

# The real effects of the credit constraints in the economic crisis

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The great recession starting in 2008 has destroyed jobs and firms at an unprecedented scale in the Western world and in particular in the EU-area. The question to many has been if the economic policy could have been more supportive for a quicker return to normal job creation and destruction. The monetary policy has in many countries been a major focus point and in some countries there has been a discussion between those who meant that the tightened credit policy is one of the reasons why firms have not grown and that firms have been more focused on increasing savings than on investing. Those who mean that demand for credit has gone down because of lack of demand from good projects have confronted this view. There has been little evidence to support the latter and only scattered newspaper and other types of coincidental evidence for the former. This paper attempts to present evidence from a study of firm behaviour that the credit constraint and perceived access to credit has had a significant effect on the real economy by contributing to the destruction of jobs. However, the paper also shows that lack of demand plays a role.

Though Denmark has been saved from direct negative effects of its own sovereign debt, Denmark has like many other countries suffered a huge job loss and has actually not done better than some of the highly indebted countries in the Euro area. Thus, the Danish evidence on firm level may be useful as a benchmark for firms in other countries.

We are using a survey with 2000 Danish firms merged with register information on economic key variables for each firm and find that the existence of financial problems for the firm means that the firm is less likely to create jobs and more likely to destroy jobs. Furthermore, we find a clear indication of an effect of having a “bad banker” who will not give credit despite good performance measured by the z-score that indicates how close the firm is to bankruptcy.

## JEL-code:

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### Introduction

The aim of this paper is to investigate to what extent credit constraints have effects on the job creation and destruction at the firm level. The Great Recession has had a severe effect on job creation and destruction almost everywhere in the Western World. The recovery has in many European countries been very slow and has been shaped by careful and limited fiscal policy interventions together with tightened bank controls with the purpose of making the banks stronger in a future crisis. Unfortunately, that has had the effect that banks have withdrawn credit and rejected more loan applications which again has meant that more firms become discouraged to even apply, see Ferrando and Mulier, 2015. The question remains, however, how much was due to the effect from a credit constraint and how much was due to the decline of demand for goods and services. One of the difficulties is to get data that links firms with credit availability. The literature is based on data collected from surveys from relative small samples and focusing on larger firms in general. This study uses data from a Danish survey covering about 2000 firms from the largest down to 20 employees followed over a three-year period supplemented with register data. Denmark is a relevant country to study because job destruction was among the largest in the OECD area compared to the labour force, OECD 2013, and because growth has been very modest since the onset of the crisis. At the same time, 18 banks have been closed and a rigorous bank authority has kept the remaining banks in a firm grip.

The combined effect of closures and credit constraints may have left the surviving Danish banks in a better shape than banks in some other countries, but has probably also left the banks more cautious in taking risks by lending money to business. The financial authority may have further aggravated these effects on lending policy by enforcing certain risk weights on assets.

That has led to a discussion whether this strict policy has resulted in a credit constraint that has cost jobs or not. One side dominated by the Central Bank and the financial authority has been claiming that there has not been a credit crunch and that the seemingly excess demand consists of bad projects. Thus, they claim, the reduction of credit to firms is just a consequence of lower activity and thus lower loan demand due to the crisis. The other side represented by small and medium size firms and their organisations say that there has been and still is a credit crunch that curbs their possibilities to grow. Incidental evidence from top bankers tends to agree with the latter but this viewpoint is only seldom repeated in public.

The task for the researcher is here to show that the lack of credit leads to fewer new jobs even in cases where the company seems to qualify for credit.

Recent literature has a growing number of examples of surveys that link financial data with data on the real economy. Campello, Graham and Harvey, 2010 is an example. They survey 1050 Chief Financial Controllers in 39 countries. Their primary aim is to contrast the actions of firms that are financially constrained with actions of less constrained firms. 10.000 invitations were sent out in the

USA in Nov 2008 and responses from 574 could be used. Despite the low response rate and statistical weaknesses, their analysis shows how firms used credit lines during the crisis and whether managers had difficulties in renewing these credit lines. The paper shows that credit lines are associated with greater real spending when companies are not cash-strapped. Firms with limited access to credit lines appear to choose between saving and investment during the crisis. The paper by Ghodorow-Reich, 2014, analyses the effects on employment of having a “bad” lender. The idea is that some banks became bad lenders in 2008 because they lost money due to the onset of the financial crisis. G-R constructs instruments for credit supply from 42 banks with syndicated loans. Bank credit supply is instrumented by using the exposure to the Lehman Brothers bankruptcy and the exposure to toxic mortgage-backed securities together with bank balance sheet information. Similarly, instruments are created for credit demand. G-R shows that the credit channel can explain between one-third and one-half of the employment decline at small and medium-sized firms (up to 1000 employees) in the sample in the year following the bankruptcy of Lehman Brothers. Altogether, the paper predicts as much as 5 percentage points decline in employment due to the lower lending. In contrast the data cannot reject that the relative availability of bank credit supply had no effect on the largest companies, or at firms with access to the bond market. G-R discusses hypotheses on lending and concludes that there are several reasons why smaller firms are more hit by bad lenders than big firms. First, the cost of switching bank is higher for a small firm because of asymmetric information between the old bank, a new bank and the firm. Furthermore, there may be lemons cost to switching lender. If the per dollar monitoring cost falls with the size of the loan, then the cost of asymmetric information falls with borrower size. Though the paper can explain why financial friction can result in a substantial reduction in employment, it cannot explain the persistence of the slump.

The scarcity of studies of small firms and the reliance of data on larger firms is probably one of the reasons why very few studies have been able to show negative effects of the crisis on the real economy of firms measured by employment. As mentioned by Ghodorow-Reich, 2014, smaller firms took the blunt of the job destruction in the US compared to larger firms.

A recent paper by Ferrando and Mulier, 2015, looks at the characteristics and behaviour of discouraged borrowers. A discouraged borrower is in their terminology a borrower who doesn't even attempt to apply for a loan. They show on an ECB survey called Survey on Access to Finance of small and medium sized Enterprises (SAFE), that discouragement has strong negative effects on investment growth, employment growth and asset growth due to the lack of access to bank finance in the two years following the discouragement. Discouraged borrowers are firms that need external finance but do not apply for a bank loan in fear of being rejected. The paper uses the SAFE data collected quarterly by ECB from about 6500 firms from nine European countries over the period 2010 to 2014. These data are matched with balance sheet data from Bureau van Dijk. Most of these firms are SME's<sup>1</sup>.

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<sup>1</sup> The 9 countries are Austria, Belgium, Germany, Spain, Finland, France, Greece, Italy and Portugal.

Levenson and Willard (2000) have shown that only 6.36% of US small businesses had an unfulfilled desire for credit in 1987-88. Of these, 1/3 was denied funding for an extended period of time, while 2/3 discouraged from applying. Furthermore Freel et al (2012) have a similar result for an investigation of small businesses in the UK. Together these studies indicate that the issue of discouraged borrowers is substantial and that there are twice as many discouraged borrowers as rejected borrowers in the US and UK.

As in G-R we have data on about 2000 firms. These are generally smaller compared to all the cited surveys as it covers down to 20+ employees. We have used register data on firms merged with survey data for the firms but we have no link to the identity to the lending bank as in G-R. The three waves of surveys of firms provide qualitative questions on financial constraints and give information on how the firm perceives the credit conditions.

The wording of these questions was taken from a survey run by The Wage Dynamics Network (WDN) organized by the European Central Bank (ECB) in 2007, 2008 and 2009. It covered a number of countries but not Denmark<sup>2</sup>. The use of qualitative data raises a common bias problem because the respondent may colour his answers on degrees of perceived credit constraints by how well it goes for the firm. In order to diminish that problem we have used z-scores (Altmann, 1968 and 2002) calculated on register data to provide an exogenous measure of financial power.

The survey was sent to more than 4000 private non-financial firms in Nov 2011 and repeated in 2012 and 2013. The surveys were administered by Statistics Denmark and sent to the person in charge of personnel. All Danish firms above 20 employees were included though a smaller sample was taken among non-manufacturing industry between 50 and 20 employees. In both years, the response rate was around 50%. The questions were about HR, wage policy, job creation and destruction and contained questions on the financial situation of the firm. The average Danish firm has about 14 employees, so the sample is only representative for the larger among these but it says something about the smaller firms compared to the cited surveys.

The first question on financial issues was if the firm had financial problems. Almost half of all firms said that they had no financial problems in 2012, 217 said they had marginal problems while 208 said moderate, 138 said strong and 62 said very strong. Furthermore, we asked if the bank had limited its funding for an existing activity (109), if the bank had refused to offer a new credit for already existing activities (107), a new activity or other (309). The third question was if the bank had limited an existing line of credit. It appears that this has happened in about 1/3 of the cases where firms have been affected. Finally, we asked if borrowing costs were considered to be too high. About one fourth answered that borrowing costs were too high in 2012. The numbers for 2011 are almost the same. The answers are summarized in Table 1 for all three years.

A little less than half of all companies have been affected but only 12-14% have been strongly affected. This interval should probably be compared with the

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<sup>2</sup>Austria, Belgium, Czech Republic, Estonia, France, Italy, Luxemburg, Netherlands, Poland, Spain.

6.36% mentioned in Levenson and Willard, 2000, when it is taken account that their number is from 1987-88 and ours is from after the worst crisis in the banking sector after the Great Depression.

Table 1. Financial difficulties, 2011, 2012 and 2013.

Financial problems	Number of firms		
	2011	2012	2013
None	754	778	747
Marginal	269	217	192
Moderate	256	208	232
Strong	119	138	132
Very strong	49	62	38
Total	1447	1403	1341
Of which affected	693	625	594
% affected	48	45	44
% strongly affected	12	14	13

Table 2. Consistency of financial difficulties, % distributions

Financial difficulties	2011	2012		2013	
		No	Yes	No	Yes
No		78	35	78	38
Yes		22	65	22	62
Total		100	100	100	100

Financial difficulties	2012	2013	
		No	Yes
No		83	36
Yes		17	64
Total		100	100

Table 2 shows the consistency over the years of having financial difficulties. It shows that 2/3 of all firms observed in 2011 and 2012 (1150) had financial problems in both years and 3/4 had no problems in neither 2011 nor 2012. However, 1/3 reports that they got into problems in 2012 and 1/5 said that they got out of problems in 2012. With other words, a large number of firms are in problems in two consecutive years and a fairly large proportion gets into and out of problems. The net movement is that a higher fraction gets into than out of problems. This tendency is even aggravated in 2013. So, it does not look like the probability of being affected changes much to the better in the surveyed period.

Financial difficulties of one or the other type could have many causes. It could be because of a company related issue or it could be because of the bank. We do not observe the identity of the bank but we do observe the key economic characteristics of the firm. Therefore, we will estimate a likelihood function for

the probability that the firm reports financial problems using all the background information we have on the firm. We could now choose the information from the survey like in Campello et al, 2010. However, this could introduce a common source bias because the respondent may be colouring his/her answers in a consistent manner, even if there was no relationship. We can avoid that bias by using register information from 2011 on a whole set of economic variables of each individual firm.

Table 3. Estimating the probability of having financial difficulties in 2011, 2012 and 2013 and for all years together explained by register data (marked with “r”, the other variables are from the survey)

	coefficient	robust std.dev	dy/dx	robust std.dev
Ln(shortrun debt/assets) r	0.770	0.143	0.134	0.023
Ln(long run debt/assets) r	0.179	0.059	0.031	0.010
Ln(revenue) r	0.105	0.088	0.018	0.015
Equity r	0.000	0.000	0.000	0.000
Profit r	0.000	0.000	0.000	0.000
Danish firm	0.600	0.190	0.104	0.033
Performance pay	-0.483	0.136	-0.084	0.023
Low competition	-0.398	0.271	-0.069	0.047
manufacturing r	ref			
Construction r	-0.031	0.053	-0.031	0.053
Trade r	-0.054	0.033	-0.054	0.033
Transport r	-0.015	0.045	-0.015	0.045
Service r	-0.090	0.040	-0.090	0.040
age of firm	0.000	0.001	0.000	0.001
Demand problems	0.440	0.024	0.440	0.024
Flexible work hours	-0.050	0.022	-0.050	0.022
Number of employees*100 r	0.000	0.000	0.000	0.000
Number of employees^2*100 r	0.000	0.000	0.000	0.000
2011	ref			
2012	0.002	0.027	0.002	0.027
2013	0.017	0.028	0.017	0.028
Constant	-1965284.000	0.991		
N	1385			
Pseudo R2	0.2188			

Table 3 shows that the debt ratio is positively related to the probability of getting into financial difficulties. 10% higher debt ratio increases the probability with 1%. 10 % more equity lowers the probability with .4%. Total revenue has no effect, while 10% higher investment lowers the probability of having financial difficulty with .2 percentage points. And finally, 10% higher profit appears to lower the probability of financial difficulties with .3 percentage points.

Firms within services appear to be much less likely to get into financial problems in 2011 than manufacturing and the other industries. If the firm has reported “demand problems” it is also more likely to have financial problems. Furthermore, having reported that wages are flexible makes them also more likely to have financial difficulties. Flexible wages are usually correlated with less blue collar work and more salaried employees. Being a home market firm increases the probability of having financial difficulties.

It is already here remarkable that a 10% higher debt ratio has a larger impact on the probability of getting into financial difficulties than a 10% higher sum of equity, investments and profit added together. Doubling of the debt ratio has the same effect as having demand problems. The importance of the debt ratio above many other effects is probably a characteristic of the Great Recession because that has been one of the key variables for the financial authority.

From this analysis we can conclude that the economic variables play the largest role with the expected signs on the probability that a firm has financial difficulties or not. On the other hand, the sector variables tend to indicate that non-performance variables together with the variable for flexible wages and for the Danish home market also play a role in the credit decision. This indicates that some banks are screening using these criteria while others are also used.

We will now refine our prediction of financial difficulties based on register information on the economic performance up to 2011 by using the z-score as defined in Altman (1968) with the latest update Altman (2002). The z-score is meant as an indicator for the likelihood that a firm goes bankrupt. It is calculated as a weighted average of the variables described below.

Formula for calculating Z score, Altman

$$Z = 0,717 X1 + 0,847 X2 + 3,107 X3 + 0,420 X4 + 0,998 X5$$

X1: Current assets - current liabilities / Total assets

X2: Retained Earnings / Total assets

X3: EBIT / Total Assets

X4: Book value of Equity / Total Liabilities

X5: Sales / Total assets

Z > 2,9 : Safe Zone

Z < 1,23: Distess zone

Table 4. Z-scores in 2011-2013 calculated on register data on firms one year prior (2010-2012).

Variable	2011		2012		2013	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Working capital/Total assets (X1)	0.11	0.45	0.14	0.32	0.12	1.48
Retained Earnings/Total assets (X2)	0.05	0.95	0.06	1.33	0.09	0.88
Earnings before interest and taxes/Total assets (X3)	0.04	0.27	0.07	0.16	0.06	0.39
Book value equity/Book value of total debt (X4)	1.13	6.47	0.92	3.06	0.89	1.96
Sales/Total assets (X5)	1.94	1.47	2.06	1.46	2.13	1.95
Overall Index (Z)	2.64	3.25	2.79	2.38	2.87	2.31
Obs	1834		1922		1897	

We can now compare this with the responses from the surveys where we asked if the firm had experienced financial difficulties. Table 6 shows that the bank acts in accordance with the z-score in 76% of all cases, but in 24% of cases the firm gets a reaction from the bank that is not in accordance with the z-score. There may be many reasons for this difference. Based on anecdotal evidence there are reasons to believe that different bank branches may have different views on providing credit that determines if the firm gets into financial difficulties or not. In some sense you can see the z-score as an objective measure of the risk of losing money for the bank. The reaction of the bank is then considered as determined by the z-score and an idiosyncratic term that reflects the bank evaluation judgement of the firm.

Table 6 collects the classification of bankers' reaction to the request of finance. It shows that almost half of all firms in 2011 are having financial difficulties. Furthermore, it shows that 19% of these are in what the z-scores call slow risk area, 59% are in the indetermined zone and only 22% are in the high risk zone. On the other hand among those with no financial difficulties, 18% are in the high risk zone, while 51% of these are having only a low bankruptcy risk. Comparing with the other years, it is remarkable that there are fewer firms which gets problems but a larger proportion of those with low risk will actually get into



financial problems. If there is a high risk of bankruptcy the banker will create financial difficulties in little more than 50% of all cases. None of these numbers change much between the different years. If the firm is in the indetermined section of the z-scores, it is remarkable that the banker is willing to give credit in two thirds of the cases. None of these numbers change much between 2011 and 2012, as can be seen in the table.

Table 6. Classification of bankers' reaction. Distribution of bankruptcy risk measured by z-scores and financial difficulties, % .

2011	Financial difficulties		Missing
	No	Yes	
High	18	22	26
Indeterm	31	59	39
Low	51	19	34
Total	100	100	100
Number	919	877	38
2012			
High	11	21	10
Indeterm	40	48	48
Low	49	30	42
Total	100	100	100
Number	1278	592	52
2013			
High	10	21	20
Indeterm	40	44	43
Low	51	35	36
Total	100	100	100
Number	1286	569	44

Thus, we can now combine the z-scores with the financial difficulty indicator and define six situations: the banker agrees with the high z-score and gives credit, the banker agrees with the low z-score and gives no credit, the z-scores says no risk but the firm does not get credit (we call this a bad banker situation<sup>3</sup>), the z-scores say that there is a high risk of bankruptcy, but the firm does not have credit difficulties (we call this a naive banker). If the z-score indicates that the firm is in the grey zone and the banker says no to credit, we call the banker for risk averse and if he says yes to credit, we call him risky. In this way we have

<sup>3</sup> Of course, the banker may have negative information about the firm which is not reflected by the z-score so it may be wrong to characterize this situation as a bad banker under all circumstances.

defined six different types of bankers. The reason why the banker determines against the z-scores may be because the bank itself is in trouble with the finance authority. 18 banks have closed down so far in this recession and it is well known that these banks change credit behaviour when the financial authorities start scrutinizing them. Unfortunately, we are not able to identify these banks in the data. The same behaviour must however be expected in the surviving banks<sup>4</sup>, so this bank reaction is probably widespread.

Table 7. The typology of bank evaluations.

	z-score	banker	Financial problems
Zbanker up	no bankruptcy	credit	no
Zbanker down	bankruptcy	no credit	yes
Bad banker	no bankruptcy	no credit	yes
Naive banker	bankruptcy	credit	no
Risky banker	indetermined	credit	no
Risk averse banker	indetermined	no credit	yes

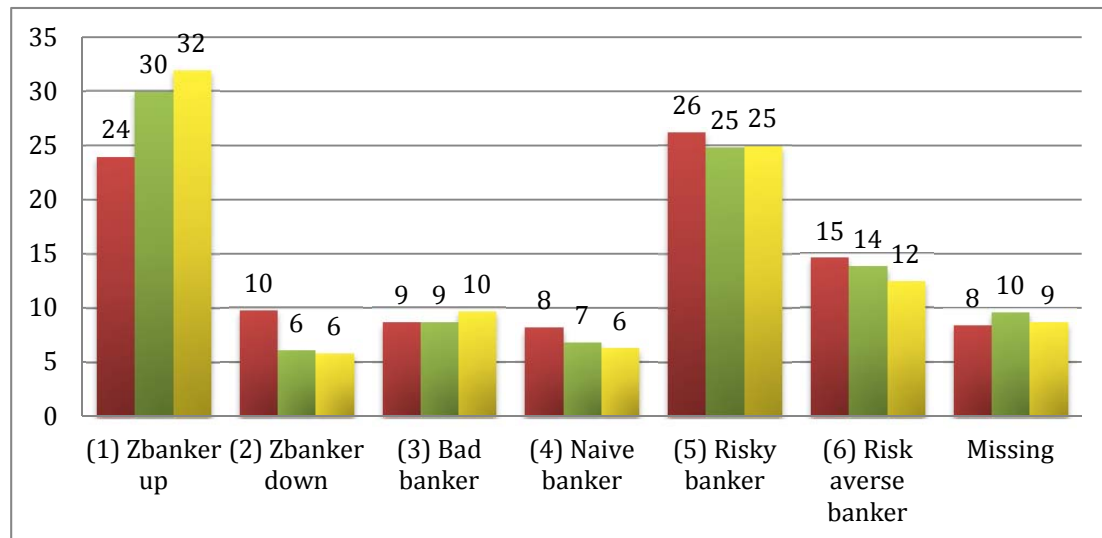
We can now characterize the different firms according to this typology. The result for 2011 is reported in Figure 1 as the red columns. The distribution is based on z-scores for 2011 (based on 2010 register information) and the survey questions in 2011. The green columns are similarly for firms surveyed in 2012 and the yellow columns are the similar figures for 2013.

The distribution in Figure 1 shows that a large proportion of credit is given according to the z-scores: (1) and (2). It is, however, remarkable that about 25% of all cases in all three years can be characterized as “risky bankers” meaning that the bank gives credit despite the firm is in the grey zone according to the z-score. This indicates either that there are some brave bankers who try to keep the wheels running after all, or that many z-scores will be in the grey area during a severe recession. A closer investigation of the consistency of z-scores over time may throw some light over that.

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<sup>4</sup> A more direct estimate of the effects on firms of having a closing bank could be estimated if we had access to data which linked bank identity to firms, but such data are not presently available.

Figure 1. Typology of bankers according to z-scores. Numbers are % of all firms in sample. Red is from 2011, green from 2012, and yellow from 2013.



We will now use this information to investigate if the existence of financial difficulties matters for the probability that a firm increases its number of jobs for each year in the interval 2011-2013.

The questionnaire contains information on job growth for different categories of jobs. From these numbers we have counted job creation and destruction for firms that are either expanding, contracting or have no growth in the total number of employees. An expanding firm is a company that has more jobs (totally) in 2012 than in 2011 for example.

Table 8 shows that there is a substantial creation and destruction of jobs each year when measured at firm level. Thus, in 2011 contracting firms destroyed 8655 jobs and created 1444 jobs while expanding firms created 15.769 jobs and destroyed 1489 jobs. Altogether net job creation mounted to 7069 in 2011. In 2012 the similar number was negative. However, we also see that job destruction is concentrated in firms which are overall contracting, while job creation is concentrated in firms, which are expanding. Therefore it seems reasonable to focus on the net creation of jobs instead of gross creation and destruction. Furthermore, we should be aware that the total number of jobs in Denmark was not growing in 2011, so we have to conclude that our sample of

firms is probably doing better than the firms with fewer than 20 employees, who are included in the total number of jobs in Denmark, but not in the survey. For 2012 both numbers were negative.

Table 8. Job creation in 2011 and 2012 in contracting and expanding firms according to the surveys.

Job growth in firm	Destroyed jobs			Created jobs			Net creation
	zero growth	expanding	contracting	zero growth	expanding	contracting	
<b>2011</b>							
Manufacturing	-77	-538	-3119	77	6948	570	3861
Construction	-12	-118	-328	12	1134	76	764
Trade	-24	-230	-2557	24	2560	403	176
Transport	-11	-191	-828	11	1952	37	970
Service	-371	-412	-1823	371	3175	358	1298
All industries							
<b>2011</b>	<b>-495</b>	<b>-1489</b>	<b>-8655</b>	<b>495</b>	<b>15769</b>	<b>1444</b>	<b>7069</b>
<b>2012</b>							
Manufacturing	-72	-500	-5457	72	5565	695	303
Construction	-49	-36	-707	49	1429	217	903
Trade	-38	-209	-2488	38	2683	251	237
Transport	-2	-193	-2213	2	1607	124	-675
Service	-56	-306	-5526	56	4066	602	-1164
All industries							
<b>2012</b>	<b>-217</b>	<b>-1244</b>	<b>-16391</b>	<b>217</b>	<b>15350</b>	<b>1889</b>	<b>-396</b>

Furthermore, the survey has a number of questions on the overall demand situation, type of wage contracts, if wages are fixed or flexible, if there is a bonus system, if the firm has a daughter company in a foreign country or it is itself a daughter firm of a foreign company. Summary statistics of these variables are reported in Table 9.

Table 9. Summary statistics of sample.

	Percentage distribution		
	2011	2012	2013
<b>INDUSTRY</b>			
Manufacturing	48.75	43.5	43.33
Construction	6.17	7.54	7.29
Trade	16.78	19.09	18.91
Transport	7.8	8.22	9.16
Service	20.5	21.65	21.32
<b>NUMBER OF EMPLOYEES IN FIRM</b>			
20-29	16.78	17.21	18.12
30-39	11.47	12.32	12.51
40-49	8.47	8.6	9.5
50-99	30.95	31.03	31.31
100+	32.33	30.84	28.56
<b>REGION</b>			
Greater Copenhagen	29.14	30.92	30.58
Midt	27.71	26.35	26.09
North	11.19	11.42	11.02
Sjælland	9.24	9.53	9.98
South	22.73	21.78	22.33
<b>OWNERSHIP FORM</b>			
Inc, stocks, A/S	83.27	81.53	81.72
Partnership	2.36	2.33	2.03
Inc partners, K/S	0.82	0.97	0.89
Small incorporated, Aps	8.26	9.29	8.99
Foundation	.	0.34	0.3
Association	1.85	2.24	2.67
Cooperative	1.23	1.26	1.58
Foreign ownership	0.67	0.92	0.64
Others	1.33	1.12	1.19
<b>FOREIGN RELATIONSHIP</b>			
Foreign mother company	19.14	17.8	18.19
Foreign daughter company	21.49	22.09	19.77
Mean			
Age of firm	25	24.48	25.26
Human Capital	2.96	3.01	3.06

### Job creation versus job destruction

A firm is considered to be expanding if the number of jobs created is higher than the number of jobs destroyed.<sup>5</sup>

<sup>5</sup>This is in line with the typology of Lazear and Spletzer, 2012 with the difference that we look at job flows and they look at workers flows with respect to hires and separations.

$$Firm\ expanding = \begin{cases} 1, & \text{if net job creation} > 0 \\ 0, & \text{otherwise} \end{cases}$$

Following the same logic, a firm is considered to be contracting if the number of jobs destroyed exceeds the number of jobs created.

$$Firm\ contraction = \begin{cases} 1, & \text{if net job creation} < 0 \\ 0, & \text{otherwise} \end{cases}$$

The expansion of a company indicates a positive evolution of the firm, a blossoming of the production generated either by an increase in the demand or by entering on a new market. The contraction of the firm indicates a restructuring of the company generated either by a reduction in demand or by the firm's decision to leave a certain market. Financial difficulties generated by the crisis can also lead to contraction.

### Estimates

The above defined equations are estimated by separate logits on survey data for job creation and destruction for all three years with a year dummy and separately for each year using z-scores based on lagged financial data. Furthermore, we have used the overall level of human capital in the firm measured as average number of years of education for the employees. The main results are reported in Table 10 as marginal effects. There are (non-reported) controls for size of firm measured by number of employees, industry, foreign daughter/mother, age of firm, and region.

Table 10. Logit estimates of probability of firm contracting or expanding the number of jobs.

	2011- 2013		2011		2012		2013	
	dy/dx	Std.Err	dy/d	Std.Err	dy/d	Std.Err	dy/d	Std.Err
EXPANDING		.	x	.	x	.	x	.
zbankerup, ref	0							
zbankerdown	<b>-0.16</b>	0.03	<b>-0.14</b>	0.04	<b>-0.17</b>	0.05	<b>-0.16</b>	0.05
bad banker	<b>-0.09</b>	0.02	-0.07	0.04	<b>-0.09</b>	0.04	<b>-0.11</b>	0.04
naive banker	<b>-0.10</b>	0.03	<b>-0.12</b>	0.05	<b>-0.08</b>	0.05	-0.07	0.05
riskybanker	<b>-0.03</b>	0.02	0.02	0.03	<b>-0.08</b>	0.03	-0.04	0.03
riavbanker	<b>-0.13</b>	0.02	<b>-0.13</b>	0.04	<b>-0.12</b>	0.04	<b>-0.14</b>	0.04
Human Capital	<b>0.03</b>	0.01	<b>0.05</b>	0.01	<b>0.03</b>	0.01	<b>0.03</b>	0.01
2011, ref	0.00							
2012	0.00	0.02						
2013	<b>0.03</b>	0.02						
Pseudo R2	0.03		0.04		0.03		0.04	
<b>CONTRACTING</b>								
zbankerup, ref	0.00							
zbankerdown	<b>0.20</b>	0.02	<b>0.25</b>	0.04	<b>0.20</b>	0.04	<b>0.13</b>	0.04
bad banker	<b>0.13</b>	0.02	<b>0.14</b>	0.04	<b>0.15</b>	0.04	<b>0.12</b>	0.03
naive banker	<b>0.09</b>	0.02	0.06	0.04	<b>0.10</b>	0.04	<b>0.08</b>	0.04
riskybanker	<b>0.04</b>	0.02	0.01	0.03	<b>0.06</b>	0.03	0.04	0.03
riavbanker	<b>0.19</b>	0.02	<b>0.19</b>	0.03	<b>0.18</b>	0.03	<b>0.18</b>	0.03
Human Capital	<b>-0.02</b>	0.01	-0.02	0.01	<b>-0.03</b>	0.01	0.00	0.01
2011, ref	0.00							
2012	0.02	0.01						
2013	-0.02	0.01						
Pseudo R2	0.04		0.05		0.05		0.05	
N	5374		1734		1826		1802	

The results show that a bad z-score where the banker agrees (called Zbanker down) increases the probability of a contraction of jobs and reduces the probability that a firm expands. This is the case for the combined analysis as it is the case in all three years. If the firm has a good z-score, but the firm reports financial difficulties (the bad banker situation) it is found that the firm is more likely to destroy jobs and less likely to create jobs.

The naïve banker who gives credit despite a bad z-score leads to a higher probability of contraction and a lower probability of expanding, so access to credit is apparently not the only factor that matters. The risky banker situation, where the banker gives credit despite of a z-score in the grey zone leads to a slightly increased contraction risk and a reduced likelihood of an expansion. Both probabilities are only significant in 2012. The risk averse banker (credit

denied, but z-core in grey zone) results in a contraction probability and reduced expansion probability close to a bad z-score.

The nature of marginal effects makes it possible to compare the coefficients across Table 10. Generally speaking, the effects of the explanatory factors are larger for contraction than for expansion. Furthermore, the coefficients show the re-assuring result that a bad z-score has the numerical largest coefficients. However, it is less reassuring that a bad banker has coefficients with around 2/3 of the size of the bad z-score. This means that a negative bank decision on a credit application may have devastating effects on job creation even if it does not seem to be justified by bad economic data for the firm. Similarly, being in the grey zone with respect to the z-score and having a risk averse banker is even worse for job creation than having a bad banker, though the relative order makes sense because this firm is in the grey area of the z-score, whereas the first was in the best class of z-scores. Finally, it should be mentioned that having a risky banker, which means a banker who gives credit despite a z-score in the grey zone, does not create jobs but has lower coefficients than the other cases. This means that a willing bank is not enough to create more jobs and avoid job destruction, but it helps. These direct effects may, however, be amplified over time by the effects from discouraged borrowers as pointed out by Ferrando and Mulier, 2015. They find that the investment growth for the average discouraged borrower is up to 4.7 percentage points lower than for the applying firm in the two years following the discouragement.

The other variables in the regression show that the human capital content measured as the average human capital content per employee in the firm has a general positive impact on the job creation and a similarly negative impact on job destruction. This means that firms with more HC are generally expanding more and contracting less than firms with less HC. Though not reported, it should be mentioned that larger firms tend to create more jobs in 2011 and 2012. This is contrary to results in Westergaard-Nielsen, 2015, where large firms generally destroy jobs for the period 1980-2011. The explanation is undoubtedly that larger firms have had better access to credit in the period following the deepest part of the Great Recession.



Part of the impact may however come via low demand. So in the next section we will investigate how credit constraints interact with demand side problems. We will do that in estimating the following model:

Prob(job creation in firm j)= f(credit constraints<sub>j</sub>\*demand problems<sub>j</sub>, μ<sub>t</sub>) and similarly

Prob(job destruction in firm j)= f(credit constraints<sub>j</sub>\*demand problems<sub>j</sub>, μ<sub>t</sub>).

We have estimated this in the same way as above but now including interaction terms together with and without level terms<sup>6</sup>.

Table 11. Estimations of the combined effect of demand and credit problems.

	Contracting			Expanding		
	Demand problems			Demand problems		
	None	marginal	severe	None	marginal	severe
zbankerup	ref	<b>0.13</b>	<b>0.28</b>	ref	<b>-0.13</b>	<b>-0.31</b>
zbankerdown	0.13	<b>0.22</b>	<b>0.38</b>	0.00	<b>-0.17</b>	<b>-0.39</b>
bad banker	0.00	<b>0.19</b>	<b>0.31</b>	0.02	<b>-0.15</b>	<b>-0.27</b>
naive banker	<b>0.10</b>	<b>0.14</b>	<b>0.37</b>	<b>-0.12</b>	<b>-0.15</b>	<b>-0.42</b>
risky banker	0.03	<b>0.15</b>	<b>0.31</b>	-0.03	<b>-0.18</b>	<b>-0.28</b>
risk averse banker	0.11	<b>0.23</b>	<b>0.35</b>	0.02	<b>-0.18</b>	<b>-0.30</b>
Pseudo R2	0.08			0.06		

Bold: significant at at least 5%-level

The estimates show that demand problems play a crucial role for the contraction and expansion of firms. Generally, severe demand problems are dominating any effect from the credit side. However, it is remarkable that firms with marginal demand problems are more likely to contract if they have a bank that gives them credit problems compared to a situation, where there were no credit problems and no or only marginal demand problems. Similarly for expansion.

We have also tried to estimate the two models as fixed effect models now assuming that it is meaningful to consider the firms as identical over the three years. This gives very few significant variables. One reason for that may be that firms are highly affected by access to credit and their market conditions, and that these factors in one year have a huge impact on the firm in the following years.

<sup>6</sup> The estimations show that the level terms are statistically similar, so we have only reported the estimates without levels

This means that there will be a complicated error structure between two years that are violating the conditions for the fixed effect estimation.

## Conclusion

This paper has on a large sample of firms showed that lack of credit has a negative effect on net job creation and increases job destruction. We have used financial information on the firms to calculate z-scores, which indicate the likelihood that a firm will go bankrupt within the next couple of years. These measures are based on the same type of information from the balance sheets as is available to the bank. Information from a survey of firms on the access to credit has been merged with the z-score information. This pairs the semi objective information from the z-scores with the actual behaviour of the bank and makes it possible to distinguish between bank created financial problems and problems arising from bad economic prospects. Regressions of net job creation and destruction shows that firms experiencing credit problems despite good economic prospects create fewer new jobs and destroy more jobs. It is also shown that firms with uncertain future are more likely to destroy fewer jobs when they have a bank, that is willing to give credit than with a negative bank .

Thus, results have been presented supporting that the banks individual evaluation of the borrowers has a significant impact on the overall job creation and destruction.

The paper is here in line with several other recent papers that show the impact of credit constraints. One paper points to a cumulative negative effect of having experienced a rejection of a loan application. We do not have any direct evidence for that but it is likely that it is also present in Denmark. Such an effect will make the effects identified in this paper even stronger.

The survey had also information on the perceived market situation of the firm. We have therefore tried to investigate if including this type of information mitigates the effect of banks creating credit problems to an extent that the latter effect disappears.

All in all, our results show that having a bank, which determines against the z-score is devastating for the job growth but a willing banker is not enough to turn

a company with relatively bad economic background into a job machine, which is completely as expected.

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