Department of
Economics and Finance

Working Paper No. 13-18

http://www.brunel.ac.uk/economics

Bank Lending Procyclicality And Credit Quality During Financial Crises[1]

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June 2013

Abstract

This paper analyses macroeconomic and financial determinants of bad loans applying a SVAR approach to investigate whether excessive loans granted during expansionary phases can explain the more than proportional increase in non-performing loans during contractionary periods. The results indicate that the effects of a permanent shock to bad loans on the excess of credit are significant and persistent for bad loans to firms, but not for bad loans to households or in the case of Cooperative Credit Banks, who adopt more efficient lending policies.

Keywords: loan losses, macroeconomic determinants, Italian banking system, SVAR.
JEL classification: E44, G01, G21, C22.

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[1] The views expressed in this paper are our own and do not necessarily reflect those of Federcasse. We are grateful to Davide Ciferri, Matteo Alessi, Yiorgos Alexopoulos, Francesco Cesarini, Fabio Di Nicolò, Roberto Di Salvo, Anna Di Trapano, Silvio Goglio, Giuseppe Lusignani, Iris Pennisi, Andrea Pezzotta, Cristiana Schena and the participants in the "XX International Conference in Banking and Finance" at the University of Rome Tor Vergata (Rome, December 2011) and in the "International Conference on the Global Financial Crisis" at the University of Southampton (Southampton, April 2013) for useful comments and suggestions.

inflation, disposable income and the growth of bank lending, also taking into account monetary policy rules and exchange rate regimes, and concluded that worsening macroeconomic conditions are a predictor for banking crises in many countries.

Demirgüç-Kunt and Detragiache (1998) and Hardy and Pazarbaşioğlu (1998) showed that bank failures can be attributed to macroeconomic shocks. In particular, the former analysed the macroeconomic determinants of banking crises using four different specifications of a multivariate logit model for a large sample of developed and developing countries during the period from 1980 to 1994. Inflation and interest rates were found to be positively correlated with banking crises, while the correlation with GDP appeared to be negative. Hardy and Pazarbaşioğlu (1998) focused instead on the identification of macroeconomic and financial conditions which are related to a stressful situation in the banking sector. They analysed a panel of 38 countries using a multinomial logit specification. The main result was that the failures in the banking sector are likely to be linked to slow economic growth.

Gambera (2000) used a VAR methodology to assess the impact of macroeconomic variables on bank loans at both national and regional level, using data on US commercial banks. He considered variables such as unemployment, income from the agricultural sector, GDP, the number of bankruptcy cases and sales of automobiles, and found that all of them, with the exception of car sales, are good predictors for the quality of loans.

Bikker and Metzemakers (2005) investigated the relationship between credit quality as measured by the stock of credit provisions, macroeconomic variables and banking. They concluded that a reversal of the economic cycle leads to a worsening of bank asset quality. All variables they considered significantly affected credit quality. Similar evidence is reported by Arpa et al. (2001), who examined banking sector cyclicality with a related approach, and Hoggarth et al. (2005), who used quarterly data for the UK during the period 1988-2004 to investigate the relationship between credit losses and several macroeconomic variables.

Baboucek and Jancar (2005) estimated an unrestricted VAR using monthly data from 1993 to 2006 to quantify the effects of macroeconomic shocks on the quality of the Czech banking sector. They used the bad loan to loans ratio as an indicator of credit quality and several macroeconomic variables. Having identified the main macroeconomic determinants of that ratio, they carried out simulations to measure the vulnerability to macroeconomic shocks of the Czech banking sector. ercks r.

banking sector. A stress test on monetary conditions highlighted the great exposure to this type of shock.

A very influential contribution was the study by Bofondi and Ropele (2011), who tested the macroeconomic determinants of credit quality measured by adjusted new bad debts. We follow their approach in the empirical analysis below.

3. Preliminary data analysis

3.1 Data description

Our dataset consists of 17 monthly series (see Table 1 for a complete list) over the sample period from June 1998 to June 2012 (169 observations). The data sources are the Data Warehouses of the Bank of Italy[4], Istat (the Italian Office for National Statistics), the European Central Bank and Bloomberg.

The data can be divided into two subsets. The first comprises the banking variables, such as loans and bad loans at the national level, including total bad loans and loans (excluding bad loans), bad loans and loans (excluding bad loans) to firms, bad loans and loans (excluding bad loans) to households of all Italian banks and bad loans and loans (excluded bad loans) only for the subset of Italian Cooperative Credit Banks (SOFF_ITA, IMP_ITA, SOFF_FIR_ITA, IMP_FIR_ITA, SOFF_HOU_ITA, IMP_HOU_ITA, SOF_BCC, IMP_BCC; see Table 1). All the variables have been deflated.

The second one consists of macroeconomic and financial variables. In particular, following Bofondi and Ropele (2011), these have been chosen

Price stability is measured by the annual growth index of consumer prices (CPI_ITA). As mentioned by Bofondi and Ropele (2011), its relationship with credit quality is not clear. On the one hand, it reduces the costs associated with high inflation, such as the opportunity cost of money, tax distortions, money illusion, and greater riskiness of financial assets. On the other hand, high inflation helps debtors by reducing the real value of their debt. On this point the literature has provided conflicting evidence. In particular, Shu (2002) found a negative relationship between inflation and bad loans, whilst Rinaldi and Sanchis - Arellano (2006) estimated a positive sign.

The cost of debt is measured by the short-term interbank 3-month Euribor rate (EURIBOR_3M), while for the long term we have chosen the 10-year interest rate swaps (IRS_10Y). The expected effect of an increase of short-and long-term interest rates on bad loans is

loans of Cooperative Banks[8]). Overall, Figures 2a – 2b offer some preliminary evidence that bad loans and loans are inversely related to the economic cycle.

The main features of the statistical distributions of the series described before are shown in Table 2. Figure 3a shows the original series, many of which appear to be non-stationary. Augmented Dickey-Fuller (Dickey and Fuller, 1979), KPSS (Kwiatkowsky – Phillips – Schmidt – Shin) and Phillips – Perron (Phillips and Perron, 1988) tests [9] suggest in most cases the presence of unit roots, except for year-over-year rate of change of industrial production and the consumer price index. Therefore, logarithmic first differences have been taken (see Figure 3b). The series have also been standardised to allow comparisons.

The one-year dynamic cross-correlations between bad loans and loans and the other macroeconomic and financial variables are reported in Tables 4a and 4b.

$$\log soff_t \quad \sum_{i=1}^{p} \quad i \quad \log soff_{t-i} \quad \sum_{j=1}^{q} \quad s,j \quad s \quad \log x_{t-j} \quad \sum_{m=1}^{M} \quad m dummy_{m,t} \quad t \qquad (2)$$

where ρ_s is a binary variable (equal to 0 for the macroeconomic and financial variables that are insignificant or affected by multicollinearity problems, equal to 1 otherwise) and $dummy_t$ is a set of

macroeconomic situation. The existence of such a surplus during recessions could be related to excess lending (due to a bad selection criteria) in the past.

A good proxy of the bad loan component not explained by its macroeconomic and financial determinants is given by the regressions residuals of equation (2). These can be assumed to follow a standardised normal distribution. Therefore, we cannot reject the null hypothesis of the existence of a "bad loan surplus" when the cumulative function of the residuals is persistently above 1.96 standard errors (equal to 1.96 in the case of a normal distribution), i.e. for at least two months.

Figures 4a – 4d report the cumulative function of the residuals from equations (2), providing support to the existence of a bad loan surplus after the recession of 2008-2009 for total bad loans and bad loans to firms, only slightly for the Cooperative Credit Banks, and not in the case of bad loans to households of all banks. Point (ii) is examined in the next sub-section using VAR techniques.

4.3 Is the bad loan surplus affected by past lending policies? A B–Q SVAR approach

We test whether the bad loan surplus is a consequence of excessive loans granted in previous periods using the Blanchard and Quah (1989) method. This allows us to identify a sequence of temporary and permanent shocks from loans to bad loans using a bivariate structural VAR (Vector Autoregressive).

(1) 0 (6)

where (1,0) .

This implies that the sum of the effects of temporary shocks on bad loans must be equal to zero. Moreover, since Δ log imp_t, Δ log $soff_t$, Δ log $soff\_bcc_t$ and Δ log imp_bcc_t are stationary and the variables $soff_t$ and imp_t, $soff\_bcc_t$ and imp_bcc_t are not cointegrated in levels (as shown by the cointegration tests reported in Table 6), the residuals can be represented in the following autoregressive form:

$$^{1}(L)Z_t \quad _t \tag{7}$$

It follows that it is possible to estimate a finite order VAR for the equation (7), which generates a vector of e_t innovations with a variance matrix equal to Σ, such that

$$e_t \quad 1 \quad (L) \; Z_t \tag{8}$$

where $\Theta(L)$ is a polynomial of finite order in the lag operator. It can be shown that the VAR residuals are a linear combination of temporary and permanent shocks:

$$\varepsilon_t \quad Ce_t \tag{9}$$

where C is a (2x2) size matrix. If all four elements of the matrix C are known, it is possible to obtain $_t$ from the VAR residuals e_t. However, to identify the elements of the C matrix four restrictions are needed, three of which can be obtained by normalising to one the innovations of a moving average representation and assuming its orthogonality, i.e.

$$CC \tag{10}$$

Substituting (8) into (7) then gives:

$$D \quad (1) \tag{11}$$

where $D = [1 - \Theta^{-1}(1)]C^{-1}$. The fourth restriction can derived using jointly equations (9) and (13):

$$D \quad 0 \tag{12}$$

Using the restrictions given by (10) and (12) we are able to identify all four elements of the C matrix, while the full sequence of temporary and permanent disturbances can be obtained from (9). The permanent loan shock can be interpreted as a supply shock, or the loan component not due to credit demand, but to an excessive decrease (increase) of credit during persistently positive (negative) phases of the business cycle. Similarly, the permanent bad loans shock can be thought of

Finally, Granger causality tests (Table 8) provides further empirical confirmation that lagged loans contain useful information to predict total bad loans and bad loans to firms of all banks and total bad loans of Cooperative Credit Banks.

5. Conclusions

The empirical literature on the relationship between credit quality in the banking sector and macroeconomic cycles has emphasised that the former is affected by negative macroeconomic and financial shocks (see Bofondi and Ropele, 2011). On the other hand, it is well known that bank loans are pro-cyclical, and therefore loans and credit quality are inversely related to the business cycle. Loans increase rapidly in periods of growth and tend to stabilise or even contract during recessions. Bad loans, considered as a measure of credit quality, are relatively stable during periods of strong economic growth, and then they grow exponentially during recessions. An issue of considerable interest is whether, given this inverse relationship with the economic cycle, an excess of credit during periods of economic growth can cause an excess of bad loans when the economy contracts.

This paper has aimed to answer this question, first identifying the macroeconomic determinants of bad loans and loans, then analysing empirically the existence of an excess of bad loans during the recession of 2008-2012 and, finally, testing the effects of a permanent shock to bad loans on the excess of credit with a bivariate structural VAR à la Blanchard and Quah (1989). The results indicate that, for the banking sector as a whole, these are significant and persistent for bad loans to firms but not for bad loans to households.

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Figure 1b. *Total bad loans to firms and to households*

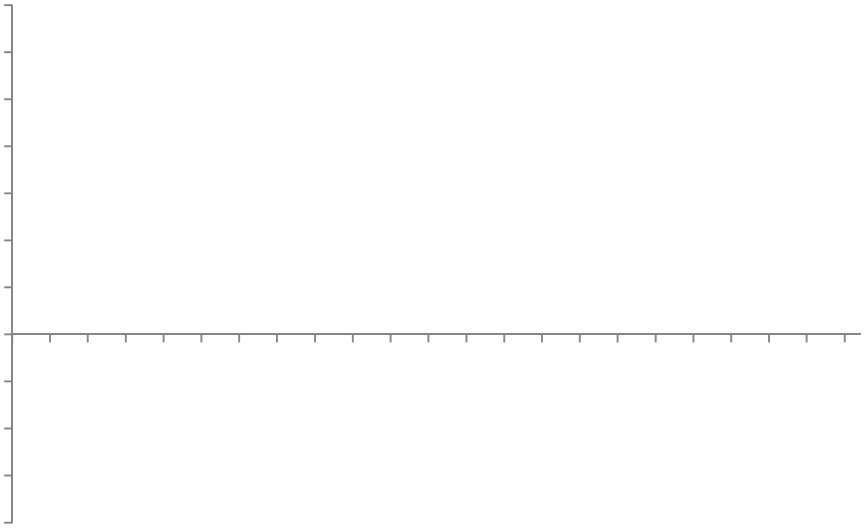


Figure 3a. *Raw series*

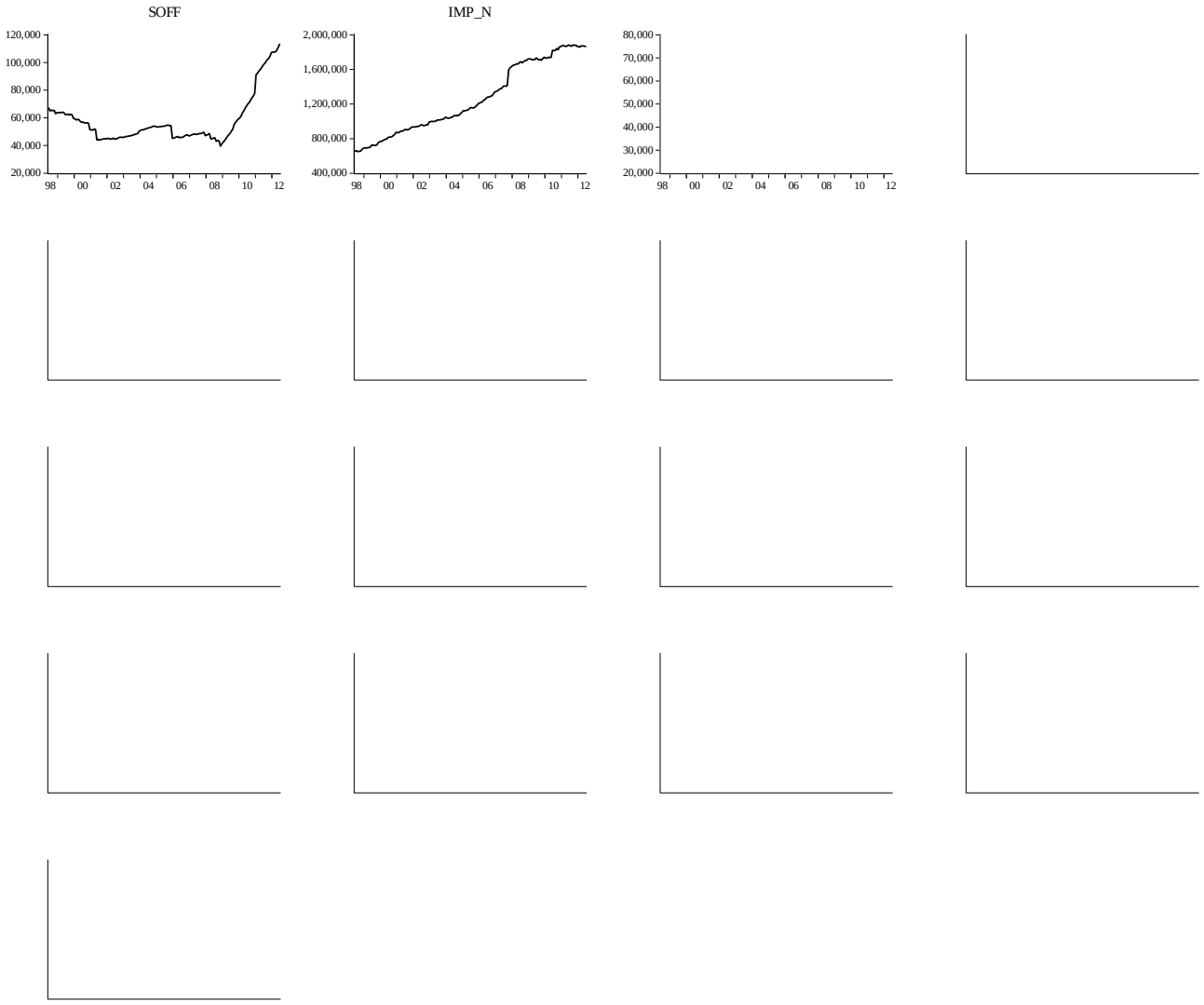


Figure 4a. *Surplus of bad loans (Italian Banks) wrt their macroeconomic determinants*

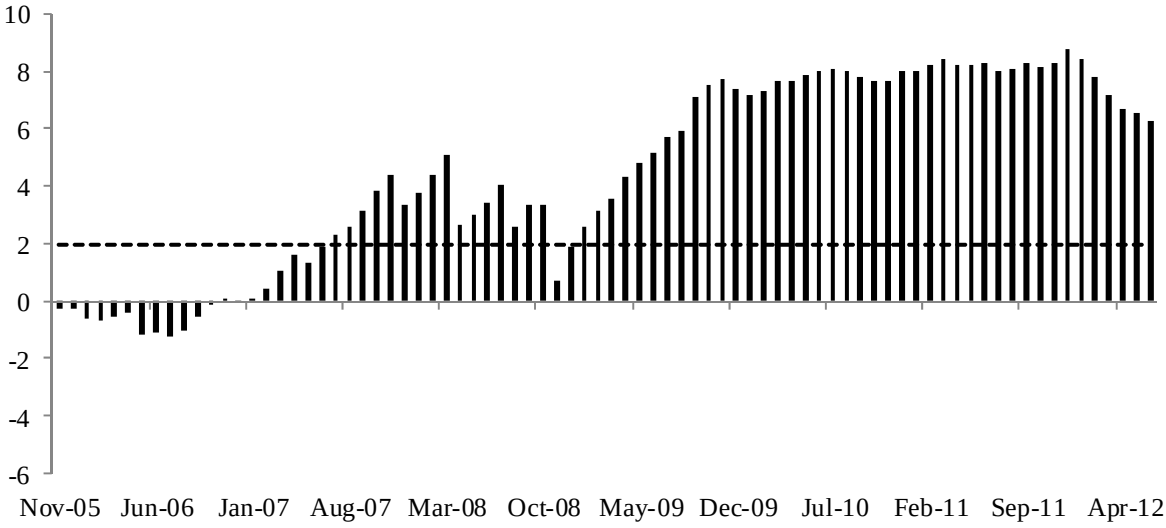
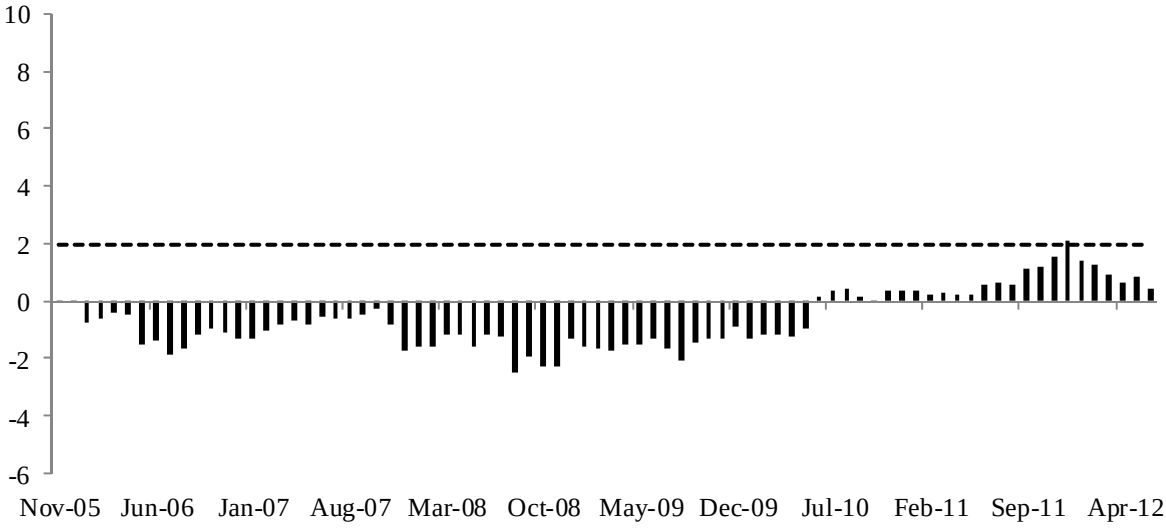


Figure 4c. *Surplus of bad loans to households (Italian Banks) wrt their macroeconomic determinants*



Note. Surplus of bad loans to households with respect to their macroeconomic fundamentals is the

Figure 5a. *Impulse Response Analysis from total loans to total bad loans of all banks*

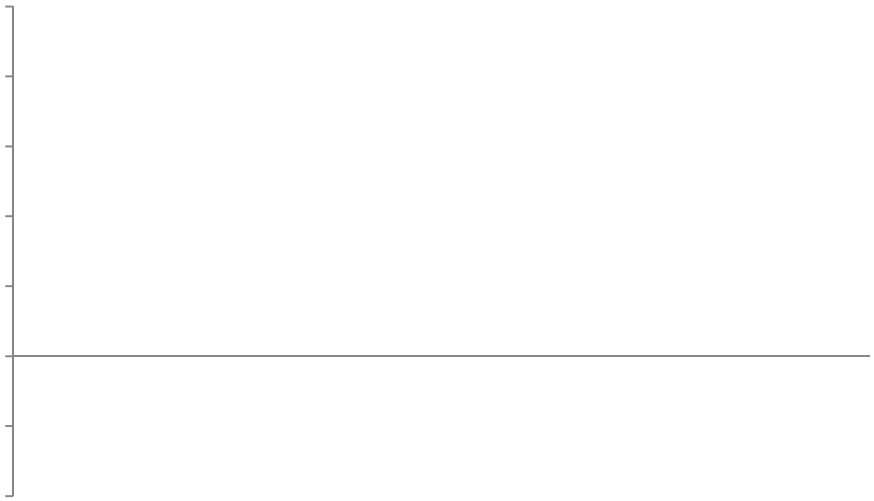
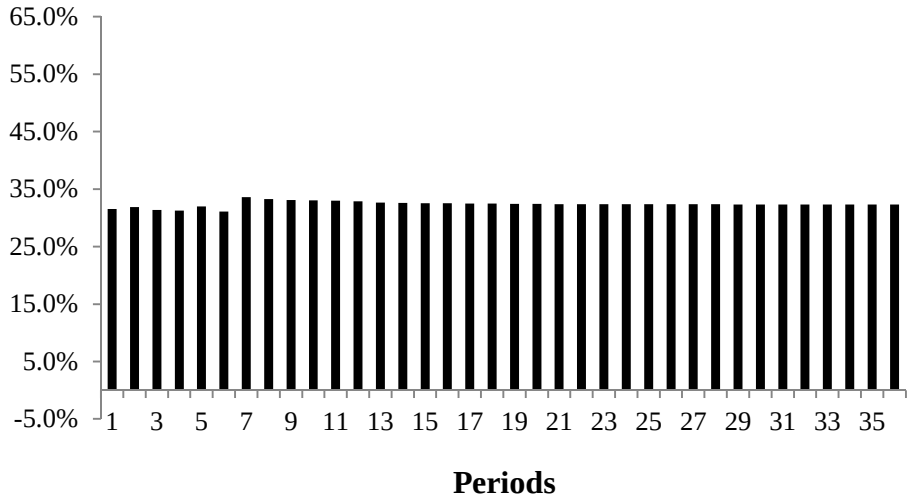


Figure 6a. *Variance decomposition (total loans to total bad loans of all banks)*



Note. Variance decomposition analysis on the basis of (3) – (12) B–Q SVAR estimations showing the percentage of variance of total bad loans explained by total loans of all Italian banks.

Figure 6b. *Variance decomposition (loans to firms to bad loans to firms of all banks)*

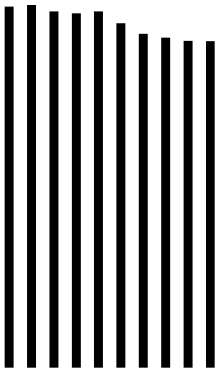
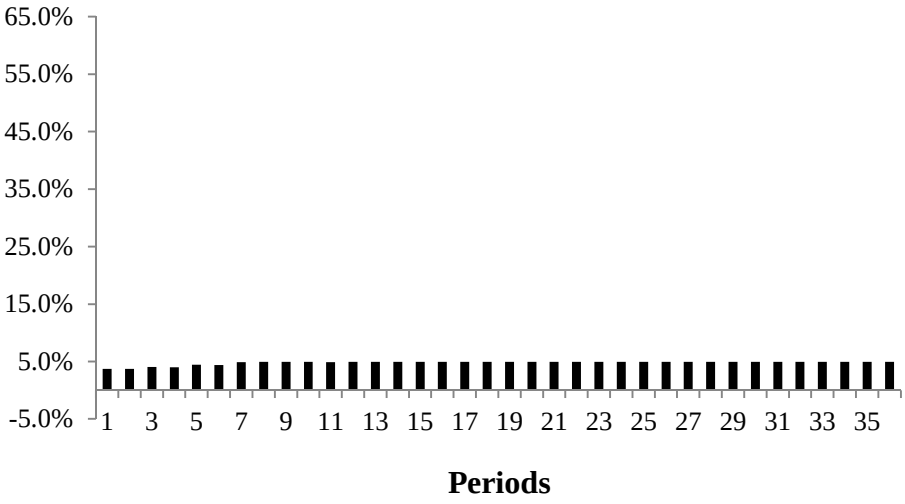


Figure 6c. *Variance decomposition (loans to households to bad loans to households of all banks)*



Note

Tables

Table 1. *List of variables*

Variables	Name	Source	Units	# observ.	Freq.
Total Bad loans	SOFF_ITA	Bank of Italy	mln. euros	169	monthly
Total Loans	IMP_ITA	Bank of Italy	mln. euros	169	monthly
Total Bad loans to firms	SOFF_FIR_ITA	Bank of Italy	mln. euros	169	monthly
Total Loans to firms	IMP_FIR_ITA	Bank of Italy	mln. euros	169	monthly
Total Bad loans to households	SOFF_HOU_ITA	Bank of Italy	mln. euros	169	monthly
Total Loans to households	IMP_HOU_ITA	Bank of Italy	mln. euros	169	monthly
Total Bad loans (BCC)	SOFF_BCC_ITA	Bank of Italy	mln. euros	169	monthly
Total Loans (BCC)	IMP_BCC_ITA	Bank of Italy	mln. euros	169	monthly
Industrial Production	IPI_ITA	Istat	(% ch. y/y)	169	monthly
Unemployment rate	146iCT2 SOF	1	e f80.4(3730.51(4%1 4.74)-2.7.8(l)2.26((/)2.79)3379(1)-479y/TT6(l)6.		

Table 2. *Descriptive statistics*

	Mean	Median	Maximum	Minimum	Standard deviation	Skewness	Kurtosis	# Observ.

Table 3. *Unit root analgUn4*

Table 4a. *Dynamic cross-correlations (I)*

	Bad loans (all banks)												
	t	*t+1*	*t+2*	*t+3*	*t+4*	*t+5*	*t+6*	*t+7*	*t+8*	*t+9*	*t+10*	*t+11*	*t+12*
Loans	-0.09	-0.11	-0.05	0.01	-0.06	-0.09	-0.15	-0.07	0.07	0.01	-0.08	-0.07	-0.09

Table 4b. *Dynamic cross-correlations (II)*

	Bad loans to households (all banks)												
	t	*t+1*	*t+2*	*t+3*	*t+4*	*t+5*	*t+6*	*t+7*	*t+8*	*t+9*	*t+10*	*t+11*	*t+12*
Loans	0.15	-0.01	-0.06	0.01	0.06	0.02	-0.09	0.34	0.01	-0.05	-0.04	-0.10	-0.06
Industrial Production	-0.10	-0.06	-0.09	-0.10	-0.16	-0.13	-0.12	-0.13	-0.16	-0.18	-0.14	-0.14	-0.21
Unemployment rate	0.12	0.03	0.06	0.22	0.01	0.02	0.19	-0.04	0.03	0.22	0.06	0.09	0.16
Consumer Price Index	-0.24	-0.28	-0.24	-0.19	-0.21	-0.19	-0.16	-0.16	-0.12	-0.12	-0.10	-0.07	-0.05
Retail sales	-0.14	-0.02	-0.10	-0.16	-0.38	-0.11	-0.07	-0.02	-0.01	-0.19	-0.04	-0.09	-0.11
House price index	-0.24	-0.24	-0.25	-0.25	-0.24	-0.24	-0.24	-0.24	-0.24	-0.23	-0.23	-0.23	-0.22
Euribor 3M interest rate	-0.37	-0.38	-0.36	-0.33	-0.32	-0.30	-0.29	-0.28	-0.26	-0.24	-0.21	-0.20	-0.18
Irs rate 10Y	-0.28	-0.28	-0.27	-0.26	-0.27	-0.26	-0.22	-0.22	-0.21	-0.20	-0.21	-0.19	-0.17
Interest rate slope	0.28	0.30	0.27	0.24	0.21	0.18	0.21	0.20	0.18	0.14	0.10	0.11	0.09
	Bad loans to firms (Cooperative Credit Banks)												
	t	*t+1*	*t+2*	*t+3*	*t+4*	*t+5*	*t+6*	*t+7*	*t+8*	*t+9*	*t+10*	*t+11*	*t+12*
Loans	0.10	-0.11	-0.33	0.10	-0.18	-0.10	-0.04	-0.12	-0.20	0.01	-0.08	-0.05	0.03
Industrial Production	-0.20	-0.18	-0.21	-0.16	-0.18	-0.16	-0.15	-0.12	-0.11	-0.14	-0.12	-0.11	-0.14
Unemployment rate	0.07	0.16	0.20	0.07	0.23	0.19	0.10	0.12	0.16	0.18	0.08	0.15	0.15
Consumer Price Index	-0.07	-0.06	-0.08	-0.08	-0.09	-0.08	-0.02	-0.01	0.01	-0.01	-0.01	0.02	0.02
Retail sales	-0.23	-0.22	-0.18	-0.19	-0.26	-0.20	-0.17	-0.22	-0.12	-0.22	-0.10	-0.15	-0.10
House price index	-0.32	-0.31	-0.31	-0.31	-0.31	-0.29	-0.31	-0.30	-0.30	-0.29	-0.29	-0.29	-0.29
Euribor 3M interest rate	-0.29	-0.28	-0.26	-0.24	-0.22	-0.20	-0.18	-0.15	-0.14	-0.13	-0.12	-0.13	-0.12
Irs rate 10Y	-0.34	-0.35	-0.33	-0.33	-0.32	-0.28	-0.26	-0.26	-0.22	-0.21	-0.22	-0.20	-0.19
Interest rate slope	0.10	0.06	0.05	0.02	0.00	0.01	-0.01	-0.05	-0.03	-0.02	-0.06	-0.02	-0.02

Note. All variables (with the exception of the industrial production and retail sales indices) are in logarithmic differences and have been standardized.

Table 5a. *Regression results*

Dependent Variable: Bad loans

Regressors	*Equation (1)*			*Equation (2)*	
	Coeff.		*Adj. R^2*	*Coeff.*	
Intercept	-		-	0.010	***
Bad loans (t-1)	-		-	0.021	
Bad loans (t-7)	-		-	0.137	***
Industrial production (-7)	-0.203	***	0.634	-	
Unemployment (-9)	0.197	***	0.630	0.084	*
Consumer price index (-1)	-0.202	***	0.625	-	
Retail sales (-2)	-0.141	***	0.682	-	
House pricing index (-3)	-0.145	***	0.607	-	
Euribor 3M (-1)	-0.379	***	0.696	-0.810	**
Euribor 3M (-2)	-0.364	***	0.685	0.475	*
IRS 10Y (-1)	-0.265	***	0.651	-	
Interest rate term structure slope (-1)	0.223	***	0.637	-	
FTSE Mib (-12)	-0.145	***	0.618	-	
Dummy 2001M05	-		-	-4.949	***
Dummy 2005M12	-		-	-6.356	***
Dummy 2011M01	-		-	-4.568	***
Adjusted R^2	-		-	0.702	
DW	-		-	2.047	
LM test - F(12, 133)	-		-	1.288	
# observations	-		-	159	

Note. The estimated regressions are equations (1) and (2). The dependent variable is total bad

Table 5b. *Regression results*

Dependent Variable: Bad loans to firms

Regressors	*Equation (1)*			*Equation (2)*	
	Coeff.		*Adj. R^2*	*Coeff.*	
Intercept	-		-	1.291	***
Bad Loans to Firms (t-1)	-		-	-0.092	*
Bad Loans to Firms (t-2)	-		-	-0.025	
Industrial production (-7)	-0.207	***	0.601	-	
Unemployment (-9)	0.199	***	0.597	0.099	**
Consumer price index (-1)	-0.183	***	0.579	-0.174	***
Retail sales (-2)	-0.170	***	0.662	-0.082	*
House pricing index (-1)	-0.134	**	0.565	-	
Euribor 3M (-1)	-0.382	***	0.663	-0.221	***
Euribor 3M (-2)	-0.363	***	0.650	-	
IRS 10Y (-1)	-0.262	***	0.616	-	
Interest rate term structure slope (-1)	0.225	***	0.603	-	
FTSE Mib (-12)	-0.120	**	0.562	-0.084	*
Dummy 2001M5	-		-	-5.222	***
Dummy 2005M12	-		-	-6.019	***
Dummy 2011M01	-		-	-4.121	***
Adjusted R^2	-		-	0.754	
DW	-		-	2.172	
LM test – F(12, 113)	-		-	0.136	
# observations	-		-	136	

Note. The estimated regressions are equations (1) and (2). The dependent variable is bad loans to firms of all Italian banks. All variables (with the exception of industrial production index and retail sales index are in logarithmic differences) and have been standardized. *: significant at the 10% level, **: significant at the 5% level, ***: significant at the 1% level.

Table 6. *Cointegration tests*

Cointegration vectors	Rank	Eigenvalue	Trace test	Maximum eigenvalue test