preliminary and based on few observations, these results to a very important issue for central banks in the new century since they are increasingly confronted with maintaining financial stability –at least in its macroeconomic sense – while achieving other goals (price stability and in some cases output stabilization).

Needless to say additional extensions to this work would be needed to confirm the results, particularly a regards increasing the sample of countries included in the analysis and also defining in a more accurate sense different central bank functions.

Table 6

Summary of results

Dependent variable	Monetary policy					Other CB functions		
	Price-stability oriented objectives	CB independence	Strategies			Lender of Last Resort	Payment System supervision	Bank supervision
			Inflation targeting	Exchange rate targeting	Money targeting			
Bank crisis	-	-			-			
Bank fragility	-	-					-	
Housing bubble	-	-			-	-	-	
Stock Market bubble	-	-				+		
Asset bubble	-							

Only significant coefficients are reported in this table.

+ implies that the sign of the estimated coefficient is positive and – that the sign is negative

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APPENDIX

Descriptive Statistics

	Mean	Median	Max.	Min.	Standard deviation	Skewness	Kurtosis	Obser-vations
Dependent variables								
Banking crisis	0.150	0	1	0	0.361	1.960	4.843	60
Bank fragility	0.000	0.35	2.68	-3.58	1.382	-0.845	3.073	49
Housing bubble	0.321	0	1	0	0.476	0.765	1.585	28
Stock bubble	0.304	0	1	0	0.470	0.850	1.723	23
Asset bubble	0.217	0	1	0	0.422	1.370	2.878	23
Explanatory variables								
Monetary policy								
Inflation focus	0.71	0.75	1	0	0.273	-1.108	3.685	70
CB indep	0.65	0.68	0.97	0.21	0.234	-0.449	1.902	71
Strategy								
Exchange target	0.48	0	1	0	0.503	0.085	1.007	71
Inflation target	0.15	0	1	0	0.364	1.907	4.638	71
Money target	0.21	0	1	0	0.411	1.415	3.001	71
Other central bank functions								
Payment systems	2.42	2	5	0	1.126	0.331	2.652	50
LOLR	3.58	3	7	1	1.245	1.561	5.691	71
Supervision	0.69	1	1	0	0.466	-0.822	1.676	71
Control variables								
Growth	2.44	3.10	9.48	-17.1	4.335	-2.038	9.664	70
GDP p.c.	6997	5270	18651	149	5491	0.509	1.855	70

Sources: Bloomberg; World Bank; national data; BIS estimates.

Correlation Statistics

	Banking crisis	Bank fragility	Housing bubble	Stock bubble	Asset bubble	Inflation focus	CB indep	Exchange target	Inflation target	Money target	Payment systems	LOLR	Supervision	Growth	GDP p.c
Banking crisis	1.00														
Bank fragility	0.31	1.00													
Housing bubble	0.67	0.35	1.00												
Stock bubble	-0.38	0.05	-0.25	1.00											
Asset bubble	0.26	-0.01	0.52	0.29	1.00										
Inflation focus	0.30	-0.19	0.04	-0.07	-0.13	1.00									
CB indep	-0.54	-0.85	-0.32	0.23	0.08	0.05	1.00								
Exchange target	0.38	0.27	0.25	0.37	0.10	0.34	-0.23	1.00							
Inflation target	0.08	0.33	0.36	-0.37	0.29	0.03	-0.27	-0.31	1.00						
Money target	0.32	-0.16	0.21	0.24	0.41	0.57	-0.06	0.48	-0.12	1.00					
Payment systems	0.43	0.12	0.29	-0.72	-0.24	0.22	-0.11	-0.12	0.39	-0.39	1.00				
LOLR	0.26	0.22	-0.07	0.36	0.18	0.22	-0.38	0.56	-0.28	0.54	-0.49	1.00			
Supervision	0.32	0.15	0.21	-0.48	0.00	0.18	-0.43	0.12	0.24	0.25	0.05	0.54	1.00		
Growth	0.93	0.45	0.74	-0.51	0.20	0.17	-0.62	0.25	0.23	0.11	0.52	0.22	0.48	1.00	
GDP p.c	-0.64	-0.40	-0.50	-0.14	-0.45	-0.41	0.51	-0.75	-0.19	-0.65	0.07	-0.66	-0.44	-0.55	1.00

Sources: Bloomberg; World Bank; national data; BIS estimates.

Table 3

	Banking crisis	Bank fragility	Housing bubble	Stock bubble
Argentina	0	a		
Armenia	0	a		
Australia	0	a	0	0
Austria		a	0	0
Bahamas				
Barbados				
Belgium	0	a	0	1
Bolivia		a		
Botswana	0	a		
Brazil		a		
Canada	0	a	0	0
Chile	0	a		
China				
Colombia	0			
Costa Rica	0			
Croatia	0	a		
Cyprus	0			
Czech Republic	1	a		
Denmark	0	a	1	0
Ecuador				
Egypt	0	a		
Estonia	1	a		
Finland	0		1	1
France	0	a	0	1
Germany	0		0	0
Ghana	0	a		
Greece	0	a	0	1
Honduras	0			
Hong Kong	0		1	0
Hungary	0	a		
Iceland	0	a		
Indonesia	1	a	1	0
Ireland	0		1	
Israel	0	a		
Italy	0	a	0	0
Japan		a	0	0
Kazakhstan	0	a		
Kenya	0	a		
Korea	1	a	0	0
Latvia	1	a		
Lithuania	0	a		
Macedonia	0	a		
Malaysia	1	a	1	0
Malta	0	a		
Mexico	0	a		
Moldova	0	a		
Mongolia	0			
Netherlands	0		1	0
New Zealand	0	a	0	
Nigeria	0	a		
Norway	0		1	
Paraguay				
Peru	0	a		
Portugal	0	a	0	
Russian	1	a		
Singapore	0		1	0
Slovenia	0	a		
South Africa	0	a	0	

Spain	0	a	0	1
Sweden	0		0	1
Switzerland	0	a	0	1
Tanzania				
Thailand	1	a	0	0
Turkey	0	a		
Uganda				
Ukraine	1			
United Kingdom	0	a	0	0
United States	0	a	0	0
Uruguay	0			
Venezuela	0	a		
Zambia	0	a		
Zimbabwe		a		