EUROPEAN CENTRAL BANK
EUROSYSTEM

WORKING PAPER SERIES
NO 1150 / JANUARY 2010

DO BANK LOANS AND CREDIT STANDARDS HAVE AN EFFECT ON OUTPUT?

A PANEL APPROACH FOR THE EURO AREA

by Lorenzo Cappiello, Arjan Kadareja, Christoffer Kok Sørensen and Marco Protopapa

EUROPEAN CENTRAL BANK

EUROSYSTEM

WORKING PAPER SERIES

NO 1150 / JANUARY 2010

DO BANK LOANS AND CREDIT STANDARDS HAVE AN EFFECT ON OUTPUT?

A PANEL APPROACH FOR THE EURO AREA[1]

by Lorenzo Cappiello[2], Arjan Kadareja[3], Christoffer Kok Sørensen[2] and Marco Protopapa[2]

In 2010 all ECB publications feature a motif taken from the €500 banknote.

This paper can be downloaded without charge from http://www.ecb.europa.eu or from the Social Science Research Network electronic library at http://ssrn.com/abstract_id=1535995.

1 We are indebted to Francesco Drudi and Manfred Kremer for valuable comments and discussions. We would also like to thank an anonymous referee for providing helpful comments. Of course, remaining errors are ours alone. The views expressed in this paper are those of the authors and do not necessarily reflect those of the European Central Bank or the Eurosystem.

2 European Central Bank, Kaiserstrasse 29, 60311 Frankfurt am Main, Germany. Corresponding author: Lorenzo Cappiello; e-mail: lorenzo.cappiello@ecb.int; tel.: +49 69 1344 8765.

3 Bank of Albania, Sheshi "Skënderbej", No.1 Tirana, Albania; e-mail: kadareja@yahoo.com

Address
Kaiserstrasse 29
60311 Frankfurt am Main, Germany

Postal address
Postfach 16 03 19
60066 Frankfurt am Main, Germany

Telephone
+49 69 1344 0

Website
http://www.ecb.europa.eu

Fax
+49 69 1344 6000

Information on all of the working papers published in the ECB's Working Paper Series can be found on the ECB's website, http://www.ecb.europa.eu/pub/scientific/wps/date/html/index.en.html

ISSN 1725-2806 (online)

CONTENTS

Abstract

Applying the identification strategy employed by Driscoll (2004) for the United States, this paper provides empirical evidence for the existence of a bank lending channel of monetary policy transmission in the euro area. In addition, and in contrast to recent findings for the US, we find that in the euro area changes in the supply of credit, both in terms of volumes and in terms of credit standards applied on loans to enterprises, have significant effects on real economic activity. This highlights the importance of the monitoring of credit developments in the toolkit of monetary policy and underpins the reasoning behind giving monetary and credit analysis a prominent role in the monetary policy strategy of the ECB.

It also points to the potential negative repercussions on real economic growth of bank balance sheet impairments arising in the context of the financial crisis erupting in mid-2007 which led to the need for banks to delever their balance sheets and possibly to reduce their loan supply.

Keywords: bank credit, bank lending channel, euro area, panel data

JEL classification: C23, E51, E52, G21

Non-technical Summary

The financial crisis which erupted in mid-2007 implied substantial impairments to euro area banks' balance sheets and their access to wholesale funding. This development raised concerns about the possible impact on banks' ability to provide lending to households and firms. Owing to the predominant position of the banking sector in the euro area financial system an impaired provision of credit by banks could have severe amplifications on real economic activity and inflation. The monetary policy actions taken by the ECB (and other central banks) since the financial turmoil surfaced, inter alia in the form of substantial reductions in key policy rates and the provision of unlimited liquidity to the banking sector, to a large extent aimed at alleviating the negative repercussions on credit supply of the balance sheet constraints that banks faced during this period.

The effectiveness of policy actions seeking to support a continued provision of credit to the non-financial private sector relies on an in-depth understanding of the links between monetary policy, credit supply and economic activity. Against this background, this paper evaluates the effects of changes in credit supply on output for the euro area. The analysis is carried out from the perspective of the bank lending channel, thereby addressing two related questions: first, whether a change in banks' financing cost has an effect on loan supply and, second, whether changes in banks' loans have an impact on output. The answer to these questions is based on two assumptions. The first one concerns the "special" status that deposits have in the liability structure of banks, in that deposits cannot be perfectly substituted with other forms of funding; a particularly realistic hypothesis at the current juncture. The second assumption regards the peculiarity of loans for firms (and households), in the sense that companies (and consumers) cannot perfectly substitute loans with bonds or equities.

When evaluating the impact of credit growth on output there are a number of issues that need to be addressed. One of the most pertinent issues concerns the endogeneity, or reverse causality, problem, since one cannot distinguish whether loan supply affects output or, vice versa, if the demand for (and supply of) loans is determined by future expected output. This issue is addressed by adopting a model à la Driscoll (2004). This framework exploits a key insight whereby euro area countries are viewed as a group of small open economies under a fixed exchange rate regime with nationally segmented retail banking markets. Therefore, country-specific shocks to money demand will lead to country-specific variations in the supply of loans. For instance, suppose that, for a given level of output and interest rate, there is a positive money demand shock in any one of the euro area member states. If households

and firms desire to hold more money, deposits will increase. As a consequence, since exchange rates are irrevocably fixed, real balances should go up in the country which has experienced the money demand shock and slightly decrease everywhere else. If the lending channel plays a role, the deposit growth should lead to an increase in the supply of loans due to the additional source of financing for banks. Therefore, output should also increase assuming the imperfect substitutability between bank loans and other sources of financing for firms and households.

In line with the above discussion, since country-specific money demand shocks are correlated with loan supply but not with output and loan demand disturbances, they are a good instrument that can be used in the regression of output on loans and identify unambiguously the causal relationship from loans to GDP growth. The use of these instrumental variables has the additional advantage that the ECB cannot smooth country-specific shocks due to the common monetary policy and the "fixed-exchange rate regime" among member states.

The estimation strategy, based on pooled regressions, involves three steps, and all the variables employed in the regressions are constructed as deviations from their cross-sectional mean values. First, output growth is regressed on the growth rate of bank loans to investigate whether there is a positive and significant relationship between these two variables (albeit, at this stage, without addressing the endogeneity issue). In the second step, in order to retrieve money demand shocks, for each country a money demand function is estimated. Moreover, bank loans are regressed on these shocks to verify whether they are good instruments for loans. Third, output is regressed on loans instrumented with money demand shocks.

Our results provide empirical evidence for the existence of a bank lending channel of monetary policy transmission in the euro area. In addition, and in contrast to recent findings for the US, we find that in the euro area changes in the supply of credit, both in terms of volumes and in terms of credit standards applied on loans to enterprises, have significant effects on real economic activity. In other words, a change in loan growth has a positive and statistically significant effect on GDP. This highlights the importance of including the monitoring of credit developments in the toolkit of monetary policy and underpins the reasoning behind giving monetary and credit analysis a prominent role in the monetary policy strategy of the ECB. These findings furthermore point to the potential negative repercussions on real economic growth arising from the financial crisis that erupted in mid-2007 and which resulted in serious impairments of euro area banks' balance sheets and the need for banks to delever and possibly to reduce their supply of loans.

1 Introduction

The financial crisis which surfaced in August 2007 has highlighted the vulnerability of financial intermediaries, and more specifically of the banking system, at least along two interrelated dimensions. On the one hand, faced with the risk of insolvency due to the erosion of their capital base after heavy losses, banks have been in need of raising fresh capital, whether through private investors or government aid programmes. On the other hand, banks have experienced difficulties in raising funds at medium and long-term as well as at short-term: *inter alia*, spreads on bank bonds increased to unprecedented levels, while Libor-OIS spreads in the inter-bank money markets also reached historical peaks, especially following the demise of Lehman Brothers, the US investment bank, in September 2008. Moreover, banks' ability to securitise their loans and transfer credit risk off their balance sheet was seriously disrupted adding further strains on their access to funding. The mounting woes of the banking system implied a significant pressure on banks to contract their balance sheets and, ultimately, in a reduction of credit. For example, according to the IMF (2009), the write-downs on securitised assets and charge-offs on banks' loan books could result in a disorderly deleveraging scenario through which without further capital injections from governments and private investors, the credit growth could shrink significantly. Indeed, in the euro area, the flows of credit to non-financial corporations and households began to significantly abate towards the end of 2008, which apart from the typical demand-driven reaction to a downturn in the business cycle might to some extent also derive from problems related directly to banks' capital positions and their access to funding. For example, the results of the ECB bank lending survey have pointed toward a combination of demand-side and supply-side factors contributing to the deceleration of the growth rate of loans to households and firms in the euro area.[1] Moreover, since the euro area financial system is relatively bank-centred compared, for instance, to the United States, it is relevant to assess whether there exists a significant relation between bank loans extended to the non-financial private sector and real activity.

From a monetary policy viewpoint, the difficulties related to bank balance sheets arising in the context of the financial crisis have raised concerns about the effectiveness with which monetary policy decisions are transmitted to the real side of the economy via its impact on banking sector conditions. Monetary policy may affect real economic activity, and ultimately inflation, via its impact on the banking sector through a number of transmission channels.[2] One transmission channel affected by

[1] See e.g. Hempell and Kok Sørensen (2009).

[2] For early contributions acknowledging the importance of banks in the monetary policy transmission mechanism, see Brunner and Meltzer (1963) and Bernanke (1983). See also ECB (2008b) for a

bank behaviour is the degree and speed with which banks pass on changes in policy rates ("interest rate channel"). It has been shown that banks tend to adjust only sluggishly their lending rates in response to changes in monetary policy rates. The stickiness of bank rates has been found to depend among other things on the financial structure and the degree of competition within the banking sector as well as on competition from market-based sources.[3] Another transmission channel often cited in the literature and having received increasing attention over the past two decades is the "credit channel". According to this view, owing to informational asymmetries and principal-agent problems between banks and their borrowers, monetary policy may impact on the supply of loans and eventually on economic activity and inflation. This could, for example, be the case if following a monetary policy tightening certain banks face balance sheet constraints, such as lower liquidity or capital holdings, and hence may choose to restrain lending, as prescribed by the "bank lending channel" (or "narrow credit channel").[4] Monetary policy via its effect on the cash flows of potential borrowers and on the value of their collateral may likewise influence the creditworthiness of bank borrowers leading to a change in their external financing premium charged by the banks. This, in turn, may induce banks to alter their supply of loans to these borrowers (the "broad credit channel").[5] Furthermore, bank credit has also been shown to be related to the boom and bust of economic cycles, for example as evidenced by the correlation between credit cycles and assets cycles. The latter fact is related to what has recently been labelled the "risk-taking" channel of monetary policy. This channel builds on the notion that monetary policy may amplify the procyclical nature of bank (and non-bank) intermediation through the impact it may have on the pricing, management and perception of risk by financial intermediaries.[6] All in all, the fact that monetary policy can affect the balance sheets of banks and

detailed description of the role of banks in the monetary policy transmission mechanim.

[3] See e.g. Gropp et al. (2007) and Van Leuvensteijn et al. (2008).

[4] See Bernanke and Blinder (1988), Bernanke and Gertler (1995), Peek and Rosengren (1995), Kashyap and Stein (2000), Van den Heuvel (2002) and Kishan and Opiela (2006) for some of the early contributions to this line of the literature. For the euro area Ehrmann et al. (2001) provided some evidence of the existence of a bank lending channel working mainly via bank liquidity positions; see also Angeloni, Kashyap and Mojon (2003) for early euro area evidence. Moreover, Gambacorta and Mistrulli (2004) and Altunbas et al. (2004) provide evidence of the importance of bank capital positions in the bank lending channel. More recently, Altunbas et al. (2008) point to the impact of securitisation, bank risk, capital and liquidity positions on monetary policy transmission.

[5] See Bernanke et al. (1999) for the seminal contribution on the balance sheet channel of monetary policy transmission.

[6] See e.g. Rajan (2005) and Borio and Zhu (2008). For recent empirical evidence of the risk-taking channel in a European context see Jiménez et al. (2007), Maddaloni et al. (2009), Altunbas et al. (2009), Ioannidou et al. (2009).

their borrowers may amplify the impact of monetary policy on the wider economy.

Whereas, as mentioned above, several studies find evidence of the importance of the bank lending channel in the sense that monetary policy impacts on bank credit supply, it cannot be taken for granted that such changes in credit supply in turn have significant effects on real economic activity. Indeed, for the US neither Driscoll (2004) nor Ashcraft (2006) find compelling evidence for a strong causal relationship between credit supply and real output.

However, owing to the central role bank financing plays in the euro area financial system, in this paper we set out to examine whether, in contrast to US findings, changes in credit supply have significant effects on real activity in the euro area. Following Driscoll (2004), using a panel econometric methodology we approach the issue from the perspective of the bank lending channel, thereby addressing two related questions: first, whether a change in banks' funding has an effect on loan supply and, second, whether changes in banks' loans have an impact on output. The answer to these questions is based on two assumptions. The first one concerns the "special" status that (non-interbank) deposits have in the liability structure of banks, in that deposits cannot be perfectly substituted with other forms of funding; a particularly realistic hypothesis at the current juncture.[7] That is, in this paper we build on the notion of imperfect substitutatibility between deposits and other sources of bank funding as a prerequisite for the bank lending channel to exist. Hence, to the extent that a change in the policy rate affect the money-holding sector's demand for bank deposits, banks may not be able to perfectly adjust their funding structure and as a result they may have to alter the composition of their assets. At the same time, our identification does not rely on the textbook notion that the central bank explicitly can affect the volume of bank reserves, which we would argue does not correspond to the way monetary policy is implemented in practice.[8] The second assumption regards the peculiarity of loans for firms (and households), in the sense that companies (and consumers) cannot perfectly substitute loans with other forms of finance, such as bonds or equities. This may be particularly pertinent in the case of the euro area where bank financing is the predominant means of financing for non-financial corporations. For example, by the end of 2007 bank loans to the private sector

[7] In the euro area banking sector balance sheet, deposits taken from the non-financial sector constitute around one-third of total liabilities and thus is the most important source of bank funding.

[8] Many macroeconomic textbooks describing the traditional bank lending channel adhere to the central bank's ability to directly control the quantity of bank reserves through binding reserve requirements, which in turn should limit the banking sector's ability to issue demand deposits. However, as for example pointed out by Diyatat (2008), this view is at odds with how monetary policy is conducted in practice. In fact, in modern central banking there is a decoupling of the short-term interest rate set by the central bank and the reserve balances; see also Borio and Diyatat (2009).

constituted 145% of GDP in the euro area compared with 63% of GDP in the US; see ECB (2009). It should furthermore be noted that Driscoll's methodology implicitly relies on the fact that US banking markets were legally segmented across US states during most of his sample period (i.e. 1965-1998).[9] While euro area retail banking markets were not segmented in a legal sense during our sample period (i.e. 1999-2008), in practice euro area banking markets remain largely fragmented.[10]

Turning to our results, we find that monetary policy has a significant effect on credit supply providing evidence for the existence of a bank lending channel in the euro area. Furthermore, contrary to the US experience, we document that changes in credit supply also exert a non-negligible impact on real economic activity in the euro area. These findings continue to hold even when we control for the impact of the stance of bank credit standards on lending and activity. Overall, the findings of this paper highlight the importance of monitoring and assessing credit developments on a regular basis when conducting monetary policy and thus provide support for the prominent role of monetary and credit analysis in the ECB monetary policy strategy.

The remainder of the paper is organised as follows. Section 2 derives the model capturing the bank lending channel. Section 3 discusses the data and Section 4 describes the empirical methodology and the results. In Section 5 our findings are discussed, while Section 6 concludes the paper.

2 A model on the banking lending channel

This section first describes the model proposed by Driscoll (2004) to derive a testable equation linking bank loans and output. The starting point is a simple aggregate demand Keynesian model augmented with two equations for the demand and supply of loans.

Assume that the economy is composed of M states, $i = 1, ..., M$, sharing a common monetary policy and currency. The portfolio choice of each investor is between bank deposits and bonds. While bonds bear the same interest rate r across states, the interest rate on bank deposits, r^d, can vary from one member state to another.

Assuming that the common monetary authority, although able to change the aggregate quantity of money (in this stylised setup), cannot target the quantity of

[9] Indeed, as argued by e.g. Berger and Hannan (1989) and Berger et al. (1995), despite the gradual deregulation of the US banking sector US banks still operated mainly along local perimeters. A more recent study by Correa and Suarez (2009), however, finds evidence that US banking deregulation (i.e. inter-State integration) have helped smooth both credit to firms and the firms' production and income flows.

[10] This is for instance illustrated by a low level of cross-border activity and still significant cross-country differences in the retail bank interest rates; see e.g. ECB (2008a).

money in a specific state i, in line with classical Keynesian models, for each state the equilibrium money demand and supply equation can be written as follows:

$$m_{it} - p_{it} = \gamma y_{it} - \delta \left(r_t - r_{it}^d \right) + \varepsilon_{it}, \tag{1}$$

where $m_{it} - p_{it}$ denotes real money balances, y_{it} the real income and ε_{it} the state-specific shock to money demand.

In Keynesian-type frameworks, real income is equal to expenditure, which can be dis-aggregated into consumption, investment, net exports and government spending. Assuming that net exports depend on the exogenous exchange rate and government spending is given, investments and consumption will (inversely) depend on the interest rates on bonds and loans, r_t and ρ_{it}, respectively. Note that the interest rate on loans can vary across countries. In equilibrium, the following equation holds:

$$y_{it} = -\theta r_t - \alpha \rho_{it} + z_{it}, \tag{2}$$

where z_{it} denotes state-specific shocks to aggregate demand.

Credit is supplied by the banking system and is a function of the interest rate on bonds and loans (that compose the asset side of the balance sheet), as well as real money balances, since deposits are considered an imperfect substitute in the financing sources available for banks. The relevant equation for loans' supply can be written as follows:

$$l_{it}^s = -\lambda r_t + \mu \rho_{it} + \beta \left(m_{it} - p_{it} \right) + w_{it}, \tag{3}$$

where w_{it} denotes state-specific shocks to loan supply.

Similarly, the loan demand depends on real income and the interest rate on bonds, which corporations can issue to finance their activities, and inversely on interest rates on loans. Therefore the demand for loans takes on the following functional form:

$$l_{it}^d = \tau r_t - \chi \rho_{it} + \omega y_{it} + \upsilon_{it}, \tag{4}$$

where υ_{it} denotes state-specific shocks to loan demand.

Since the ultimate goal of the model is to obtain a framework which allows to test for the lending channel, it is important to isolate the effects that money demand shocks have on loans (an increase in deposits increases the funding sources of the banks which can then grant more loans) and, in turn, the impact that loans have on real income. To this end, it is crucial to distinguish between the banking lending channel from the interest rate channel. To solve this identification problem, Driscoll (2004) suggests to de-mean each relevant variable x_{it} with its cross-sectional mean:

$\widetilde{x}_{it} \equiv x_{it} - M^{-1}\sum_{i=1}^{M} x_{it}$. The system of equations (1)-(4) can then be re-written as follows:

$$\widetilde{m}_{it} - \widetilde{p}_{it} = \gamma\widetilde{y}_{it} + \delta\widetilde{r}^{d}_{it} + \varepsilon_{it}, \tag{5}$$

$$\widetilde{y}_{it} = -\alpha\widetilde{\rho}_{it} + z_{it}, \tag{6}$$

$$\widetilde{l}^{s}_{it} = \mu\widetilde{\rho}_{it} + \beta\left(\widetilde{m}_{it} - \widetilde{p}_{it}\right) + w_{it}, \tag{7}$$

$$\widetilde{l}^{d}_{it} = -\chi\widetilde{\rho}_{it} + \omega\widetilde{y}_{it} + \upsilon_{it}. \tag{8}$$

The demeaning permits to remove the liquidity preference channel together with the possible impacts that changes in monetary policy can have via bond yields. However, the endogeneity between money demand and output is not yet eliminated, since the former can be affected by expected future changes in output, and, at the same time, money demand can have an impact on output via its effect on bank lending rates. The endogeneity can easily be seen solving equations (5)-(8) for real income and loans:[11]

$$\widetilde{y}_{it} = \frac{\alpha}{\chi + \omega\alpha}\widetilde{l}_{it} - \frac{\alpha}{\chi + \omega\alpha}\upsilon_{it} + \frac{\chi}{\chi + \omega\alpha}z_{it}, \tag{9}$$

$$\widetilde{l}_{it} = \frac{\beta\delta\chi}{\chi + \mu}\widetilde{r}^{d}_{it} + \frac{\chi\beta\gamma + \omega\mu}{\chi + \mu}\widetilde{y}_{it} + \frac{\chi\beta}{\chi + \mu}\varepsilon_{it} - \frac{\mu}{\chi + \mu}\upsilon_{it} + \frac{\chi}{\chi + \mu}w_{it}. \tag{10}$$

Equations (9) and (10) show the inter-dependence of $\widetilde{y}_{it}$ and $\widetilde{l}_{it}$ and, therefore, between money demand shocks and output via the impact that these shocks have on loans. However, assuming that $Corr\left(\varepsilon_{it}, \upsilon_{it}\right) = Corr\left(\varepsilon_{it}, z_{it}\right) = 0$ solves the endogeneity between money demand shocks and real income. The assumption is plausible, since money demand shocks can depend on factors different from real income (and loan demand) such as institutional frameworks and/or preferences. Furthermore, since the country-specific shocks ε_{it} are correlated with loans (see equation (10)), but not with output, they can be used as instruments to estimate the relation between real income and loans. Ultimately, instrumenting loans with money demand shocks allows to test whether changes in the supply of loans depend on changes in deposits, i.e. an important source of funding for the banking system, and, next, the impact of loans on real output.

[11] Equations (9) and (10) can be obtained by solving for ρ_{it} in equation (8), substituting this into equations (6) and (7), and substituting equation (5) into equation (7).

Driscoll's (2004) model is next extended to include changes in credit standards from the ECB Bank Lending Survey (BLS), which capture whether lenders are growing more or less cautious in granting loans. Thus, a tightening of credit standards (measured as a positive value of $\widetilde{cs}_{it}$) is expected to exert a negative influence on bank loan supply. When adding credit standards, the (de-meaned) loan supply equation (7) reads as follows:

$$\widetilde{l}_{it}^{s} = \mu\widetilde{\rho}_{it} + \beta\left(\widetilde{m}_{it} - \widetilde{p}_{it}\right) - \theta\widetilde{cs}_{it} + w_{it}, \tag{11}$$

where $\widetilde{cs}_{it}$ denotes the variable "credit standards."[12] The solution of the model generates the same real income equilibrium equation as before (see 9) and a new loan equilibrium equation which includes $\widetilde{cs}_{it}$:

$$\widetilde{l}_{it} = \frac{\beta\delta\chi}{\chi+\mu}\widetilde{r}_{it}^{d} + \frac{\chi\beta\gamma+\omega\mu}{\chi+\mu}\widetilde{y}_{it} - \frac{\theta\chi}{\chi+\mu}\widetilde{cs}_{it} + \frac{\chi\beta}{\chi+\mu}\varepsilon_{it} - \frac{\mu}{\chi+\mu}\upsilon_{it} + \frac{\chi}{\chi+\mu}w_{it}. \tag{12}$$

Similarly to bank loans, credit standards are endogenous to GDP growth. Since credit availability depends on lenders' standards, if, for instance, credit standards tighten, this can generate a decrease in the credit-based level of activity of companies and households and ultimately a GDP contraction. At the same time, loan officers change their credit standards according to their expectations on real GPD growth. For instance, during business cycle downturns, banks are typically more cautious in granting credit, as collateral values and firms' net worth deteriorate, and may decide to tighten credit standards. Therefore, to identify unambiguously the impact of changes in credit standards to GDP variations, when regressing GDP growth on loan growth and changes in credit standards, also this latter explanatory variable has to be instrumented. For loan growth, similarly to the original Driscoll's (2004) model, money demand shocks are the relevant instruments used in the empirical analysis. The information variables that are employed for credit standards are those factors affecting them but with limited or no dependence on GDP growth. For example, in the second question of the bank lending survey ("Over the past three months, how have the following factors affected your bank's credit standards as applied to the approval of loans or credit lines to enterprises?") loan officers can choose among a number of determinants: some of them explicitly take into account "expectations regarding general economic activity." Other determinants do not.[13] Therefore, one can assume

[12] Note that, abusing the notation, the error term we use in equation (11) is the same as the disturbance term in equation (7).

[13] When answering question 2, loan officers are supposed to provide an answer for four determinants (A, B, C, and D), each with its own subset of possible replies. The four determinants are as follows.

that these latter factors are correlated with overall credit standards but show no or limited dependence on output disturbances and thus use them as instruments.

3 Data

The euro area countries included in the analysis are: Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, the Netherlands, Portugal and Spain.[14] Data are observed at quarterly frequency and cover the period 1999 Q1 to 2008 Q1, i.e. from the inception of the European Monetary Union. This avoids the results from being biased by any structural breaks in the empirical relationships following the introduction of the euro.

Data on nominal and real GDP (at constant prices) as well as the GDP deflator are from Eurostat. As for the money variables, we use M3 less currency, which constitute all bank deposits and therefore should influence the ability of banks to grant loans. For robustness checks, we also use M2 minus currency and time deposits, i.e. a measure of money that consists of demand and saving deposits only. In this paper, the loan data refer to outstanding loans to non-financial corporations. The source for both the money and loan data is ECB. As for the interest rates on bank deposits we use rates on deposits to households up to one year maturity provided by the ECB's MFI interest rate statistics.[15] Data on credit standards are taken from the ECB's bank lending survey. Table 1 provides basic descriptive statistics.

A) Cost of funds and balance sheet constraints, with three choices: (i) costs related to your bank's capital position; (ii) your bank's ability to access market financing; (iii) your bank's liquidity position. B) Pressure from competition, with three choices: (i) competition from other banks; (ii) competition from non-banks; (iii) competition from market financing. C) Perception of risk, with three choices: (i) expectations regarding general economic activity; (ii) industry or firm-specific outlook; (iii) risk on the collateral demanded. D) Other factors, please specify. The instruments adopted in the analysis are those under point B) relating to the effect of competition on bank credit standards, which is motivated by the presumption that this factor is more structurally determined and at most weakly related to the business cycle.

[14] For the remainder of the euro area countries (i.e. Luxembourg, Cyprus, Malta, Slovenia and Slovakia), the relevant data series were not available for the full sample period and hence these countries were not included in the analysis. Morevoer, apart from Luxembourg the non-included countries only entered the euro area towards the end of the sample and therefore in the earlier part of the sample were not exposed to the single monetary policy to the same degree as the original euro area countries.

[15] Prior to January 2003 (where the official MFI interest rate series start) we use internally estimated back series of the deposit rates.

4 Empirical methodology and results

This section discusses the empirical methodology we employ and the results we obtain.

The first important step of the analysis concerns the estimation of the money demand equation (5) for each member state. Its estimation will allow us to recover the corresponding residuals. The results of this first-step of our analysis are reported in Table 2.

As an aside, we also estimate two OLS panel regressions, a first of GDP growth on total loan growth and a second of GDP growth on changes in credit standards. At this stage regressors are not instrumented since the objective of this exercise is to assess the existence of a significant relation between GDP and loan growth, on the one hand, and GPD growth and changes in credit standards, on the other hand. Results, which are reported in Table 3, panels A and B, suggest a significant and *positive* contemporaneous relation between GDP changes and loan growth, as well as a significant and *negative* relation between GDP growth and changes in credit standards lagged twice. Note that the sample period for the first panel regression starts in 1999 Q1, while the sample for the second regression begins in 2002 Q4, since the BLS data are only available from that quarter onwards.[16] Since there exists significant relations between GDP and loan growth, as well as GDP growth and changes in credit standards, this suggests that we can bring the analysis forward by instrumenting our regressors.

In the second stage of our empirical analysis, we regress loan growth on money demand shocks based on M2 and M3, respectively. Results are reported in Table 4, panels A and B. Money demand shocks derived from M2 are statistically significant only contemporaneously, while those derived from M3 are significant when lagged once and twice. To illustrate, this means that if the residuals $\widetilde{\varepsilon}_{it}$ $\forall i$ (as estimated from M2) change at a rate of one percentage point above their cross-sectional average rate, loans will grow by 0.15% above their cross sectional average (in terms of quarter-on-quarter growth rates), reflected by the coefficient of the panel regression of $\Delta\widetilde{l}_{it}$ on $\Delta\widetilde{\varepsilon}_{it}$ being equal to 0.15. The key message suggested by these regressions is that the level of bank deposits is important in determining the loan supply, a necessary condition for the existence of the banking lending channel. In other words, a positive value of ε indicates a larger amount of deposits in the banking system, which allows

[16] The regression between GDP and credit standards only includes the five euro area countries with the largest GDP share relative to the whole euro area GDP, i.e. France, Germany, Italy, the Netherlands, and Spain. The main reason for not including the smaller countries is that sample sizes in those countries are rather small, which typically results in highly erratic net percentages of changes in credit standards.

banks to supply more loans. To complete our assesment of the importance of the banking lending channel, we next investigate the existence of a significant relation between GDP and loans.

To this end, in the final step of our estimation strategy, we run two panel regressions: first, we regress output on loans instrumented with those money demand shocks that turn out to be statistcally significant in the second estimation stage (i.e. $\widetilde{\varepsilon}_{it}$ from M2, as well as $\widetilde{\varepsilon}_{it-1}$ and $\widetilde{\varepsilon}_{it-2}$ from M3); second, as a robustness check, we run a regression where output depends on loans (again instrumented with information variables) *and* credit standards. These latter variables, in turn, are instrumented with those BLS determinants which exhibit limited correlations with GDP growth. Results are reported in Table 4, panels A and B. The coefficient corresponding to the variable $\Delta\widetilde{l}_{it}$, i..e. the log change in loan growth, is positive and statistically significant and denotes a non-negligible effect of bank loans on GDP. To illustrate, suppose that as a consequence of the event that have recently hit financial markets, there is a deleveraging which, for a given euro zone country, brings about a say 5% decrease in credit growth below the euro area average. For that country, this would result into a real output growth reduction below the corresponding (simple) average equal to 5%*0.077 = 0.4%. While this represents the immediate impact of a credit shock, the long-run multiplier effect should equal $5\%^{*}\left(0.077-0.004\right)/\left(1-0.456-0.322\right)=1.6\%$.[17]

When the exercise is extended to include changes in credit standards, Table 5 shows that credit growth still remains a significant determinant of changes in GDP growth, although its weight decreases (the coefficient attached to $\Delta\widetilde{l}_{it}$ is now equal to 0.027). Moreover, changes in credit standards (lagged twice) enter the regression significantly and with the expected sign, indicating that their tightening has a negative impact on real GDP growth. To illustrate assume that credit standards tighten by 30%. This implies a decline in GDP growth below the average equal to 30%*0.002 = 0.066%. However, these results need to be interpreted with some caution. First, the power of the test is limited since in the euro area sufficiently long time series on credit standards are not available (we use data from 2003 Q2 till 2008 Q1). Second, data on credit standards are only recently undergoing a full cycle, which may bias the coefficients of our estimates.

5 Discussion

What could be the reasons for the finding of a significantly positive impact of

[17] These results are broadly similar in magnitude to those obtained from imposing comparable shocks to banks ' balance sheet in more encompassing DSGE models for the euro area; see e.g. Gerali et al. (2009).

changes in the supply of credit (both in terms of volumes and in terms of lending standards) on real economic activity in the euro area while such effects are not apparent in a US context (at least according to Driscoll, 2004)? Possible explanations most likely derive from cross-Atlantic differences in the banking and financial structures affecting the preconditions underlying the existence of a bank lending channel (i.e. the non-substitutability of bank deposits and the existence of bank dependent firms and households).

As regards the uniqueness and importance of customer deposits in bank funding structures between the euro area and the US, it might be noted that in terms of on-balance sheet items the share of customer deposits is on aggregate not markedly different between commercial banks in the two economic areas. However, this may abstract from the fact that in the US a large part of financial intermediation is not registered on the balance sheets of commercial banks. This is, for example, illustrated by the major role played by the Government-Sponsored Agencies in the mortgage financing in the US. Furthermore, off-balance sheet funding by US banks is generally more widespread than in the euro area. One example is the fact that securitisation is considerably more advanced in the US compared to the euro area. For instance, by end-2007 the annualised sum of securitisation transactions in the euro area amounted to only around 3% of GDP compared to 12% of GDP in the US.[18] In addition, given the sheer size and depth of US capital markets banks may typically find it easier to substitute deposits with market-based funding sources (such as commercial papers, certificates of deposits, bonds and equity). As an illustration, by end-2007 the combined amount of quoted equity and debt securities issued in the US amounted to 312% of GDP compared to only 166% of GDP in the euro area.[19] Despite these differences Driscoll (2004) does find evidence that US banks cannot perfectly substitute deposits. In other words, the first precondition of a bank lending channel appear to be fulfilled both in the US and in the euro area.

Therefore, the difference between our results for the euro area and the US-based studies (e.g. Driscoll, 2004; Ashcraft, 2006) propably stems primarily from the greater dependence on bank credit of the euro area private sector. Indeed, by end-2007 bank loans to the private sector constituted 145% of GDP in the euro area. This compares with a corresponding ratio of 63% in the US.[20] Furthermore, bank dependent firms should normally be found among the small and medium-sized enterprises (SME) which are not able to raise funds in the capital markets. Moreover, it may be noted that whereas the number of SMEs to the total number of firms is roughly equal in the

[18] Based on gross issuance data from Dealogic. See also ECB (2008b).
[19] See e.g. ECB (2009).
[20] See ECB (2009).

US and the euro area[21], in terms of the number of employees on the payroll in SMEs compared to the total number of employed people the SME sector is substantially more important in the euro area (with a percentage of 67% of the total number of employees) compared with the US (43%). All in all, in light of such structural differences with respect to the role of banks in the financing of enterprises, in particular, and the private sector more broadly, it should not be surprising that the impact on real economic activity from shocks to banks' supply of credit are more pronounced in the euro area than in the US. Our findings hence seem to corroborate apriori expectations based on the cross-Atlantic differences in financial structures.[22]

Finally, it cannot of course be excluded that the discrepancy between our findings and those of Driscoll (2004) to some extent also pertains to the different sample periods considered in the two studies. Hence, whereas Driscoll's sample period is 1965-1998 our sample covers a more limited period of 1999-2008. Concerns may also be raised as to the fact that our sample partly overlaps with the financial crisis and as a result it could be questioned whether our results are largely driven by dynamics triggered by the crisis. However, we do not think this is a major issue as our sample ends in Q1 2008 and thus does not include data for the intensification of the crisis occurring in Q3 2008 onwards.[23]

6 Conclusion

To conclude, using the framework derived by Driscoll (2004), this paper has provided empirical evidence for the existence of a bank lending channel of monetary policy transmission in the euro area. In addition, and in contrast to recent findings for the US, we find that in the euro area changes in the supply of credit, both in terms of volumes and in terms of credit standards applied on loans to enterprises, have significant effects on real economic activity. This highlights the importance of including the monitoring of credit developments in the toolkit of monetary policy and underpins the reasoning behind giving monetary and credit analysis a prominent role

[21] Summing to 99% in both economic areas; according to the European Commission and the US Census Bureau. The official definition of SMEs vary between the EU and the US authorities. Here we follow the EU definition according to which SME are firms with no more than 250 employees; see European Commission Recommendation of 06 May 2003 (2003/361/EC).

[22] Our findings furthermore seem to corroborate well with the different non-standard measures taken by the Eurosystem and the Federal Reserve during the 2007-9 financial crisis. Whereas the former mainly focused its efforts at alleviating the situation of the euro area banking sector (e.g. through massive liquidity operations and covered bond purchases), the latter complemented such measures by also introducing outright asset purchases vis-à-vis the non-bank private and government sectors.

[23] Indeed, loan growth of loans to euro area non-financial corporations reached its historical high during the first quarter of 2008.

in the monetary policy strategy of the ECB. These findings furthermore point to the potential negative repercussions on real economic growth arising from the financial crisis that erupted in mid-2007 and which resulted in serious impairments of euro area banks' balance sheets and the need for banks to delever and possibly to reduce their supply of loans. Also in this light and notwithstanding the findings of this paper, further research is needed to enhance the knowledge of the dynamic relationships between the situation of the financial sector, credit provision, real economic activity and inflation.

References

[1] Altunbas, Y., de Bondt, G. and Marqués-Ibañez, D. (2004), "Bank capital, bank lending and monetary policy in the euro area", *Kredit und Kapital*, 4/2004.

[2] Altunbas, Y., Gambacorta, L. and Marqués-Ibañez, D. (2008), "Securitisation and the bank lending channel", *European Economic Review* (forthcoming).

[3] Altunbas, Y., Gambacorta, L. and Marqués-Ibañex (2009), "Bank risk and monetary policy", *Journal of Financial Stability* (forthcoming).

[4] Angeloni, I., Kashyap, A.N. and Mojon, B. (eds.), (2003), *Monetary Policy Transmission in the Euro Area*, Cambridge University Press.

[5] Ashcraft, A. (2006), "New evidence on the lending channel", *Journal of Money, Credit and Banking* 38(3), pp. 751-76.

[6] Bernanke, B.S. (1983), "Nonmonetary effects of the financial crisis in the propagation of the Great Depression", *American Economic Review* 73(2), pp. 257-76.

[7] Bernanke, B.S. and Blinder, A. (1988), "Credit, money and aggregate demand", *American Economic Review*, Papers and Proceedings 75(1), pp. 435-39.

[8] Bernanke, B.S. and Gertler, M. (1995), "Inside the black box: The credit channel of monetary policy transmission", *Journal of Economic Perspectives* Vol. 9(4), pp. 27-48.

[9] Bernanke, B.S., Gertler, M. and Gilchrist, S. (1999), "The financial accelerator in a quantitative business cycle framework", in Taylor, J. and Woodford, M. (eds.), *Handbook of Macroeconomics*, Amsterdam, North-Holland.

[10] Berger, A.N. and Hannan, T.H. (1989), "The price-concentration relationship in banking", *Review of Economics and Statistics* Vol. 71 (2), pp. 291-299.

[11] Berger, A.N., Kashyap, A.K. and Scalise, J.M. (1995), "The transformation of the US banking industry: What a long strange trip it's been", *Brookings Papers on Economic Activity* Vol. 2, pp. 55-218.

[12] Borio, C. and Diyatat, P. (2009), "Unconventional monetary policies: An appraisal", BIS Working Papers No. 292.

[13] Borio, C. and Zhu, H. (2008), "Capital regulation, risk-taking and monetary policy: A missing link in the monetary policy transmission mechanism?", BIS Working Paper No. 268.

[14] Brunner, K. and Meltzer, A.H. (1963), "The place of financial intermediaries in the tranmission of monetary policy", *American Economic Review* 53(2), pp. 372-82.

[15] Campbell, J.Y., A.W. Lo and A.C. MacKinlay (1997), *The Econometrics of Financial Markets*, Princeton University Press, Princeton, N.J.

[16] Correa, R. and Suarez, G.A. (2009), "Firm volatility and banks: Evidence from U.S. banking deregulation", Federal Reserve Board Finance and Economics Discussion Paper No. 2009-46.

[17] Diyatat, P. (2008), "Monetary policy implementation: Misconceptions and their consequences", BIS Working Papers No. 269.

[18] Driscoll, J.C. (2004), "Does bank lending affect output? Evidence from the US states", *Journal of Monetary Economics* 51, pp. 451-71.

[19] European Central Bank (2008a), *Financial Integration in Europe*, April.

[20] European Central Bank (2008b), "The role of banks in the monetary policy transmission mechanism", Monthly Bulletin, August.

[21] European Central Bank (2009), "The external financing of households and non-financial corporations", Monthly Bulletin, April.

[22] Gambacorta, L. and Mistrulli, P. (2004), "Does bank capital affect lending behaviour?", *Journal of Financial Intermediation* Vol. 13, pp. 436-57.

[23] Gerali, A., Neri, S., Sessa, L. and Signoreti, F.M. (2009), "Credit and Banking in a DSGE model of the euro area", paper presented at the Conference on Financial Markets and Monetary Policy organised by the Federal Reserve Board of Governors, June 4-5 2009, Washington D.C.

[24] Hempell, H.S. and Kok Sørensen, C. (2009): "The Impact of Supply Constraints on Bank Lending in the Euro Area – Crisis Induced Crunching?", paper presented at the ECB Workshop on "Challenges to monetary policy implementation beyond the financial market turbulence" (30 Nov.-1 Dec. 2009, Frankfurt).

[25] Gropp, R., Kok Sørensen, C. and Lichtenberger, J. (2007), "The dynamics of bank spreads and financial structure", ECB Working Paper No. 714.

[26] IMF (2008), "Global Financial Stability Report", October.

[27] Ioannidou, V., Ongena, S. and Peydró, J.L. (2009), "Monetary policy and subprime lending: A tall tale of low Federal Funds Rates, hazardous loan, and reduced loan spreads", European Banking Center Discussion Paper, No. 2009-04S.

[28] Jiménez, G., Ongena, S., Peydró, J.L. and Saurina, J. (2007), "Hazardous times for monetary policy: What do twenty-three million bank loans say about the effects of monetary policy on credit risk?", CEPR Discussion Paper No. 6514.

[29] Kashyap, A.N. and Stein, J. (2000), "What do a million observations say about the transmission of monetary policy?", *American Economic Review* 90(3), pp. 407-28.

[30] Kishan, R.P. and Opiela, T.P. (2006), "Bank capital and loan asymmetry in the transmission of monetary policy", *Journal of Banking and Finance* Vol. 30, pp. 259-85.

[31] Maddaloni, A., Peydró, J.L. and Scopel, S. (2009), "Does monetary policy affect bank credit standards? Evidence from the euro area bank lending survey", ECB Working Paper, forthcoming.

[32] Peek, J. and Rosengren, E. (1995), "Is bank lending important for the transmission of monetary policy: An overview", Federal Reserve Bank of Boston Conference Series: Proceedings, pp. 1-14.

[33] Rajan, R. (2005), "Has financial development made the world riskier?", NBER Working Paper No. 11728.

[34] Van den Heuvel, S. (2002), "Does bank capital matter for monetary transmission?", Economic Policy Review, Federal Reserve Bank of New York, May 2002, pp. 259-65.

[35] Van Leuvensteijn, M., Kok Sørensen, C., Bikker, J.A. and Van Rixtel, A. (2008), "Impact of bank competition on the interest rate pass-through in the euro area", ECB Working Paper No. 885.

A Figures and Tables

Table 1: Descriptive statistics

	Mean	Median	Maximum	Minimum	Standard deviation	Coefficient of variation
Nominal GDP (€bill.)	678.3	278.4	2452.1	81.7	709.4	1.0
Real GDP (€bill.)	595.1	258.9	2331.0	69.1	672.7	1.1
Deflator (in %)	1.2	1.2	1.6	1.0	0.1	0.1
M3 (€bill.)	509.8	287.4	1891.8	63.7	481.7	0.9
M2 (€bill.)	434.6	276.3	1751.3	55.5	407.7	0.9
Deposit rate (in %)	2.7	2.9	9.2	0.1	0.8	0.3
Loans (€bill.)	272.5	117.8	903.9	20.5	260.8	1.0
credit standards*	12.7	12.5	100.0	-50.0	6.8	0.5
- bank competition*	-17.8	-18.3	50.0	-75.0	6.9	-0.4
- non-bank competition*	-17.8	-18.3	33.3	-40.0	6.9	-0.4
- competition from markets*	-17.8	-18.3	40.0	-40.0	6.9	-0.4

Sources: Eurostat and ECB. Note: Apart from the maximum and minimum values, figures reported refer to cross-country means and medians, and standard deviations of country averages. *Credit standards (and the three contributing factors) are measured as the net percentage of banks reporting a tightening of standards compared with the previous quarter.

Table 2: Country-based OLS regressions of monetary aggregates on real GDP and interest rates

This table reports country-based OLS regressions of M2 (Panel A) and of M3 (Panel B) on real GDP and interest rates. Coefficients significant at 5% confidence level are reported in bold.

Panel A: OLS regressions of M2 on real GDP and interest rates

Dependent variable: $\tilde{M}2_{it}$		
	$\tilde{y}_{it}$	$\tilde{r}^{d}_{it}$
Portugal	**0.76**	**0.14**
Netherlands	**2.39**	**0.16**
Italy	**0.78**	0.00
Ireland	**0.90**	-0.02
Greece	**1.00**	0.01
France	**0.78**	-0.01
Finland	**1.41**	**-0.15**
Spain	**0.98**	-0.02
Germany	**0.95**	**-0.04**
Belgium	**0.56**	**-0.07**
Austria	**1.09**	0.01

Data are observed at quarterly frequency and cover the period 1999 Q1 to 2008 Q1. Variables are computed as deviations from the corresponding cross-sectional average, which is denoted with "~".

Panel B: OLS regressions of M3 on real GDP and interest rates

Dependent variable: $\tilde{M}3_{it}$		
	$\tilde{y}_{it}$	$\tilde{r}^{d}_{it}$
Portugal	**0.86**	0.12
Netherlands	**1.89**	**0.12**
Italy	**0.82**	-0.03
Ireland	**0.93**	-0.02
Greece	**0.87**	**-0.15**
France	**0.94**	0.00
Finland	**1.34**	**-0.10**
Spain	**1.16**	0.06
Germany	**0.92**	**-0.04**
Belgium	**0.44**	**-0.03**
Austria	**1.33**	**0.04**

Data are observed at quarterly frequency and cover the period 1999 Q1 to 2008 Q1. Variables are computed as deviations from the corresponding cross-sectional average, which is denoted with "~".

Table 3: OLS panel regressions of output on loans and overall credit standards

This table reports OLS panel regressions of changes in GDP on loan growth (Panel A) and changes in overall credit standards (Panel B). Variables are computed as deviations from the corresponding cross-sectional average, which is denoted with a tilde symbol " ~". $\Delta\widetilde{y}_{it}$, $\Delta\widetilde{l}_{it}$ and $\Delta\widetilde{cs}_{it}$ denote log changes in real GDP, log changes in loans and changes in overall credit standards, respectively. Coefficients significant at 5% confidence level are reported in bold.

Panel A: OLS panel regression of GDP on loans

Dependent variable: $\Delta\widetilde{y}_{it}$		
	Coefficient	Standard errors
$\Delta\widetilde{y}_{it-1}$	**0.474**	0.082
$\Delta\widetilde{y}_{it-2}$	**0.394**	0.073
$\Delta\widetilde{l}_{it}$	**0.010**	0.005
$\Delta\widetilde{l}_{it-1}$	0.010	0.009
$\Delta\widetilde{l}_{it-2}$	-0.017	0.009
$\overline{R}^2$	0.74	
# Obs.	366	

Data are observed at quarterly frequency and cover the period 1999 Q1 to 2008 Q1. The countries included in the analysis are: Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, the Netherlands, Portugal and Spain.

Panel B: OLS panel regression of GDP on overall credit standards

Dependent variable: $\Delta\widetilde{y}_{it}$		
	Coefficient	Standard errors
$\Delta\widetilde{y}_{it-1}$	**0.973**	0.049
$\Delta\widetilde{y}_{it-2}$	-0.083	0.059
$\Delta\widetilde{cs}_{it}$	0.000	0.000
$\Delta\widetilde{cs}_{it-1}$	-0.000	0.000
$\Delta\widetilde{cs}_{it-2}$	**-0.001**	0.000
$\overline{R}^2$	0.85	
# Obs.	100	

Data are observed at quarterly frequency and cover the period 2002 Q4 to 2008 Q1. The countries included in the analysis are: France, Germany, Italy, the Netherlands, and Spain.

Table 4: OLS panel regressions of loans on money demand shocks from M2 and M3

This table reports OLS panel regressions of loan growth on GDP changes and money demand shocks from M2 (Panel A) and M3 (Panel B). Variables are computed as deviations from the corresponding cross-sectional average, which is denoted with a tilde symbol " ~". $\Delta\widetilde{y}_{it}$, $\Delta\widetilde{l}_{it}$ and $\widetilde{\varepsilon}_{it}$ denote log changes in real GDP, log changes in loans and money demand shocks, respectively. Data are observed at quarterly frequency and cover the period 1999 Q1 to 2008 Q1. The countries included in the analysis are: Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, the Netherlands, Portugal and Spain. Coefficients significant at 5% confidence level are reported in bold.

Panel A: OLS panel regression of loans on money demand shocks (M2)

Dependent variable: $\Delta\widetilde{l}_{it}$		
	Coefficient	Standard errors
$\Delta\widetilde{y}_{it-1}$	**0.957**	0.302
$\Delta\widetilde{y}_{it-2}$	**1.569**	0.237
$\Delta\widetilde{\varepsilon}_{it}$	**0.153**	0.076
$\Delta\widetilde{\varepsilon}_{it-1}$	-0.049	0.083
$\Delta\widetilde{\varepsilon}_{it-2}$	0.062	0.036
$\Delta\widetilde{\varepsilon}_{it-3}$	-0.002	0.032
$\overline{R}^2$	0.25	
# Obs.	366	

Panel B: OLS panel regression of loans on money demand shocks (M3)

Dependent variable: $\Delta\widetilde{l}_{it}$		
	Coefficient	Standard errors
$\Delta\widetilde{y}_{it-1}$	**0.855**	0.307
$\Delta\widetilde{y}_{it-2}$	**1.678**	0.310
$\Delta\widetilde{\varepsilon}_{it}$	0.074	0.073
$\Delta\widetilde{\varepsilon}_{it-1}$	**0.145**	0.043
$\Delta\widetilde{\varepsilon}_{it-2}$	**0.109**	0.041
$\Delta\widetilde{\varepsilon}_{it-3}$	0.004	0.046
$\overline{R}^2$	0.26	
# Obs.	366	

Table 4: Instrumental variable panel regressions of GDP on loan growh and changes in credit standards

This table reports IV panel regressions of GDP growth on loan growth (Panel A) as well as GDP growth on loan growth and changes in credit standards (Panel B). Variables are computed as deviations from the corresponding cross-sectional average, which is denoted with a tilde symbol " ~". $\Delta\widetilde{y}_{it}$, $\Delta\widetilde{l}_{it}$ and $\widetilde{\varepsilon}_{it}$ denote log changes in real GDP, log changes in loans and money demand shocks, respectively. Loan growth is instrumented with money demand shocks, $\Delta\widetilde{\varepsilon}_{it}$ (as estimated from M2) as well as $\Delta\widetilde{\varepsilon}_{it-1}$ and $\Delta\widetilde{\varepsilon}_{it-2}$ (as estimated from M3). Changes in credit standards are instrumented with those BLS determinants which exhibit limited correlation with GDP grwth. Data are observed at quarterly frequency and cover the period 1999 Q1 to 2008 Q1 for the first panel regression and the period 2003 Q2 to 2008 Q1 for the second panel regression. In the first regression, the countries included in the analysis are: Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, the Netherlands, Portugal and Spain; in the second regression, the countries included are: France, Germany, Italy, the Netherlands, and Spain. Coefficients significant at 5% confidence level are reported in bold.

Panel A: IV panel regression of GDP growth on loans growth

Dependent variable: $\Delta\widetilde{y}_{it}$		
	Coefficient	Standard errors
$\Delta\widetilde{y}_{it-1}$	**0.456**	0.080
$\Delta\widetilde{y}_{it-2}$	**0.322**	0.061
$\Delta\widetilde{l}_{it}$	**0.077**	0.036
$\Delta\widetilde{l}_{it-1}$	-0.004	0.012
$\Delta\widetilde{l}_{it-2}$	-0.035	0.020
$\overline{R}^2$	0.66	
# Obs.	366	

Table 5 - Contnued

Panel B: IV panel regression of GDP growth on loans growth and changes in credit standards

Dependent variable: $\Delta\widetilde{y}_{it}$		
	Coefficient	Standard errors
$\Delta\widetilde{y}_{it-1}$	**0.907**	0.062
$\Delta\widetilde{y}_{it-2}$	-0.051	0.067
$\Delta\widetilde{l}_{it}$	**0.027**	0.012
$\Delta\widetilde{l}_{it-1}$	-0.008	0.012
$\Delta\widetilde{l}_{it-2}$	-0.007	0.009
Δcs_{it-1}	0.002	0.001
Δcs_{it-2}	**-0.002**	0.001
$\overline{R}^2$	0.82	
# Obs.	100	