ACCESS TO CREDIT BY NON-FINANCIAL FIRMS*

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ABSTRACT

In order to study the availability of credit to non-financial firms, we use in this article two different approaches, one based on prices and the other on amounts of loans. Using unique data sets, the first exercise is to estimate an econometric model for the interest rates on new or renegotiated loans made by non-financial firms in June 2010, controlling for characteristics of the loan and the company. Then, we show that the part of the increase between June 2010 and October 2011 in interest rates for similar loans that is explained by variations in the characteristics of loans and businesses is residual. This suggests that factors such as the increase in banks' financing and capital costs may have been the source of this increase in interest rates. In the exercise with quantities, we estimate a model of the amount of credit using a panel of loans (or companies), including loan (or firm) fixed effects. We show that the typical credit amount of a non-financial firm fell rapidly from the beginning of 2009 on, attaining a minimum of several years. This decline was especially sharp for companies which first sought credit.

1. INTRODUCTION

On 6 April 2011 the Portuguese government officially requested to the European Commission a programme of economic and financial assistance, in the same day when the short-term sovereign debt reached its highest price since the introduction of the euro. Although this outcome had been signalled by many market participants and political commentators since the beginning of 2011, the situation deteriorated rapidly since early 2010 with the publication of a substantial revision of the budget deficit for 2009. From May 2010 on, Portuguese banks lost access to international medium and long term wholesale debt markets. The question of access by non-financial firms to credit became particularly relevant, both because of the importance of this sector for the country's GDP, and of its role within the programme of economic and financial assistance.

We propose two complementary approaches to the problem, one based on prices and the other on quantities. The first approach is to use two unique databases: the *Informação Empresarial Simplificada* (IES),[1] which contains annual balance sheets of non-financial firms, and a data set from Banco de Portugal that contains detailed information about new or renegotiated loans granted by five major Portuguese banking groups in two different moments: one corresponds to minimum recent interest rates in this type of loan (June 2010) and the other (October 2011) corresponds to the maximum reached after a period of rapid increase. Additionally, the start of the programme of economic and financial assistance mediates these two moments. We used data from the IES on the firms' balance sheets to control for important

* The opinions expressed are those of the author and not necessarily those of Banco de Portugal or the Eurosystem. Any errors and omissions are the sole responsibility of the author.

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1 Simplified Business Information, in Portuguese.

sources of risk at that level. We then combined this information with data on new or renegotiated loans in order to assess the impact of the quality of the company's balance sheet and the characteristics of loans on the interest rates. We estimated a model using data at the reference moment (June 2010) and then used the model to predict interest rates in October 2011. By comparing the actual and observed interest rates at that time, we can have an idea of what part of the changes in observed interest rates can be explained by changes in firm and loan characteristics, and what part should be attributed to other factors such as credit restrictions, negative business outlook (not explained by changes in firms' balance sheets), increasing risk aversion, increased costs of financing by creditors, systemic increases in interest rates, and increased costs of capital. Also explored are differences in access to credit across banks through fixed effects. An important feature of IES is that it contains the universe of companies that operated in Portugal during the years in question. For this reason, our estimates of the determinants of interest rates on loans can be adjusted for the selection bias that results from the fact that only loans that were granted are actually observed.

The second approach to the problem, which although simpler is broader, is to use a third unique data set, the Central de Riscos de Crédito (CRC), which is the Portuguese central credit register. We propose two alternatives. The first is to estimate calendar fixed effects in the amount of credit granted, once we control for heterogeneity at the firm-bank relationship, firm and bank levels. The calendar fixed effects capture the secular evolution of the typical loan amount, and this can be useful in the detection of abrupt breaks or sudden increases.

The second alternative is to observe the amount of credit extended to companies in the quarter in which they first access credit. Although this phenomenon is sensitive to the economic cycle, we can compare the current situation with previous recessions and get a sense of the differences between this episode and previous episodes.

These two approaches are complementary and allow us to illustrate in detail and identify potential problems in access to credit by firms.

The results of both exercises suggest the existence of constraints on access to credit by businesses, and access to funds by banks. On the one hand, between June 2010 and October 2011, the variation in the characteristics of loans and companies cannot explain the observed variation in the prices of new loans. Among other factors, this may be due to the sharp increase in financing costs and capital costs of banks during this period. Moreover, the typical loan amount attributed to firms decreased markedly right from the beginning of 2009. This was especially true for firms that accessed credit for the first time.

2. IES AND THE LOAN INTEREST RATES

In this approach we used data from two unique data sets: the *Informação Empresarial Simplificada* (IES) and a an internal database with detailed information about new or renegotiated loans granted by five major Portuguese banking groups at two different times, corresponding to a recent minimum and a recent maximum of loan interest rates, respectively before and after the start of the assistance programme. We use data from the IES on firms' balance sheets to control for important factors governing risk at the firm level, such as size, industry, and various financial ratios. This information is then merged with the data on new or renegotiated loans. We estimate a model using data at the reference date (June 2010) and then estimate interest rates in October 2011. By comparing the estimated and the actual interest rates, we can decompose the actual change in interest rates into two effects: the first due to changes in the characteristics of the loans and the firms; the second due to other factors, including changes in the rates of aggregate interest rates, changes in financing conditions by creditors, regulatory changes, changes in the risk aversion of lenders, and changes in the cost of capital. We control for differences in access to liquidity at the bank level using bank fixed effects. Because we have the set of all potential borrowers, we can also correct for the selection bias in loans using the Heckman (1979) selection model.

We chose this approach because we want to isolate the effect of observable characteristics of loans and firms, as well as bank fixed effects, in interest rates. The other factors that could affect interest rates and that are not in the model include changes in interest rates at the euro area, credit constraints, risk aversion, financing conditions and cost of capital for creditors. Some of these factors are likely to have changed between June 2010 and October 2011, and including observations in the model estimation would contaminate parameters with any structural changes that occurred after the start of the programme of economic and financial assistance.

Alternative methods can be devised. One would be estimating the model using observations from 2010 and 2011 and a panel approach. One problem with this approach is that each company can have multiple loans, which by definition are new (or with new conditions) in both years, and this is inconsistent with the notion of a panel of loans. To avoid this problem, we could consolidate credit data by company and form a single synthetic loan characterized by average values for the interest rate, maturity, collateral and the total amount of loans. But that would imply the loss of a set of rich and detailed information. A second problem is that we are then unable to correct for selection bias.

The use of a cross section of data at a specific time to predict the interest rate at other times may be problematic in some cases. There are two facts that mitigate this problem in our application. First, the comprehensive nature of both data sets and the generous number of observations suggest that the model for the interest rate should adhere to the z-scoring models used by banks in granting credit. Related internal research and the literature (see, for example, Altman and Narayanan 1997 and Smith 2007) demonstrated that the balance sheet variables used in the model also have predictive power for a possible credit event during the following year, a major determinant of the level of interest rates. Secondly, looking at the estimates that include only companies present in both 2010 and 2011, we investigate to what extent our results are sensitive to changes in the composition of the sample; we will return to this issue later.

Data

Informação Empresarial Simplificada (IES) is a mandatory annual survey containing information about the balance sheet of Portuguese non-financial firms. The original database contains about 300 thousand companies each year. After merging this data set with the data set of new or renegotiated loans, which contains the interest rate, maturity, amount and existence of collateral, we have a sample of 66 140 new or renegotiated loans (35736 in June 2010 and 30404 in October 2011), awarded to a total of 11826 companies in June 2010 and 9489 companies in October 2011, some of them common to both moments.[2] We define the loan as the unit of observation.

Companies report data to the IES for a given year until May of the next year. In estimating the econometric model, we assume that the relevant information for granting a loan in 2010 is the balance sheet data of the firm in 2009, since for most companies this is indeed the latest official information available; we will use the same convention for loans in 2011, that is, in this case the relevant information for the firm is that of 2010.

At the firm level, we use the balance sheet and sector of activity. We construct a measure of firm size based on the recommendations of the European Commission. Micro firms are those with fewer than 10 employees and assets or sales not exceeding 2 million; small firms have fewer than 50 employees and sales or assets below 10 million; medium-sized firms have fewer than 250 employees and sales are less than 50 million or assets are less than 43 million euros, or both; large firms are the remaining ones. Table 1 presents summary statistics for the firm sample after merging the two sets of data and calculating various financial ratios, by sector; Table 2 does the same by firm size.

2 There are 4471 firms with loans in both June 2010 and October 2011.

Table 1

SUMMARY STATISTICS, OBSERVATIONS AT THE FIRM LEVEL BY SECTOR OF ACTIVITY

Number of firms			
Activity sector	Year		
	2009	2010	Total
Tourism	410	257	667
Trade	4744	3814	8558
Construction	1946	1450	3396
Real estate	278	193	471
Services	695	574	1269
Manufacturing	3239	2802	6041
Transportation	514	399	913
Total	11826	9489	21315

Number of employees			
Activity sector	Year		
	2009	2010	Total
Tourism	11607	11698	23305
Trade	110627	69535	180162
Construction	69931	65362	135293
Real estate	1210	832	2042
Services	7727	6648	14375
Manufacturing	124475	111374	235849
Transportation	14254	16985	31239
Total	339831	282434	622265

Turnover			
Activity sector	Year		
	2009	2010	Total
Tourism	1.493	2.145	1.744
Trade	1.378	1.449	1.410
Construction	1.098	1.132	1.113
Real estate	0.548	0.611	0.573
Services	1.057	1.017	1.038
Manufacturing	1.007	1.024	1.015
Transportation	1.196	1.296	1.240
Total	1.188	1.244	1.213

Non-financial debt			
Activity sector	Year		
	2009	2010	Total
Tourism	0.457	0.623	0.521
Trade	0.448	0.416	0.433
Construction	0.429	0.412	0.422
Real estate	0.423	0.296	0.371
Services	0.484	0.377	0.436
Manufacturing	0.403	0.405	0.404
Transportation	0.372	0.353	0.364
Total	0.431	0.410	0.422

Financial debt			
Activity sector	Year		
	2009	2010	Total
Tourism	0.339	0.470	0.389
Trade	0.265	0.305	0.283
Construction	0.268	0.312	0.287
Real estate	0.479	0.597	0.527
Services	0.318	0.310	0.315
Manufacturing	0.284	0.319	0.300
Transportation	0.250	0.302	0.272
Total	0.281	0.321	0.299

Own funds			
Activity sector	Year		
	2009	2010	Total
Tourism	0.137	-0.179	0.016
Trade	0.255	0.250	0.253
Construction	0.267	0.243	0.257
Real estate	0.011	0.019	0.014
Services	0.147	0.267	0.201
Manufacturing	0.272	0.247	0.261
Transportation	0.328	0.310	0.320
Total	0.249	0.235	0.243

Return on assets			
Activity sector	Year		
	2009	2010	Total
Tourism	-0.072	-0.221	-0.130
Trade	0.001	0.002	0.001
Construction	0.017	-0.002	0.009
Real estate	-0.115	-0.081	-0.101
Services	-0.010	0.027	0.007
Manufacturing	-0.006	-0.017	-0.011
Transportation	0.008	-0.002	0.004
Total	-0.004	-0.011	-0.007

Source: *IES.*

Note: See definitions of variables in the text. The number of firms and employees are totals; all other variables are averages.

Table 2

SUMMARY STATISTICS, OBSERVATIONS AT THE FIRM LEVEL BY FIRM SIZE

Number of firms			
Size	Year		
	2009	2010	Total
Micro	6206	4532	10738
Small	4349	3758	8107
Medium	1118	1060	2178
Large	153	139	292
Total	11826	9489	21315

Number of employees			
Size	Year		
	2009	2010	Total
Micro	25912	19807	45719
Small	89757	78673	168430
Medium	101099	95415	196514
Large	123063	88539	211602
Total	339831	282434	622265

Turnover			
Size	Year		
	2009	2010	Total
Micro	1.203	1.285	1.238
Small	1.190	1.231	1.209
Medium	1.100	1.122	1.111
Large	1.179	1.203	1.190
Total	1.188	1.244	1.213

Non-financial debt			
Size	Year		
	2009	2010	Total
Micro	0.480	0.466	0.474
Small	0.389	0.368	0.380
Medium	0.333	0.327	0.330
Large	0.353	0.359	0.356
Total	0.431	0.410	0.422

Financial debt			
Size	Year		
	2009	2010	Total
Micro	0.259	0.304	0.278
Small	0.293	0.325	0.307
Medium	0.350	0.369	0.359
Large	0.339	0.388	0.362
Total	0.281	0.321	0.299

Own funds			
Size	Year		
	2009	2010	Total
Micro	0.210	0.180	0.197
Small	0.291	0.289	0.290
Medium	0.297	0.286	0.292
Large	0.270	0.217	0.245
Total	0.249	0.235	0.243

Return on assets			
Size	Year		
	2009	2010	Total
Micro	-0.018	-0.036	-0.026
Small	0.012	0.013	0.012
Medium	0.012	0.012	0.012
Large	0.014	0.018	0.016
Total	-0.004	-0.011	-0.007

Source: Data from an internal data set with new or renegotiated loans granted by five large banking groups.
Note: The average maturity and interest rate are weighted by the loan amount.

In the sample, there are 11826 firms in 2010 and 9489 firms in 2011, representing 340 thousand workers in 2009 and 282 thousand workers in 2010, respectively. The most important sector in terms of number of employees is manufacturing.

Return on assets is defined as the ratio between the firm's profits and assets. Turnover is equal to sales of goods and services divided by assets. Non-financial debt is total debt to third parties except banks and bondholders, divided by assets. Total financial debt is debt to banks and bondholders, divided by assets. Own funds is equity capital plus reserves, excluding corporate profits and shareholder debt, divided by assets. In general, we see a decline in the quality of the balance sheet of firms in the sample during the period under review, and this is also true, with few exceptions, when we look at the data by industry or company size. For example, there is a decrease of capital from 0.249 to 0.235; return on assets falls

from -0.004 to -0.011; financial debt rises from 0.281 to 0.321. Turnover has a more benign behaviour, increasing from 1.19 to 1.24, like non-financial debt, which falls from 0.431 to 0.410.

Considering new or renegotiated loans (Tables 3 and 4), we see that the total loan amount increased from 1.6 billion euros in June 2010 to 1.9 billion euros in October 2011, although the number of loans

Table 3

SUMMARY STATISTICS, OBSERVATIONS AT THE LOAN LEVEL AND BY SECTOR OF ACTIVITY

Activity sector	Number of loans					
	Jun-10			Oct		
	No collateral	Collateral	Total	No collateral	Collateral	Total
Tourism	224	292	516	125	177	302
Trade	12369	4620	16989	10450	4125	14575
Construction	2500	1209	3709	1995	1009	3004
Real estate	211	193	404	141	148	289
Services	733	411	1144	575	318	893
Manufacturing	8541	3500	12041	7192	3370	10562
Transportation	598	335	933	513	266	779
Total	25176	10560	35736	20991	9413	30404

Activity sector	Total loan amount, in millions of euros					
	Jun-10			Oct		
	No collateral	Collateral	Total	No collateral	Collateral	Total
Tourism	9.0	66.4	75.5	5.3	44.5	49.7
Trade	216.4	282.7	499.2	215.4	306.3	521.7
Construction	95.5	214.5	310.0	92.6	371.2	463.8
Real estate	25.9	91.7	117.6	9.7	167.1	176.8
Services	26.3	32.4	58.7	46.9	55.0	101.9
Manufacturing	190.1	280.4	470.6	176.9	329.8	506.7
Transportation	44.9	21.7	66.6	33.6	42.8	76.5
Total	608.3	989.9	1598.2	580.5	1316.7	1897.2

Activity sector	Average maturity, in years					
	Jun-10			Oct		
	No collateral	Collateral	Total	No collateral	Collateral	Total
Tourism	0.76	2.57	2.36	0.27	0.74	0.69
Trade	0.56	1.33	1.00	0.63	1.24	0.98
Construction	1.06	2.11	1.79	0.51	0.55	0.54
Real estate	0.49	2.00	1.67	0.35	1.29	1.24
Services	0.69	1.30	1.03	1.56	1.51	1.53
Manufacturing	0.41	1.45	1.03	0.50	0.57	0.55
Transportation	5.71	1.79	4.43	0.31	0.61	0.48
Total	0.98	1.69	1.42	0.62	0.86	0.78

Activity sector	Average interest rate, in natural units					
	Jun-10			Oct		
	No collateral	Collateral	Total	No collateral	Collateral	Total
Tourism	0.0559	0.0439	0.0453	0.0688	0.0563	0.0576
Trade	0.0617	0.0495	0.0548	0.0717	0.0737	0.0729
Construction	0.0539	0.0482	0.0500	0.0739	0.0754	0.0751
Real estate	0.0657	0.0442	0.0489	0.0692	0.0724	0.0723
Services	0.0429	0.0537	0.0488	0.0645	0.0754	0.0703
Manufacturing	0.0521	0.0473	0.0492	0.0741	0.0743	0.0742
Transportation	0.0434	0.0485	0.0451	0.0865	0.0691	0.0767
Total	0.0554	0.0478	0.0507	0.0730	0.0735	0.0733

Source: Data from an internal data set with new or renegotiated loans in five large banking groups.
Note: The average maturity and interest rate are weighted by the loan amount.

Table 4

SUMMARY STATISTICS, OBSERVATIONS AT THE LOAN LEVEL AND BY FIRM SIZE

Number of loans

Activity sector	Jun-10			Oct		
	No collateral	Collateral	Total	No collateral	Collateral	Total
Micro	211	193	404	141	148	289
Small	733	411	1144	575	318	893
Medium	8541	3500	12041	7192	3370	10562
Large	598	335	933	513	266	779
Total	25176	10560	35736	20991	9413	30404

Total loan amount, in millions of euros

Activity sector	Jun-10			Oct		
	No collateral	Collateral	Total	No collateral	Collateral	Total
Micro	9.0	66.4	75.5	5.3	44.5	49.7
Small	216.4	282.7	499.2	215.4	306.3	521.7
Medium	95.5	214.5	310.0	92.6	371.2	463.8
Large	25.9	91.7	117.6	9.7	167.1	176.8
Total	608.3	989.9	1598.2	580.5	1316.7	1897.2

Average maturity, in years

Activity sector	Jun-10			Oct		
	No collateral	Collateral	Total	No collateral	Collateral	Total
Micro	0.76	2.57	2.36	0.27	0.74	0.69
Small	0.56	1.33	1.00	0.63	1.24	0.98
Medium	1.06	2.11	1.79	0.51	0.55	0.54
Large	0.49	2.00	1.67	0.35	1.29	1.24
Total	0.98	1.69	1.42	0.62	0.86	0.78

Average interest rate, in natural units

Activity sector	Jun-10			Oct		
	No collateral	Collateral	Total	No collateral	Collateral	Total
Micro	0.0559	0.0439	0.0453	0.0688	0.0563	0.0576
Small	0.0617	0.0495	0.0548	0.0717	0.0737	0.0729
Medium	0.0539	0.0482	0.0500	0.0739	0.0754	0.0751
Large	0.0657	0.0442	0.0489	0.0692	0.0724	0.0723
Total	0.0554	0.0478	0.0507	0.0730	0.0735	0.0733

Source: Data from an internal data set with new or renegotiated loans in five large banking groups.
Note: The average maturity and interest rate are weighted by the loan amount.

decreased. However, the average maturity suffered a strong decrease from 17 to 9.4 months. The largest sector in terms of loans is trade. Overall this sector and the sectors of manufacturing and construction are the most important of the sample. In terms of firm size, all four categories are important. In 2010, the interest rate seemed to have a decreasing pattern as we increased the size of the firm, but in 2011 this feature disappeared.

We chose the interest rate as the dependent variable. Since there is a dependency between the different components of a loan (price, quantity, maturity and collateral), the other components were included in the regressions we present below. Note that the average interest rates rise quite dramatically: between June 2010 and October 2011 they increased on average 226 basis points. With almost no exception, this significant increase occurred in all sectors of activity, for all firm sizes, and with or without the existence

of guarantees. It is also interesting to note that the presence of collateral does not necessarily imply a lower interest rate. While we must be careful about the fact that the portfolios are heterogeneous, the table suggests that in some cases, the existence of collateral reduces interest rates (as in the tourism sector or for the micro firms), but in others that does not seem to be the case (services and large companies). This is an issue to be resolved by regression analysis.

Regression analysis

We present two estimates of econometric models of the interest rate. The first is a simple linear regression and the second is a regression model with sample selection (Heckman 1979). The regressors previously described were used. For the selection equation, beyond the data on the company's balance sheet, we used three additional variables. Two are the terms of a quadratic polynomial of the firm age. The third is the value of the social capital value, which determines the voting rights in the legal management of the company and that rarely changes over time. These additional selection variables should ideally be correlated with the selection decision, but uncorrelated with the terms of the loan agreement. Regarding age, the hypothesis is that it is a sign of the likelihood of survival of the company, which does not necessarily determine the interest rate; this role should be attributed to the company's financial ratios. The social capital, on the other hand, represents the level of commitment of business owners in the credit relationship: the greater the commitment, the greater the probability of obtaining a loan. Again, the interest rate of the contract would be determined by the balance sheet information and the remaining terms of the contract.

Table 5 presents the estimates. For the model with correction for selection bias we also show the results of the selection equation. The models are estimated with the subsample of June 2010. If we compare the two models, we see that the results do not change much. An exception is non-financial debt, which is statistically significant and negative in the linear regression, but is not significant in the regression with correction for selection bias. Another exception is the company size: the two largest categories lose significance when accounting for selection bias.

The regression with correction for selection bias also suggests that sample selection is positively correlated with the interest rate, that is, companies that are not in the sample of loans tend to benefit from lower interest rates. This can be rationalized by the fact that companies that survive without resorting to bank loans use internal financing more frequently, which is usually an indicator of financial strength.

By focusing now on the model with selection bias correction, with few exceptions the results are consistent with an extensive literature on credit risk factors (see *e.g.* Santos 2009). The loan amount tends to decrease the interest rate and maturity: larger loans and longer terms are associated with lower interest rates. The existence of collateral appears to increase interest rates. To the extent that the guarantee may reflect the concern of the creditor that the company will not be able to repay the loan, the existence of collateral may be associated with riskier loans. In this case, the coefficient is statistically significant.

The financial ratios have a statistically significant influence on the interest rate, as expected. The higher own funds and return on assets, the lower the interest rate, and the same happens with turnover. As for non-financial debt, the respective coefficient is not significantly different from zero. Finally, financial debt tends to lower the interest rate. This may seem surprising but is consistent with a vast literature on the debt as a signalling device. In fact, if a company already has debt it is because it was able to convince lenders that it could afford it; this implies a lower interest rate for an identical firm but without previous loans. Although there are also theoretical and empirical results pointing in the opposite direction (e.g., the "hold-up problem", see Santos and Winton 2008), in this case the signalling effect seems to dominate. Firm size appears to be of little importance.

Table 5

LINEAR REGRESSION MODEL AND MODEL WITH SELECTION BIAS CORRECTION FOR THE INTEREST RATE

	Linear regression			Regression with correction of selection bias					
				Dependent variable			Selection		
	Coef.	Std. Err.	p-value	Coef.	Std. Err.	p-value	Coef.	Std. Err.	p-value
Log of loan amount	-0.0014	0.0001	0.000	-0.0014	0.0001	0.000			
Maturity	-0.0064	0.0002	0.000	-0.0066	0.0002	0.000			
Collateral	0.0023	0.0006	0.000	0.0020	0.0006	0.000			
Return on assets	-0.0053	0.0013	0.000	-0.0066	0.0013	0.000	0.0406	0.0070	0.000
Own funds	-0.0118	0.0018	0.000	-0.0044	0.0019	0.018	0.3313	0.0261	0.000
Turnover	-0.0007	0.0002	0.000	-0.0017	0.0002	0.000	-0.0215	0.0029	0.000
Non-financial debt	-0.0048	0.0018	0.009	-0.0002	0.0018	0.904	0.2843	0.0263	0.000
Financial debt	-0.0118	0.0019	0.000	-0.0037	0.0019	0.052	0.3296	0.0262	0.000
Size (base Micro)									
Small	-0.0083	0.0004	0.000	0.0047	0.0009	0.000	0.8057	0.0094	0.000
Medium	-0.0211	0.0005	0.000	-0.0015	0.0012	0.225	1.2464	0.0169	0.000
Large	-0.0192	0.0011	0.000	0.0005	0.0016	0.774	0.8495	0.0377	0.000
Activity sector (base Tourism)									
Trade	-0.0117	0.0015	0.000	0.0026	0.0017	0.125	1.0095	0.0208	0.000
Construction	-0.0004	0.0016	0.813	0.0071	0.0016	0.000	0.5458	0.0224	0.000
Real estate	-0.0078	0.0022	0.000	-0.0062	0.0022	0.004	-0.0300	0.0302	0.320
Services	-0.0057	0.0017	0.001	0.0003	0.0018	0.862	0.4995	0.0249	0.000
Manufacturing	-0.0072	0.0015	0.000	0.0052	0.0016	0.001	0.9158	0.0215	0.000
Transportation	-0.0032	0.0018	0.072	0.0030	0.0018	0.104	0.2456	0.0268	0.000
Firm age							0.0236	0.0007	0.000
Firm age squared / 100							-0.0320	0.0011	0.000
Log of social capital							0.1876	0.0025	0.000
Mills lambda				0.0147	0.0008	0.000			
Constant	0.1026	0.0024	0.000	0.0588	0.0034	0.000	-4.6581	0.0394	0.000
Obs.	35736			35736			284771		
R-squared	0.2342								
Rho				0.4252					
Sigma				0.0345					
Root MSE	0.03255								

Sources: *IES* and data from an internal data set with new and renegotiated loans granted by five large Portuguese banking groups.
Notes: Dummy variables for banks included but not shown. Loan data are for June 2010 and October 2011; balance sheet data are from December 2009 and December 2010, respectively.

Explaining the rise in interest rates

We proceed now to the main exercise of this section, which is to use the model to predict interest rates of loans in October 2011, and then compare them with actual data. Tables 6 and 7 show the results.

The most striking result is the underestimation of the interest rates by the model in October 2011. This is true for all firm size classes, and for all sectors of activity. In 2011, the model underestimates the weighted average of the interest rate by 354 basis points; within the sample, the model also underestimates the observed interest rates by 146 basis points. This means that the contribution of the regressors for the increase in average interest rate is only 18 basis points, compared to a net increase of 226 basis points. The underestimation is larger in real estate and services to firms. The manufacturing sector seems to be less prone to underestimation than other sectors. When we look at the size of the company, the underestimation is almost the same in all categories.

As mentioned earlier, if we repeat the entire procedure with the data for 2010, but using only existing businesses both in 2010 and in 2011, we have an idea of the sensitivity of results to changes in sample

Table 6

IN- AND OUT-OF-SAMPLE RESULTS FOR THE INTEREST RATE BY SELECTED SECTOR OF ACTIVITY

		Jun-10			Oct-11		
Activity sector		No collateral	Collateral	Total	No collateral	Collateral	Total
Trade	*actual*	0.0617	0.0495	0.0548	0.0717	0.0737	0.0729
	pred.	0.0430	0.0365	0.0393	0.0382	0.0346	0.0361
	diff.	0.0187	0.0131	0.0155	0.0336	0.0391	0.0368
Construction	*actual*	0.0539	0.0482	0.0500	0.0739	0.0754	0.0751
	pred.	0.0452	0.0351	0.0382	0.0429	0.0431	0.0431
	diff.	0.0087	0.0131	0.0117	0.0309	0.0322	0.0320
Real estate	*actual*	0.0657	0.0442	0.0489	0.0692	0.0724	0.0723
	pred.	0.0292	0.0179	0.0204	0.0339	0.0255	0.0260
	diff.	0.0364	0.0263	0.0285	0.0353	0.0469	0.0463
Services	*actual*	0.0429	0.0537	0.0488	0.0645	0.0754	0.0703
	pred.	0.0309	0.0403	0.0361	0.0186	0.0348	0.0273
	diff.	0.0120	0.0134	0.0128	0.0459	0.0406	0.0430
Manufacturing	*actual*	0.0521	0.0473	0.0492	0.0741	0.0743	0.0742
	pred.	0.0461	0.0374	0.0409	0.0430	0.0415	0.0420
	diff.	0.0061	0.0098	0.0083	0.0311	0.0328	0.0322
Total	*real*	0.0554	0.0478	0.0507	0.0730	0.0735	0.0733
	prev.	0.0397	0.0340	0.0362	0.0389	0.0375	0.0379
	dif.	0.0157	0.0138	0.0146	0.0341	0.0360	0.0354

Sources: *IES* and data from an internal data set with new and renegotiated loans granted by five large Portuguese banking groups.

Notes: Loan data are for June 2010 and October 2011; balance sheet data are from December 2009 and December 2010, respectively. All values weighted by loan amount.

Table 7

IN- AND OUT-OF-SAMPLE RESULTS FOR THE INTEREST RATE BY FIRM SIZE

		Jun-10			Oct-11		
Size		No collateral	Collateral	Total	No collateral	Collateral	Total
Micro	*real*	0.0617	0.0495	0.0548	0.0717	0.0737	0.0729
	prev.	0.0430	0.0365	0.0393	0.0382	0.0346	0.0361
	dif.	0.0187	0.0131	0.0155	0.0336	0.0391	0.0368
Small	*real*	0.0539	0.0482	0.0500	0.0739	0.0754	0.0751
	prev.	0.0452	0.0351	0.0382	0.0429	0.0431	0.0431
	dif.	0.0087	0.0131	0.0117	0.0309	0.0322	0.0320
Medium	*real*	0.0657	0.0442	0.0489	0.0692	0.0724	0.0723
	prev.	0.0292	0.0179	0.0204	0.0339	0.0255	0.0260
	dif.	0.0364	0.0263	0.0285	0.0353	0.0469	0.0463
Large	*real*	0.0429	0.0537	0.0488	0.0645	0.0754	0.0703
	prev.	0.0309	0.0403	0.0361	0.0186	0.0348	0.0273
	dif.	0.0120	0.0134	0.0128	0.0459	0.0406	0.0430
Total	*real*	0.0554	0.0478	0.0507	0.0730	0.0735	0.0733
	prev.	0.0397	0.0340	0.0362	0.0389	0.0375	0.0379
	dif.	0.0157	0.0138	0.0146	0.0341	0.0360	0.0354

Sources: *IES* and data from an internal data set with new and renegotiated loans granted by five large Portuguese banking groups.

Notes: Loan data are for June 2010 and October 2011; balance sheet data are from December 2009 and December 2010, respectively. All values weighted by loan amount.

composition.[3] The results (not reported here) suggest that the part of the variation in interest rates between June 2010 and October 2011 explained by changes in firms' balance sheets and the characteristics of its loans is even lower than using all observations. The same happens if we estimate the model using observations for firms present either in 2010 or 2011, or both.

This implies that variations in firms' balance sheets and the observable characteristics of loans only explain a small part of the total increase in interest rates that occurred between June 2010 and October 2011. We have to look to causes other than the firms' balance sheets and the structure of the loan portfolio. An obvious candidate is the level of interest rates in markets where there is no liquidity or solvency problems. A measure for this would be the change in Euribor. The 6-month Euribor rate was 1.012 per cent in June 2010 and 1.776 per cent in October 2011. This implies an increase of 76 basis points during this period. This rise in the Euribor helps explain an additional part of the rise in interest rates in two periods: of the total increase of 226 basis points, depending on the assumptions that we make on the pass-through of the interest rate to loan rates, 76 basis points could be explained by changes in the general level of the interest rates, and 18 basis points could be attributed to changes at the level of observable characteristics of loans and firms; 132 basis points remain unexplained.

There are some possible explanations for this difference. One is the time lapse between the balance sheet data and the beginning of the loan. However, it is reasonable to assume that the loan contracts are not immediately granted by lenders, which would reduce this delay. Moreover, the official statement of the balance sheet of the previous year is the most reliable information that many companies have to provide to banks, other than unobserved variables such as the value of the project in question or the existence of deposits of the firm in the bank. Data from 2010, on the other hand, were relatively benign, with recent indicators pointing to a substantial deterioration of balance sheets in 2011.

Another possible explanation is the increase in funding costs for banks. Faced with liquidity constraints and a demanding economic and regulatory environment, banks may shift the supply curve of funds for loans to the left, increasing equilibrium interest rates.[4] During this period, banks resorted to deposits as a way to finance their activities. As a result, rates of new deposits increased by about 120 basis points above the increase in Euribor. This value closes the gap referred to above of 132 basis points, if we are prepared to assume that all funding for new loans came from new deposits and that the pass-through was 1 for 1. There is some literature arguing that this does not happen in practice. For example, Hülsewig, Wollmershäuser and Mayer (2009) show that banks tend not to reflect the full magnitude of monetary shocks in interest rates on loans. However, given the circumstances of particular vulnerability of creditors and debtors in this period, these absorption mechanisms might not be available. This hypothesis can be investigated and is an interesting topic for future research.

During this period there was an increase in capital requirements in terms of quality of eligible regulatory capital. This raised the cost of capital and, thereby, led to an increase in interest rates for active operations. This may be another reason for the observed increase in interest rates.

Another factor may have been responsible for the sharp increase in interest rates on loans between June 2010 and October 2011: a change in banks' behaviour towards risk. This was one of the reasons why, in the base specification, we prefer not to use the 2011 data to estimate the model of the interest rate. It is easily seen that if banks become more demanding and with everything else being equal, the loan interest rates will rise.[5]

3 This corresponds to roughly 2/3 of the 2010 subsample.

4 A related explanation would be lower competitiveness in credit markets.

5 If we estimate an interest rate model using only data from October 2011, we will observe some differences in the coefficients of the financial ratios.

Finally, a sudden increase in overall demand for credit would be consistent with a literature that emphasizes the reaction of firms to the economic cycle: faced with a more demanding economic environment and less funds available, companies may choose to rely primarily on external financing. This at least would be consistent with the overall reduction in own capital documented in table 1. The validity of this hypotheses is, again, an interesting topic for future research. This hypothesis does not seem convincing in light of the results of the next section.

3. Changes in quantities of credit with loan heterogeneity

In this section we present an approach for the analysis of credit to non-financial firms that is based on the study of the amounts of credit. Note that this approach uses only data from the *Central de Responsabilidades de Crédito* (CRC), so it does not take into account the financing that some firms can get abroad, including large companies and holding companies. While this may affect the picture of the evolution of credit aggregates, is not likely to affect the regression results and the analysis in this section.

Let us first look at the evolution of total loans to non financial corporations in the CRC. Chart 1 below documents the growth rates in annual terms of total loans to non-financial firms using the CRC, as well as the rate of growth of nominal GDP for the same period.

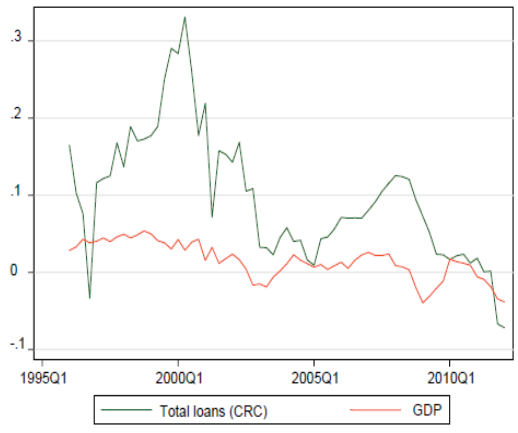
The total credit in CRC grew at rates in excess of nominal GDP in most of the period, with minima in 1996q4, 2005q1 and 2012q1.[6] The chart documents the apparent inconsistency between the economic cycle, measured by growth in nominal GDP and credit growth in the CRC. There is concern that the credit crunch may be strong enough to negatively affect the prospects of the Portuguese economy, inefficiently forcing companies to shut down or not realising business opportunities.

Fixed-effects regressions with a CRC sample

An approximate way to identify credit constraints is to run a panel regression of the logarithm of the total amount of each loan of a company, taking into account fixed effects at that level. These fixed

Chart 1

YEAR-ON-YEAR GROWTH RATE OF THE TOTAL AMOUNT OF LOANS TO NON-FINANCIAL FIRMS AND NOMINAL GDP | IN NATURAL UNITS



Source: *CRC*, 1995q1 - 2012q1, and National Accounts.

6 In 2011q4 credit sales occurred that had an impact on the credit aggregates present in the CRC, since part of the loans became owned by non-participants. However, we estimate that the impact of correcting for these sales in the annual growth rates shown in Chart 1 for 2011q4 and 2012q1 (of -6.7% and -7.1%, respectively) is at most 41 basis points.

effects will also control for the heterogeneity of firms and banks. The coefficients of the time dummies will represent the average level of loans (in logs) granted in a particular quarter, taking into account fixed effects at the level of the bank, the company and the bank-company relationship. This approach has its own share of econometric problems, so we must look at these results with caution.

Using a representative sample of companies present in the CRC from 1995q1 to 2012q1 on a quarterly basis, we consolidated the positions of each non-financial firm with respect to each credit institution; the result we called "loan". Note that this is not exactly a loan because we do not have information operation by operation, but we will keep this convention until the end of the article. We ignored registers in which the debtor appears as a secondary obligor. The sample was drawn randomly by keeping a fraction of the existing observations; then, for companies holding these loans, we recovered all the observations not taken initially. Thus, we have a representative sample of loans for each company that includes all its loans. The number of observations is 7759368. After taking logarithms of these values we estimated the following econometric model:

$$y_{i,t} = \sum_{j} \alpha_j d_{j=i} + \sum_{u} \beta_u d_{u=t} + \varepsilon_{i,t}$$

In this expression, i denotes the loan and t denotes the calendar time; $y_{i,t}$ is the logarithm of the loan i at time t; $d_{j=i}$ is an indicator function of the loan i and α_j is the respective coefficient; $d_{u=t}$ is an indicator function of time t, and β_u is the respective coefficient; and $\varepsilon_{i,t}$ is an error term. As stated, with this specification the bank and firm fixed effects are automatically considered. In simple terms, the temporal evolution of the time dummies coefficients reflects changes in the average value of the loans that cannot be explained by the usual practice in each loan during the sample period. The difficulty in estimating this model is the extremely high dimension of vector $\{\alpha_j\}$.

Full sample

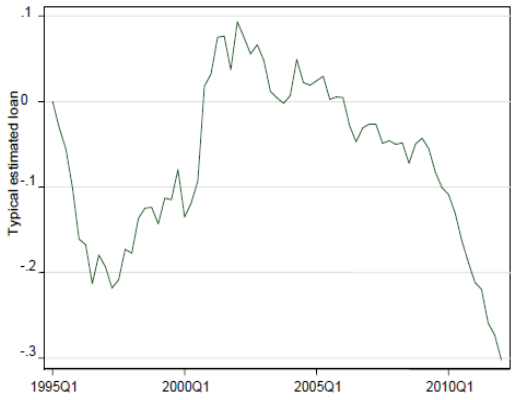
The result of this exercise using the within estimator of panel regressions and the complete sample is shown in Chart 2.

The interpretation of the figures in this chart is not immediate, so we will spend some time on this point. If we look at the regression equation above, we see that for each banking relationship (or, in our terminology, each loan), we have a number of regressors. One of these regressors is the indicator of the loan, which controls for the average level of this loan over time. We have to estimate a coefficient for each loan, which is a computationally demanding task since we have about 470 thousand loans in the sample. The other regressors are the time dummies. Unlike the previous regressors, these are common to all loans, and each coefficient will be estimated by looking at all contemporaneous loans. This allows us to interpret the coefficients as the average level of all existing loans at the same time, once we discount the fixed effect of each loan. It should be noted that the regression is performed in logarithms and thus, in the chart, the difference between two values represents a variation; the level corresponding to 1995q1 was normalized to 0. It should also be noted that in calculating the coefficient of each time dummy, all loans have the same weight, regardless of their value.

We see that initially there was a decline in the average loan value (after discounting fixed effects) until the end of 1996, followed by a sharp increase during the early 2000s. The typical loan amount peaked around 2002q4, and we observed a slow decrease until 2009q1, when it fell sharply until the end of the period under analysis. The magnitude of the reduction in the final period is very large (above 26 log points), but is particularly impressive due to the relatively short period of time ranging from 2009q1 to 2012q1. Although this number is only indicative of the possible presence of restrictions in access to credit for firms, it suggests that at least the past practices are not sufficient to explain the fall of the

Chart 2

LEVEL OF THE TYPICAL ESTIMATED LOAN (CALCULATED BY CALENDAR FIXED-EFFECTS) OBTAINED WITH FIXED EFFECTS AT THE LOAN LEVEL | IN LOGS



Source: *CRC*, 1995q1 - 2012q1.
Note: Number of observations: 7,759,368.

typical estimated loan recently observed.

There are several reasons related to the economic cycle that could help explain this pattern. The difficulty lies in understanding whether the dynamics of the business cycle can explain the evolution of credit. If we compare the behaviour of credit to GDP growth during this period (see Chart 1), we see that the annual change in GDP is much smoother than the change of credit. The chart documents the apparent inconsistency between the economic cycle, measured by GDP growth, and credit growth. Chart 3 also shows the growth rate of the typical loan estimate, calculated from Chart 2. The decline in credit (after deducting fixed effects) from 2009q1 to 2012q1, evident in the rate of growth of the typical loan during this period, is difficult to reconcile with the observed economic contraction.

In conclusion, although the value of the fall in the average level of the loan does not have a literal meaning, since it is an unweighted average on a loan by loan basis, the chart suggests a very significant

Chart 3

YEAR-ON-YEAR GROWTH RATES OF THE TOTAL AMOUNT OF LOANS TO NON-FINANCIAL FIRMS AND OF THE TYPICAL ESTIMATED LOAN | IN NATURAL UNITS

Source: *CRC*, 1995q1 - 2012q1.

change in the pattern of access to credit by firms in 2009q1 that continued until 2012q1.

We can do the same exercise, but only with firm fixed effects, that is, using the company's total bank debt vis-à-vis the entire financial system, and then proceed as before. The results are shown in Chart 4. Again, the interpretation of the graph should not be done literally, since we are also not weighting the calendar fixed effects by the debt of each firm.

Although there are differences from Chart 2, especially at the beginning of the period under review, there is also a sharp decline from 2009q1 on. This result shows a situation not unlike that seen at the level of loans, with an overall decline between 2009q1 and 2012q1 of about 23 log points in the typical firm debt. The differences between Charts 2 and 4 have to do with changes in the number of loans for each company and the distribution of loan amounts for each bank. For example, if a company that has five loans for a long period of time begins to diminish the value of all its loans except one, which is by far the largest, the contribution of this company to reduce the calendar fixed effects will be large in the first exercise, as each loan has the same weight. However, the contribution of this company to reduce the calendar fixed effects in the second exercise will be small, because the company's total debt will be reduced in a relatively small amount compared to its historical level. As a result, an explanation consistent with the observed differences between the two charts is that companies, especially early in the sample, may have increased the number of meaningful credit relationships, and now tend to reduce them.

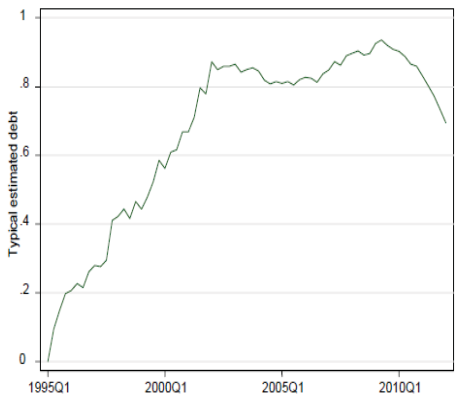
These two ways of looking at amounts of credit - by loan and by firm - are complementary. While the second reflects the evolution of average debt per company, the first gives an idea of the funding opportunities open at all times to companies, since all banking relationships have the same weight. Naturally, faced with more difficult conditions for financing, firms tend to concentrate their operations in a single banking relationship and to reduce the importance of the remaining ones; thus, the first indicator may be a more accurate measure for the conditions of access to credit for companies.

The fact remains that credit (by loan or by company) began to decline in early 2009, a situation which lasted until 2012q1, and occurred at a much faster rate than what would be predicted from the rate of growth of loans to non financial firms (Chart 1). This point is well illustrated by Chart 5.

The chart presents the annual percentage change in average debt per firm (discounting fixed effects at the firm level) and the rate of change of the total amount of loans to non financial corporations. We see that the average debt grew at negative rates for longer periods than total loans to non financial

Chart 4

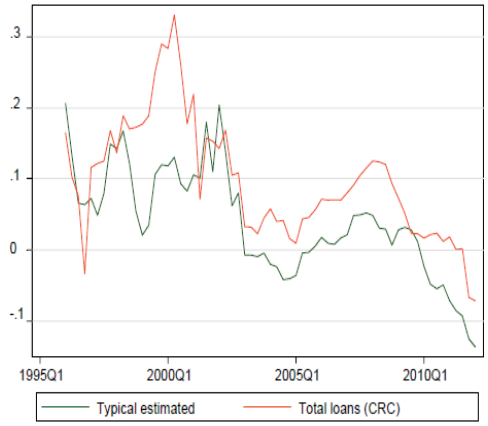
LEVEL OF THE TYPICAL ESTIMATED FIRM DEBT (CALCULATED BY CALENDAR FIXED-EFFECTS) OBTAINED WITH FIXED EFFECTS AT THE FIRM LEVEL | IN LOGS



Source: *CRC*, 1995q1 - 2012q1.
Note: Number of observations: 2,772,582.

Chart 5

YEAR-ON-YEAR GROWTH RATES OF THE TOTAL AMOUNT OF LOANS TO NON-FINANCIAL FIRMS AND OF THE TYPICAL ESTIMATED FIRM DEBT | IN NATURAL UNITS



Source: *CRC*, 1995q1 - 2012q1.

corporations. In the end, the average annual rate of firm debt has become negative in 2010q1; this only happened to total loans to non financial corporations in 2011q4. The difference between the two curves is explained by the heterogeneity in the distribution of debt. If all companies were equal and did not enter or leave activity over time, the graphics should coincide. If all companies were equal but there were companies entering in net terms, we would expect to see an increase in total credit larger than the typical firm debt. However, it can be shown that the number of firms with credit in the sample has been falling since 2007q4, which implies that the observed differences are due to differences between firms. Since the total credit to non financial firms grew more (or decreased less) than the typical firm debt, this means that there is a tendency for firms with larger debt to have higher credit growth. That is, the problem seems to affect most the smaller companies.

New firms

A second way to look at potential quantitative restrictions on credit to non-financial firms is to focus on new businesses. Although it is natural that there are fewer companies starting their activity in the negative phase of the cycle, it is not clear that, for those which are born, financing needs are larger or smaller than during the high phase of the cycle. By restricting our attention to new business and looking at the size of its initial level of funding, we get an idea of the overall level of credit constraints.

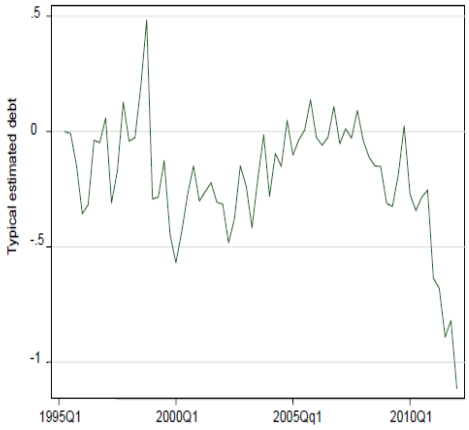
Unfortunately, we cannot identify new businesses using only the CRC. What we can do is to identify companies seeking credit for the first time. In many cases this actually correspond to new companies, but this designation is subject to the important caveat that they are new only in relation to the banking system. If we regress the logarithm of each loan for each new company, in the quarter of their appearance, on the calendar fixed effects, we obtain Chart 6. The interpretation of the figures in this chart is simpler than the previous charts: in this case, each value is simply the average of the logarithm of the loans of all the companies that appeared in this quarter. We can see that the average value of loans to new businesses had a mixed pattern until 2009, when it fell abruptly.

The same approach at the firm level does not change this picture significantly, because new companies usually have only one loan; for this reason we omit the respective graph.

The results suggest that, regardless of the reasons for the drop in credit to non-financial firms in Portugal during 2009, 2010 and 2011, it affected new (and presumably also small) firms disproportionately. In

Gráfico 6

LEVEL OF THE AVERAGE INITIAL LOAN (CALCULATED BY CALENDAR FIXED EFFECTS) RESULTING FROM AN ESTIMATION ONLY WITH NEW FIRMS AND IN THE QUARTER WHEN THEY FIRST APPEAR | IN LOGS



Source: *CRC*, 1995q1 - 2012q1.
Note: Number of observations: 472,090.

fact, if we look at the total credit for a typical company, we see a decline of about 23 per cent between 2009q1 and 2012q1, but for a new company the drop is about 70 per cent between 2009q4 and 2012q1. This is a cause for serious concern, since new firms create jobs and improve the prospects of the economy in the long run. Moreover, there is a vast literature describing the effects of the founding companies in their survival (see *e.g.* Geroski, Mata and Portugal 2011); hence it is clear that the lack of adequate initial funding may involve lower viability of businesses in the future.

Finally, it should be noted that the process of falling credit amounts documented in this section had its beginning before the programme of economic and financial assistance to Portugal, which started in May 2011. The evidence points to the beginning of the reduction in credit occurring during the first half of 2009.

4. Final remarks

The two independent sets of exercises presented in this paper suggest that access to credit by non-financial firms became more difficult from the beginning of 2009 on. Access to credit has also become much more difficult for new companies from the end of 2009 on.

In one of the exercises in this article, we show that the increase in interest rates is difficult to reconcile with the observed changes in firms' balance sheets and the characteristics of their loans, even discounting the systemic movements in interest rates on liquid markets. To the extent that new deposits could have been channelled into new loans during this period, the increase in interest rates on loans may be explained by increased funding costs of banks, and also by the rising cost of capital. However, this question cannot be adequately treated using only the available data.

In another exercise, we documented the fact that the average amount of credit has begun to fall at least since 2009, once we account for some (but not all) heterogeneity of loans and businesses. We also show that the situation of new companies in terms of funding is particularly serious.

Although there are many possible reasons for this sudden increase in the prices of loans and in the observed reduction in the quantities of credit, it seems reasonable to assume that liquidity problems for both banks and businesses were crucial. A different question is whether the regulatory intervention can alleviate the financing problems of new and old firms. The past experience suggests that one should be

very careful in designing such policies.

References

Altman, E. and Narayanan, P. (1997), "An International Survey of Business Failure Classification Models", Financial Markets, *Institutions & Instruments* 6(2), pp. 1-57

Geroski, P, J. Mata and P. Portugal (2011) "Founding conditions and the survival of new firms", *Strategic Management* 31(5), pp. 510-529

Heckman, J.(1979) "Sample Selection Bias as a Specification Error", *Econometrica* 47(1), pp. 153-162

Hülsewig ,O., E. Mayer and T. Wollmershäuser (2009) "Bank behaviour, incomplete interest rate pass-through, and the cost channel of monetary policy transmission", *Economic Modelling* 26(6), pp. 1310-1327

Santos, J. (2011) "Bank Corporate Loan Pricing Following the Subprime Crisis", *Review of Financial Studies* 24(6), pp. 1916-1943

Santos, J. and A. Winton (2008) "Bank Loans, Bonds, and Information Monopolies across the Business Cycle", *Journal of Finance* 63(2), pp. 1315-1359

Soares, M. C. (2007) "Modelling of an Indicator for Credit Scoring of Non-Financial Corporations – a Preliminary Research Based on Discriminant Analysis", *Financial Stability Report*, Banco de Portugal