What Caused the Global Financial Crisis?–Evidence on the Drivers of Financial Imbalances 1999-2007*†

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Abstract: This paper investigates empirically the drivers of financial imbalances ahead of the global financial crisis. Three factors may have contributed to the build-up of financial imbalances: (i) rising global imbalances (capital flows), (ii) monetary policy that might have been too loose, (iii) inadequate supervision and regulation. Panel data regressions are performed for OECD countries from 1999 to 2007, so as to shed light on the relative importance of these factors, as well as the extent to which these factors might have interacted in fuelling the build-up. We find that the build-up of financial imbalances was driven by capital inflows and an associated compression of the spread between long and short rates. The effect of capital inflows on the build-up is amplified where the supervisory and regulatory environment was relatively weak. We find that, by contrast, differences in monetary policy cannot account for differences across countries in the build-up of financial imbalances ahead of the crisis.

JEL: E5, F3, G28
Keywords: Global imbalances, monetary policy, supervision and regulation

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1 Introduction

The crisis that began as the U.S. "subprime" crisis in the summer of 2007 spread to a number of other advanced economies through a combination of direct exposures to subprime assets, the gradual loss of confidence in a number of asset classes and the drying-up of wholesale financial markets. In this process it came to expose "home-grown" financial imbalances in a number of advanced economies, typically characterized by an overreliance on wholesale funding sources by the banking system and asset bubbles in residential property markets.

Three years after the onset of the crisis, there is still no full agreement among policymakers and researchers on what caused the build-up of financial imbalances globally. While most commentators concede that supervision and regulation were lacking with hindsight and efforts to strengthen regulation are well underway, strong disagreement persists on whether it was overly accommodative monetary policy from 2001 that fuelled the build-up (Taylor, 2007, White, 2009) or whether the widening global imbalances and associated capital flows were the root cause of the build-up of financial imbalances across advanced economies (e.g., Bernanke, 2009, King, 2010, Portes, 2009). As argued by some (e.g., Acharya and Richardson, 2009, Obstfeld and Rogoff, 2009), it may have been a combination of accommodative monetary policy and growing global imbalances that caused the build-up. But even if this were to be so, an empirical determination of these factors' relative contribution remains an important and unfinished task.

Taylor (2007) argued that in the United States, the demand for housing is sensitive to money-market interest rates and that accommodative policy on the part of the Federal Reserve from 2001 was likely therefore to have contributed to the build-up in housing demand and asset prices. Similarly, White (2009) conjectured that when the stock market boom of the late 1990s collapsed and rates were sharply reduced in response "the seeds of the housing market boom and bust were sown."

Against this, Del Negro and Otrok (2007) found that the impact of accommodative monetary policy on house prices had been small relative to the overall housing price increase in the United States.[1] Greenspan (2010) pointed out that U.S. house prices are more closely related to long-term rates, whereas the relationship between short and long rates had been weak over the period. Indeed, some economists argue that as a matter of principle, monetary policy has little control over long-term rates[2] and instead point to increasing global imbalances as the main cause of low nominal and real rates over the period in the United States as well as elsewhere.[3] Looking across countries, IMF (2009a) found that while in many economies, policy rates had been low by historical standards, there was virtually no association between measures of the monetary policy stance and

[1] Dokko et al (2009) come to similar conclusions.

[2] Gerlach et al (2009)

[3] Bernanke (2005), Paulson (2008), Gourinchas (2010)

house price increases across advanced economies.[4]

On the other hand, existing cross-country evidence points to a robust relationship between capital inflows and house price appreciations. Aizenman and Jinjarak (2009) found for a sample of 43 countries that a one standard deviation (4 per cent) increase in the (lagged) current account deficit is associated with a 10 per cent increase in real estate prices, controlling for a range of other macro factors. Obstfeld and Rogoff (2009) found a significant negative relationship between the change in the ratio of the current account to GDP and the cumulative appreciation in real house prices over 2000-2006. And Reinhart and Reinhart (2008) found that surges in capital inflows are associated with increases in both real equity prices and house prices across advanced economies over much longer sample periods.

In this research we expand on the existing evidence in several ways. First, we present cross-country evidence on what caused the build-up of imbalances within the financial sector ahead of the crisis. This complements the existing cross-country evidence on the build-up of asset (house) prices. It also complements single-country studies on the effect of monetary policy on banking sector risk taking.[5]

Second, we assess both the role of monetary policy and that of global imbalances in contributing to the build-up of financial sector imbalances. This addresses what could be an important shortcoming in existing research on the effect of monetary policy on financial sector risk taking, where capital flows and their effect on long-term interest rates are often ignored.[6]

Third, we examine the role of key aspects of supervision and regulation. Bringing in the supervisory dimension enables us to come to a firmer assessment of which—if any—macro factor (monetary policy or global imbalances) might have been at the root of the crisis, by examining the extent to which these factors interact with weakness in the supervisory environment.

Fourth, there is scant existing evidence on the role of supervision and regulation in the run-up to the crisis and the existing regulatory reform agenda has largely been shaped without the benefit of such evidence. This research starts to close this gap,

[4] According to IMF (2009a), for example, whereas Ireland and Spain had low real short-term rates and large house price rises, Australia, New Zealand, and the United Kingdom also had large house price rises, but relatively high real rates. At the same time, several countries such as Germany, Switzerland and Japan experienced little or no increase of house prices, or even saw declines, notwithstanding persistently low interest rates in some cases (Dokko et al, 2009).

[5] Adrian and Shin (2008) show that a low federal funds rate causes balance sheets of U.S investment banks to grow, as low rates reduce the cost of funding in wholesale markets. Adrian and Shin do not find this effect to be at work for U.S. commercial banks however. A growing number of single-country studies analyzed whether banks take more credit risks and loosen lending standards when policy rates are low, e.g., Jiménez et al (2007).

[6] Sá, Towbin and Wieladek (2009) study the effect of both capital inflows and monetary policy on the housing market. Our study differs in that we focus on imbalances within the financial sector, rather than housing related outcomes.

enabling a firmer assessment of which aspects of supervision and regulation may need to be strengthened to avoid a repeat of the crisis.

Our main measure of "home-grown" financial sector imbalances ahead of the crisis is the rapid expansion of credit sourced in wholesale funding markets over the period 1999 to 2007. The increase in wholesale funding may have been encouraged by abundant liquidity ahead of the crisis, but became the Achilles heel of the global financial system when funding markets dried up from the summer of 2007 and increasingly from the autumn of 2008.

We find that cross-country differences in the strength of capital inflows over the sample period had a strong impact on the build-up of these imbalances. We identify a compression of long rates relative to short rates from 2004 as an important mechanism through which rising global imbalances had an effect on the balance sheet expansion sourced in wholesale funding markets. By contrast, we do not find that differences in monetary policy—as measured by short rates or deviations from Taylor rule benchmarks—had an effect on the build-up of financial imbalances when capital flows are accounted for.

When assessing the effect of differences in the supervisory regime on the build-up of financial sector imbalances we find that the balance sheet expansion sourced in wholesale funding markets was less pronounced where (i) supervisory and resolution powers were strong (ii) the central bank was in charge of supervision and regulation and (iii) barriers to entry were high. These findings points to widespread moral hazard and ineffective supervision as additional causes of the build-up. Not only are these factors shown to be economically relevant, they also reduce the effect of capital flows—and of the resulting compression of spreads between long and short rates— on the build-up of financial imbalances, strengthening the causal interpretation of our findings.

Our main conclusions on the relative importance of global imbalances and monetary policy carry through when we replace our main measure of financial imbalances—the ratio of bank credit to deposits—by alternative measures of "home-grown" financial imbalances across countries, such as the ratio of bank credit to GDP (a more standard measure), the ratio of financial sector credit to deposits (a broader measure, including credit provided by non-banks), household sector leverage (an alternative broader measure) and house prices. For each of these measures, the strength of capital inflows, rather than the local monetary policy stance, re-emerges as the key determinant of differences in the growth of financial imbalances across OECD countries over the pre-crisis period.

Finally, while our main measure of financial imbalances—the ratio of bank credit to deposits—abstracts from cross-border exposures held in trading books as well as those created by conduits and held off the sponsoring banks' balance sheet, in an extension we examine the effect of policy rate differentials on the pattern of capital flows across countries—and hence cross-country exposures measured in the aggregate. We find that for smaller advanced countries, inflows are stronger where policy rates had been high relative to global rates.

In Section 2 we review in greater detail the channels through which current account deficits, monetary policy and the supervisory environment might have led to the build-up of financial imbalances globally ahead of the crisis. This section also highlights testable hypotheses and prepares the ground for a more in-depth discussion of our data and empirical approach, contained in Section 3. Section 4 presents the main results. Section 5 offers a discussion of a range of additional tests that were conducted to assess the robustness and economic plausibility of our results. Section 6 extends the analysis further by asking to what extent monetary policy might have contributed to capital flows across countries. In Section 7 we offer some thoughts on implications for policy.

2 Macroeconomic Causes and Hypotheses Tested

2.1 Monetary policy

The literature has identified a number of channels through which monetary policy might have contributed to the build-up in financial imbalances. Most of these are thought to have worked through policy rates that were kept low for too long.[7] Loose monetary policy (a low short-term rate) may have (i) reduced the cost of wholesale funding for intermediaries, leading those intermediaries to build-up leverage (Adrian and Shin, 2008); (ii) may more generally have caused banks to take more risks, including credit and liquidity risks (Borio and Zhu, 2008); and (iii) may have increased the supply of and demand for credit (mortgages), causing asset (house) prices to rise (Taylor, 2007).

Whether low policy rates affect financial intermediaries through a "risk-taking" channel is investigated empirically in a number of studies.[8] Against this, De Nicolò et al (2010) argued that the effect of low short term rates on risk-taking could be ambiguous. They point to an opposing "risk-shifting" channel whereby lower policy rates are associated with lower risk taking, since low short rates increase intermediation margins and profits, which in turn can reduce the incentive for intermediaries to take risks.[9]

[7] Some commentators argue that markets had come to expect central banks to reduce policy rates in response to crises and that this in turn had created incentive to take risks, a mechanism often referred to as the "Greenspan put". The incentive effect of such a conditional expectation is difficult to capture empirically, since it is likely to be bound up with expectations of broader state support in the event of a crisis. Such support might include in addition government guarantees of liabilities issued by banks, unlimited deposit insurance and capital support provided by the government, Alessandri and Haldane (2009). Some argue nonetheless that monetary policy should lean against the build-up of financial imbalances, so as to reduce the asymmetry that otherwise results from central banks' inclination to ease policy in response to crises, White (2009). Such a prescription hinges once again on the assumption that a high rate would tend to reduce the build-up of financial imbalances.

[8] E.g., Jiménez et al (2007) and Gambacorta (2009).

[9] The idea that an increase in deposit rates increases banks' incentives to take risks has first been modeled formally by Bhattacharya (1982). Hellman, Murdoch and Stiglitz (2000) offer a multi-period version of his model and examine whether prudential policies can induce efficient risk choices. In both

Some commentators argue that the U.S. Federal Reserve had kept policy rates low for too long after the 2001 recession. Others argue that policy rates had been unusually low globally ahead of the financial crisis.[10] Both at the national (U.S.) and at the global level, measuring the effect of monetary policy on financial sector risk runs up against the lack of a counterfactual path of monetary policy. Identification of the effect of monetary policy in a national or a global time series context is therefore plagued by omitted variable biases that can lead to spurious relationships.

In our empirical exercises, we achieve a more robust identification of the effect of monetary policy on risk taking by exploiting differences in the time path of the monetary policy stance across countries. We turn to an examination of the effect of global monetary conditions only as part of a robustness check.

2.2 Global imbalances

Rising global imbalances are associated with a greater dispersion of current account positions across countries and larger net flows of capital between countries. At the level of an individual country, a current account deficit is matched by net capital inflows, as foreign investors build up claims on the domestic economy.

High capital inflows in turn (i) can reduce the cost of wholesale funding for domestic banks in international markets (Ostry et al 2010); (ii) may reduce long–term interest rates (and thus compress spreads), causing financial institutions to lever up and investors to "search for yield" (Bernanke, 2005) [11]; and (iii) may increase the total supply of credit to the domestic economy, causing local asset (house) prices to rise (Reinhart and Reinhart, 2008).

Even before the crisis some commentators argued that global imbalances had reduced long-term interest rates around the world (Bernanke, 2005). The argument advanced was that a global excess of desired savings relative to desired investment—a "savings glut"—had reduced long term rates globally, including in the United States.[12] In a variation on

studies, deposit rates are determined in equilibrium, however, rather than closely tied to the monetary policy stance.

[10] According to Obstfeld and Rogoff, 2009, "the high level of global liquidity, including the possibly global reach of U.S. monetary policy contributed to the worldwide upward pressure on housing." According to Hume and Sentence (2009), "while monetary policy seemed appropriate for many countries individually, at the global level it was too loose".

[11] Rajan (2005) explains how insurance companies and hedge funds have an incentive to seek out riskier investments when long-term nominal rates are low. These risk-shifting incentives may arise more generally when intermediaries have minimum targets for nominal returns.

[12] Among the factors explaining the increase in desired savings, Bernanke emphasized the effects of the Asian crises in the late 1990s which prompted many emerging economies to increase international reserves, in an effort to self-insure against future vulnerability. This led to capital flows from emerging economies into advanced economies, including notably the United States. Similarly, according to Caballero et al, following the Asian financial crisis Asian economies' capacity to generate safe financial assets had

this idea, Caballero, Farhi and Gourinchas (2008) argued that the coexistence of global imbalances and low interest rates stemmed not from a "savings glut" but from a shortage of safe financial assets. In particular, growth in emerging economies had outstripped these countries' ability to produce safe financial assets, causing savings to flow into advanced economies, and depressing long rates in the process. Whatever their precise origin, low nominal long rates might in turn have induced investors to seek risky strategies and "search for yield".

As re-stated by King (2010), "the massive flows of capital... into western financial markets pushed down interest rates and encouraged risk-taking on an extraordinary scale. Banks expanded their balance sheet and new instruments were created to satisfy the search for yield."

A rigorous empirical test of the effect of global conditions on global developments again runs up against the lack of a counterfactual.[13] As a result, according to Taylor, "the main problem with this explanation is that there is no actual evidence of a global savings glut." However, what had been less well appreciated ahead of the crisis, but is alluded to above, is a more precise and testable hypothesis: that a compression of the spread between long and short rates that is brought on by capital inflows at the individual country level affects the incentives of financial institutions to lever up.

Such an incentive arises when, as is often claimed, banks have nominal targets for their return on equity (ROE).[14] Since banks lend long but borrow short, a compression of the spread between long rates and short rates will tend to reduce banks' margins. To compensate and maintain the same return on equity, banks have an incentive to expand their balance sheet and increase leverage.[15] As noted by Haldane et al (2010), "the decision by many banks to increase leverage appears to have been driven in part by a desire to maintain ROE, relative to competitors, even as return on assets fell."

2.3 Supervisory and regulatory factors

Supervision and regulation of the financial system is a key means to prevent crises, by controlling moral hazard and discouraging excessive risk-taking on the part of financial institutions. Inadequate supervision and regulation are therefore prime candidates to

diminished, with the consequence that Asian central banks stepped in to provide a financial intermediary role whereby domestic savings were directed to the United States.

[13] We attempt to assess the effect of a rise in global net capital flows on the build-up of financial imbalances in a robustness check only.

[14] Indeed, in practice, banks typically announce a long-term target for their return on equity. Acharya and Franks (2008) discuss how such targets can distort decisions, especially when combined with an assumption that the cost of (non-equity) funding is independent of the level of leverage taken.

[15] Few theoretical studies focus on the differential effect of long and short rates on banks' risk choices. However, the models by Bhattacharya (1982), Thakor (1996) and Diamond and Rajan (2009a) are all consistent with the idea that, for a given short rate, low long-term interest rates increase the incentives for banks to increase credit and leverage.

have caused the global financial crisis. We examine the relationship between the build-up of financial imbalances and differences in the strength of the supervisory and regulatory regime across countries, along a number of dimensions that are further spelled out below, in Section 3.

More specifically, a number of commentators have pointed out that supervision and regulation failed to rein in the build-up of risks that was fuelled by macroeconomic factors. For example, according to King (2010), "Capital flows provided the fuel which the developed world's inadequately designed and regulated financial system then ignited to produce the firestorm that engulfed us all."

King (2010) stressed capital inflows as the key macroeconomic factor. However, an alternative and perhaps a priori no less compelling argument can be made that that it was loose monetary policy that provided the "fuel" for the build-up of financial imbalances, while the "transmission" from loose monetary policy to the build-up of financial imbalances was left unchecked by inadequate supervisory and regulatory policies (Figure 1).

These competing hypotheses open the door for a powerful test of whether monetary policy or global imbalances were at the root of the crisis. If either monetary policy or global imbalances are to have caused the crisis, by driving the build-up of financial imbalances, the effect of the relevant macro factor should have been less pronounced where the supervisory environment was relatively strong. We assess this formally by interacting both global imbalances and monetary policy with key aspects of the supervisory environment.

3 Data, Variables, and Empirical Approach

3.1 Outcome variables

Existing cross-country research has analyzed the effect of macro factors on asset (house) prices and other housing related outcomes, such as residential investment. This research focuses instead on the drivers of the build-up of imbalances within the banking system. In so doing, we follow many commentators who note that a defining feature of this crisis was an increase of bank leverage that was sourced in wholesale financial markets rather than in traditional deposit markets, e.g., Brunnermeier (2009), Diamond and Rajan (2009b), Acharya and Richardson (2009), IMF (2010b), Perotti and Suarez (2010). Reliance on wholesale funding exposed banks to significant roll-over risks which crystallized when wholesale funding markets dried up from the summer of 2007 and increasingly the autumn of 2008. As a result, commercial banks from across the OECD with a larger share of wholesale funding experienced greater stock price declines and were more likely to face government intervention (Huang and Ratnovski, 2009, IMF 2009b). Indeed, Huang and Ratnovski conclude that a large share of wholesale funding was the most robust predictor of distress for financial institutions during the crisis.

To capture the build-up of leverage sourced in wholesale markets at the country level, we use the ratio of private credit extended by banks to bank customer deposits at the country level. A higher reading corresponds to a greater amount of wholesale funding in the capital structure. When the local supply of deposits is fixed in the short-run, an increase in wholesale funding also allows banks to "lever up" so as to expand their balance sheets and extend a greater amount of credit. For brevity, we therefore often refer to the ratio of bank credit to deposits simply as "leverage".[16]

The ratio of credit to deposits is available consistently over time for OECD countries over the sample period (1999-2007). It therefore lends itself to a test of whether abundant funding liquidity, as manifest in this variable, was brought on by capital flows (global imbalances) or low policy rates (monetary policy) ahead of the crisis.[17]

In addition, since the ratio of credit to deposits measures a key vulnerability of the banking system, it can also be related to differences in the regulatory regime as applied to banks, for which consistent data are readily available.

While the ratio of credit to deposits captures well conceptually the vulnerabilities arising from wholesale-funded increases in leverage, we also validate this measure empirically in a number of ways. We first verify that there has indeed been a sizable increase in the average across OECD countries of this measure in the run-up to the crisis (Figure 2). We find, moreover, that a similar build-up of the ratio of credit to deposits preceded previous regional crises: for both the Nordic crisis of 1991 and the Asian crisis of 1997 we document an increase in the ratio of credit to deposits starting some 10 years ahead of the crisis, followed by sharp decreases during the crisis episodes (Figure 3).

Second, sharp rises in household sector indebtedness and sizable house price increases in a number of countries are further features of the run-up to the global financial crisis. Since we want to focus on developments within the banking sector, so as to assess, inter alia, the effect of supervision and regulation on these developments, we do not use household sector indebtedness or house prices as our primary outcome variables. However we find that there is substantial correlation across countries between the ratio of credit to

[16] The ratio of credit to deposits corresponds closely traditional concepts of "leverage" for banking firms. First, since deposits are sticky, but wholesale funding is often short-term an increase in the ratio of credit to deposits corresponds to an increase in the ratio of short-term debt to long-term funding. In addition when capital requirements are insensitive to the increase in liquidity risks an increase in the ratio of wholesale funding would also tend to result in an increase in the ratio of non-deposit debt to equity. Both of these ratios are often referred to as measures of leverage for banking firms, see e.g. IMF (2009b).

[17] The ratio of bank credit to bank deposits measures the extent of non-deposit funding for on-balance sheet credit to the domestic non-financial sector. It is a comprehensive measure of all non-deposit funding of on-balance sheet credit, including short-term secured and unsecured funding, such as commercial paper issued by banks and held by domestic money market mutual funds, and medium term notes and bonds held by a range of domestic and foreign investors. While desirable, a breakdown of funding into short-term and long-term instruments is not available either from the IFS data we use, or even from international bank-level databases (Huang and Ratnovski, 2009).

deposits and house price increases across the OECD (Figure 4). The correlation is about 50 per cent and is significant at the 5 per cent level.

Moreover, in robustness exercises, we assess formally whether our main conclusions on the relative importance of monetary policy and global imbalances carry through to alternative and broader measures of financial imbalances, such as the ratio of financial sector credit to bank deposits, the ratio of household sector debt to GDP and house prices. These tests account for the fact that the importance of the banking sector in providing credit has differed across countries and that in some countries, the share of domestic credit provided by non-banks and through securitization off the balance sheet of the banking system was sizable.

Third, the recent global financial crisis was characterized by an unprecedented level of government support for banking systems that appeared close to systemic collapse around the world, with most systemic measures taken from the autumn of 2008. We find that the ratio of credit to deposits ahead of the crisis is correlated with the total amount of support granted across countries (Figure 5), in line with existing bank-level evidence on the importance of wholesale funding in determining the likelihood of government intervention. At the country level, the correlation is again around 50 per cent and it is significant at the 5 per cent level. This underscores the importance of "home-grown" imbalances in accounting for the fiscal cost of the crisis across countries.

Despite our finding of a high correlation between the ratio of credit to deposits and ex post support to the banking system for OECD countries, this ratio cannot account for all sources of vulnerability at internationally active banks ahead of the crisis, such as cross-border exposures to U.S. subprime assets in trading books and implicit exposures to such assets through asset-backed commercial paper (ABCP) conduits set up off balance sheet. Existing research suggests that these structures contributed to the funding of current account deficits (e.g., of the United States and the United Kingdom) by facilitating the flow of savings from surplus into deficit countries ahead of the crisis (Acharya and Schnabl, 2010). This research also suggests that the geographic distribution of the sponsoring internationally active banks was concentrated in a small number of countries and driven strongly by differences across countries in the detailed regulatory treatment of these exposures.

While desirable, this implies that analysis of any additional effect of monetary policy on the geographic distribution of these exposures would need to contend with omitted variable biases and a small sample problem. In addition, it would have to account for monetary conditions both in the source and the target countries. Rather than looking specifically at cross-border exposures in trading books and through the sponsoring of ABCP conduits, in an extension we examine more broadly the extent to which policy rate differentials are useful to account for the pattern of cross-border capital flows—and hence a comprehensive measure of cross-border exposures—ahead of the crisis.

3.2 Empirical approach

In our main empirical exercises we relate our measure of "home-grown" financial sector imbalances—the ratio of bank credit to deposits—to measures of the monetary policy stance, capital flows and supervisory variables at the country level, for OECD countries over the period 1999-2007.[18] To sharpen the causal interpretation of our findings we also interact the main macro variables with key features of the supervisory regime.

Throughout, we include year-fixed effects and country-fixed effects wherever possible. When assessing country-specific variables that do not vary through time we are sometimes forced to drop country-fixed effects. In these cases we report the results of a random effects estimator, and check its validity through a Hausman test. In all cases inference is based on standard errors that are clustered by country and consistent with both heteroskedasticity and autocorrelation.

The advantage of including country-fixed effects is that these control for any time-invariant differences between countries that might affect the mean level of the dependent variable and that would otherwise need to be controlled for explicitly to address omitted variable biases. They control, for example, for differences between countries in the competitive structure and development of the financial sector.

Year-fixed effects control for any changes through time that might have affected the build-up of financial imbalances globally. One example is what might have been a strengthening belief among market participants that in advanced economies macroeconomic volatility was a thing of the past, which in turn might have led to an underestimation of macroeconomic "tail risks".[19] Year-fixed effects also control for the effect of global macroeconomic conditions, such as global monetary conditions and global current account imbalances, on the build-up of financial imbalances. This means that the variables of interest are identified only through differences in their evolution across countries, rather than through their common components, which might be correlated with a number of other, unobservable variables.

The remainder of this section discusses the main explanatory variables used. Variable definitions and data sources are contained in Appendix II, while summary statistics for the main variables are presented in Table 1.

3.2.1 Macro variables

The monetary policy stance in each country and through time is captured by the deviation from a (contemporaneous) Taylor rule.[20] This closely follows Ahrend et al (2008) and

[18] The sample comprises Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Japan, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, UK, USA.

[19] Gerlach et al (2009).

[20] Bernanke (2010) argued that deviations from contemporaneous Taylor rules do not capture well the influence of central banks' expectations on future inflation. However, this should be less of a concern in

IMF (2009).[21] Figure 6 shows the average deviation from the Taylor rule across OECD countries over the sample period. It confirms that on average, policy rates were low for much of the period, by the standard of a contemporaneous Taylor rule. We assess alternative measures of the monetary policy stance in a number of robustness exercises.

Capital flows are measured for each country and through time by a country's current account relative to GDP.[22] As documented in Figure 7, the dispersion of current account balances widened considerably over the sample period. This can be taken to illustrate an increase in "global imbalances" that would have been associated with an increase in global flows of capital over the period. In our panel regressions we focus on the current account balance for each country as a measure of the net flow of capital at the country level.

As an alternative to the current account, we investigate the spread between the long-term and the short-term nominal rate. Obstfeld and Rogoff (2009) argued that an increase in world gross savings from 2003 may explain why both real and nominal long-term interest rates remained relatively low during this period, despite a shift towards monetary tightening in industrial countries starting in 2004. The resulting remarkable compression of the global long-term short term spread from 2004 is documented in Figure 8.[23]

Moreover, theory suggests that—at the country level—capital inflows (current account deficits) would drive down the local long-term short-term spread, as capital inflows would affect the long end of the yield curve. Panel regression analysis confirms empirically that the current account position is a key driver of the spread between long and short rates at the country level, significant at the one per cent level, Appendix I.[24] Our panel

a cross-country context since such expectations relate not least to global demand and supply conditions that should be similar across countries.

[21] For a detailed description of the estimation technique the reader is referred to Ahrend et al (2009). Ahrend et al also provided us with the data necessary to estimate the Taylor rule for each country and through time.

[22] Since the overall balance of payments must sum to zero, a current account surplus is associated with an increase in a country's net foreign assets—a net capital outflow—by the corresponding amount, and a current account deficit is associated with a net capital inflow.

[23] The fact that long-run real interest rate have been declining despite efforts by central banks to raise interest rates, is often referred to in the literature as "Greenspan's Conundrum", see, e.g., Caballero, Farhi and Gourinchas (2008). Testifying before the Committee on Banking, Housing and Urban Affairs in February 2005, Greenspan had noted: "For the moment, the broadly unanticipated behavior of world bond markets remains a conundrum."

[24] Our findings on the relationship between capital inflows and the long-term short-term spread are consistent with and expand on a study by Warnock and Warnock (2009). These authors found that capital flows into the United States have a statistically significant and economically sizable effect on long term (10 year) rates, while the measured impact on shorter term (2 year) Treasury yields is smaller, suggesting that capital inflows explain some of the flattening of the U.S. yield curve. The magnitude of the effect of capital flows on the real U.S. 10-year yield found by Warnock and Warnock is similar to that of the effect on the long-term short term spread in our OECD panel. Warnock and Warnock control explicitly for long-term inflation expectations and the volatility of long-term interest rates. They find

regressions document in addition that differences across countries in the monetary policy stance do not explain differences in the spread between long and short rates. We treat the current account and the long-term short-term spread as alternative measures of the global imbalances hypothesis and avoid including both measures at the same time.

3.2.2 Supervisory variables

We further examine the influence of the following five dimensions of the supervisory and regulatory environment: (i) the supervisory structure, (ii) the strength of supervisory and resolution powers, (iii) regulatory restrictions on entry into banking, (iv) regulatory restrictions on activities, (v) the stringency of capital regulation.

The reason for choosing these five dimensions is two-fold. For one, empirical measures along each of these dimensions are readily available, from the World Bank database assembled by Barth et al (2004, 2008), and have been used extensively in existing research. In addition, each of the dimensions is associated with a hypothesis that, against the background of the existing reform agenda, appeared to us important to test.

First, over the sample period, institutional frameworks for financial stability have varied considerably across countries. Since the crisis, there has been a revision of these frameworks in some countries, where the central bank is assigned a stronger role in prudential policy. [25] Some commentators argue specifically that a central bank's role in providing last resort liquidity to the banking sector may lead central banks to be a "tough" supervisor of the liquidity management by banking firms and—in the absence of an international liquidity standard over the sample period—any domestic liquidity ratios. [26] We assess the empirical relevance of this argument using an indicator variable that reflects the extent of the central bank's formal responsibility in supervision, distinguishing whether the central bank has no role in banking supervision (as in, e.g., Sweden and the United Kingdom), a shared role (such as in Germany and the United States) or full responsibility (such as in Italy and France).

Second, where the supervisor has strong powers to intervene—e.g., by suspending a bank's decision to pay bonuses and dividends—these powers can be used to discipline banks. In addition, where supervisors have strong powers in bank resolution, this may temper moral hazard—too important to fail— ex ante. Cihák and Nier (2009) emphasized inadequate powers in resolution as a key lacuna in the supervisory regime across advanced

that reductions in inflation expectations and interest volatility may have helped reduce long-term rates over the course of the 1990s, but that there was no further gain in these measures since 1999. In addition, Hume and Sentance (2009) document that CPI inflation had been stable across the OECD at around 2 per cent since 1994. This also suggests that inflation expectations were well anchored across our sample countries and for our sample period, from 1999. In our panel regression we nonetheless control for any further change through time in inflation expectations by including year-fixed effects and differences across countries through country-fixed effects.

[25] IMF (2010a) provides detail on changes across countries.

[26] Nier (2009)

economies ahead of the crisis. They argued that if in the absence of other resolution options, public capital support becomes the only alternative, this was likely to create moral hazard and reduce the force of market discipline ex ante. In line with this argument, prior empirical research suggests that institutions who expect to receive public support hold smaller amounts of equity relative to total assets, on average.[27] We construct an index to assess empirically the extent to which strong powers in supervision and resolution may have reduced the build-up of financial imbalances ahead of the crisis.[28]

Third, while barriers to entry into banking markets are not currently part of the reform agenda, the merit of dismantling these barriers has historically been debated in the context of the benefits and risks of financial liberalization, e.g., Caprio and Summers (1996).[29] Theory suggests that, by limiting competition, entry barriers increase profits and hence the franchise value of incumbents, which in turn reduces the incentive for banking institutions to take risks, Keeley (1990). Entry barriers can also reduce competition in the market for deposits and could thus reduce the need for banks to tap wholesale funding sources. Empirically, entry restrictions have been shown in a number of studies to reduce banking sector risk taking.[30] Barth et al (2004) construct an index of the extent to which countries placed limitations on the foreign ownership of domestic banks and the legal requirements placed on new entrants to obtain a banking license. We assess whether such barriers to entry have been important in reducing the build-up of financial imbalances ahead of the crisis.

Fourth, Barth et al (2004) also provide an index of the degree to which countries place restrictions on the range of permissible activities for deposit takers, such as restrictions on banks to become engaged in securities, insurance and real estate. In the wake of the crisis, there is renewed debate whether restrictions on the business activities of commercial banks is a useful element of the regulatory framework. This debate is most active in the United States, where activities restrictions, notably the separation of investment banking and commercial banking had been introduced in response to the Great Depression, through the Glass-Steagall Act of 1933, but were lifted in 1999, by enactment of the Gramm-Leach-Bliley Act. Barth et al (2004) survey the reasons for countries to restrict bank activities and bank commerce links. These include (i) reducing opportunities for banks to

[27] Nier and Baumann (2006).

[28] This index uses survey information collected by Barth et al, but the construction places greater weight on whether or not there is separate legislation on bank resolution. See Appendix III for detail.

[29] Hellman, Murdoch and Stiglitz (2000) argue that the Asian financial crises of the late 1990s arose in part as a result of financial market liberalization, which included a reduction of entry barriers.

[30] Keeley (1990) documents for the United States that lower barriers to entry led to a decline in bank charter values, which in turn caused banks to increase default risk through increases in asset risk and reductions in capital ratios, precipitating a sharp increase in bank failures in the early 1980. Nier and Baumann (2006) confirm for a cross-country sample that lower entry barriers, as measured by the index constructed by Barth et al (2004), are associated with lower capital ratios. Favara and Imbs (2009) document for the United States that since 1994, the lifting of branching restrictions increased the supply of mortgage credit and ultimately house prices, across the United States.

increase risk, (ii) reducing complexity and increasing the ability of supervisors to monitor banks, (iii) limiting the scope for banks to become too important to fail. We therefore assess whether the extent of such restrictions might have affected the build-up of financial imbalances ahead of the crisis.

Fifth, and finally, while capital requirements in line with Basel standards were in place in all countries over the period, there was variation in the stringency of the definition of capital, e.g. as regards the permissible sources of capital across countries. A centerpiece of the current reform agenda is to introduce a more uniform definition of capital that would raise the quality of bank capital resources globally.[31] The main objective of better quality capital is to increase the resilience of the banking system to a range of risks. However, more stringent capital requirements could also affect the amount of credit extended by the banking system, and hence potentially the build-up of financial imbalances, as measured by the ratio of banking system credit to deposits.[32] We assess empirically whether this has been the case for our sample.

While these five dimensions appeared to us the most important to test, prior beliefs on what aspects are important may differ. We therefore examine further measurable aspects of the supervisory regime in robustness exercises.[33]

4 The Effect of Macro and Supervisory Variables

4.1 The effect of macro factors

We start by examining the impact of macroeconomic factors on the build-up of financial imbalances for the sample of OECD countries over the period 1999-2007. To measure the impact of macroeconomic factors with the greatest possible precision we include both country-fixed and year-fixed effects in columns (1) and (2) of Table 2. In addition, we control for the current account position when assessing the effect of monetary policy and vice versa. This is because the monetary policy stance and the current account position are unlikely to be independent. For example, a deteriorating current account would tend to be offset by increasing capital inflows, putting upward pressure on the exchange rate. An appreciating exchange rate will in turn reduce inflationary expectations and can lead to a more accommodative monetary policy stance. Inspection of Panel B of Table 1 confirms a positive correlation between the current account position and the monetary policy stance, consistent with a policy response to current account imbalances. Both the

[31] In December 2009 the Basel Committee issued a consultation paper on a set of reform proposals to strengthen the resilience of the banking system, including through a higher quality of capital. See http://www.bis.org/publ/bcbs164.htm .

[32] Barth et al (2004) did not find a robust effect of capital stringency on their outcome variables.

[33] The World Bank database we drawn on for information on the supervisory and regulatory regime does not contain information on the supervision and regulation of liquidity. This may reflect a lack of a consensus ahead of the crisis as to whether and how liquidity should be regulated.

current account and the monetary policy stance need therefore be included in order to identify the independent effect of each.[34]

According to the regression results reported in column (1) of Table 2, differences across countries in current account balances and the net capital flows associated with these differences had a statistically strong effect on financial sector imbalances. In countries with a capital account surplus and net capital outflows the balance sheet expansion sourced in wholesale funding markets is reduced, while a current account deficit and the corresponding net capital inflow increases banking sector leverage. These effects are also economically sizable. The mean level across countries and time of the ratio of credit to deposits is about 1.4 (Table 1). A deterioration of the current account by one standard deviation (6.6%) leads to an increase of about 0.4 in the ratio of credit to deposits.

By contrast, we do not find that differences in the monetary policy stance—as measured by the deviation from the local Taylor rule— had a measurable effect on the balance sheet expansion sourced in wholesale funding markets across countries according to column (1) of Table 2, with the coefficient clearly statistically insignificant. We subject this finding to a battery of further tests, in this as well as the following section.

In addition, we assess the hypothesis that a compression of the long-term short-term spread might have led to an increase in banking sector leverage ahead of the crisis, column (2) of Table 2. We find that a lower spread is associated with greater leverage. Since a compression of spreads at the local level is driven in part by capital inflows (Appendix I), the empirical evidence on the effect of the spread between long-term and short term rates on banking sector leverage confirms and complements the evidence on the effect of capital flows on banking sector leverage. In particular, it documents an important mechanism through which capital inflows will have led to an increase in leverage.

Finally, while we prefer to include year-fixed effects so as to reduce the potential for omitted variable bias, the results reported in columns (3) and (4) document that dropping year-fixed effects from the equation does not materially change the estimated coefficients.

4.2 The effect of the supervisory environment

In a first pass at evaluating the effect of differences across countries in the supervisory environment on financial sector imbalances we include supervisory variables in our baseline and suppress country-fixed effects in the remainder of Table 2, using a Hausman test to verify that the measured coefficients do not change materially when estimation is based on a random effects specification.[35] We continue to include year-fixed effects so as to control

[34] Endogeneity of monetary policy to the current account position is routinely ignored by existing studies of the bank lending and risk-taking channels of monetary policy. In our view this represents an important omission.

[35] P-values of the Hausman test are comfortably large, e.g. 0.9 and 0.8 for the models estimated in columns (1) and (2), suggesting that a random effects estimator is a valid alternative to the fixed effects estimator. Indeed, inspection of colums (5) to (11) relative to columns (1) to (4) suggests that the

for changes in the global macroeconomic environment through time. We also control for differences across countries in the current account position and the monetary policy stance relative to the local Taylor benchmark.

Holding these elements equal we find strong evidence overall that the supervisory and regulatory environment affected the build-up of financial imbalances ahead of the crisis, even though the strength of the evidence differs across the five dimensions of the supervisory and regulatory environment we assess.

The strongest evidence emerges in favor of the hypothesis that strong powers on the part of the supervisors to intervene in problem banks and to resolve failing financial institutions may have reduced the build-up of banking sector leverage ahead of the crisis. This evidence is consistent with the idea that strong powers in supervision and resolution can reduce moral hazard and correct risk-taking incentives that otherwise lead banks to become overexposed to aggregate credit and liquidity risks. This evidence is statistically highly significant and robust across specifications. It is also economically relevant: a decrease in supervisory power from the highest reading of the index to its lowest reading is associated with an increase in banking sector leverage of 0.9, a variation equal to about 1.5 standard deviations about its mean.

There is also some, though weaker evidence that institutional structure matters. In countries where the central bank was in charge of supervision and regulation, the balance sheet expansion sourced in wholesale funding markets appears to have been less pronounced than in countries where the central bank played no role in supervision and regulation. This is consistent with the conjecture that central banks are tougher supervisors of banks' liquidity risks, since they act as the lender of last resort to the banking system. The evidence is economically significant: moving from a framework where the central bank has no role in supervision to a framework where it has sole responsibility reduces the ratio of credit to deposits by 0.195 about its mean of 1.4.

Evidence also emerges in favor of the hypothesis that barriers to entry reduce the ratio of credit to deposits. This finding confirms bank-level evidence that entry restrictions are associated with reduced leverage.[36] It is consistent with the theory outlined by Keeley (1990), according to which entry restrictions reduce competition, increase franchise values and thus reduce the incentive to take risks. In particular, entry restrictions reduce competition for deposits and hence the need for banks to seek funding in wholesale markets. This finding is again sizable economically: an increase in the tightness of entry barriers from its lowest to its highest reading reduces the ratio of credit to deposits by about one standard deviation (0.5).

Despite the claims made for activities regulation—that it might help in supervision by reducing complexity and that it prevents banks from becoming too important to fail and

measured coefficients on the macro variables change very little when we move from the fixed effects to a random effects estimator.

[36] Keeley (1990), Nier and Baumann (2006).

hence reduces risk-taking—we find no evidence that variation in activities regulation had a measurable effect on the build-up of overall banking sector leverage ahead of the crisis. We also find no evidence that the degree of capital stringency affected the ratio of credit to deposits. This finding confirms empirically the widely held notion that while capital can increase the resilience against a range of shocks, capital regulation alone was not effective in preventing an increased reliance on wholesale funding and the associated build-up of liquidity risks ahead of the crisis. This is the key motivation for the development by the Basel Committee of international liquidity standards to complement capital regulation.

4.3 Interactions between macro factors and supervisory variables

We next turn to an analysis of interactions between macroeconomic factors and the supervisory and regulatory regime. This analysis is important in coming to a more definite answer as to what caused the build-up of financial imbalances ahead of the global financial crisis, in three ways.

First, if certain macroeconomic factors are to have caused the build-up of financial imbalances, we would expect their effect on these imbalances to be reduced where the supervisory and regulatory environment was strong. If, on the other hand we find that there is no interaction between a candidate macroeconomic factor and the supervisory regime, it is less plausible to argue that the macro factor had been causal. Since there is more than one candidate macroeconomic factor (global imbalances and monetary policy) interaction exercises allow us to determine which, if any, of these factors were causal in encouraging the build-up of financial imbalances.

Second, these exercises can also strengthen or weaken the case in favor of the causal influence of particular dimensions of the supervisory and regulatory regime. If there is no evidence that where the supervisory and regulatory regime was strong along a particular dimension this served to reduce the impact of macroeconomic factors, this makes it less plausible to argue that weakness along that particular dimension was causal for the build-up of financial imbalances ahead of the crisis.

Third, from the point of view of identifying the effect of the supervisory variables, an advantage of interaction exercises is that we can bring back country-fixed effects. This controls for other differences across countries that might be correlated with the included supervisory dimensions, reducing the scope for omitted variable biases.

In all, we assess three macroeconomic and five supervisory variables, resulting in fifteen possible interactions, shown in the three Panels of Table 3. We start by assessing interactions between the current account position and the supervisory variables, shown in Panel A. We find that a stronger supervisory environment reduces the effect of capital inflows on the ratio of credit to deposits, in line with the hypothesis that current account

imbalances were causal for the build-up of financial imbalances.[37]

We also find that the elements of the supervisory and regulatory regime that matter in this regard are those where we found evidence for a base effect. In particular, the effect of a current account deficit on the build-up of banking sector leverage is reduced where (i) the central bank has supervisory responsibility, (ii) formal supervisory and resolution powers are strong and (iii) barriers to entry are relatively high. These findings suggest that these elements can plausibly be argued to have been causal in reducing the build-up of financial imbalances in some countries.

In panel B we analyze interactions between the monetary policy stance and supervisory variables. We find only few, if any, statistically significant interactions between supervisory variables and the monetary policy stance, with only the interaction with supervisory power marginally significant in column (6), where the base effect remains insignificant. This casts doubt on the idea that monetary policy was causal for the build-up of financial imbalances in advanced countries across the sample period, by stimulating a balance sheet expansion sourced in wholesale markets.

In panel C we document statistically strong interactions between the long-term short-term spread and all three supervisory variables that were shown to have an effect in the baseline. The effect of a compression of spreads on the build-up of banking sector balance sheets is reduced where (i) the central bank has supervisory responsibility, (ii) the supervisor is vested with strong powers and (iii) entry barriers are high.

Overall, these findings imply that current account imbalances rather than accommodative monetary policy led the increase in wholesale-funded banking sector leverage ahead of the crisis. Specifically, a compression of the spread between long and short rates appears to have led banking firms to lever up, thereby exposing banks to greater funding liquidity risk. This finding points to the empirical importance of "risk-shifting" or "moral hazard" incentives at banking firms that are exacerbated by a compression of margins.

Each of the three significant interactions with supervisory aspects also point to the presence of risk-shifting incentives. First, supervision is the primary means to counter moral hazard incentives that arise from limited liability and explicit and implicit safety nets. Consistent with this idea, our findings document that where powers in supervision and resolution were strong this helped contain the build-up of risks. Second, and more specifically, banks have an incentive to increase exposure to liquidity risks when they can "put" this risk to the central bank ex post. Since central banks are aware of this moral hazard they tend to be tougher supervisors of banks' liquidity risks. In line with this, we find that where central banks have a strong role in supervision and regulation, the build-up of liquidity risks is less pronounced. Third, competition tends to reduce margins and

[37] We find these effects to be economically meaningful. For instance, in column (2) of Table 3, a 1 standard deviation increase in the supervisory power index around its mean is associated with a 40 per cent reduction in the size of the coefficient on the current account.

can exacerbate risk-shifting incentives. Consistent with this, we find that where barriers to entry are low and banks were facing fierce competition, the build-up of risk through increases in wholesale-funded leverage was more pronounced.

Weak or insignificant interactions between monetary policy and supervisory variables finally suggest that low short rates over the sample period are more likely to have been co-incidental to the build-up of financial imbalances, rather than its root cause. It is plausible, for instance, that rising global imbalances caused both the build-up of financial imbalances and accommodative monetary policy in some advanced economies, since the rising share of imports should have reduced inflationary pressures over the sample period.

5 Further Analysis and Robustness

5.1 Composition of capital flows—and additional macro controls

A main result of our analysis is that net capital inflows can contribute to the build-up of financial imbalances, as measured by the ratio of credit to deposits. The net capital flow is the difference between gross inflows—increases in foreign claims on the domestic economy— and gross outflows—increases in resident claims on foreign economies. We ask whether the build-up of financial imbalances might depend on the composition of the gross inflows rather than, or in addition to, the size of the net flow relative to GDP.

The IMF balance of payments statistics distinguish between four main categories of capital flows: (i) foreign direct investment (FDI), (ii) portfolio investments—including investments in sovereign and private (debt and equity) securities, (iii) other investment—including increases in bank accounts as well as loans to banks and corporations, and (iv) changes in foreign reserves assets held by the central bank.

Table 4 presents the results of panel regressions where the main components of the gross inflow scaled by GDP are added to the baseline specification. We find that, controlling for the net flow, both the size of other investments and of portfolio investments have a statistically significant effect on the build-up of financial imbalances, while the size of foreign direct investment does not.[38] These results are plausible since some share of both other investments and portfolio investments would be expected to contribute to the funding of the domestic banking system, through foreign interbank loans and debt securities respectively. We find, finally, that controlling for the composition of gross flows does not alter the baseline result of a negative effect on the net flow, as measured by the current account. This is not surprising since, as we document in Appendix I, the net flow is a key determinant of long-term interest rates, which in turn can have an independent effect on banking system leverage.

[38] An increase in other investments by one standard deviation increases the ratio of credit to deposits by about 0.1 around its mean of 1.4. An increase in portfolio investments by one standard deviation increases the ratio of credit to deposits by about 0.16.

Next, we check and confirm that our baseline results are unaffected when real output growth and inflation are added as additional controls, Table 4, column (2). We find that these additional controls are in fact uncorrelated with the build-up of financial imbalances within the banking system. This finding accords with existing cross-country evidence that, in the run-up to crises there is no short-run relationship between financial sector developments and output and inflation, IMF (2009a). In particular, ahead of banking crises, neither output nor inflation typically increase beyond their trend levels.[39]

We argue that this is natural when, as we find, the build-up of financial imbalances is fuelled by capital inflows. While inflows can set off a boom in consumption and investment, increased demand need not come to stretch domestic capacity and hence increase inflationary pressures when it can spill into imports. Consistent with this line of reasoning, Hume and Sentance (2009) point out that over the sample period, output growth had risen outside the OECD. They conclude that, as a result, output and inflation were generally stable in the advanced economies where credit expansion was concentrated, but increased in the emerging economies, where it was not.

5.2 Monetary policy—alternative measures and samples

A second main result of our analysis is that the monetary policy stance had only a weak, if any, effect on the build-up of financial imbalances across advanced economies ahead of the crisis. We test the robustness of this conclusion in a number of ways.

First, in our baseline specification we measure the stance of monetary policy by deviations from a Taylor rule. While this has become standard in the literature, we explore whether alternative ways of measuring monetary policy might lead to different conclusions, Table 5, Panel A. We find that results are unchanged when instead of the deviation from Taylor we simply use the short term nominal rate or alternatively the short term real rate. Neither measure of short term interest rates enters significantly. When we include both the short rate and the long rate we find that it is low long rates that are associated with a build-up of financial imbalances. This is consistent with the evidence in our baseline regressions that a compression of the spread between long rates and short rates had driven increases in banking system leverage across advanced economies.

Second, we examine more fully the argument, advanced in parts of the literature, that monetary policy had an effect on the build-up of financial imbalances where rates were kept "low for too long". [40] A closer investigation of this idea calls for consideration of the monetary policy stance over a longer period. We construct two alternative measures. First, we count the number of quarters over the past three years where the policy rate

[39] Barrel et al (2010) analyze the factors that help predict banking crises in OECD countries over the 1980-2008 period. They find that neither real output growth nor inflation help predict banking crises. Moreover, and consistent with the findings reported in this paper, Barrel et al also find that the current account is an important predictor of banking crises, whereas the short-term rate is not.

[40] Taylor (2007), Maddaloni and Peydro (2010)

is below Taylor by more than 1 per cent. This is broadly equivalent to a measure of the average monetary policy stance over the past three years. As an alternative, and closely following Maddaloni et al (2010), we compute the number of consecutive quarters over which the short rate was kept at least 1 per cent below what is suggested by the Taylor rule. This stresses the cumulative effect of holding rates low over an extended period. If rates that were kept low for too long had contributed to the build-up of financial imbalances we should expect to find a positive coefficient on both these measures. However, as documented in Panel A of Table 5, we find that neither measure has a significant effect on the build-up of financial imbalances in our sample.

Third, the empirical literature examining the effects of monetary policy on financial sector outcomes is sometimes criticized for ignoring a potential endogeneity of monetary policy that arises when monetary policy responds to financial sector outcomes. However, IMF (2010a) assesses that in the run-up to the crisis, "policy objectives other than price stability—notably output or exchange rate stability—were taken into account, but financial stability was often not a major consideration." This would make it seem unlikely that our regressions should suffer from an endogeneity bias. To put any remaining concern to rest we lag all variables by one period. We find that the results remain virtually unchanged.

Fourth, a fair number of sample countries are members of the euro area.[41] This enables us to assess whether the effect of monetary policy on the build-up of financial imbalances might have been different for countries inside the common currency area.[42] One potential source of a difference is that in a common currency area, local deviations from Taylor may be more pronounced than in countries where monetary policy can fully adjust to local conditions. Larger deviations might help empirically in identifying an effect of the monetary policy stance on the build-up of financial imbalances. To explore this empirically, we re-estimate all specifications shown in Panel A for euro area countries only. The finding, documented in Panel B of Table 5 is that there are no differences in the effect of the monetary policy variables, with the euro area sample yielding results that are virtually identical to the results for the whole sample.

From this evidence, the monetary policy stance in and of itself does not appear to have been an important determinant of the strength of the build-up of financial imbalances across OECD countries. However, accommodative policy across a number of advanced countries might still have played a role, when it served to compound the effect of capital inflows on the build-up of financial imbalances. To assess whether loose monetary policy could have given an additional "kick" to the effect of capital inflows on the build-up of financial imbalances we investigate formally the extent to which the effect of capital flows

[41] The euro area countries are Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Portugal, Spain.

[42] Dokko et at (2009) discuss whether in the euro area monetary policy might have had a stronger effect on residential investment than elsewhere.

on the build-up of financial imbalances is conditioned by the monetary policy stance. In columns (1) and (2) of Panel C we define monetary policy to be tight when the policy rate exceeds the Taylor benchmark. In columns (3) to (5) we run through a number of alternative ways in which policy can be classified as tight. In each case we test whether there is a statistically significant difference in the effect of capital inflows depending on whether the stance is tight or loose. We find that there is no such difference. In other words, the effect of capital inflows on the build-up of financial imbalances is independent of the monetary policy stance.

5.3 Financial sector structure and alternative supervisory dimensions

When assessing the effect of macroeconomic factors we control for time-invariant differences between countries by including country-fixed effects. However, when assessing the effect of differences in the supervisory and regulatory regime—including when computing interaction effects between supervisory and macro-variables—we rely to a significant extent on cross-country differences in the chosen supervisory and regulatory dimensions. We conduct a number of robustness exercises to establish to what extent this is a concern for our estimation.

A first concern relates to differences across countries in the importance of non-banks as providers of credit as well as potential differences in the supervisory control of non-banks versus banks. For instance, while in the United States, commercial banks are closely supervised and subject to strong prompt corrective action and resolution powers, U.S. investment banks were subject to a lesser degree of oversight, and remained outside the perimeter of special resolution powers vested in the Federal Deposit Insurance Corporation (FDIC).[43] The increase in credit intermediated by the so called "shadow banking system", including special purpose entities, investment banks and the government sponsored entities (GSEs), and that involved an increasing share of securitized credit, is viewed by many as a proximate cause of the crisis in the United States.[44]Consistent with this view, Hume and Sentance (2009) document that in the United States there has been a rapid increase in non-bank credit to households and firms starting as early as the mid-1990s. They also show that, elsewhere in the OECD, non-bank credit to domestic households and firms has

[43] As a result of the stock market crash of 1929 and the ensuing "Great Depression" in the early 1930s, measures were taken to segregate commercial banking from investment banking.

[44] Claessens et al (2010) document that in the United States, the increase in leverage in the commercial banking sector was less pronounced than the increases observed in the investment banking sector. See in particular their Figure 11. We find that both the initial banking sector leverage and the increase in leverage within the U.S banking sector was relatively modest: the ratio of U.S. banking sector credit to deposits rises from a value of 0.76 in 1999 to a peak of 0.83 in 2006. IMF (2009b) provides further discussion of differences in the structure of the financial system between the Unites States, and other advanced countries.

not risen nearly as fast and conclude that "the growth of the shadow-banking system has been largely a U.S. phenomenon".

Since the ratio of bank credit to bank deposits does not account for the growth of the U.S. shadow banking system we check whether our conclusions are robust to the exclusions of the United States from the sample.[45] As documented in Table 6, exclusion of the United States does not change the evidence on the influence of the key macroeconomic factors on the build-up of financial imbalances within the banking system.[46]

A second potential concern arises since capital regulation differed across countries not only as regards the stringency of the definition of capital, which is examined explicitly, but also in that a leverage ratio was in place in two of the sample countries, in the United States and Canada. The effect of the leverage ratio is not addressed in our main regressions because the lack of meaningful variation makes it hard to evaluate its effectiveness. However, for robustness we check whether inclusion of a leverage ratio dummy—that assigns one to both the United States and Canada— might affect the results. As documented in Table 6 we find that inclusion of the leverage ratio dummy leaves unaffected the baseline results on interactions between macro factors and the supervisory variables.

Third, as discussed by Turner (2009) countries differed in their approach to banking supervision and there is broad agreement that a more intrusive and systemic approach to supervision is required going forward (Turner, 2009, and Vinãls et al, 2010). However, continued debate surrounds the specific issue of whether differences in the intensity of onsite supervision can account for differences in crisis experiences across countries (Turner (2009, page 90). We assess this issue formally using a measure of the frequency of onsite examinations carried out by supervisory agencies.[47] We add an interaction term between this measure and the macro variables of interest in Table 6. We find that the marginal explanatory power of this indicator is low when added to those interactions that were found significant in the baseline.[48] Moreover, inclusion of frequency of onsite visits does not materially affect the sign or significance of the baseline findings on interactions between macro and supervisory variables, where the evidence on supervisory powers and entry barriers in particular, remains strong.[49]

[45] The finding by Adrian and Shin that balance sheet expansion in the investment banking sector is sensitive to the federal funds rate, while commercial bank balance sheets do not respond to variations in the federal funds rate also suggests that monetary transmission in the United States could be quite different from other, more bank-based economies.

[46] In additional tests we also examine alternative outcome variables that take direct account of the shadow banking system, as discussed further below.

[47] This measure is sourced from the World Bank Barth and Levine database and takes value 1 if on-site examinations are conducted once a year, 2 if such visits occur every two years and 3 in all other cases.

[48] The frequency of on-site visits correlates relatively strongly with whether or not the central bank is in charge of supervision, with a correlation of 44 per cent.

[49] We do not want to claim that these findings show on-site examinations to be unimportant. It is possible, for example, that the intensity of on-site examinations may have affected the extent to which banks were exposed to what with hindsight turned out to be doubtful "subprime" assets.

5.4 Determinants of financial imbalances—boom versus bust

Our sample covers a fairly long period, 1999-2007, which includes two potentially quite different regimes: a global "recession" regime, from 1999 to 2002, and a global "boom" regime, from 2003 to 2007. It is natural to ask whether the effect of potential drivers of financial imbalances may differ across regimes. To assess this, we perform separate regressions for the two sub-periods. We find that results for the boom period are very similar to those obtained for the whole sample, while most variables lose significance in regressions performed on the bust period only, Table 7. We also find that when regressions are performed on the boom period, the overall fit of the regression is improved relative to regressions on the whole sample.

This suggests that data from the boom period contribute strongly to the measured effect on drivers of financial imbalances ahead of the crisis. We think that the main reason why we find stronger evidence for the boom years is that over the same period global imbalances were rising fast relative to the preceding recession years (Figure 7). Obstfeld and Rogoff (2009) explain how global boom conditions and rising global imbalances are intimately related. When global growth strengthened this led to rising imbalances in growth paths and net exports, as commodity prices soared and exporters more generally increased their current account surpluses. This led to stronger capital inflows and a compression of spreads in deficit countries, in turn setting off increases in financial sector imbalances.

5.5 Determinants of financial imbalances—global factors

In our main regressions we use year-fixed effects to control for all global factors that might affect financial sector developments. The effect of both global imbalances and monetary policy are thus identified through cross-country differences in the time path of the relevant variables. While this estimation approach should generate confidence that our results are unbiased, it leaves unexplored available information on monetary policy conditions and the increase in current account imbalances globally ahead of the crisis.

In an attempt to shed further light on which of these two factors contributed more strongly to the build-up of financial imbalances ahead of the crisis, we assess the effect of global measures of monetary policy and global imbalances, relying once more on interactions with supervisory variables to improve identification. The global monetary stance is measured by the average across OECD countries of the deviation from Taylor, as shown in Figure 6. The extent of global imbalances is measured by the standard deviation of current account positions, as shown in Figure 7.

We find that, when we suppress year-fixed effects, the global monetary policy stance is assigned a negative coefficient, Table 8, column (1), in line with the idea that low policy rates globally contributed to the build-up of financial imbalances ahead of the crisis. We also find that the standard deviation of current account positions is assigned a positive

coefficient, in line with the hypothesis that the increase in capital flows associated with increasing global imbalances contributed to ample liquidity ahead of the crisis, Table 8, column (8). It turns out that the base effect on global imbalances is statistically significant at the one per cent level, and substantially stronger than the base effect on the global monetary stance, which is significant at the ten per cent level only. Since neither of these regressions include year-fixed effects, however, both of these effects are likely to be measured with some error.

To improve identification we interact both global measures with aspects of the supervisory and regulatory regime. We find that while there is some evidence of an interaction between the global monetary policy stance and supervisory variables, Panel A, the interactions between global imbalances and supervisory variables are, once again, stronger, Panel B. Overall therefore, the conclusions we draw from our baseline specifications are not overturned when we use additional information on global developments ahead of the crisis.

5.6 Alternative outcome variables

To complete our set of robustness exercises, we finally check whether our main findings on the relative importance of global imbalances and monetary policy carry through when we use a range of alternative outcome variables to capture the build-up of financial imbalances ahead of the crisis.

As a first alternative measure we examine the ratio of bank credit to GDP. This ratio captures less well the vulnerabilities arising from banks' reliance on wholesale funding than does our primary outcome variable. On the other hand, existing research documents that strong growth in banking sector credit relative to GDP is a fairly reliable predictor of banking crises, especially when increases in asset prices are accounted for as well. [50]

As a second alternative measure we use the ratio of credit extended by the financial sector to deposits taken by the banking sector. The difference to our primary outcome variable is that it is broader, taking in not only credit extended by commercial banks, but in addition credit extended by other bank-like financial intermediaries, such as specialized mortgage lenders and finance companies as well as the credit that is extended by banks and non-banks but then moved off-balance sheet and held and funded by special purposes entities in the context of securitized credit. Since it measures the size of all this credit relative to the funding available through traditional bank deposits, the ratio of financial sector credit to deposits can be viewed as a measure of the size of the "shadow banking system", Hume and Sentance (2009).

The third alternative measure we investigate is the level of household sector leverage, as measured by total household debt relative to income (GDP). The period from around

[50] Borio and Lowe (2002) first established this finding. Borio and Drehmann (2009) provide more recent evidence.

2000 was characterized by a strong build-up of household sector debt in a number of countries, related to both mortgages and unsecured consumer credit, Hume and Sentance (2009). Again, not all of this credit was provided by commercial banks, but might have been provided by non-bank financial institutions, or funded through securitization to varying degrees. In contrast to our primary outcome variable the measure of household sector indebtedness captures all of this credit irrespective of the funding source.

We finally examine house prices. As noted, a number of prior studies investigate the effect of capital inflows and monetary policy on house prices in both advanced and emerging market economies. The available cross-country evidence points to capital flows as a key driver of house price appreciations while monetary policy is not typically found an important determinant of house prices. We check whether these results carry through in our sample and set-up, where both monetary policy and capital inflows are accounted for.

As in our benchmark regressions we control for year-fixed effects as well as country-fixed effects, so that the effects of monetary policy and current account imbalances are, once again, identified through differences across countries in the time-path of the relevant variables, rather than through their global time profile.

We find that capital inflows—current account deficits—re-emerge as an important driver of the build-up of financial imbalances, as measured using every one of the alternative measures. Capital inflows are an important determinant of each of: the ratio of credit to GDP, the ratio of financial sector credit to deposits, the ratio of household sector debt to GDP, and the appreciation in house prices ahead of the crisis, with coefficients statistically significant and economically sizable.[51] By contrast, the monetary policy stance does not appear to have a measurable effect on any of these outcome variables, Table 9.

We further document that, across countries ahead of the crisis, there has been a fairly tight correlation between the size of current account deficits and the issuance of mortgage backed securities, with a correlation coefficient of 58 per cent, significant at the one per cent level (Figure 9). This suggests that the market for securitized credit provided an additional conduit for the flow of savings from surplus countries into deficit countries which—together with the increase in domestic bank credit— spurred the rise in household indebtedness and house prices in deficit countries that we document in our regressions (Table 9).

Overall therefore, the conclusions drawn on the relative importance of current account imbalances and monetary policy not only pertain narrowly to the build-up of financial imbalances within the banking sector, but carry through to a range of alternative measures that capture the broader build-of financial imbalances ahead of the crisis, including developments that might have been encouraged by the growing market in securitized credit.

[51] For example, in column (5), a 1 standard deviation increase in capital inflows is associated with 30% of a standard deviation increase in household leverage (0.013*6.613/0.262).

6 Extensions

If the crisis was at least in part caused by "global imbalances" this begs the question: what caused global imbalances? While a comprehensive answer to this question is outside the scope of this paper we nonetheless provide a contribution, by investigating empirically the determinants of current account imbalances ahead of the crisis. Our main interest is whether policy rate differentials affected the pattern of capital flows across countries. Specifically, we investigate whether—all else equal—monetary tightness relative to the U.S. dollar increased net capital inflows, while monetary ease relative to the dollar reduced net capital inflows (led to capital outflows).

Such an analysis can also shed light on whether monetary policy has the ability to affect the pattern of cross-border exposures that resulted from capital flows across countries at the aggregate. In particular the current account measures for each year the change in the net exposures to a country held by the rest of the world, irrespective of whether the exposure is held in the trading and banking books of foreign banks, by non-bank financial intermediaries, or directly by households and corporations.

To investigate these issues empirically, we regress a country's current account balance on the spread between the domestic short-term rate and the U.S. short-term rate. In addition, we control for factors that are suggested by the previous literature, including the government surplus, the private savings rate, the country's openness and output growth, as well as the country's level of financial development and other country specific factors, through country-fixed effects.

We find interest differentials between the domestic and U.S short-term rate to be a key driver of the current account over our sample period (Table 10). Apart from the country's private savings rate, which also has a strong effect, monetary policy is the only variable that consistently enters significantly. High domestic rates relative to rates in the U.S. are associated with net capital inflows (a current account deficit) while low rates are associated with outflows.

It is worth noting that this finding is unlikely to be driven by an endogenous monetary policy response to capital flows, where, if anything, we would expect capital inflows to be associated with an appreciation of the local currency and hence lower inflationary pressures, potentially prompting domestic monetary easing. Causation therefore runs from monetary policy to capital flows rather than the other way around.

Further investigation reveals that the effect of the spread on capital flows is largely confined to the smaller open economies among OECD countries. Moreover, we find that the effect of the spread on capital inflows is more pronounced in the boom period, 2003-2007. This is plausible since for smaller advanced countries and in boom times capital flows might have been more strongly driven by "carry trade" strategies.

Overall, this evidence suggests that monetary policy across the OECD was not entirely neutral with respect to the build-up of imbalances. While we found little empirical support

in the previous sections for the notion that low policy rates had contributed to the build-up of "home-gown" imbalances within the financial and household sectors, we find that the tighter was monetary policy relative to the U.S. the stronger the build-up of current account imbalances and hence the build-up of cross-border exposures in the aggregate. Monetary policy may therefore in this way—and likely unwittingly—have contributed to the global financial crisis.

Finally, and at a more basic level, these results confirm the notion that (private) capital tends to flow from where interest rates are low to where they are high, all else equal, rather than the other way around. Low policy rates in the United States ahead of the crisis are unlikely therefore to help explain the build-up of exposures to U.S (subprime) assets that were held by banks, other financial intermediaries and households elsewhere in the world.

7 Conclusions

This research offers comprehensive evidence on the underlying, or "root" causes of the global financial crisis by examining the relative importance of capital flows, monetary policy and the supervisory environment in encouraging the build-up of financial imbalances ahead of the crisis. Overall, our findings lend strong support to the conjecture that "Capital flows provided the fuel which the developed world's inadequately designed and regulated financial system then ignited to produce the firestorm that engulfed us all.", (King, 2010).

Our results on the importance of capital flows in fuelling the build-up underscore the need for a rethink of policy tools to address global imbalances and the associated capital flows. In surplus countries, structural policies to reduce excessive savings rates and policies to develop domestic and regional financial markets hold some promise. In deficit countries, monetary policy and capital controls are traditionally viewed as the main tools to address capital inflows. In addition, macroprudential tools may need to be developed that can be closely targeted at the build-up of vulnerabilities associated with capital flows.

We document that the period ahead the crisis coincided with low policy rates globally, making it reasonable to worry that low policy rates ahead of the crisis might have played a role in stimulating the build-up of financial imbalances. However, we provide comprehensive evidence that higher policy rates in some countries did not appear to slow the build-up of financial imbalances. While much of this evidence focuses on the build-up of financial imbalances on the balance sheet of traditional intermediaries, the main findings are shown to carry through to broader measures of financial imbalances, including a measure of the size of the shadow-banking system, household sector indebtedness and house prices. This suggests that accommodative monetary policy from 2001 was likely co-incidental to the build-up of financial imbalances, rather than its root cause.

Whether or not monetary policy has played a causal role in the build-up, the question

arises whether it should be used more actively to address emerging financial imbalances in future. Here our results also call for caution. Specifically, a variation of policy rates of an order of magnitude as observed in the sample—where a one standard deviation variation amounts to 2 percentage points—has no measurable impact on financial sector imbalances. In addition, we show that intermediary balance sheets react more strongly to the spread between long rates and short rates, over which monetary policy has had little control. Both these findings cast doubt on the effectiveness of the use of monetary policy in seeking to influence balance sheet choices in the financial sector.

Our results do suggest, however, that monetary policy may need to be more aware of how it can affect capital flows. For smaller advanced economies, a monetary policy stance that is tight relative to global rates can contribute to capital inflows and may indirectly encourage the build-up of financial imbalances domestically. Conversely, a loose monetary policy stance—or an exchange rate policy that amounts to a loose stance—can contribute to current account surpluses and capital outflows that may fuel the build-up of financial imbalances elsewhere in the world.

Our findings on prudential policy are in line with the hypothesis that the build-up of financial imbalances was fuelled by widespread moral hazard, and inadequate prudential policies that failed to address the systemic externalities associated with excessive use of wholesale funding.

- Our results document the inability of capital regulation in preventing the build-up of leverage sourced in wholesale funding markets. This underscores the need for a greater emphasis on liquidity regulation.
- Our results also strongly support the call for more formal intervention and resolution powers on the part of supervisory agencies, so as to increase the effectiveness of supervision and reduce systemic externalities of failure.
- Our results finally suggest that central banks appeared to have been more effective in the supervision of systemic liquidity, supporting a revision of policy frameworks that assign central banks a more formal role in macroprudential regulation.

Finally, our results confirm the relevance for understanding the global financial crisis of earlier evidence that a full liberalization of banking markets increases fragility. The relationship between competition and stability in banking markets and the potential merits of entry barriers in reducing excessive competition and the resulting risk-taking incentives therefore deserve greater debate.

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Figure 1. Interactions between Macro Factors and the Supervisory Environment

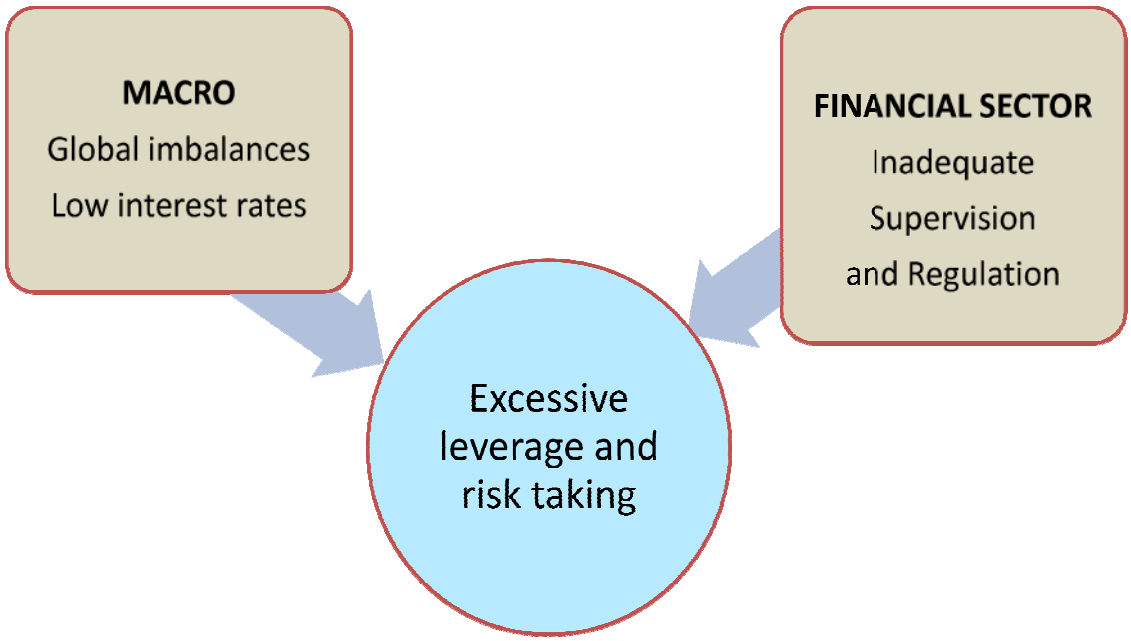
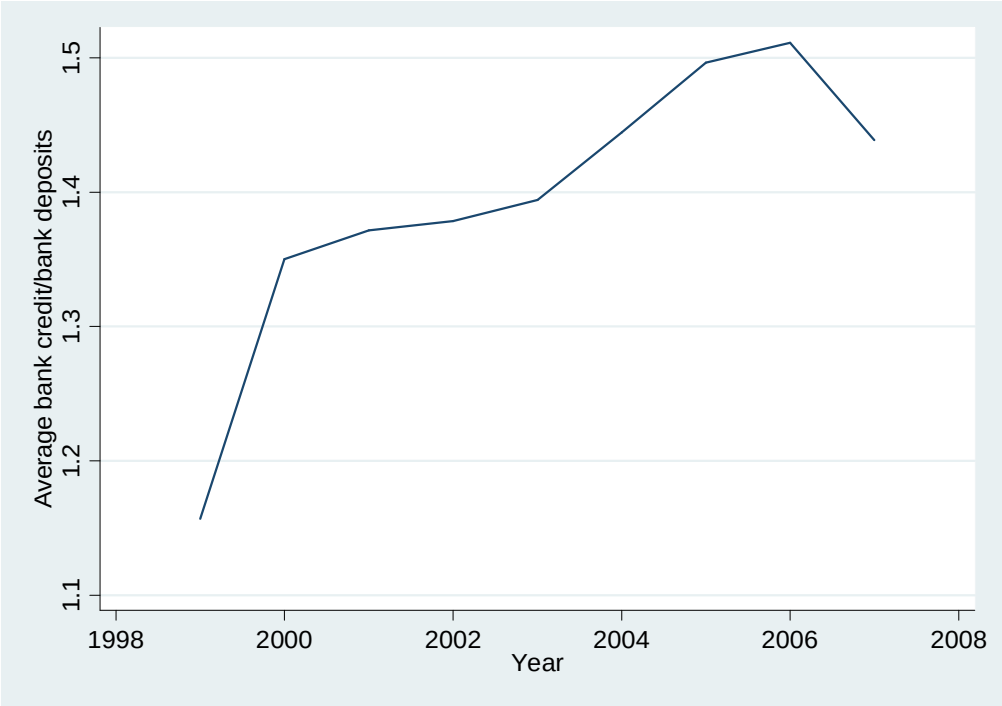


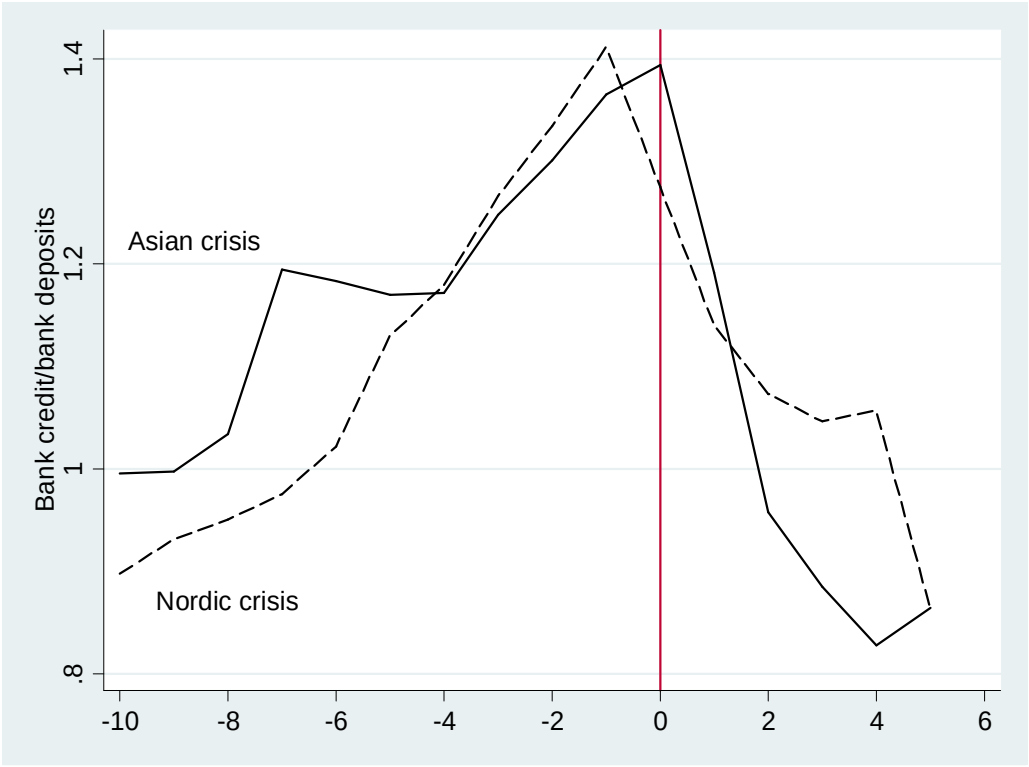
Figure 2. Ratio of Bank Credit to Bank Deposits, Average across OECD Countries (1999–2007)



Note: This chart plots the average ratio of bank credit to deposits across OECD countries.

Source: Authors' calculations from the World Bank Financial Development and Structure Database (2008)

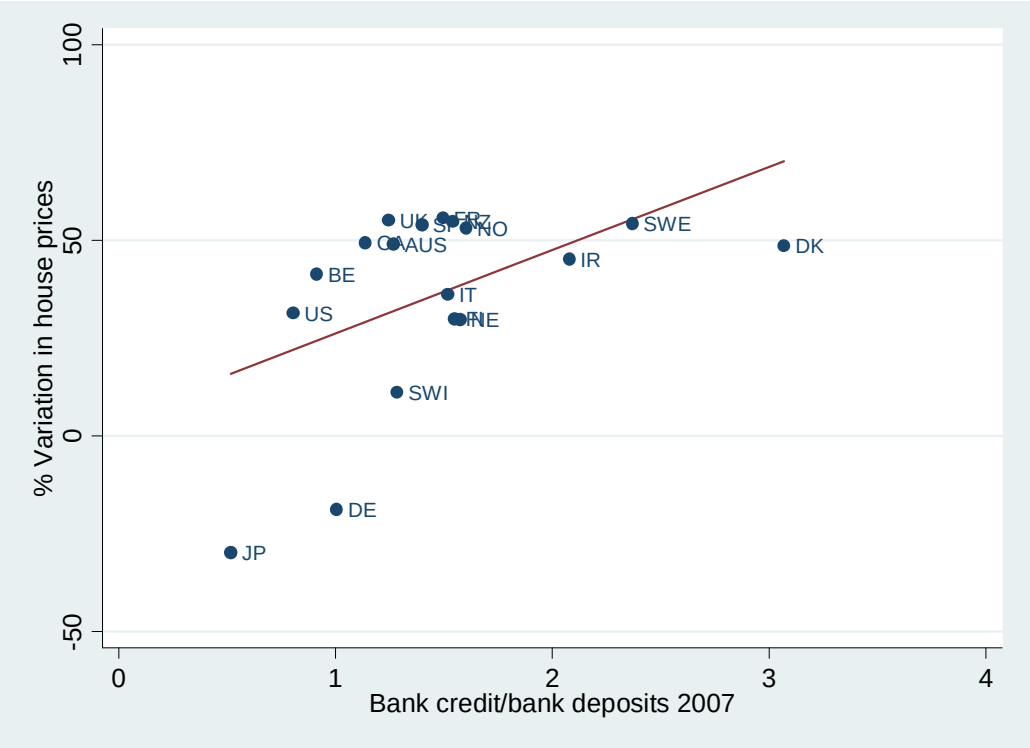
Figure 3. Credit to Deposit Ratio Before and During Crises



Note: This chart plots the average ratio of bank credit to deposits within a 15-years window around banking crises. The crisis date is 1991 for the Nordic crisis and 1997 for the Asian crisis. Asian countries include Indonesia, Malaysia, South Korea, and the Philippines. Nordic countries include Norway, Sweden, and Finland.

Source: Authors' calculations from the World Bank Financial Development and Structure Database (2008)

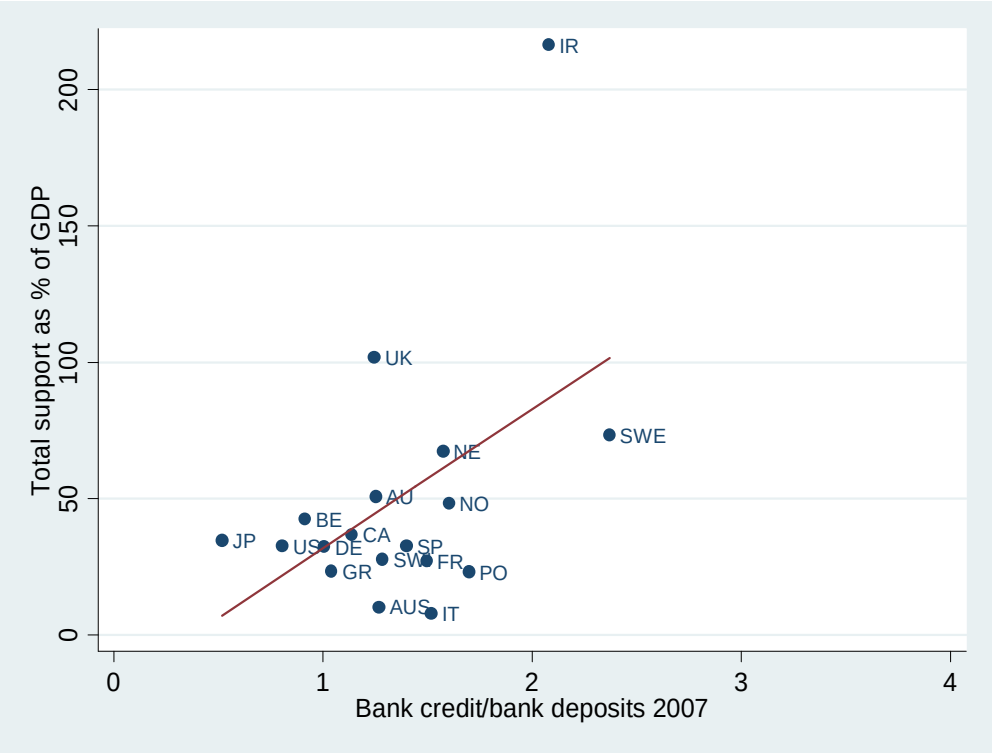
Figure 4. Correlation between House Price Growth and the Credit to Deposit Ratio (2007)



Note: This chart plots the ratio of bank credit to deposits in OECD countries at the eve of the crisis against house price growth in the period 1999-2007. The relationship is statistically significant at the 5 per cent level and the correlation is 50%.

Source: Authors' calculations from the World Bank Financial Development and Structure Database (2008) and OECD Source-Database for the house price index.

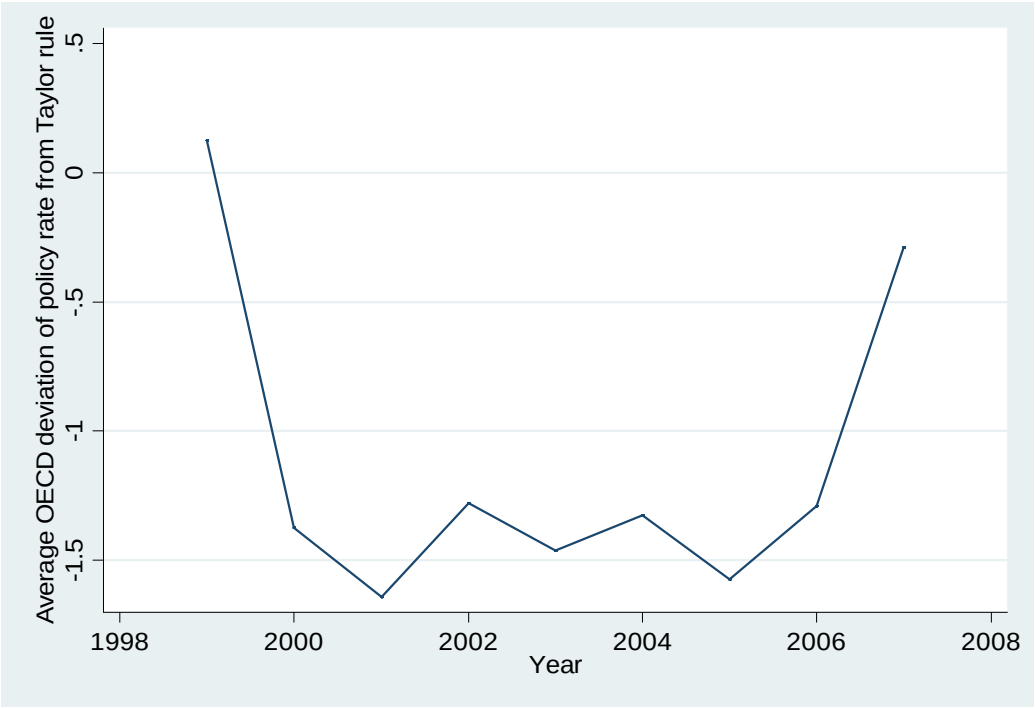
Figure 5. Correlation between Support for the Financial Sector during the Sub-prime Crisis and the Ratio of Credit to Deposits
(2007)



Note: This chart plots total public support to the banking sector against the ratio of bank credit to deposits for OECD countries. Total support includes capital injections, purchase of assets and lending by the Treasury, guarantees (excluding deposit insurance), liquidity provision and other support by the central bank, and upfront government financing, in percentage of GDP. Announced or pledged amounts, and not actual uptake. The correlation is 47% and is statistically significant at the 5 per cent level.

Source: Claessens et al (2010) and World Bank Financial Development and Structure Database (2008).

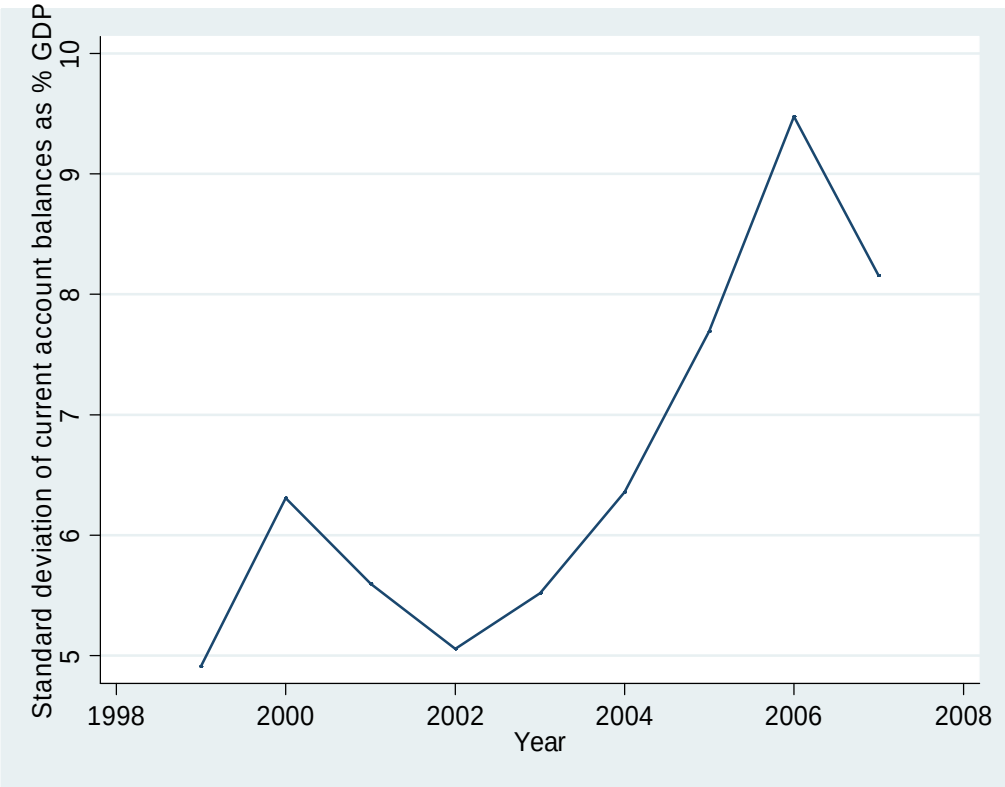
Figure 6. Average OECD Country Monetary Policy Stance
(1999-2007)



Note: This chart plots the average monetary policy stance across OECD countries during 1999-2007. The monetary policy stance is measured as the policy rate deviation from the Taylor rule benchmark.

Source: Ahrend et al (2008)

Figure 7. Dispersion of Current Account Balances among OECD Countries (1999-2007)



Note: This chart plots the cross-sectional dispersion of current accounts across OECD countries, as measured by its standard deviation.

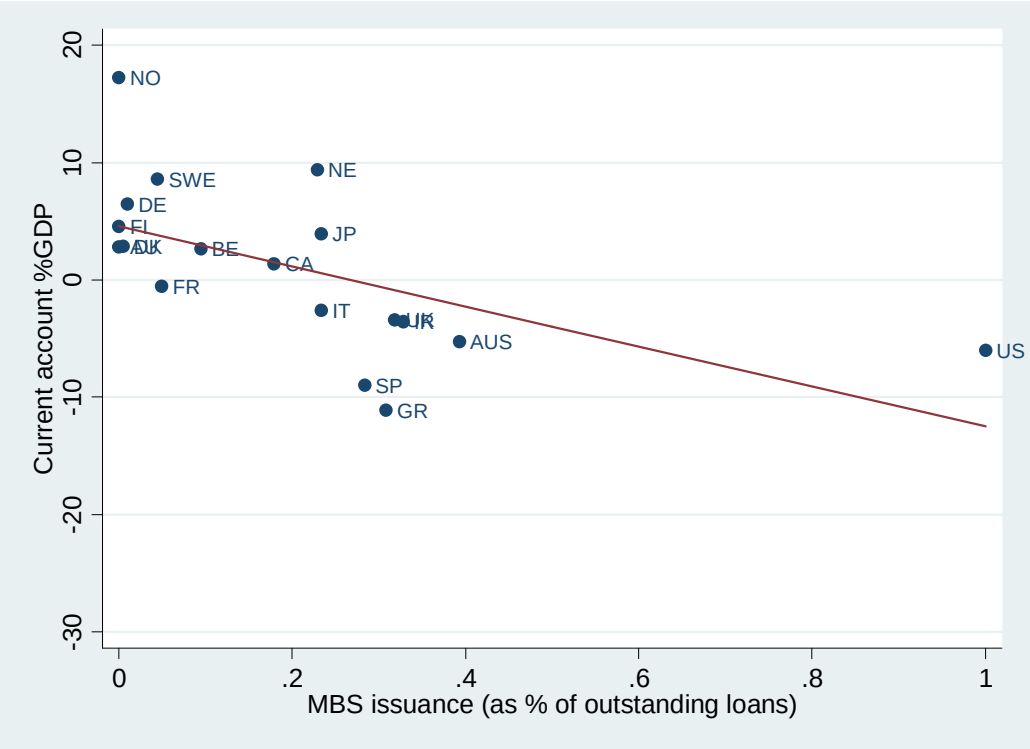
Source: Authors' calculations using the IMF IFS statistics

Figure 8. Average Long-term Short-term Spread, OECD Countries (1999-2007)

Note: This chart plots the average long-term short-term spread across OECD countries. The long-term rate is the 10 year government bond rate. The short term rate is the 3 months rate.

Source: Authors' calculations from the OECD SourceDatabase.

Figure 9. Mortgage Backed Securities (MBS) Issuance and Capital Inflows



Note: This chart plots the current account against mortgage backed securities issuance in OECD countries. Mortgage backed securities issuance (average over the period 2003-2006) is in percentage of outstanding loans and scaled by the value of the largest issuer (hence it is 1 for the USA). The current account is measured as of 2006. The correlation between MBS issuance and current account is 58% and significant statistically at the 1 percent level.

Source: IMF (2008) for MBS issuance and OECD database for the current account.

Table 1. Summary Statistics

In this table we report descriptive statistics of the variables used in the regression analysis. Bank credit/bank deposits is the ratio of credit to the private sector extended by banks to total customer deposits held with banks. This variable is from the World Bank "Financial Development and Structure Database", Beck and Demirguc-Kunt (2009). Capital flow components are from the IMF IFS database. All other macroeconomic variables (interest rates, current account, GDP) are obtained or constructed from the OECD database SourceOECD. Monetary policy stance-past 3 years is the number of quarters in the past 3 years when the short term rate is below what is prescribed by the Taylor rule by at least 1 percent. Alternatively, we use the number of past consecutive quarters when the short term rate was below the Taylor rule by at least 1 per cent. The indices of financial regulation and supervision are constructed using the World Bank "Financial Regulation and Supervision Database", Barth et al (2008). Details on the variables definitions and the data sources are provided in Appendix II. Appendix III describes the construction of the regulation and supervision indices. The sample covers 22 OECD countries during the period 1999-2007.

Variables	Obs	Mean	Std. Dev.	Min	Max
Dependent variables					
Bank credit/bank deposits	196	1.393	0.564	0.506	3.647
Bank credit/GDP	184	1.064	0.392	0.341	2.698
Financial sector credit/bank deposits	192	1.504	0.597	0.513	3.455
Household debt scaled by GDP	187	0.680	0.262	0.102	1.279
House price index	162	90.881	17.000	54.441	126.612
Macroeconomic factors					
Current account balance %GDP	198	0.246	6.613	-24.975	17.272
Deviation of policy rate from Taylor rule	198	-1.124	1.747	-7.622	4.720
Long-term short-term spread	198	0.901	1.066	-4.444	2.853
Short-term rate (3 months rate)	198	3.791	2.171	0.029	14.291
Long-term rate (10 years government bonds yield)	198	4.691	1.423	1.003	11.195
Monetary policy stance- past 3 years	195	5.903	4.488	0	12
Monetary policy stance- consecutive quarters	198	6.318	8.758	0	35
Domestic-USA short-term spread	198	0.007	2.344	-6.235	9.010
Foreign direct investments/GDP	195	0.055	0.069	-0.048	0.498
Other investments/GDP	195	0.098	0.153	-0.084	0.836
Potfolio investments/GDP	195	0.114	0.191	-0.001	1.203

Regulation and supervision					
Central bank supervision index	22	0.773	0.903	0	2
Supervisor power index	22	12.455	2.911	5	18
Banking sector activity restriction index	22	8.000	1.912	5	12
Banking sector entry barriers index	22	10.636	2.860	7	21
Capital regulation stringency index	22	6.227	1.862	3	10
Onsite visits index (1=annual; 2=every two years; 3=other)	20	1.550	0.742	1	3
Other control variables					
Openess ([Exports+Imports]/GDP)	198	65.690	53.338	0.167	239.765
Government budget surplus % GDP (receipts-disbursements)	198	1.360	4.040	-5.660	19.581
Private savings rate	193	18.881	5.959	-30.447	30.655
Inflation rate	198	2.280	1.294	-0.898	7.756
Real GDP growth	196	0.695	0.461	-0.469	2.911

Panel B. Correlations

In this panel we report correlations between the main variables used in Tables 1 and 2.

	Bank credit/bank deposits	Current account balance %GDP	Deviation of policy rate from Taylor rule	Long-term short-term spread	Central bank supervision index	Supervisor power index	Banking sector activity restriction index	Banking sector entry barriers index
Bank credit/bank deposits	1							
Current account balance %GDP	-0.0883	1						
Deviation of policy rate from Taylor rule	-0.0554	0.2375*	1					
Long-term short-term spread	-0.1954*	0.3046*	-0.2493*	1				
Central bank supervision index	-0.1231	-0.3928*	-0.0718	0.1057	1			
Supervisor power index	-0.3678*	0.1301	-0.076	0.2003*	0.0916	1		
Banking sector activity restriction index	0.1464*	0.1517*	0.039	-0.1743*	0.1058	-0.0164	1	
Banking sector entry barriers index	-0.1754*	-0.0443	0.0276	0.049	-0.1382	-0.0294	-0.3676*	1
Capital regulation stringency index	0.0417	-0.3103*	-0.0507	-0.0838	0.1939*	0.3602*	-0.1155	0.2472*

(*) denotes statistical significance at the 5 per cent level and above.

Table 2. Drivers of Financial Imbalances

The dependent variable is the ratio of private sector credit extended by banks to customer deposits. Panel fixed-effect and random effects estimates are reported. Standard errors clustered by country are reported in brackets. Details on the variables definitions and the data sources are provided in Appendix II. Appendix III describes the construction of the regulation and supervision indices. The sample covers 22 OECD countries during the period 1999-2007.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Current account %GDP	-0.029**		-0.029*		-0.027**	-0.025*	-0.026*	-0.026*	-0.026*	-0.026**	
	[0.013]		[0.015]		[0.014]	[0.013]	[0.014]	[0.014]	[0.014]	[0.013]	
Deviation of policy rate from Taylor rule	0.018		-0.006		0.018	0.018	0.018	0.018	0.018	0.018	
	[0.022]		[0.018]		[0.021]	[0.021]	[0.021]	[0.021]	[0.021]	[0.021]	
Long-term short-term spread		-0.063*		-0.056**							-0.061**
		[0.031]		[0.022]							[0.030]
Central bank supervision index					-0.159					-0.195*	-0.116
					[0.126]					[0.117]	[0.106]
Supervisor power index						-0.068**				-0.080***	-0.092***
						[0.028]				[0.020]	[0.020]
Banking sector activity restriction index							0.058			0.047	0.026
							[0.064]			[0.060]	[0.056]
Banking sector entry barriers index								-0.038***		-0.049	-0.051
								[0.013]		[0.032]	[0.031]
Capital regulation stringency index									-0.014	0.074	0.096
									[0.052]	[0.066]	[0.065]
Constant	1.412***	1.550***	1.393***	1.445***	1.615***	2.341***	1.027*	1.896***	1.578***	2.329***	2.462***
	[0.048]	[0.076]	[0.020]	[0.021]	[0.205]	[0.410]	[0.584]	[0.227]	[0.330]	[0.828]	[0.788]
Country FE	x	x	x	x							
Year FE	x	x			x	x	x	x	x	x	x
Observations	196	196	196	196	196	196	196	196	196	196	196
Number of countries	22	22	22	22	22	22	22	22	22	22	22
R-squared	0.25	0.19	0.08	0.03	0.25	0.25	0.25	0.25	0.25	0.25	0.19

Robust standard errors clustered by country in brackets

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 3. Amplification Effects of Features of the Supervisory and Regulatory Regime

The dependent variable is the ratio of private sector credit extended by banks to customer deposits. In this table we report estimates of interaction effects between macro factors (i.e. external imbalances and the stance of monetary policy) and features of the supervisory and regulatory regime. Panel fixed effects estimates are reported with standard errors clustered by country in brackets. Details on the variables definitions and the data sources are provided in Appendix II. Appendix III describes the construction of the regulation and supervision indices. The sample covers 22 OECD countries during the period 1999-2007.

Panel A. Current account % GDP, interactions

Dependent variable in all three panels: bank credit/bank deposits ratio

	(1)	(2)	(3)	(4)	(5)	(6)
Current account %GDP	-0.037**	-0.068***	0.024	-0.152***	-0.004	-0.124**
	[0.014]	[0.012]	[0.051]	[0.037]	[0.058]	[0.050]
Deviation of policy rate from Taylor rule	0.015	0.019	0.019	0.021	0.02	0.024
	[0.022]	[0.021]	[0.022]	[0.021]	[0.021]	[0.022]
Current account % GDP*Central bank supervision index	0.015					0.012*
	[0.009]					[0.007]
Current account % GDP*Supervisor power index		0.004***				0.002**
		[0.001]				[0.001]
Current account % GDP*Banking sector activity restriction index			-0.006			-0.002
			[0.006]			[0.005]
Current account % GDP*Banking sector entry barriers index				0.012***		0.016***
				[0.003]		[0.005]
Current account % GDP*Capital regulation stringency index					-0.004	-0.012
					[0.009]	[0.008]
Constant	1.528***	1.404***	1.503***	1.427***	1.470***	1.414***
	[0.041]	[0.048]	[0.048]	[0.049]	[0.046]	[0.055]
Year FE	x	x	x	x	x	x
Country FE	x	x	x	x	x	x
Observations	196	196	196	196	196	196
Number of countries	22	22	22	22	22	22
R-squared	0.27	0.28	0.26	0.29	0.25	0.34

Robust standard errors in brackets

* significant at 10%; ** significant at 5%; *** significant at 1%

Panel B. Deviation of policy rate from Taylor rule, interactions

	(1)	(2)	(3)	(4)	(5)	(6)
Current account %GDP	-0.030**	-0.027**	-0.028**	-0.029**	-0.029**	-0.026**
	[0.013]	[0.010]	[0.013]	[0.013]	[0.012]	[0.010]
Deviation of policy rate from Taylor rule	0.007	-0.148	0.049	0.03	0.003	-0.07
	[0.039]	[0.108]	[0.050]	[0.066]	[0.063]	[0.146]
Deviation of policy rate from Taylor rule*Central bank supervision index	0.011					0.009
	[0.020]					[0.022]
Deviation of policy rate from Taylor rule*Supervisor power index		0.014				0.014*
		[0.008]				[0.008]
Deviation of policy rate from Taylor rule*Banking sector activity restriction index			-0.004			-0.006
			[0.006]			[0.007]
Deviation of policy rate from Taylor rule*Banking sector entry barriers index				-0.001		-0.001
				[0.006]		[0.010]
Deviation of policy rate from Taylor rule*Capital regulation stringency index					0.002	-0.006
					[0.010]	[0.015]
Constant	1.414***	1.490***	1.484***	1.486***	1.413***	1.419***
	[0.047]	[0.041]	[0.040]	[0.040]	[0.048]	[0.045]
Year FE	x	x	x	x	x	x
Country FE	x	x	x	x	x	x
Observations	196	196	196	196	196	196
Number of countries	22	22	22	22	22	22
R-squared	0.25	0.28	0.25	0.25	0.25	0.29

Robust standard errors in brackets

* significant at 10%; ** significant at 5%; *** significant at 1%

Panel C. Long-term short-term spread, interactions

	(1)	(2)	(3)	(4)	(5)	(6)
Long-term short-term spread	-0.101**	-0.183***	-0.039	-0.152*	-0.108	-0.380**
	[0.040]	[0.046]	[0.077]	[0.075]	[0.071]	[0.138]
Long-term short-term spread *Central bank supervision index	0.042**					0.040***
	[0.018]					[0.014]
Long-term short-term spread *Supervisor power index		0.010***				0.008***
		[0.003]				[0.002]
Long-term short-term spread *Banking sector activity restriction index			-0.003			0.007
			[0.009]			[0.007]
Long-term short-term spread * Banking sector entry barriers index				0.009		0.014*
				[0.006]		[0.007]
Long-term short-term spread *Capital regulation stringency index					0.007	-0.003
					[0.011]	[0.010]
Constant	1.559***	1.539***	1.550***	1.483***	1.552***	1.491***
	[0.073]	[0.065]	[0.077]	[0.034]	[0.077]	[0.035]
Year FE	x	x	x	x	x	x
Country FE	x	x	x	x	x	x
Observations	196	196	196	196	196	196
Number of countries	22	22	22	22	22	22
R-squared	0.21	0.21	0.2	0.2	0.2	0.23

Robust standard errors in brackets

* significant at 10%, ** significant at 5%; *** significant at 1%

Table 4. Drivers of Financial Imbalances: The Composition of Capital Inflows

In this table we explore the importance of the composition of capital inflows for banking sector leverage. Panel fixed effects estimates are reported with standard errors clustered by country in brackets. The components of gross capital inflows are scaled by GDP and include foreign direct investments (FDI), portfolio inflows, and other investments (which include loans to banks). The dependent variable is the ratio of private sector credit extended by banks to customer deposits. Details on the variables definitions and the data sources are provided in Appendix II. Appendix III describes the construction of the regulation and supervision indices. The sample covers 22 OECD countries during the period 1999-2007.

Dependent variable: Bank credit/bank deposits

	(1)	(2)
Current account %GDP	-0.021***	-0.021***
	[0.005]	[0.006]
Foreign direct investments/GDP	0.246	0.198
	[0.590]	[0.575]
Other investments/GDP	0.601**	0.591**
	[0.235]	[0.237]
Portfolio investments/GDP	0.855*	0.940*
	[0.490]	[0.534]
Deviation of monetary policy from Taylor rule	0.036	0.034
	[0.023]	[0.023]
Inflation rate		-0.003
		[0.036]
Real GDP growth rate		0.021
		[0.040]
Constant	1.305***	1.303***
	[0.054]	[0.105]
Country FE	x	x
Year FE	x	x
Observations	193	191
Number of countries	22	22
R-squared	0.34	0.33

Robust standard errors in brackets

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 5. Monetary Policy: Alternative Specifications and Samples

The dependent variable is the ratio of private sector credit extended by banks to customer deposits. Monetary policy stance-past 3 years is the number of quarters in the past 3 years when the short term rate is below what is prescribed by the Taylor rule by at least 1 percent. Alternatively we use the number of past consecutive quarters in the past when the short term rate was below the Taylor rule by at least 1 per cent. Panel fixed effects estimates are reported with standard errors clustered by country in brackets. In columns (7) through (12) all variables in the regressions are lagged by one period. Details on the variables definitions and the data sources are provided in Appendix II. Appendix III describes the construction of the regulation and supervision indices. The sample covers 22 OECD countries during the period 1999-2007.

Panel A. Whole sample

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
							All variables lagged					
Current account %GDP	-0.029**	-0.028**	-0.028**	-0.027**	-0.028**	-0.028**	-0.026**	-0.028**	-0.027**	-0.026**	-0.024**	-0.020**
	[0.012]	[0.012]	[0.012]	[0.012]	[0.011]	[0.011]	[0.009]	[0.011]	[0.012]	[0.011]	[0.010]	[0.007]
Deviation of monetary policy from Taylor rule	0.013						-0.031					
	[0.023]						[0.028]					
Short-term nominal rate		0.021	0.077					-0.033	0.043			
		[0.031]	[0.047]					[0.033]	[0.031]			
Long-term nominal rate			-0.157**						-0.209**			
			[0.057]						[0.082]			
Short-term real rate				0.027						-0.009		
				[0.036]						[0.025]		
Monetary policy stance-past 3 years					-0.006						0.004	
					[0.010]						[0.006]	
Monetary policy stance-consecutive quarters						0.002						0.007
						[0.004]						[0.005]
Real GDP growth rate	0.053	0.05	0.08	0.052	0.02	0.049	0.035	0.043	0.082	0.048	0.055	0.06
	[0.048]	[0.054]	[0.075]	[0.054]	[0.045]	[0.051]	[0.060]	[0.062]	[0.094]	[0.066]	[0.079]	[0.066]
Inflation rate	-0.011	-0.036	-0.03		-0.018	-0.029	-0.080*	-0.028	-0.023		-0.033*	-0.053**
	[0.038]	[0.048]	[0.047]		[0.042]	[0.039]	[0.044]	[0.019]	[0.021]		[0.019]	[0.023]
Constant	1.418***	1.296***	1.871***	1.031***	1.457***	1.441***	1.558***	1.566***	2.200***	1.442***	1.443***	1.484***
	[0.118]	[0.179]	[0.154]	[0.193]	[0.145]	[0.134]	[0.070]	[0.105]	[0.214]	[0.029]	[0.062]	[0.040]
Country FE	x	x	x	x	x	x	x	x	x	x	x	x
Year fFE	x	x	x	x	x	x	x			x	x	x
Observations	194	194	194	194	191	194	172	172	172	172	169	172
Number of countries	22	22	22	22	22	22	22	22	22	22	22	22
R-squared	0.25	0.25	0.27	0.25	0.22	0.25	0.28	0.28	0.35	0.24	0.26	0.3

Robust standard errors clustered by country in brackets

* significant at 10%; ** significant at 5%; *** significant at 1%

Panel B. Euro Area

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
									All variables lagged			
Current account %GDP	-0.024**	-0.026**	-0.021**	-0.022**	-0.024**	-0.018	-0.019*	-0.025**	-0.020**	-0.022**	-0.019*	-0.015
	[0.010]	[0.010]	[0.008]	[0.010]	[0.011]	[0.010]	[0.010]	[0.008]	[0.008]	[0.009]	[0.010]	[0.010]
Deviation of monetary policy from Taylor rule	0.023						-0.032					
	[0.041]						[0.033]					
Short-term nominal rate		-0.007	0.049*					-0.037	0.032			
		[0.017]	[0.023]					[0.021]	[0.023]			
Long-term nominal rate			-0.105**						-0.097**			
			[0.041]						[0.032]			
Short-term real rate				0.031						0.048**		
				[0.023]						[0.020]		
Monetary policy stance-past 3 years					-0.002						0.006	
					[0.004]						[0.007]	
Monetary policy stance-consecutive quarters						0.003						0.006*
						[0.003]						[0.003]
Real GDP growth rate	-0.032	-0.045	-0.047	-0.041	-0.044	-0.027	-0.05	-0.046**	-0.046**	-0.036	-0.031	-0.007
	[0.039]	[0.027]	[0.026]	[0.039]	[0.038]	[0.036]	[0.030]	[0.020]	[0.019]	[0.041]	[0.041]	[0.039]
Inflation rate	0.007	-0.028	-0.025		-0.027	-0.04	-0.101*	-0.037	-0.043*		-0.056**	-0.063**
	[0.072]	[0.023]	[0.020]		[0.023]	[0.023]	[0.055]	[0.024]	[0.022]		[0.019]	[0.022]
Constant	1.281***	1.421***	1.701***	1.319***	1.351***	1.355***	1.519***	1.552***	1.787***	1.351***	1.412***	1.429***
	[0.140]	[0.039]	[0.111]	[0.035]	[0.082]	[0.078]	[0.095]	[0.053]	[0.110]	[0.028]	[0.070]	[0.063]
Country FE	x	x	x	x	x	x	x	x	x	x	x	x
Year FE	x			x	x	x	x			x	x	x
Observations	97	97	97	97	97	97	86	86	86	86	86	86
Number of countries	11	11	11	11	11	11	11	11	11	11	11	11
R-squared	0.48	0.24	0.38	0.47	0.48	0.49	0.48	0.36	0.46	0.46	0.48	0.52

Robust standard errors in brackets

* significant at 10%; ** significant at 5%; *** significant at 1%

Panel C. Does monetary policy amplify the effect of capital inflows on financial imbalances?

In this panel we interact the monetary policy stance and capital inflows to identify possible amplification effects. We use several alternative definitions of the monetary policy stance. In columns (1) and (2) we define the stance as tight if the policy rate is above what is prescribed by the Taylor rule. In column (3) we define the stance as tight if the number of quarters when monetary policy was below the Taylor rule benchmark by more than 1 per cent in the past three years is lower than sample median. In column (4) we define the stance as tight if the number of past consecutive quarters when monetary policy was below the Taylor rule benchmark by more than 1 per cent is lower than sample median. And in column (5) we define the stance as tight if the short term rate is below the country specific median.

Dependent variable: Bank credit/bank deposits

		(1)	(2)	(3)	(4)	(5)
(1)	Current account %GDP*Tight Regime	-0.029***	-0.133**	-0.150**	-0.125**	-0.130**
		[0.009]	[0.054]	[0.056]	[0.052]	[0.052]
(2)	Current account %GDP*Loose Regime	-0.029**	-0.129**	-0.133**	-0.124**	-0.137**
		[0.014]	[0.052]	[0.052]	[0.051]	[0.053]
	Deviation of policy rate from Taylor rule	0.018	0.025	0.023	0.025	0.026
		[0.022]	[0.022]	[0.021]	[0.021]	[0.022]
	Current account % GDP*Central bank supervision index		0.013*	0.013*	0.012*	0.012
			[0.007]	[0.007]	[0.007]	[0.007]
	Current account % GDP*Supervisor power index		0.002**	0.002**	0.002**	0.003**
			[0.001]	[0.001]	[0.001]	[0.001]
	Current account % GDP*Banking sector activity restriction index		-0.001	-0.001	-0.002	-0.001
			[0.005]	[0.005]	[0.005]	[0.005]
	Current account % GDP*Banking sector entry barriers index		0.016***	0.016***	0.016***	0.016***
			[0.005]	[0.005]	[0.005]	[0.005]
	Current account % GDP*Capital regulation stringency index		-0.012	-0.012	-0.012	-0.013
			[0.008]	[0.007]	[0.007]	[0.008]
	Constant	1.485***	1.509***	1.496***	1.435***	1.410***
		[0.037]	[0.050]	[0.053]	[0.052]	[0.055]
	P-value test (1)=(2)	0.961	0.552	0.234	0.900	0.192
	Year FE	x	x	x	x	x
	Country FE	x	x	x	x	x
	Observations	196	196	196	196	196
	Number of countries	22	22	22	22	22
	R-squared	0.25	0.34	0.34	0.34	0.34

Robust standard errors in brackets

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 6. Alternative Supervisory Variables

The dependent variable is the ratio of private sector credit extended by banks to customer deposits. In this table we report estimates of interaction effects between macro factors (i.e. external imbalances and the stance of monetary policy) and features of the supervisory and regulatory regime. Panel fixed effects estimates are reported with standard errors clustered by country in brackets. In columns (1)-(3) we report estimates excluding the US from the sample. In columns (4)-6) we add interactions with a leverage ratio dummy. Leverage ratio is a dummy that takes value one for the US and Canada. In columns (7)-(9) we add interactions with onsite supervision. The onsite visits index takes value 1 if visits are annual; 2 if visits are every two years; 3 otherwise. Details on the variables definitions and the data sources are provided in Appendix II. Appendix III describes the construction of the regulation and supervision indices. The sample covers 22 OECD countries during the period 1999-2007.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Macro-Factor=Current Account	Macro-Factor=Monetary Policy Stance	Macro-Factor=Long-Term Short-Term Spread	Macro-Factor=Current Account	Macro-Factor=Monetary Policy Stance	Macro-Factor=Long-Term Short-Term Spread	Macro-Factor=Current Account	Macro-Factor=Monetary Policy Stance	Macro-Factor=Long-Term Short-Term Spread
	Excludes USA			**Leverage ratio dummy**			**Onsite supervision**		
Current account %GDP	-0.177***	-0.027**		-0.179***	-0.028**		-0.186***	-0.025**	
	[0.038]	[0.010]		[0.039]	[0.010]		[0.044]	[0.012]	
Deviation of policy rate from Taylor rule	0.02	-0.182		0.02	-0.14		0.021	-0.211	
	[0.022]	[0.157]		[0.021]	[0.151]		[0.026]	[0.146]	
Long-term short-term spread			-0.329***			-0.307***			-0.285***
			[0.065]			[0.060]			[0.087]
Macro-Factor*Central bank supervision index	0.006	0.007	0.037**	0.005	0.012	0.035**	-0.002	-0.012	0.051**
	[0.008]	[0.017]	[0.015]	[0.008]	[0.017]	[0.016]	[0.014]	[0.031]	[0.020]
Macro-Factor*Supervisor power index	0.003**	0.016*	0.010***	0.003**	0.011	0.009***	0.003**	0.016*	0.006**
	[0.001]	[0.009]	[0.003]	[0.001]	[0.008]	[0.003]	[0.001]	[0.007]	[0.003]
Macro-Factor*Entry barriers	0.012***	0.000	0.012**	0.012***	0.000	0.011**	0.011***	-0.004	0.014*
	[0.003]	[0.007]	[0.005]	[0.004]	[0.007]	[0.005]	[0.004]	[0.011]	[0.007]
Macro-Factor*Leverage ratio				0.001	0.058	-0.031			
				[0.056]	[0.071]	[0.024]			
Macro-Factor*Onsite visits index (1=annual; 2=every two years; 3=other)							0.017	0.059	-0.032
							[0.029]	[0.055]	[0.031]
Constant	1.461***	1.452***	1.553***	1.431***	1.460***	1.528***	1.457***	1.441***	1.586***
	[0.050]	[0.045]	[0.066]	[0.049]	[0.047]	[0.066]	[0.067]	[0.043]	[0.091]
Year FE	x	x	x	x	x	x	x	x	x
Country FE	x	x	x	x	x	x	x	x	x
Observations	187	187	187	196	196	196	178	178	178
Number of countries	21	21	21	22	22	22	20	20	20
R-squared	0.32	0.29	0.23	0.31	0.29	0.23	0.32	0.3	0.24

Robust standard errors in brackets

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 7. Boom versus Bust

The dependent variable is the ratio of private sector credit extended by banks to customer deposits. The boom period is 2003-2007 and the bust period is 1999-2002. In this table we report estimates of interaction effects between macro factors (i.e. external imbalances and the stance of monetary policy) and features of the supervisory and regulatory regime separatly for the boom period and the bust period. Panel fixed effects estimates are reported with standard errors clustered by country in brackets. Details on the variables definitions and the data sources are provided in Appendix II. Appendix III describes the construction of the regulation and supervision indices. The sample covers 22 OECD countries during the period 1999-2007.

	(1)	(2)	(3)	(4)	(5)	(6)
	Macro-Factor=Current Account	Macro-Factor= Monetary Policy Stance	Macro-Factor=Long-Term Short-Term spread	Macro-Factor=Current Account	Macro-Factor= Monetary Policy Stance	Macro-Factor=Long-Term Short-Term spread
	Boom period			**Bust period**		
Current account %GDP	-0.119***	-0.032***		-0.148	0.002	
	[0.032]	[0.005]		[0.157]	[0.016]	
Deviation of policy rate from Taylor rule	-0.021	-0.186		0.065	-0.017	
	[0.013]	[0.108]		[0.058]	[0.151]	
Long term-short term spread			-0.257**			-0.91
			[0.092]			[0.549]
Macro-Factor*Central bank supervision index	0.006	0.015	0.029*	0.015	-0.029	0.132
	[0.005]	[0.019]	[0.016]	[0.020]	[0.034]	[0.097]
Macro-Factor*Supervisor power index	0.002**	0.011*	0.010***	-0.002	0.008	0.015
	[0.001]	[0.006]	[0.003]	[0.003]	[0.008]	[0.012]
Macro-Factor*Activity restriction index	-0.002	0.008	-0.006	0.000	-0.006	0.04
	[0.002]	[0.005]	[0.005]	[0.010]	[0.008]	[0.040]
Macro-Factor*Entry barriers index	0.004**	0.007	0.006	0.011	-0.015	0.026
	[0.002]	[0.005]	[0.005]	[0.010]	[0.015]	[0.032]
Macro-Factor*Capital regulation stringency index	0.005	-0.022*	-0.002	0.008	0.033	-0.01
	[0.003]	[0.011]	[0.008]	[0.011]	[0.029]	[0.054]
Constant	1.526***	1.362***	1.601***	1.521***	1.174***	1.476***
	[0.037]	[0.030]	[0.043]	[0.169]	[0.075]	[0.101]
Year FE	x	x	x	x	x	x
Country FE	x	x	x	x	x	x
Observations	108	108	108	88	88	88
Number of countries	22	22	22	22	22	22
R-squared	0.6	0.58	0.53	0.18	0.2	0.21

Robust standard errors in brackets.

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 8. Global Factors

The dependent variable is the ratio of private sector credit extended by banks to customer deposits. The global monetary policy stance is measured as the average across OECD countries of the policy rate deviation from the Taylor rule benchmark. Global imbalances are measured by the cross-country standard deviation of current accounts scaled by GDP. Panel fixed effects estimates are reported with standard errors clustered by country in brackets. Details on the variables definitions and the data sources are provided in Appendix II. Appendix III describes the construction of the regulation and supervision indices. The sample covers 22 OECD countries during the period 1999-2007.

Panel A. Global monetary policy stance and global imbalances

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
	Global Factor=Global monetary policy stance							**Global Factor=Global imbalances**						
Current account %GDP	-0.032**	-0.029**	-0.028**	-0.028**	-0.029**	-0.029**	-0.029**	-0.024*	-0.030**	-0.025**	-0.029**	-0.029**	-0.029**	-0.024***
	[0.014]	[0.012]	[0.012]	[0.013]	[0.013]	[0.013]	[0.012]	[0.013]	[0.011]	[0.009]	[0.013]	[0.012]	[0.012]	[0.007]
Deviation of policy rate from Taylor rule	0.018	0.013	0.02	0.018	0.018	0.018	0.015	-0.004	0.026	0.019	0.018	0.019	0.019	0.029
	[0.023]	[0.020]	[0.022]	[0.022]	[0.022]	[0.021]	[0.019]	[0.016]	[0.023]	[0.021]	[0.021]	[0.021]	[0.021]	[0.022]
Global Factor	-0.122*							0.048***						
	[0.065]							[0.015]						
Global Factor*Central bank supervision index		0.058					0.077		-0.029*					-0.035**
		[0.048]					[0.046]		[0.016]					[0.015]
Global Factor*Supervisor power index			0.021*				0.034***			-0.009				-0.011**
			[0.011]				[0.011]			[0.006]				[0.005]
Global Factor*Banking sector activity restriction index				0.015			0.017				0.004			0.001
				[0.027]			[0.027]				[0.007]			[0.006]
Global Factor*Banking sector entry barriers index					0.005		0.023					-0.007***		-0.011***
					[0.009]		[0.016]					[0.002]		[0.003]
Global Factor*Capital regulation stringency index						-0.019	-0.053						-0.005	0.009
						[0.029]	[0.037]						[0.007]	[0.008]
Constant	1.283***	1.478***	1.116***	1.607***	1.506***	1.163***	1.085***	1.083***	1.739***	1.719***	0.999***	2.268***	1.798***	3.590***
	[0.060]	[0.088]	[0.117]	[0.398]	[0.177]	[0.104]	[0.135]	[0.098]	[0.155]	[0.308]	[0.250]	[0.229]	[0.417]	[0.822]
Year FE		x	x	x	x	x	x	x	x	x	x	x	x	x
Country FE	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Observations	196	196	196	196	196	196	196	196	196	196	196	196	196	196
Number of countries	22	22	22	22	22	22	22	22	22	22	22	22	22	22
R-squared	0.14	0.27	0.27	0.26	0.25	0.26	0.33	0.16	0.27	0.28	0.25	0.27	0.25	0.33

Robust standard errors in brackets

* significant at 10%; ** significant at 5%; *** significant at 1%

Panel B. Multiple interactions

	(1)	(2)
Current account %GDP	-0.024***	-0.026***
	[0.007]	[0.008]
Deviation of policy rate from Taylor rule	0.030	0.030
	[0.023]	[0.023]
Global imablances*Central bank supervision index	-0.035**	-0.031**
	[0.015]	[0.015]
Global imbalances*Supervisor power index	-0.010**	-0.008**
	[0.004]	[0.004]
Global imbalances*Banking sector activity restriction index	0.001	
	[0.006]	
Global imbalances*Banking sector entry barriers index	-0.011***	-0.009***
	[0.003]	[0.002]
Global imbalances*Capital regulation stringency index	0.009	
	[0.008]	
Global monetary policy stance*Supervisor power index	0.018*	0.018*
	[0.009]	[0.009]
Constant	2.139***	3.888***
	[0.325]	[0.766]
Year FE	x	x
Country FE	x	x
Observations	196	196
Number of countries	22	22
R-squared	0.34	0.33

Robust standard errors in brackets

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 9. Alternative Outcome Variables

This table reports baseline estimates using alternative outcome variables. Panel fixed effects estimates are reported with standard errors clustered by country in brackets. Details on the variables definitions and the data sources are provided in Appendix II. Appendix III describes the construction of the regulation and supervision indices. The sample covers 22 OECD countries during the period 1999-2007.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Bank credit/GDP		Financial sector credit/bank deposits		Household debt/GDP		House price index	
Current account %GDP	-0.038**	-0.038**	-0.031**	-0.031**	-0.013**	-0.012**	-2.242**	-2.199**
	[0.014]	[0.015]	[0.012]	[0.011]	[0.005]	[0.005]	[0.975]	[0.968]
Deviation of monetary policy from Taylor rule	0.008	0.000	0.024	0.021	0.008	0.010	0.218	-1.111
	[0.016]	[0.018]	[0.025]	[0.021]	[0.007]	[0.009]	[0.907]	[1.212]
Real GDP growth rate		-0.03		0.02		-0.008		-4.364*
		[0.047]		[0.035]		[0.014]		[2.427]
Inflation rate		-0.014		-0.011		-0.002		-2.685
		[0.031]		[0.034]		[0.013]		[2.135]
Constant	1.021***	0.891***	1.524***	1.546***	0.626***	0.604***	84.766***	91.147***
	[0.039]	[0.145]	[0.063]	[0.134]	[0.014]	[0.036]	[3.721]	[6.735]
Country FE	x	x	x	x	x	x	x	x
Year FE	x	x	x	x	x	x	x	x
Observations	184	182	192	190	187	186	162	161
Number of countries	21	21	22	22	21	21	18	18
R-squared	0.45	0.44	0.25	0.24	0.73	0.73	0.73	0.73

Robust standard errors in brackets

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 10. Extension: Determinants of Current Account Imbalances

We report panel fixed effects estimates of the determinants of current account balances. The domestic-USA spread is the short-term (3 month) spread. The government surplus is defined as revenues minus expenditures. Private savings include household and corporate savings. Small (large) countries are countries with GDP below (above) the sample median. The boom period is 2003-2007 and the bust period is 1999-2002. Standard errors clustered by country are reported in parentheses. Details on the variables definitions and the data sources are provided in Appendix II. Appendix III describes the construction of the regulation and supervision indices. The sample covers 22 OECD countries during the period 1999-2007.

		Small countries	Large countries		Small countries	Large countries
	(1)	(2)	(3)	(4)	(5)	(6)
	Current account %GDP			Current account %GDP		
Government budget surplus %GDP	0.233	0.313	-0.087	0.352	0.524**	-0.086
	[0.263]	[0.252]	[0.300]	[0.222]	[0.201]	[0.280]
Openess ([Exports+Imports]/GDP)	0.044	0.063	0.043	0.036	0.027	0.038
	[0.040]	[0.057]	[0.050]	[0.037]	[0.055]	[0.048]
Private savings rate	0.262***	0.166	0.471**	0.14	-0.062	0.555***
	[0.090]	[0.099]	[0.155]	[0.149]	[0.150]	[0.149]
Real GDP growth rate	-0.18	-0.813	1.426**	-0.185	-0.637	1.165**
	[0.954]	[1.056]	[0.501]	[0.739]	[0.702]	[0.393]
Domestic-USA spread	-0.796**	-1.416***	0.23			
	[0.305]	[0.259]	[0.313]			
Domestic-USA spread*Boom				-1.322**	-2.170***	-0.165
				[0.471]	[0.595]	[0.355]
Domestic-USA spread*Bust				-0.366	-0.601	0.515
				[0.246]	[0.373]	[0.290]
Constant	-5.153	-1.163	-12.695**	-3.116	2.852	-14.087**
	[3.088]	[3.254]	[4.905]	[4.210]	[5.436]	[4.513]
Test Boom=Bust p-value				0.003	0.001	0.003
Country FE	x	x	x	x	x	x
Year FE	x	x	x	x	x	x
Number of observations	191	95	96	191	95	96
Number of countries	22	11	11	22	11	11
R-squared	0.33	0.44	0.34	0.33	0.44	0.34

Robust standard errors in brackets

* significant at 10%; ** significant at 5%; *** significant at 1%

Appendix I. Determinants of the Long-term Short-term Spread

This table reports fixed effects estimates of the determinants of the long-term short-term spread. We lag the current account and alternative measures of the monetary policy stance by one year and include a set of contemporaneous control variables. Monetary policy stance is the number of quarters in the past 3 years when the short term rate is below what is prescribed by the Taylor rule by at least 1 percent. Alternatively, we use the number of past consecutive quarters when the short term rate was below the Taylor rule by at least 1 per cent. Standard errors clustered by country are reported in brackets. Details on the variables definitions and the data sources are provided in Appendix II. Appendix III describes the construction of the regulation and supervision indices. The sample covers 22 OECD countries during the period 1999-2007.

	(1)	(2)	(3)	(4)	(5)	(6)
Lagged Current account %GDP	0.100***	0.102**	0.101***	0.097***	0.106***	0.100***
	[0.032]	[0.037]	[0.035]	[0.030]	[0.033]	[0.031]
Lagged Deviation of monetary policy from Taylor rule	-0.003			-0.002		
	[0.034]			[0.029]		
Lagged Monetary policy-stance past 3 years		0.005			0.009	
		[0.020]			[0.021]	
Lagged Monetary policy-stance consecutive quarters			0.002			0.003
			[0.010]			[0.010]
Real GDP growth rate				0.03	0.016	0.033
				[0.055]	[0.052]	[0.054]
Inflation rate				0.035	0.058	0.037
				[0.062]	[0.056]	[0.061]
Government budget surplus %GDP				-0.051	-0.068	-0.051
				[0.051]	[0.057]	[0.051]
Real effective exchange rate				-0.011	-0.013	-0.011
				[0.013]	[0.014]	[0.013]
Constant	0.726***	1.665***	-0.273**	1.643	2.726*	1.603
	[0.116]	[0.223]	[0.126]	[1.395]	[1.447]	[1.335]
Country FE	x	x	x	x	x	x
Year FE	x	x	x	x	x	x
Observations	176	173	176	176	173	176
Number of countries	22	22	22	22	22	22
R-squared	0.7	0.71	0.7	0.72	0.74	0.72

Robust standard errors in brackets

* significant at 10%; *** significant at 1%

Appendix II. Data Sources

Variable	Details	Source
Bank credit/bank deposits	Private credit by deposit money banks as a share of demand, time and saving deposits in deposit money banks. Raw data are from the electronic version of the IMF's International Financial Statistics, October 2008. Private credit by deposit money banks (IFS line 22d); bank deposits (IFS lines 24 and 25).	World Bank Financial Structure and Development Data http://econ.worldbank.org/WBSITE/EXTERNALE Raw data are from the electronic version of the IMF's International Financial Statistics, October 2008. Private credit by deposit money banks and other financial institutions (IFS lines 22d and 42d)
Bank credit/GDP		World Bank Financial Structure and Development Database
Financial sector credit/bank deposits	Includes non-bank credit institutions	World Bank Financial Structure and Development Database
Household sector debt		OECD source database
House price index		OECD source database
Current account %GDP	The current account includes all the transactions (other than those in financial items) that involve economic values and occur between resident and non-residents entities. Also covered are offsets to current economic values provided or acquired without a quid pro quo. Specifically, the major classifications are: goods and services; income; current transfers.	OECD source database
Capital inflows components	Includes foreign direct investments, portfolio investments, and other investments	IMF-IFS statistics
Deviation of policy rate from Taylor rule	Spread between short term rate and Taylor rule benchmark. The calculation of the Taylor benchmark uses the inflation rate, inflation target, equilibrium interest rate, the short term rate, and the output gap.	Ahrend et al (2008)
Long-term rate	Long term (in most cases 10 year) government bond yield.	OECD source database
Short-term rate	3 months rate	OECD source database
Long-term short-term spread	Difference between the long-term rate and the short-term rate	
GDP	Gross domestic product	OECD source database
Exports and Imports		OECD source database
Savings rate %	Private savings over private disposable income	OECD source database
Government budget surplus	% of GDP revenues-expenditures of the central government	OECD source database
Inflation rate		OECD source database
Real GDP growth		OECD source database
Central bank supervision index	Scored 0 to 2: 0 for no supervisiory power; 1 for shared power; 2 for full power	The Dexia Central Bank Directory 2009.
Other supervisory and regulatory variables	See Appendix 3 for details	World Bank Group Barth and Levin database

Appendix III. Definition of Supervisory and Regulatory Indices

Index	Construction and Sources	Survey Questions
Supervisor power index	Measures the extent to which official supervisory authorities have the authority to take specific actions to prevent and correct problems and to resolve problem banks. Index= 11.3.1 + 11.3.2 +11.3.3 + 11.6 + 11.7 + 11.9.1 + 11.9.2 + 11.9.3 +11.9.4+4*(11.9.5) Yes = 1; No = 0 A higher value indicates greater power.	11.3 Can the supervisory agency suspend the directors' decision to distribute: 11.3.1 Dividends? 11.3.2 Bonuses? 11.3.3 Management fees? 11.6 Can the supervisor legally declare - such that this declaration supersedes some of the rights of shareholders - that a bank is insolvent? 11.7 According to the Banking Law, does the supervisor have authority to intervene - that is, suspend some or all ownership rights - a problem bank? 11.9. Regarding bank restructuring and reorganization, can the supervisory agency or any other government agency do the following: 11.9.1 Supersede shareholder rights? 11.9.2 Remove and replace management? 11.9.3 Remove and replace directors? 11.9.4 Forbear certain prudential regulations? 11.9.5 Is there a separate insolvency law?
Banking sector activity restriction index	Includes restrictions on securities, insurance, and real estate activities plus restrictions on the ability of banks to own and control nonfinancial firms. Unrestricted=1 Permitted=2 Restricted=3 Prohibited=4 Index=4.1+4.2+4.3 A higher value indicates greater restrictions.	4.2. What is the level of regulatory restrictiveness for bank participation in securities activities? 4.2. What is the level of regulatory restrictiveness for bank participation in insurance activities? 4.3. What is the level of regulatory restrictiveness for bank participation in real estate activities?
Capital regulation stringency index	Measures the extent of regulatory requirements regarding the amount of capital that banks must have relative to specific guidelines. And	3.1.1 Is this ratio risk weighted in line with the Basle guidelines? 3.3 Does the minimum ratio vary as a function of market risk?

	the extent to which the source of funds that count as regulatory capital can include assets other than cash or government securities, borrowed funds, and whether the sources of capital are verified by the regulatory or supervisory authorities. Index= 3.1.1 + 3.2 + 3.3 + 3.9.1 + 3.9.2 + 3.9.3 + (1 if 3.7 < 0.75) Yes = 1; No = 0 Higher values indicating greater stringency. 1.5: Yes = 1, No = 0: 1.6&1.7: Yes = 0, No = 1. A higher value indicates greater stringency.	3.9.1 Are market value of loan losses not realized in accounting books deducted? 3.9.2 Unrealized losses in securities portfolios? 3.9.3 Unrealized foreign exchange losses? 1.5 Are the sources of funds to be used as capital verified by the regulatory/supervisory authorities? 1.6 Can the initial disbursement or subsequent injections of capital be done with assets other than cash or government securities? 1.7 Can initial disbursement of capital be done with borrowed funds?
Banking sector entry barriers index	Measures whether there are any limitations placed on the ownership of domestic banks by foreign banks, whether there are any limitations placed on the ability of foreign banks to enter the domestic banking industry, and whether there are specific legal requirements for obtaining a license to operate as a bank. Index=sum(1.8.1–1.8.8)+1.9 Yes = 1; No = 0 A higher value indicating greater entry barriers.	1.8 Which of the following are legally required to be submitted before issuance of the banking license? 1.8.1 Draft by-laws? 1.8.2 Intended organization chart? 1.8.3 Financial projections for first three years? 1.8.4 Financial information on main potential shareholders? 1.8.5 Background/experience of future directors? 18.6 Background/experience of future managers? 1.8.7 Sources of funds to be disbursed in the capitalization of new bank? 1.8.8 Market differentiation intended for the new bank? 1.9 Are there any limitations placed on foreign bank entrance or acquisition of domestic banks? Yes/No