

Els Opuscles del CREI

num. **35**

December 2013

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CREI 

Centre de Recerca
en Economia Internacional

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Published by: CREI
Universitat Pompeu Fabra
Ramon Trias Fargas, 25-27 08005 Barcelona
Tel. 93 542 28 26

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Design: Fons Gràfic
Printed by: Masanas Gràfiques

ISSN: 1137 - 7828
Dipòsito legal: B. 3121-2014

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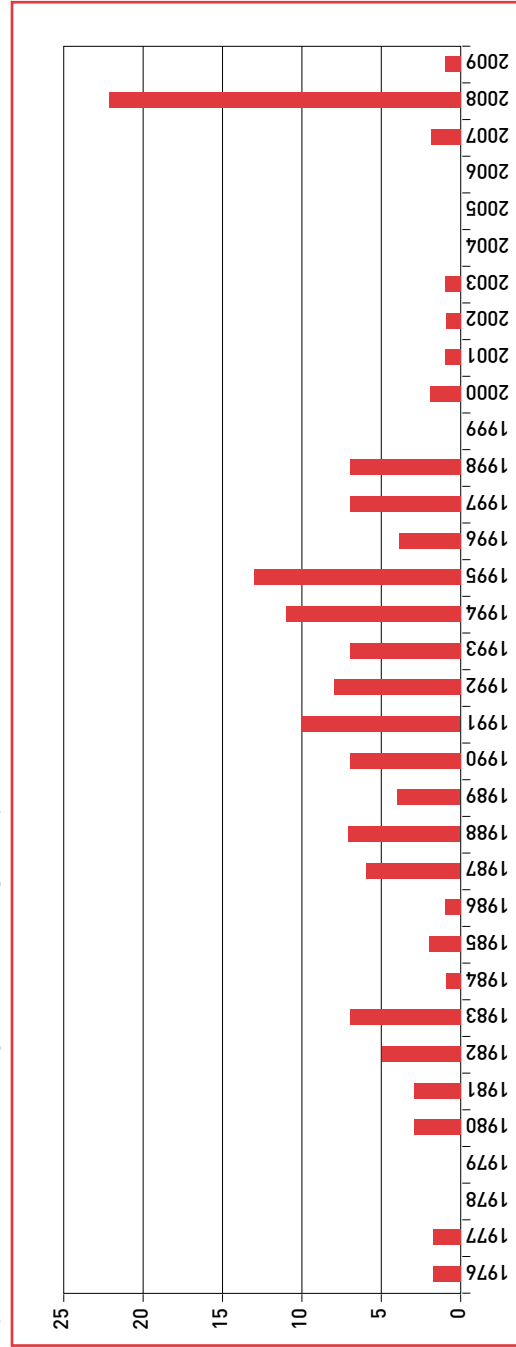
1. Introduction

Western Europe and USA suffered recently a strong banking crisis, followed by a severe economic recession with important costs in terms of aggregate output and employment. These phenomena are not unique: Banking crises are recurrent phenomena, triggering deep and long-lasting recessions (see Kindelberger (1978) and Reinhart and Rogoff (2009a) for historical evidence and Figure 1 based on Laeven and Valencia (2012) on recent systemic banking crises). The main channel by which banks' balance-sheet weaknesses affect the real economy is via a reduction of the supply of credit, a credit crunch, and also through some compositional changes of credit supply as the so-called zombie lending (or loan ever-greening) or a significant reduction of appetite for risk. Importantly, banking crises are not random events that come from exogenous risks, but come after periods of very strong private credit growth (Schularick and Taylor, 2012). Therefore, for systemic risk, it is crucial to understand the determinants and implications of credit in good and bad times — the so-called credit cycles.

This *opuscle* analyzes the relationship between credit cycles and systemic risk, where systemic risk is defined, based on Freixas, Laeven and Peydró (2014), as “the risk of threats to financial stability that impair the functioning of the financial system as a whole with significant adverse effects on the broader economy.” In particular, I analyze the following questions: Are credit cycles one of the main determinants of the likelihood and severity of systemic financial crises? What is the role of the banking sector? Do financial innovation, globalization, deficient corporate governance and market disciplining, and public policy (including macroprudential and monetary policy) affect credit cycles?¹

In the rest of this *opuscle*, first, I distinguish between credit cycles caused by financial frictions in non-financial borrowers (the demand side), and the ones by frictions in banks (credit supply cycles). Second, I analyze credit supply in good times and its implications for the endogenous building-up of excessive bank risk-taking. Third, I analyze credit supply at the time of financial crises. Finally, I offer some concluding remarks. In all these cases, I examine the sources of excessive credit cycles, in particular financial globalization and deregulation, financial innovation (securitization), deficient corporate governance and market disciplining, and monetary and prudential policy.

Figure 1. Number of banking crises starting each year, 1976-2009



Based on Laeven and Valencia (2012). The sample includes 116 countries, with a total of 147 banking crises, of which 26 are border events and the rest are systemic events. A banking crisis is defined as systemic if two conditions are met: (1) significant signs of financial distress in the banking sector, and (2) significant banking policy intervention measures in response to significant losses in the banking system.

2. Financial frictions and credit cycles

The cycles in credit growth consist of periods during which the economy is performing well and credit growth is robust (on average 7%) and periods when the economy is in recession or crisis and credit contracts (on average -2% for a sample of 14 major developed countries over the last 140 years, see Schularick and Taylor (2012) and their following papers with Oscar Jordà). Figure 2 shows aggregate granted credit and output cycles in the USA and Spain since 2000. Granted credit is not as forward looking as change in the supply of committed credit as it is also affected by credit demand, notably drawn of existing credit lines; instead, change in lending standards from lending surveys from central banks is more forward looking (see Maddaloni and Peydró, 2011).

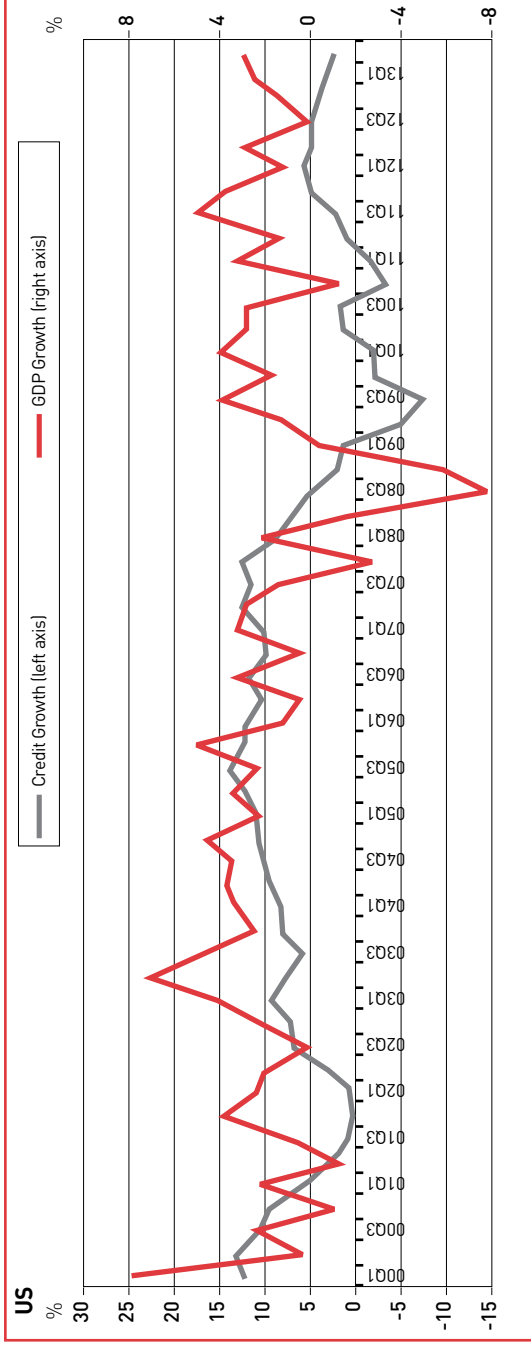
Credit cycles stem from either: (1) Non-financial borrowers' agency frictions and investment opportunities (credit demand) as in, for example, Bernanke and Gertler (1989), Kiyotaki and Moore (1997), Lorenzoni (2008), and Jeanne and Korinek (2010), where better investment opportunities or better firms' and households' collateral and net worth imply higher credit, or (2) banks' agency frictions (credit supply) as in, for example, Rajan (1994), Holmstrom and Tirole (1997), Diamond and Rajan (2006), Allen and Gale (2007), and Adrian and Shin (2011), where changes in bank capital, liquidity and competition allow changes in credit supply.

The main explanation of credit supply cycles is based on an agency view. I believe that one cannot understand systemic risk without this agency view of risk-taking.² The agency view highlights agency problems at the core of the build-up of systemic risk that have to do with the difficulties

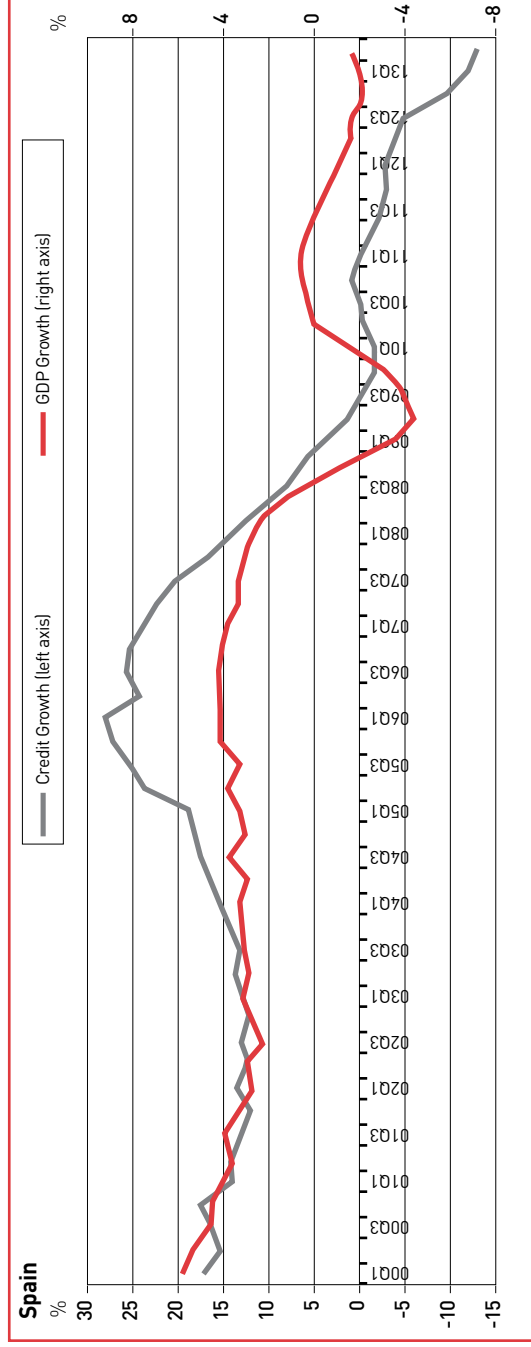
of aligning the incentives between the principal (for instance, bank bondholders or the taxpayers) and the agent (bank managers or shareholders). First, the basic agency problem stems from the fact that most financial intermediaries have limited liability (their losses are limited) and invest money on behalf of others (the final investors). Moreover, they are highly leveraged, notably banks that are funded almost entirely with debt (some banks are funded with 50 units of debt over 1 of equity and many have leverage ratios higher than 30 to 1). These frictions create strong incentives for excessive risk-taking as there is little skin in the game for bank shareholders but high potential upside profits. Second, excessive risk-taking notably increases when there are explicit and implicit guarantees and subsidies from the government (taxpayers) in case of negative ex-post aggregate risks (such as a financial crisis). This increases ex-ante agency problems of financial intermediaries as financial gains are privatized, but losses are in great part socialized.³

For example, the excessive credit boom and lending standards deterioration in the USA and Spain real estate market before the recent crisis has partly been blamed on several factors: (i) the financial innovation that fostered in the USA the development of an unregulated shadow banking system to arbitrate (evade) bank capital regulation; (ii) in the USA and Spain strong funding liquidity through securitization sold to foreign financial intermediaries due to financial globalization (in Spain more covered bonds than ABS); (iii) deficient corporate governance and lack of market discipline; (iv) very loose monetary policy (in Spain real interest rates were negative as Germany was having low GDP growth and the ECB had therefore too low monetary rates for countries like Spain and Ireland); and (v) deficient prudential regulation and supervision, both micro and macro. Moreover, the potential government bailouts

Figure 2. Credit and GDP cycles for the USA and Spain, 2000-2013



USA: 'credit' is 'Loans and leases in bank credit, all commercial banks'. GDP is in real terms. Both variables are seasonally adjusted and taken, from the website of the Federal Reserve Bank of Saint Louis. They are expressed in annual growth rates.



Spain: 'credit' is 'Credit by credit institutions to other resident sectors', from the Bank of Spain. GDP is in real terms from the INE. Both variables are seasonally adjusted and expressed in annual growth rates.

imply a lack of market disciplining by bank creditors by not imposing losses on these debt-holders (as in the case of Ireland), which creates ex-ante moral hazard and appetite for excessive risk. Importantly, this view is based on agency problems in both the private sector (financial intermediaries and their investors and managers) and in the public sector (central banks, supervisory agencies, and regulatory bodies).⁴

The theory suggests that financial intermediaries might take excessive ex-ante risks, increasing collectively the systemic risk in the financial system. But what are the specific factors and decisions that will cause excessive risks? The main channel is excessive credit and leverage. In fact, these variables show the strongest ex-ante correlate with the incidence of financial crises as shown in the empirical literature analyzing large historical and cross-country episodes of systemic financial crises. Private credit (debt and leverage) acceleration notably increases the likelihood of financial crises, and conditional on a crisis occurring, it increases its systemic nature and the negative effects on the real economy associated with the crisis.⁵

Credit booms, however, may also result from (and promote) sound economic fundamentals (demand-driven credit) and, therefore, could be benign for systemic risk.⁶ For example, since 1970s across a broad range of countries, research has shown that two thirds of credit booms did not end up in a financial crisis (IMF, 2012). Therefore, a key question that we analyze is what are the determinants of the bad credit booms, in particular the ones associated with credit supply (i.e. based on pervasive bank incentives). Credit supply booms that are negative for systemic risk generally stem from correlated risk-exposures by the financial intermediaries that end up developing asset-price bubbles in real estate or in other asset classes. This herding by financial intermediaries may also make

small and medium banks become systemic since the government may ex-post bailout them, as otherwise there would be *too many to fail* (Acharya and Yorulmazer, 2007). Deficient corporate governance where bank managers maximize only bank shareholder value (a small part of the bank total assets) with executive compensation based on relative performance with stock options and lack of claw-back options also encourage this type of excessive risk-taking.

3. Credit and imbalances in good times

The recent financial crisis has come after a period of significant credit expansion. In order to understand systemic risk, we need to know whether this fact is unique to this crisis or shared among many financial crises. However, financial crises are not frequent events, and hence in order to study the determinants of such crises it is necessary to use long time series for several countries. A set of papers by Reinhart and Rogoff and Schularick and Taylor focuses precisely on this issue.⁷ Both sets identify periods of strong debt growth preceding banking crises. Reinhart and Rogoff's focus is on government and private debt, while for Schularick and Taylor focus on bank credit. Not only does the likelihood of systemic crises increases with ex-ante debt, but they also show that when a crisis occurs, the real costs are higher if the prior debt increase has been higher. Moreover, Jordà et al. (2011 and 2013) show that the main determinant is ex-ante private (bank) credit rather than public debt or external debt.

Reinhart and Rogoff cover almost eight centuries for 66 countries, both advanced and developing ones. They find: First, external debt increases sharply in advance of banking crises. Second,

banking crises tend to lead sovereign-debt crises (with an increase in domestic government debt). Their results suggest that banking crises increase broader debt crises (Kaminsky and Reinhart, 1999). All in all, the results point out that ex-ante leverage is crucial to explain banking crises, and that public (sovereign) debt crises tend to be a consequence, rather than a cause, of banking crises.

Schularick and Taylor (2012) analyze the relationship of financial crises with aggregate bank credit growth. They build a 140-year panel data set for fourteen developed countries and construct bank credit and total asset series. Before the Great Depression, money and credit aggregates have a stable relationship with GDP, increasing before the crisis and decreasing afterwards. After the 1940s, credit itself decoupled from broad money by increasing leverage and funding via nonmonetary liabilities of banks.

Schularick and Taylor (2012) also analyze the likelihood and severity of financial crises and show that changes in bank loans are a strong predictor of financial crises. Furthermore, broad money aggregates do not have the same predictive power, particularly in the post-1940 period. Jordà, Schularick, and Taylor (2014) study the role of credit in the whole business cycle, not only around financial crises. They find that financial-crisis recessions are more costly than normal recessions in terms of lost output, and for both types of recessions, they show that the financial imbalances built up in the period preceding the crisis (bank credit) are important drivers of the strong negative real effects to the broad economy during the crisis. Specifically, not only does ex-ante credit growth affect the likelihood of a financial crisis, but conditional on a crisis, the real effects are worse when the crisis is preceded by a credit boom. Therefore, this historical analysis shows that ex-ante financial imbalances are a first-order determinant of systemic risk.

Their findings suggest that the prior evolution of credit shapes the business cycle. This has important implications for macroeconomic models: if credit were to just follow economic fundamentals and had little impact on the business cycle, then models omitting the frictions in the financial sector might be sufficient. Nevertheless, these findings suggest that more sophisticated macro models featuring financial intermediation are needed.⁸

Using the same dataset, Jordà et al. (2011) analyze whether ex-ante external imbalances increase the risk of financial crises. In other words, are external imbalances associated with higher costs in the recession, or are credit booms the only important variable? Their overall finding is that ex-ante credit growth emerges as the single best predictor of financial instability; however, the correlation between current account imbalances and credit booms has increased significantly in the recent decades, which indicates that financial globalization plays a role as well. In a globalized economy, with free capital mobility, credit cycles and foreign capital flows have the potential to reinforce each other more strongly than otherwise (on this argument, see also Shin, 2012). Clearly, a strong and sustained credit boom cannot typically be financed with an increase of domestic deposits and wealth (especially if not driven by very strong fundamentals); therefore, foreign liquidity, or liquidity stemming from expansive monetary policy or financial innovation (e.g. securitization), need to be present and interact with credit cycles.⁹ Finally, Jordà et al. (2013) show that the main determinant is ex-ante private (bank) credit rather than public debt.

The historical evidence clearly suggests that high rates of credit growth coupled with widening imbalances pose financial stability risks that policy makers and academics should not ignore. Moreover, in the recent crisis, the credit booms

and large current account imbalances in many countries, low levels of short-term (monetary) and long-term rates, and increasing recourse to securitization, all seem to confirm that credit growth and capital inflows and other forms of liquidity nowadays interact in a stronger way. Maddaloni and Peydró (2011) analyze these issues for the recent crisis. Using the survey of lending conditions and standards for the Euro area countries and the USA that the national central banks and regional Feds request from banks, they analyze the determinants of lending conditions and standards for the financial crisis that started in 2007. They find that countries with worse economic performance during the crisis are those with ex-ante softer lending conditions. They also find that lower monetary policy rates imply softer lending conditions and standards. However, after controlling for key factors (such as country fixed effects and business cycle conditions), current account deficits or lower long-term interest rates do not correlate with softer lending conditions. Finally, Maddaloni and Peydró (2011) find that lending standards are pro-cyclical (in the upside of the business cycle, lending conditions are softer and banks take on higher risk), a result consistent with Jiménez and Saurina (2006) for Spain.

Credit booms are therefore a crucial ex-ante correlate of financial crises. Yet, all of these empirical analyses condition on the occurrence of a crisis and ask what its determinants are. But, do all credit booms end up in a crisis? The IMF (2012) analyzes credit booms for 170 countries over the last 40 years of data. They show three important results: credit booms have become more frequent after the 1980s (a period of significant financial deregulation); most booms happen in relatively underdeveloped financial systems; and only one in three credit booms ends up in a financial crisis.

Determinants of credit supply booms and other financial imbalances

We have seen that credit booms appear to precede financial crises, but only one third ends up in a crisis, thus an important part of credit booms are driven by strong economic fundamentals and do not pose a risk for systemic risk. What are the determinants of credit supply booms and other financial imbalances?

One of the key questions to understand problems with pervasive bank incentives is whether bankers were aware of the excessive risk-taking of their institutions. In Akin, Marin and Peydró (2013), we test for US banks whether banks that performed the worst in the 2007–08 crisis were correlated to bank insiders' net sale of shares in the period prior to the initial fall in house prices in the middle of 2006. If that is the case, then it would suggest that insiders knew about the risks in their institutions. We find robust evidence that on average ex-ante insiders' net sale of shares implies worse bank performance during the crisis. Importantly, the negative relationship becomes more significant for top officers such as CEO and CFO, i.e. the ones with the highest set of information, for bigger banks (i.e. banks with higher agency problems) and for banks more engaged in real estate. In other words, results suggest that bank insiders knew that they were taking excessive risks.¹⁰

One of the main agency channels, especially highlighted by the media, is bank compensation. Compensation for the top officers may not be as important for the build-up of systemic risk as the remuneration structure of loan officers. Contracts to loan officers that maximize loan volume imply excessive risk-taking in lending (as it was the case in Spain). But why do banks choose compensation structures that promote excessive risk-taking

of bank top managers and middle managers as loan officers? Why were these compensation structures designed in the first place? Why is corporate governance not working well in banking?

One cannot explain well the heterogeneity in lending standards both during the cycle and across financial intermediaries without focusing on the role of incentives and institutions. Since credit decisions are usually delegated to agents inside financial institutions, if one wants to understand what causes the changes in lending standards one needs to understand the incentives that financial intermediaries face. But these incentives are also influenced by regulations, accounting standards, financial competition, innovation, central bank policies, corporate governance, and compensation structures (see Stein, 2013). Many of these problems had already been mentioned before the crisis. As explained by Rajan (2005) at the Jackson Hole conference when he was the chief economist at the IMF, a fundamental challenge in financial intermediation (notably delegated investment management) is that many quantitative rules are vulnerable to agents who act to boost measured returns by selling insurance against unlikely events — what is known as tail risk.

Since credit risk by its nature involves an element of put-writing (initial fees and interest payments during the life of the loan but a medium term risk of default on the principal) it is always going to be challenging in an agency context, especially to the extent that the risks associated with the put-writing can be structured to partially evade the relevant measurement scheme. Even more in bank loans, one can avoid defaults by simply renewing or lengthening the loan maturity (i.e., a practice known as loan ever-greening or zombie lending; see Caballero, Hoshi and Kashyap, 2008). Moreover, these agency problems may be exacerbated by competitive pressures among inter-

mediaries and by the associated phenomenon of relative performance evaluation. Furthermore, as explained in Section 2 of this *opuscle* and in Freixas et al. (2014), corporate governance in banking is not working well, as maximizing bank shareholders' value can lead to excessive risk in banks — i.e., negative externalities to bank debtholders and depositors, to taxpayers and to non-financial borrowers (firms and households).

A classical example in banking is Rajan's (1994) model, which develops a theory why bank credit policies fluctuate over the business cycle. In a rational profit-maximizing world, banks should maintain a credit policy of lending if and only if borrowers have positive net present value (NPV) projects. Therefore, a change in the level of bank credit should be a consequence only of a change in the credit quality of borrowers (a change in the economic fundamentals). Bank supply of credit should not exert an independent influence on the level of credit.

Bank managers try to maximize bank's earnings, but they also care about their reputation: they care about stock and labor market's perception of their abilities. However, the composition of the bank portfolio and the specific performance of borrowers are not immediately observable by the market, as it can only observe banks' earnings. Therefore, bank managers attempt to manipulate current earnings to shape market's perceptions, for instance by extending the maturity of a bad loan: Extending the term of loans, lending new money, and weakening covenants so as to avoid recognizing default — i.e., loan ever-greening or zombie lending. Similarly, the bank may attempt to convince the market of the profitability of its lending by promoting a soft credit policy that generates up-front fees at the expense of future credit quality (like the put option in the previous example).

In general, a liberal credit policy boosts current earnings at the expense of future performance. The bank is trapped into this second-best credit policy simply because the market expects it. The market is more forgiving of a bank's poor performance if it knows that the entire borrowing sector has been hit by a systematic and unpredictable adverse shock. When multiple banks lend to a sector, the market learns something about the systematic component of uncertainty from each bank's earnings. This informational externality makes bank credit policies interdependent. A bank's reputation is less sensitive to poor earnings when other banks admit to poor earnings. Because true earnings are less likely to be high when the borrowing sector is distressed, banks collectively coordinate (herd) on an adverse shock to borrowers to tighten credit policy. In addition, banks are more eager to declare loan defaults when other banks do so because there may be too many banks to fail and thus a bailout is easier to obtain. This theory therefore yields systemic risk through credit supply cycles that stem from financial intermediaries' limited liability, compensation structure and governments' policies.

Once we understand the agency problems in the banking system, we need a 'trigger' for a particular credit boom. The worst credit booms are usually funded by more than just the local savings of the economy. I am going to focus here on four additional distortions: too much reliance on wholesale funding, the increase in available funds due to globalization, the effects of financial innovation such as securitization, and the effects of monetary policy on the credit expansion.

One of the main reasons why it was easy to finance a credit boom, especially for countries that have suffered the crisis more (i.e., peripheral euro zone), was financial globalization. This is clearly the case for the euro area. In Kalemlı-Ozcan, Pa-

paioannou, and Peydró (2010) we study the reasons behind the increase in financial integration. We conclude that the elimination of currency risk is the main driver, although financial regulation convergence played an important role as well. However, as we show in Kalemlı-Ozcan, Papaioannou, and Peydró (2013), financial globalization has reduced the synchronization in economic activity in normal times. This suggests that when a country is hit by a positive shock — or it is having a credit bubble — foreign capital will flow into the country, thereby augmenting even more the amount of funds available at the expense of other countries.

As we have seen in the previous section, in the second part of the 20th century monetary and credit aggregates started to behave very differently. This points to another element that allows increasing credit even if no additional funds are available: financial innovation. Securitization is an activity that allows the bank to sell illiquid balance sheet items such as loans to third parties, thereby increasing their liquidity and decreasing capital requirements. In Jiménez, Mian et al. (2013), we focus on the effects of securitization on lending from Spanish banks, where securitization was done using real-estate loans.¹¹ We find very interesting results that shed light on how credit booms are characterized. Securitization did not affect firms with already strong access to the banking sector. However, it was the extensive margin (i.e., new borrowers) the ones that were more affected by credit volume supplied. Banks engaged in real estate activities were able, through securitization, to expand their credit to new borrowers, which are usually riskier and, in fact, defaulted more. In Maddaloni and Peydró (2011) we find that securitization also implied a softening of lending conditions and standards in Europe and the USA.

Monetary policy can also worsen the credit boom, both by making it bigger and riskier. In Jiménez et al. (2012) we analyze the bank lending channel of monetary policy transmission. By studying detailed loan-level and loan-application data, we find that, exactly as predicted by the theory, softer monetary conditions increase lending, especially for banks with weak balance sheets in terms of capital and liquidity.

But not only too low short term rates can expand credit supply, but also can increase the risk-taking incentives of banks. This is what Adrian and Shin call '*the risk-taking channel of monetary policy*' in the last *Handbook of Monetary Economics* (Adrian and Shin, 2011).¹² In Jiménez et al. (2014) we study this channel. The very detailed data on loan applications and outcomes in Spain has allowed us to identify the effect of monetary policy on banks' risk-taking behavior. We separate the changes in the composition of the supply of credit from the concurrent changes in the volume of supply and quality and volume of demand. We employ a two-stage model that analyzes the granting of loan applications in the first stage and loan outcomes for the applications granted in the second stage, and that controls for both observed and unobserved, time-varying, firm and bank heterogeneity through time \times firm and time \times bank fixed effects. We find that a lower overnight interest rate induces lowly capitalized banks to grant more loan applications to ex-ante risky firms and to commit larger loan volumes with fewer collateral requirements to these firms, yet with a higher ex-post likelihood of default. A lower long-term interest rate and other relevant macroeconomic variables have no such effects.

4. Credit in bad times and the real costs of financial crises

As we explain in detail in Freixas et al. (2014), the real costs of systemic financial crises are significant.¹³ As the financial system performs several important functions for the real sector, its impairment creates strong costs as, for example, the smooth functioning of the payment system, risk-sharing, and saving products. The main transmission channel from the impairment of the financial sector is the disruption of the flow of funds from savers to firms for investment and to households for consumption purposes; in particular, the credit crunch is one of the most important channels that transmit the financial distress from banks to the real sector.

Laeven and Valencia (2012) study the costs of banking crises since 1970. They find that, on average, the cost of the fiscal outlays committed to the financial sector was 12.4% of GDP, with cases as high as 56.8% in 1997 in Indonesia. In terms of output loss, on average the cost was 30.1% of GDP. These numbers are huge. While public debt does not increase in all banking crises, in those countries where it indeed increased the average increase was 26%. The heterogeneity is high: in Guinea-Bissau, public debt increased by 108.1% of GDP, while Ireland (to show the case of a developed country) it increased by 72.8% of GDP in the last crisis. Table 1 shows the estimated costs for the recent banking crises in terms of output loss, fiscal costs, the liquidity support, and the resulting increase in public debt. In the last column, it also shows whether the country experienced a credit boom prior to the crisis.

Schularick and Taylor (2012) analyze financial crises for the past 140 years.¹⁴ A general lesson is that a speedy resolution of the crisis is crucial to mitigate its costs, even if accompanied by high fis-

Table 1. Costs of the recent banking crises

Country	Start	Output loss	Fiscal Costs (% of GDP)	Liquidity support	Increase in public debt	Credit boom
Austria	2008	14.0	4.9	7.7	14.8	0
Belgium	2008	19.0	6.0	14.1	18.7	1
Denmark	2008	36.0	3.1	11.4	24.9	0
France *	2008	23.0	1.0	7.4	17.3	0
Germany	2008	11.0	1.8	3.6	17.8	0
Greece	2008	43.0	27.3	42.3	44.5	1
Hungary *	2008	40.0	2.7	1.3	-0.3	1
Iceland	2008	43.0	44.2	16.8	72.2	1
Ireland	2008	106.0	40.7	16.3	72.8	1
Italy	2008	32.0	0.3	5.7	8.6	0
Kazakhstan *	2008	0.0	3.7	5.0	9.1	0
Latvia	2008	106.0	5.6	3.4	28.1	1
Luxembourg	2008	36.0	7.7	4.1	14.6	...
Mongolia	2008	0.0	4.2	9.4	-5.0	0
Netherlands	2008	23.0	12.7	3.7	26.8	0
Nigeria	2009	14.0	11.8	11.7	7.7	0
Portugal *	2008	37.0	0.0	16.7	33.6	0
Russia *	2008	0.0	2.3	23.9	6.4	1
Slovenia *	2008	38.0	3.6	9.6	18.0	1
Spain	2008	39.0	3.8	6.4	30.7	1
Sweden *	2008	25.0	0.7	13.0	11.1	0
Switzerland *	2008	0.0	1.1	3.0	-0.2	0
Ukraine	2008	2.0	4.5	9.2	28.9	1
United Kingdom	2007	25.0	8.8	5.6	24.4	1
United States	2007	31.0	4.5	4.7	23.6	0

* Borderline cases

Source: Laeven and Valencia (2012). Output loss is defined as the sum of the differences between trend real GDP and actual real GDP during the first three years of crisis, expressed as percentage of trend real GDP. The trend is computed by applying the HP filter to the real GDP series for the 20 years before the crisis. Fiscal costs refer to the direct fiscal outlays due to the financial sector rescue packages as a percentage of GDP. Liquidity support is defined as the ratio of central bank claims on deposit money banks to total deposits and liabilities to non-residents. Increase in public debt is measured as the difference between pre- and post-crisis debt projections as a percentage of GDP.

cal outlays to support the financial sector. A postponement of such action will not only delay the recovery but risks adding to the real costs by prolonging the credit crunch and the negative spirals associated with slow growth and debt overhang. Turning to real effects, despite the much more aggressive policy response in the postwar period, the cumulative real effects have been somewhat stronger in the postwar period. In the aftermath of postwar financial crises, output dropped a cumulative 6.2% relative to trend, and real investment by more than 22%. The pre-war output decline effect, however, is largely an artifact of the massive financial implosions of the 1930s. Excluding the 1930s, the cumulative real output and investment declines after crises were substantially smaller. The finding of limited losses prior to the 1930s would be consistent with the idea that financial sectors played a less central role in the economy, and financial crises were thus less costly in the earlier decades of the Schularick and Taylor (2012)'s sample.

Why are output losses so large today, despite more activist policies? Governments and central banks have tried since the 1930s to prevent negative feedback loops in the economy and have sought to cushion the real and nominal impact of financial crises through policy activism. But, at the same time, the financial sector has grown in size and increased leverage. As a result, the shocks hitting the financial sector might now have a potentially larger impact on the real economy, without the policy response. Moreover, explicit and implicit government insurance and other public guarantees may have in turn contributed to the spectacular growth of finance and leverage within the system, creating excessive risk-taking incentives.

Reinhart and Rogoff (2009b) analyze the aftermath of financial crises, which share three characteristics. First, asset market collapses are deep and

prolonged; real housing price declines average 35% (over six years), while equity price collapses on average 55% (over three and a half years). Second, the aftermath of banking crises is associated with profound declines in output and employment; the unemployment rate rises an average of 7 percentage points over the down phase of the cycle (lasts on average over four years), while output falls (from peak to trough) an average of over 9% (averaging two years, which is significantly shorter than for unemployment). Third, the real value of government debt tends to explode, rising an average of 86% in the major post-1945 episodes. Interestingly, a substantial part of debt explosions is not due to the costs of bailing out and recapitalizing the banking system, but to the collapse in tax revenues that governments suffer in the wake of deep and prolonged output contractions, as well as the countercyclical fiscal policies aimed at mitigating the downturn and the rise in automatic stabilizers such as unemployment benefits (Laeven and Valencia, 2012).

Credit crunch

A reduction in credit is an important negative spillover from financial crises to the economy at large. This does not imply that credit supply is being cut: in a recession, credit demand also goes down. Economic perspectives look worse, so firms cut back investment decisions. Moreover, collateral also falls in value, which allows non-financial firms and households to borrow less — this is known as the firm and household balance-sheet channel.

In order to have a credit crunch, then, we need banks to be reducing the supply of credit for reasons unrelated to the borrowers. Hence, firms may still have a positive demand for credit but be unable to obtain it. Credit crunches are very costly, since they happen precisely when bank funds are

more needed (because firm cash flows and thus internal finance are low).

Nevertheless, from an empirical perspective, it is difficult to see whether there is a credit crunch or not. When analyzing aggregate credit dynamics, one cannot distinguish between supply and demand. Even when comparing strong and weak banks (in terms of balance sheet strength) before and during a crisis, one cannot be sure whether the two banks are lending to the same type of firms (maybe weak banks are lending to riskier firms and thus the reduction in credit is entirely demand driven). Hence, one needs very detailed data to estimate the effects of a credit crunch. This is what we do in Jiménez et al. (2012), where we analyze the credit crunch in the 2008–2010 crisis in Spain using a dataset consisting of loan applications and outcomes.

To achieve identification we focus on the set of loan applications made in the same month by the same borrower or for the same loan to different banks of varying balance-sheet strengths (by including in the specifications firm x month or alternatively loan fixed effects). Within this set of loan applications, for which the quality of potential borrowers is constant, we study how economic conditions affect the granting of loans depending on bank capital and liquidity. Moreover, we analyze whether firms that get rejected in their initial loan application can undo the resultant reduction in credit availability by successfully applying to other banks.

We find that lower GDP growth reduces the probability that a loan application is granted, particularly during crisis times. The negative effect on loan granting is statistically stronger for banks with low capital. We also find that firms that get rejected in their initial loan application cannot undo the resultant reduction in credit availability by apply-

ing to other banks, especially in periods of tighter economic conditions. Therefore, credit constraints seem to be binding for these firms during a crisis. This shows, moreover, that heterogeneity of financial conditions of banks matter for borrowers' decisions (on top of the aggregate banking conditions) and they have real consequences.

But why is that other stronger banks do not compensate for the cut in credit from more affected banks? In other words, why do healthy banks — if they exist during a crisis — not expand the supply of credit? The main reason comes from the value of relationship lending: banks collect soft information on borrowers that allow them to make valuable relationship loans. For example, Bae, Kang and Lim (2002) show that firms with closer relationships to their banks benefited from easier access to credit from their banks during the Korean financial crisis of 1997. When a lending relationship is cut, this soft information is lost, and so healthy banks cannot compensate this. Hence, problems in the banking system — both aggregate and heterogeneity — imply strong real effects.¹⁵

In Ciccarelli et al. (2013a and 2013b) we analyze the credit supply effects on the real economy and the effect of the standard monetary policy (changes in the overnight rate) during the crisis and gauge whether the functioning of the transmission mechanism is smooth across the euro area. We study how financial fragility of financial intermediaries and of borrowers (the non-financial sector) has affected the monetary policy transmission in the euro area, in particular through the credit channel, exploiting several dimensions of heterogeneity, in a vector autoregression (VAR) model estimated recursively over the sample 2002Q4–2011Q3 for a panel of 12 euro area countries. The model accounts also for the non-standard monetary policy measures implemented until the end of 2011 (in particular the full allotment

policy and the increased provision of long-term refinancing).

The transmission through the credit channel is identified using the responses of the euro area Bank Lending Survey (BLS) at the country level. Specifically, the different channels of transmission are identified by looking at the factors affecting the decision of banks to change lending conditions and standards for their borrowers. Factors related to bank balance sheet capacity and competitive pressures identify the bank lending channel, since the decisions to change these lending conditions apply to all borrowers independently of their credit quality. The factors linked to borrowers' creditworthiness and net worth characterize the (borrower) balance sheet channel. Finally the BLS information on loan demand helps to further isolate the credit demand channel.

The analysis suggests that the effect of the bank lending channel has been partly mitigated especially in 2010–2011 by the policy actions. By providing ample liquidity through the full allotment policy and the longer-term refinancing operations (LTROs), the ECB was able to reduce the costs arising to banks from the restrictions to private liquidity funding by effectively substituting the interbank market and inducing a softening of lending conditions. At the same time, when looking at the transmission through banks of different sizes, it seems that, until the end of 2011, the impact of credit frictions of borrowers has not been significantly reduced, especially in distressed countries. Since small banks tend to lend primarily to small and medium enterprises (SMEs), we infer that the policy framework until the end of 2011 might have been insufficient to reduce credit availability problems stemming from deteriorated firm net worth and risk conditions, especially for small firms in countries under stress.

The previous analysis therefore supports the complementary actions that have been put in place successively, and in particular those specifically targeted at increasing credit to small firms to reduce their external finance premia and credit rationing. In fact, the decision to enlarge the collateral framework of the Eurosystem — in particular by accepting loans to SMEs as eligible collateral — had the explicit objective of meeting the demand for liquidity from banks in order to support lending to all type of firms.

Using a similar dataset in Maddaloni and Peydró (2013), we analyze the impact on lending standards of short-term interest rates and macro-prudential policy before the 2008 crisis, and of the provision of central bank liquidity during the crisis. After the start of the 2008 crisis, we find that low monetary rates helped to soften lending conditions that were tightened because of bank capital and liquidity constraints, especially for business loans. Importantly, this softening effect is stronger for banks that borrow more long-term liquidity from the Eurosystem. Therefore, the results suggest that monetary policy rates and central bank provision of long-term liquidity complement each other in working against a possible credit crunch for firms.

A key feature of the recent financial crisis was the ‘excessive’ reliance on the market to obtain liquidity. In a boom, banks tend to hold little liquidity since the opportunity cost is very high and there is plenty of liquidity in the market, so it is easy and fast to obtain it. However, by behaving this way, banks create a negative externality: if the banking sector is hit by a negative shock, many of them will go to the interbank market to obtain liquidity, creating a dry-up that will worsen the initial shock. By keeping too few liquid assets in their balance sheets, banks make it harder to obtain liquidity for other banks precisely when they

need it most. This is precisely what we find in Iyer et al. (2014). We study the effect of the freeze in the international interbank markets in August 2007 on credit supply by Portuguese banks. With data on all commercial and industrial loans in Portugal, we find that the freeze caused a credit crunch: those banks that relied more on interbank borrowings cut lending more (compared to banks with less interbank funds) to the same borrower. Moreover, firms could not substitute easily the credit by going to less affected banks. There was no credit crunch for large firms, indicating that small, young and entrepreneurial firms are the ones most at risk in a financial crisis.

Moreover, we find some evidence of zombie lending or loan evergreening, since banks cut lending less to weaker firms in terms of loan coverage. Caballero et al. (2008) show that the zombie lending could have caused extremely negative effects in Japan, not only in the size but also in the time (a very long period) to overcome the financial crisis that started in 1990. Some even argue that the recent policies in the Euro area are keeping “zombie” banks artificially alive through a combination of regulatory forbearance and easy lending by the Eurosystem of central banks.

Bank failures also generate negative externalities for other banks, i.e. contagion. These negative externalities associated with bank failures offer the main rationale for financial regulation: to prevent socially costly bank failures (see Freixas et al., 2014). In Iyer and Peydró (2011), we study the effect of the failure of a big bank in India in 2001. This failure was unrelated to economic fundamentals. With detailed data on interbank exposures, we are able to see that banks more exposed to the failed bank experienced higher deposit withdrawals. Moreover, interbank linkages with other banks further propagated the shock. We also find real effects of this failure were significant, driving an

overall reduction in loan supply. In other words, interbank contagion can have important real effects in a credit crunch.

An overhang of illiquid assets, often associated with banking crises, can also cause a credit market freeze. Banks that hold large quantities of illiquid assets may trigger sales at fire sale prices when faced with negative liquidity shocks. Diamond and Rajan (2011) argue that, although the prospect of such fire sales depresses the bank's current value, banks may actually prefer to hold on to the illiquid assets because the bank's survival is positively correlated with a recovery in asset prices. This creates high demand by banks for liquid assets, causing banks to cut back on loans. Holmstrom and Tirole (1998) show that economies may suffer efficiency losses when credit markets are disrupted such as during banking crises and are no longer able to provide funds to entrepreneurs that are hit by liquidity shocks and need to raise funds to avoid bankruptcy. Such bankruptcies cause a significant loss in welfare. Consistent with this, Jiménez, Mian, et al. (2013) find that banks with higher proportion of illiquid assets such as real estate provide less credit supply to firms.

Macroprudential policy and credit

The 2008–09 global economic and financial crises have changed the consensus on how to conduct prudential regulation. Before it was 'micro-oriented', focused on ensuring the solvency of individual financial institutions and paying little attention to the financial system as a whole. The consensus was that by ensuring adequate capital ratios at the individual level, the whole system would be solvent. However, after a negative shock, banks may try to increase their capital buffers by decreasing their lending, which can create a credit crunch and fire sales that can in fact worsen the initial shock. In other words, by trying to increase

their *individual* solvency, banks may be imposing negative externalities on the rest of the system, thus decreasing the *overall financial stability*. Micro-prudential policy, hence, is not well equipped to deal with systemic risk. Financial regulation is now becoming more macro-focused, focusing on the risks of the financial system as a whole, both the build-up of financial imbalances, and the externalities within the financial sector and from the financial to the real sector. In other words, going forward prudential regulation should also focus on systemic risk (see Freixas et al., 2014).

Examples of this type of macroprudential policy approach are the so-called countercyclical capital buffers. This new policy requires banks to hold additional capital when aggregate credit is expanding fast. The intention is twofold: by requiring this additional capital, banks will be more capitalized when a recession comes, thus alleviating the credit crunch problem. On top of that, the additional capital may cool down the credit expansion, thus lowering both the probability of a crisis and the cost of it if it occurs. Dynamic provisioning, a regulation introduced in 2000 in Spain, is also an example of a macroprudential policy on countercyclical capital requirements.

In Jiménez, Ongena, et al. (2013) we analyze the impact of countercyclical capital buffers held by banks on the supply of credit to firms and their subsequent performance, exploiting the Spanish dynamic provisioning. Spain introduced dynamic provisioning unrelated to specific bank loan losses in 2000 and modified its formula parameters in 2005 and 2008. In each case, individual banks were impacted differently. The resultant bank-specific shocks to capital buffers, coupled with comprehensive bank-, firm-, loan-, and loan application-level data, allow us to identify its impact on the supply of credit and on real activity. Our estimates show that countercyclical dynamic pro-

visioning smoothes cycles in the supply of credit and in bad times upholds firm financing and performance.¹⁶

The estimates are also economically relevant. Firms borrowing from banks with a 1 percentage point higher dynamic provision funds (over loans) prior to the crisis get a 6 percentage points higher credit growth, a 2.5 percentage points higher asset growth, a 2.7 percentage points higher employment growth, and a 1 percentage point higher likelihood of survival.

5. Conclusions

All in all, the evidence described in this *opuscle* shows that either looking at the history of financial crises or looking at the recent global crisis, ex-ante credit growth (debt and leverage) is the main ex-ante correlate in determining the likelihood of systemic financial crises, and conditioning on the crisis, ex-ante credit growth increases the severity of the financial crisis, with stronger negative real effects. Important channels during the crisis are credit crunches, (wholesale) illiquidity, flight to quality and the so-called zombie lending. Financial globalization and deregulation, financial innovation (notably securitization), deficient corporate governance and lack of market disciplining, monetary and macroprudential policies affect credit cycles. Both policymakers and academics should pay more attention to credit cycles, notably supply driven.

Notes

(1) This opuscle is mainly based on my book with Xavier Freixas and Luc Laeven on systemic risk: Freixas, Laeven and Peydró (2014) and on my papers on credit, liquidity and systemic risk, in particular: Iyer, and Peydró (2011), Jiménez et al. (2012), Jiménez et al. (2014), Jiménez, Ongena, Peydró and Saurina (2013), Jiménez, Mian, Peydró and Saurina (2013), Iyer et al. (2014), Maddaloni and Peydró (2011 and 2013), Ciccarelli, Maddaloni and Peydró (2013a and 2013b), Kalemli-Ozcan, Papaioannou, and Peydró (2010 and 2013). I thank an anonymous referee for very helpful comments and suggestions. I thank Francesc R. Tous for his excellent research assistance. I also thank Antonio Ciccone and Michael Greenacre for helpful comments and suggestions.

(2) Another important view is the preference channel, in particular behavioral biases. See Freixas et al. (2014) and Shleifer and Vishny (2010). It is important to stress that depending on which is the correct view of the determinants of excessive risk-taking (preferences vs. agency channel) in financial intermediaries, optimal prudential policy will be different. For example, higher capital requirements would be positive by increasing buffers in a crisis under both channels, but under the agency channel they may also reduce ex-ante excessive risk-taking by making the financial intermediaries have more own skin in the game.

(3) Despite the fact that, once the financial crisis occurs, these guarantees may reduce the systemic costs.

(4) See Pagano (2012), Stein (2013) and Freixas et al. (2014).

(5) See e.g. Schularick and Taylor (2012), Jordà, Schularick and Taylor (2013), and Freixas et al. (2014).

(6) This does not mean that all demand-driven credit booms result from fundamentals. For example, they can be driven by collateral values. Although there is an extensive literature focusing on frictions on credit demand, it is not the focus of this opuscle.

(7) Reinhart and Rogoff (2008, 2009a, 2011), Schularick and Taylor (2012) and Jordà, Schularick and Taylor (2011 and 2013). The initial part of this section is based on Gorton and Metrick (2012) and Freixas, et al. (2014).

(8) See Freixas et al. (2014) for models of finance and macro to analyze systemic risk.

(9) Of course, some credit booms can be financed by domestic savings as we are seeing recently with China.

(10) As these banks were investing heavily in the real estate bubble (lack of diversification and strong softening of lending standards), risks were excessive from an ex-ante (and an ex-post) view.

(11) Another contribution of this paper is to develop a technique to identify credit supply. See Freixas et al. (2014).

(12) See also Borio and Zhu (2012).

(13) This section is based on Freixas et al. (2014).

(14) Bordo et al. (2001), analyzing a database spanning 120 years of financial history, find that crisis frequency since 1973 has doubled compared to the Bretton Woods and classical gold standard periods, and is only related to the period of the 1920s and 1930s.

(15) A large empirical literature has shown that financial conditions have real consequences (Rajan and Zingales, 1998; Levine, 2005). Bernanke (1983) and Calomiris and Mason (2003) find that the U.S. banking crisis during the Great Depression reduced the efficiency with which credit was allocated, and that the resulting higher cost and reduced availability of credit reduced domestic output.

(16) Aiyar, Calomiris, and Wieladek (2012) study the case of the UK, where time-varying capital requirements were in place for all banks under the FSA jurisdiction. They find that increases in capital requirements are followed by decreases in credit growth to the real economy. However, part of this decrease is compensated by an increase in lending of those banks not falling under the FSA rules: foreign branches. Therefore, those financial intermediaries not subject to macroprudential regulation could reduce the effects of this policy.

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