SME Recovery Following a Financial Crisis: Does Debt Overhang Matter?

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Abstract: The years before the financial crisis saw a dramatic build-up in private debt levels in several countries and this increase was particularly marked in Ireland. In this paper, we look at whether outstanding debt taken out by small and medium sized enterprises in Ireland constrains current performance. We find that the level of debt is generally associated with positive firm performance, facilitating growth and investment. Higher debt burdens (measured as the ratio of debt to turnover), on the other hand, have significant negative effects on all measures of firm performance, in particular investment, employment and indicators of financial distress.

Keywords: Financial crises; SMEs; Debt overhang; Recovery; Financial distress

JEL codes: D92; G01.

1. Introduction

Many causes have been put forward for the recent global financial crisis and preceding credit boom including lapses in financial regulation and supervision and financial innovation (Cihak et al., 2013; Kim et al., 2013; Masciandaro et al., 2013) as well as changes to credit standards for mortgage lending and the housing cycle. Regardless of the cause, one undisputed legacy is a large residual stock of outstanding corporate and household debt, in particular in severely hit economies in the European periphery such as Ireland and Spain. Recently, this large build-up in private debt in many European countries has led to expressions of concern that these debt levels may hamper economic growth and recovery on an on-going basis (Elmeskov and Sutherland, 2012; Brown and Lane, 2011). This in turn has led to discussion as to what the optimal level of financial deepening should be (Beck, 2014).

The existence of these large debt burdens raises questions as to whether such overhangs will materially restrict growth prospects as households and firms continue deleveraging. In this context, the impact of household leverage and indebtedness following financial crises has received attention in the literature (Barrell et al, 2006; Duca et al., 2010), with much less work done on the effect of corporate debt overhang following financial crises. Instead, many firm studies have focused on access to credit issues and the impact of new finance availability on investment and employment (Honkapohja, 2014; Holton et al., 2014; Gerlach-Kristen et al., 2014). Two noticeable exceptions are Davis and Stone (2004) who find that investment declines are highly correlated with the debt-to-equity ratio following financial crises and Őztűrk and Mrkaic (2014) who link the firm's ability to access new financing to higher funding costs and borrowers debt-to-assets ratio across Eurozone economies since the onset of the financial crisis.

To address this gap, our paper attempts to provide some evidence on the effect of debt overhang and debt sustainability on firm performance using a firm-level survey for Ireland since the recent financial crisis. We investigate how debt overhang affects the performance of micro, small-and medium-sized enterprises (SMEs) following a severe financial crisis. We measure debt overhang using a debt-to-turnover ratio and link this ratio to SME economic performance (investment and employment) as well as the degree to which SMEs face financial distress (loan adjustments, credit rejections, default, trade credit difficulties). We also link debt overhang to an index of financial distress which combines the aforementioned variables. In this vein, our work is linked to the research which measures financial distress and its interaction with credit volumes at the country level (Cevik et al., 2013; Cardarelli et al., 2011; Illing and Liu, 2006). To our knowledge, this is the first study that considers the effect of debt overhang on SME performance in a post-crisis setting. It is also the first study

to explore the relationship between debt overhang and financial distress for SMEs following a systemic financial crisis.

Our analysis for Ireland is an interesting case study given the scale of the financial crisis and the serious deterioration in the real economy that occurred in the crisis aftermath. Although the growth in house prices and associated increases in household indebtedness are the better known features of the Irish credit boom, borrowing by firms also increased at a rapid pace. Credit extended to Irish non-financial firms increased from slightly under €50 billion in 2003 to a peak of €175 billion in 2007, before falling back sharply as the financial crisis and recession hit. From 2003 to present, resident Irish NFCs have accounted for approximately 40 per cent of both NFC and household debt. The construction and real estate sector accounted for nearly 60 per cent of debt outstanding over this period. However, in Ireland, a large number of SMEs not in the construction sector also entered the property market with investments to chase expected property price appreciations and capital gains. This left many Irish SMEs with a potentially viable core business but carrying a property debt overhang (O'Toole et al, 2013; McCann, 2014; McIndoe-Calder and McCann, 2014). Exploring the effects of these increases in leverage on the post-crisis firm performance should provide important insights into the determinants of corporate recovery following financial crises.

Our research is further related to a number of literatures. Firstly it is linked to the research on the interaction between private debt balances and the real economy. Private debt stocks may affect economic performance through a number of avenues. For banks to reduce the size of their balance sheet to meet stricter capital ratios, they will have to either sell assets or reduce lending. This raises the possibility that even creditworthy borrowers may be at risk of rejection in their loan applications. On the demand side of the market, debt overhang can put pressure on the firms themselves to deleverage, thus decreasing the incentive to invest and reducing demand for credit. The potentially negative effect of outstanding debt on firm investment was first discussed by Myers (1977) and expanded in models such as Lamont (1995). Debt overhang reduces the incentive to invest as the proceeds of any profitable new venture could be appropriated by existing debt holders. This also reduces the incentive for lenders to extend new credit to a firm with considerable existing liabilities.

Despite this channel there has been little study of direct effects of outstanding debt levels and debt sustainability at firm level. While Holton, Lawless and McCann (2014) showed that links exist between firm credit constraints and aggregate private debt to GDP ratios and the cost of funding for governments and banks, they did not examine the effects of the debt stocks or debt sustainability of the firms themselves. Some evidence that debt overhang has negative consequences for investment decisions in larger listed firms has been found by Hennessy (2004). Due to data limitations, the Tobin's Q approach used by Hennessy is difficult to apply to small and medium enterprises (SMEs) as they are generally unlisted.

However, in the context of the financial crisis, it is the SME sector that has been the main focus of policy concern as these firms are considerably more reliant on banks as a source of funding than larger firms. Focusing again on listed enterprises, Aivazian et al. (2005) examine the impact of leverage on firms' investment activities on a sample of Canadian firms. They find that leverage has a negative effect on investment and the effect is greater for firms with lower growth opportunities (as measured by Tobin's Q). They state that the results support the agency theory of leverage which plays a disciplining role on leveraged firms.

Cai and Zhang (2011) use data on US listed firms and document a negative and significant effect of increased leverage ratios on firm performance (investment, default risk and stock performance). This research does not focus specifically on SMEs, in particular, following a financial crisis. Long-lasting effects of a credit crunch on firm investment were found following the Asian financial crisis of the late 1990s (Coulibaly and Millar, 2008, 2011). Moyen (2007) examines the debt overhang investment relationship in an analytical model accounting for debt maturity and flexible investment. The model calculates the loss in firm value that is incurred due to the lower investment undertaken by heavily indebted enterprises relative to low debt firms.

A number of other studies are related to our research. Coricelli, Driffield, Pal and Roland, (2010, 2012) find that having some debt has a positive effect on firm productivity as it facilitates investment but that excessive leverage has the opposite effect, increasing the likelihood of financial distress and hampering productivity. Costanzo. Silipo and Succurro (2013) find a similar type of relationship between indebtedness and innovation, with an initially positive effect of debt on ability to invest in innovative technologies turning negative if the firm becomes overleveraged.

Given this existing research, we make a number of contributions. This paper uses firm-level survey data to examine how debt overhang at the beginning of the survey period affected the subsequent performance of the firm. Our data contains mainly SMEs, which have not been studied in this context of debt overhang in the existing literature. Our measurement of indebtedness is also distinct from previous research that use the leverage ratio (debt-to-assets) as we focus on both the level of outstanding debt and the debt burden (measured as the ratio of debt to turnover). We then test the impact of the volume and burden of debt on employment changes and investment decisions of the firm, controlling for a range of other characteristics. To date no research has undertaken such an evaluation for SMEs following the recent financial crisis. Our research is the first to document how the incidence of debt overhang impacted different groups of SMEs during the recovery phase of a severe financial crisis.

Using a debt-to-turnover ratio is similar to the debt-to-income ratio used in the household finance literature (Dynan, 2012; Mian et al., 2011; 2012; 2013). Using such a measure is a departure from the corporate literature which mainly measures debt overhang using a debt-to-asset ratio. There are a number of reasons to believe that our measure is a more accurate in the context of financial crises. Firstly, firm assets are priced to book values on the balance sheet and this does not capture the potential valuation changes that may occur following excess volatility in real estate prices. Second, while debt to asset measures may capture firm solvency, the relative size of generated resources (turnover) relative to debt may provide a more accurate representation of the firm's liquidity position.

A number of findings emerge. Higher debt burdens, measured as the level of debt relative to turnover, have significant negative effects on all measures of firm performance. This suggests potential problems with debt sustainability and overstretching of earlier credit commitments have a material effect on the investment and employment growth of domestic SMEs. We also find that higher levels of debt-to-turnover are associated with higher credit constraints and default rates as well as higher levels of our financial distress index.

Across age groups an interesting pattern emerges. For all measures of firm performance (employment, investment and financial distress), we find that it is only firms who would have been in early to mid-life cycle prior to the crisis that are suffering the negative effects of debt overhang. The standard Berger and Udell (1998) lifecycle model of SME capital structure indicates that mid-life cycle enterprise are the most likely to increase leverage ratios as younger firms use external equity and more mature enterprises have a broader range of funding options available (Berger and Udell, 1998; Lawless et al., 2015).

Given the date of the surveys we use (2013-2014), our findings suggest that these enterprises would have been have been established between the years of 1994 and 2003 which is the period in which credit flows to the Irish economy increased substantially and credit standards loosened. These enterprises would have been in debt-growth phase (mid-later development stage as in Berger and Udell, 1998) during the lending boom and are the ones now suffering from the debt overhang. Older firms and post crisis start ups are not affected by the negative effects of debt overhang following the crisis, it is only enterprises who were in a growth phase of gearing up during the pre-crisis period of looser lending conditions that suffer severe debt overhang impacts post crisis.

We also find some other interesting patterns with the impact of debt overhang on performance being non-uniformly distributed across groups of firms. For employment growth, we find that the effects are higher micro firms with small and medium sized firms unaffected. The wholesale and retail sector is the most affected. For investment, the effects

are greatest for micro and medium-sized enterprises as well as enterprises in the hotels and other sectors. In summary, these results indicate that enterprises which are very reliant on the domestic economy or local domestic markets for sales are more likely to suffer from the impact of debt overhang in the post crisis period. These include micro enterprises, enterprises in the hotels sector and wholesale and retail. All of these enterprises would have mainly been reliance on non-traded, domestic growth which was the main driver of the pre crisis Irish economy. Given the declines in domestic demand in Ireland following the crisis were high relative to previous crisis episodes (O'Connell et al., 2013), it is unsurprising that sectors reliant on domestic sales are most affected.

The remainder of the paper is structured as follows: Section 2 outlines the data and summary statistics, Section 3 presents the empirical results on the effects of debt overhang on firm employment and investment and Section 4 concludes.

2. Data

In this research we use data from a credit supply and demand survey of Irish SMEs completed by the Irish government's Department of Finance. This survey has been undertaken on a six monthly basis since the crisis to provide an understanding of how firm access to finance and performance has developed. The questions included are similar to those of international surveys such as the ECB/EC SAFE survey and the EBRD/World Bank enterprise surveys. Information is collected on applications and success rates for bank and non-bank finance as well as a range of categorical information on firm size (indicators of firm size by employment category: Micro (0-9 employees), Small (10-49 employees), Medium (50-250 employees)), sector, performance (in terms of profitability and turnover), innovation activity (product, process and organisational), whether or not the firm is an exporter and financial capacities. Additional data is also collated on whether or not the firm has missed a loan repayment in the last size months, had a formal adjustment/arrangement made to their current loans, and whether or not the timing on their accounts receivable and payables changed.

The Irish economy since the 2008 financial crisis provides an interesting case study in which to test the effect of debt overhang on firm performance. In the period prior to 2007 Irish corporate balance sheets expanded significantly. With the onset of the banking crisis and its knock-on effects on the real economy, SMEs faced large reductions in demand for their goods and services (See O'Connell et al., 2012 for an overview of the development of the Irish domestic economy following the crisis). Coupled with the reduction in sales from the economic crisis, a reduction in real estate values of circa 50 percent (Kennedy and McQuinn, 2012) has caused considerable losses on property investments and reduced the value of available collateral. The concurrent impact of these factors has led to a position where many

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Irish SMEs are potentially carrying large debt overhangs. Our aim is to investigate the effect of the sustainability of these liabilities on firm economic performance and risk of financial distress.

To assess the effect of indebtedness on Irish SMEs, a special module was included to capture information on the total outstanding debt levels of SMEs and continuous information on turnover, employment and investment. The data is available for three survey waves in the periods: from October 2012 to March 2013, from April 2013 to September 2013 and October 2013 to March 2014. The outstanding debt data refers to total liabilities on the firm's balance sheet and cannot be separated by term structure or source as this data is unavailable in the survey. We therefore cannot split out trade credit or other debt sources from total liabilities. However, to provide some insight into the general funding of Irish enterprises, data from the Quarterly Financial Accounts indicates that on average over the period 2003-2014, loan term and short term loans including other debt securities accounted for approximately 40 per cent of NFC liabilities in Ireland, book equity accounted for 44 per cent of and trade credit accounted for 17 per cent.

In evaluating the effects of debt overhang on SME performance, it is firstly informative to review the distribution of debt holders across the sample. Table 1 provides an overview of the distribution of debt holders overall, by firm age categories, by firm size and by whether or not the firms undertake innovation or export. It also captures information on the total debt volumes and the average debt-to-turnover ratios for firms who indicate they have debt.

Table 1 Summary Statistics for Debt Data

	Have debt?	Mean LnDebt	Mean Debt-to-turnover
All firms	0.74	10.08	0.69
Less than five years	0.68	8.54	0.56
Between 5 and 10 years	0.77	10.27	0.72
Between 11 and 20 years	0.74	9.82	0.68
Greater than 20 years	0.74	10.32	0.71
Manuf.	0.77	10.71	0.72
Const & Real Estate	0.71	9.40	0.67
Wholesale and retail	0.75	10.12	0.69
Hotels	0.82	11.64	0.81
Micro	0.70	8.57	0.65
Small	0.77	10.75	0.72
Medium	0.76	11.64	0.73
Non-Exporter	0.72	10.03	0.70
Exporter	0.75	10.26	0.66
No Innovation	0.72	9.72	0.68
Innovation	0.76	10.40	0.70

About 74 percent of firms indicate that they have some financial debt on their balance sheet. Younger firms (less than five years of age) are the least likely to have financial debt at 68 percent while there is little variation across higher age categories. On the sectoral distribution of firm debt holding, the highest share of SMEs with formal debt is in the hotels sector, while the lowest is in construction and real estate. That the construction sector is the lowest may appear surprising given the scale of the property boom in Ireland. However, given that our data are collected nearly four years into the crisis, a large number of highly indebted construction firms have to date become insolvent and ceased trading. There is therefore a survivor bias in our cross-sectional data towards lower-debt construction firms.

Focusing on firm size, we consider three categories: micro (less than 10 employees), small (between 10 and 49 employees), and medium-sized firms (between 50 and 250 employees). Micro firms are less likely to have balance sheet debt while there does not appear to be differences between small and medium-sized firms. We also find that exporters appear to be more likely to have debt and also that firms that undertake innovation are more likely to be indebted. A clear pattern emerges with debt increasing with firm size. However, there does not appear to be any clear patterns across firm age: the highest volumes are reported for the oldest firm group (greater than 20 years of age). Debt volumes are highest in the hotels and manufacturing sectors. Debt levels are higher for exporting firms but no discernible difference is evident between innovative and non-innovative firms.[1]

Our main research question is to investigate whether debt overhang from the financial crisis is Ireland is affecting firms' economic performance and financial distress. To test this hypothesis, we use a debt-to-turnover ratio. In our data, the survey information is designed to cover the operations of the firm for the previous six months. However, for the debt data, we have information on the volume of debt measured at the beginning of the six month period. We use this as the numerator in our key ratio as including beginning period data should deal with issues relating to reverse causality in the period between debt and economic and financial performance.

Younger firms appear to have the lowest debt to turnover ratio. This is unsurprising in our data as, given this age category is measured as less than five years, the time period for the survey would indicate all these firms have been established since the financial crisis. It is

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[1] Innovative firms are defined as those that responded that they introduced new or substantially improved products or services over the preceding six-month period or made significant changes to their production or business process.

therefore unlikely that they have property legacy debt. These patterns are also consistent with the literature which considers the differential usage and balancing of debt and equity across SMEs lifecycle. This general research area highlights the fact that as firms transition between growth phases, leverage ratios increase as firms age due to both financing constraints for younger age groups and better access to a range of diversified debt financing activities for older enterprises (Berger and Udell, 1998; Chittenden et al., 1996; Sahlman, 1990; La Rocca et al., 2011). We explore this in our data by interacting the effects with firm age indicators to test whether there are differential patterns by firm age group.

Interestingly the debt to turnover ratio is higher for micro-firms than small firms. Medium-sized firms have the highest debt-to-turnover ratios. Splitting the data by sector, we find that the hotels sector has the highest debt to turnover ratio with construction firms second.

To model the effects of debt overhang on firm economic and financial performance, we use a range of variables as controls or outcome variables of interest which are presented in detail in the next section. We provide a brief overview and summary statistics for these variables. As the majority of the questions in our data are categorical, we develop a number of indicator variables to include in our empirical estimations. To capture the demand side of the firms operations and to control for borrower-specific profitability that may determine economic or financial performance, we include controls for whether or not the firm had increases in turnover "Turnover Up" in the past six months, whether or not they export, whether or not they undertook either product, process, organisational or marketing innovation, or posted a net profit or loss in the past six months.

Relating to the financial distress of SMEs, we use a range of indicators. We have information as to whether or not the firm was rejected a loan application in the six months prior to the survey information "Past rejection" as well as whether a loan application was rejected during the six month time frame of the survey ("Credit rejected"). Past rejection is used as a control in the employment and investment models while credit rejection is part of our assessment of financial distress. We include a measure of default which captures whether or not the firm missed a loan repayment in the last six months as well as a control for whether or not the firm received a formal bank adjustment on their outstanding debt balances. Additional controls for age, size and sector are included. Given the importance of trade credit to financing firms during financial crises, in particular in Ireland (Casey and O'Toole, 2014; Lawless et al., 2013), we also include a measure of if there has been an increase in the number of days taken to pay suppliers or to collect payments from customers.

The summary statistics that describe our sample and provide information on these variables are presented in Table . Additional summary statistics are presented in table A1 in Annex 1. The total sample size is approximately 3,744. The average values for the variables are also

split out for whether or not the firms report positive debt. We provide a simple t-test comparison of the mean values between firms that hold debt and those that do not.

Table 2 Summary Statistics For Main Variables

	(1) Overall Mean	(2) Mean if Debt = 0	(3) Mean if Debt > 0	(4) T-stat ((2) = (3))
Turnover up	0.33	0.32	0.34	-0.83
Export	0.20	0.21	0.19	1.32
Innovation	0.53	0.48	0.54	-3.16***
Profit	0.45	0.50	0.44	3.31***
Loss	0.21	0.18	0.23	-3.35***
Credit rejection	0.06	0.04	0.08	-3.74***
Past rejection	0.04	0.02	0.05	-3.74***
Receivable Days Increased	0.29	0.27	0.30	-1.59*
Payable Days Increased	0.16	0.09	0.18	-6.56***
Less than five years	0.05	0.07	0.05	2.24**
Between 5 and 10 years	0.13	0.12	0.14	-1.61
Between 11 and 20 years	0.28	0.28	0.28	0.34
Greater than 20 years	0.53	0.53	0.53	-0.20
Micro	0.40	0.45	0.38	4.26***
Small	0.39	0.35	0.40	-3.15***
Medium	0.21	0.20	0.22	-1.29
Manuf.	0.15	0.14	0.15	-1.38
Const & Real Estate	0.12	0.14	0.12	1.80*
Wholesale and retail	0.38	0.37	0.38	-0.33
Hotels	0.14	0.09	0.15	-4.54***

Source: Authors' analysis using Department of Finance survey data: N = 3,744

The composition of our sample is as follows: just under 40 percent of firms are micro enterprises, with a further 40 percent small and the final 20 percent medium-sized. Only 5 percent of the data are firms under 5 years of age, 13 percent are aged between 5 and 10 years, 28 percent between 11 and 20 years and over 50 percent are aged greater than 20 years. The highest sectoral representation is wholesale and retail covering 32 percent of the firms with hotels and construction the lowest on 11 percent.

On the financial distress variables, we observe that circa 6 percent of firms are credit constrained (rejections of formal loan applications). Nearly 45 percent of firms posted a profit while 21 percent posted losses. Over 29 percent of firms experienced an increase in the number of days that suppliers pay them for goods provided on credit while 16 percent of firms increased the number of days that they said they delayed payment to suppliers for. These indicators were significantly higher for firms holding debt compared to debt-free firms.

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While it provides insight to consider each of these distress indicators individually, we also calculate an index of financial distress, which is the simple sum of the binary indicators for each of the above factors: a) credit rejected b) loss making c) trade credit days increased d) missed a loan repayment e) received a loan adjustment. In this regard our research is complementary to the work that measures financial distress at an aggregate level (Cevik et al., 2013; Cardarelli et al., 2011; Illing and Liu, 2006). Due to a lack of observations, we cap the index at 4. This index should provide insight into the degree to which Irish SMEs are facing financial distress. Summary statistics for the index by firm characteristics is presented in Table .

The index values indicate that over 45 percent of Irish firms do not appear to suffer any financial distress as measured. The groups with the lowest share of firms facing financing constraints are micro firms, young firms (less than 5 years) and firms in the construction sector. In general less than 2 percent of Irish firms are captured at the highest point in the financial distress index.

Table 3 Financial Distress Index – Summary Statistics

| | Index Value (0 = no indication of stress, 4 = max) | | | | | |
	0	1	2	3	4	N
Overall	45.46	30.72	15.30	6.04	2.48	3744
Micro	42.83	31.72	16.30	6.40	2.76	1485
Small	44.05	30.63	16.17	6.61	2.55	1453
Medium	52.92	28.94	11.93	4.35	1.86	805
Age < 5	48.00	30.00	16.00	4.00	2.00	200
Age 5 -10	47.80	31.60	15.40	3.80	1.40	500
Age 11-20	47.90	29.01	13.74	6.30	3.05	1048
Age 20 +	43.36	31.43	16.04	6.67	2.51	1995
Manu	47.32	29.82	13.75	5.89	3.21	560
C & RE	41.18	31.37	16.34	8.50	2.61	459
W & R	45.50	31.18	16.16	5.03	2.13	1411
Hotels	45.40	27.59	17.22	7.24	2.54	511

Source: Authors' analysis using Department of Finance survey data

3.   Effects of Debt Overhang on Firm Performance

3.1 Specifications

The key focus of this paper is to examine the effects of outstanding debt burdens on the performance of firms, as measured by developments in firm-level employment, investment and financial distress. To measure employment performance, we an indicator variable describing if employment has increased, decreased or remained unchanged over the previous six month period. For investment, we use two measures: we first use a binary variable to indicate if the firm has invested in a fixed asset in the previous six months and secondly examine the level of investment spending. To test the effects of debt overhang on financial distress we estimate equations both for the overall financial distress index and separate models for each of the subcomponents. The different specifications and corresponding econometric approaches appropriate to each dependent variable are discussed in more detail below.

In the first specification, we examine if debt overhang has a relationship with changes in firm employment in the current period. Although we do not have panel data to calculate exact changes in the number of workers, respondents to the survey are asked whether in the last six months they increased, maintained or decreased employment levels. Given the categorical nature of the three-point scale of the dependent variable, designated $EmpChange_i$, we estimate the following equation using an ordered probit regression:

$$EmpChange_i = \alpha + \phi Debt_i^{lag} + \omega Burden_i + \beta X_i + \varepsilon_i$$

Where $LnDebt_i^{lag}$ is the log of the outstanding debt of the firm at the start of the period, $Burden_i$ is the debt burden relative to the turnover of the firm and X_i is a vector of other firm controls, which will be described in the next subsection.

Following employment changes, the second aspect of firm performance that we want to investigate is current investment decisions, where outstanding debt burdens could be expected to prove an obstacle.   Firms were asked if they purchased any fixed assets in the previous six months, and if they did were further asked what their total expenditure was on these assets. This allows us to identify whether or not a firm actually purchased capital assets and the level of such investment. We look separately at these two elements to examine if debt burdens are having an effect on investment and, if they do, if these effects are operating at the intensive margin by preventing investment or at the extensive margin by reducing investment expenditures.

We model the probability that a firm decides to invest using a dummy variable $InvestDum_i$ which takes a value of 1 if the firm is observed to have positive investment spending over the period and zero otherwise:

$$InvestDum_i = \begin{cases} 1 \ if \ I_i^* > 0 \\ 0 \ if \ I_i^* \leq 0 \end{cases}$$

We then run a probit regression with the investment dummy as our dependent variable, controlling for debt levels, debt burden and other firm characteristics:

$$InvestDummy_i = \alpha + \ \phi Debt_i^{lag} + \ \omega Burden_i + \ \beta X_i + \varepsilon_i$$

Our final specification models the investment level as a function of the debt and firm characteristics as in the other specifications. Given that investment spending is only observed when an investment decision is taken (and we cannot observe any disinvestment by the firm through asset sales or amount of depreciation), this variable is censored at zero. To control for this censoring, we use a Tobit regression with robust standard errors to estimate the investment expenditure:

$$Investment_i = \alpha + \ \phi Debt_i^{lag} + \ \omega Burden_i + \ \beta X_i + \varepsilon_i$$

The final set of specifications examines the link between the debt-to-turnover ratio and the indicators of financial distress discussed earlier. As the data is from a cross-sectional survey, we cannot directly measure if debt overhang is resulting in firm failure. However, the tests of the effect of debt overhang on these other measures of firm financial health should give some useful indications of the extent to which debt is causing difficulties for firms. The specification for each of the indicators of financial difficulties is a probit model for the binary indicator and, in addition, a combined index which will be modelled both using a multinomial logit specification and an ordered count specification:

$$Distress_i = \alpha + \ \phi Debt_i^{lag} + \ \omega Burden_i + \ \beta X_i + \varepsilon_i$$

Where *Distress* is proxied by a) firms that had a credit application rejected b) firms that default c) firms that increase the time to pay accounts outstanding, d) firms that experience increases in the time to receive payment and e) firms that receive a loan adjustment. The index of financial distress is the simple sum of the binary indicators for each of the factors. The explanatory variables for each of the specifications are outlined in the next section.

3.2 Explanatory Variables

Our main variables of interest, in terms of their effects on the employment and investment performance of the firm as well as financial distress, are the outstanding stock of debt and debt burden. We use the log of the debt of the firm at the beginning of the six month survey

period as our debt variable. As noted, using the beginning period values should deal with any reverse causality that runs from debt to economic/financial outcomes within the period. Unfortunately, due to the cross-sectional nature of the data we have not been able to use an explicit methodology to control for endogeneity that arises from omitted variables. However, including a large range of firm and other controls should mitigate this effect somewhat. The impact of the debt value variable on firm performance is ambiguous as the firm may have taken out this debt to finance expansion and to take advantage of business opportunities that have facilitated growth. On the other hand, if the firm took on excessive debt during the credit boom period, this could hamper current performance. The level of debt therefore does not have an obvious relationship with firm performance.

The extent to which the firm's debt can be regarded as a burden or at levels that may be unsustainable is better captured by comparing the stock of debt to the current turnover of the firm. We use this debt-to-income ratio as a measure of the extent to which the firm can service its debt obligations and hence to estimate more accurately if the firm is being constrained in its current performance by historic credit overhang. We will discuss some alternative measures as robustness checks later in the paper.

We include a range of other firm characteristics as controls. Firm age group indicators are included to control for differences in lifecycle growth stages and also to capture to some extent prior bank credit access. Berger and Udell (1998) discuss how firm financing options vary over the life cycle with younger firms less likely to be in a position to have taken out bank credit due to information asymmetries in the banking system. For the specifications on firm investment, we include categories of firm size as an additional control. Our reference category is micro firms (i.e. those with fewer than 10 employees) and we report the effects of firms being in the small category (between 10 and 50 employees) and of being in the medium category (between 50 and 250 employees). As the survey specifically targets SMEs, there are no large firms in the data we use.

In the employment regressions, we do not include size categories based on the number of employees due to reverse causality concerns. Instead, we use categories based on turnover instead. Higher turnover firms should be in a stronger position to take on and service higher levels of debt. We include a categorical variable for the turnover of the firm where the reference group is firms with turnover of less than €2 million and the reported categories are firms with between €2 million and €20 million, and firms with between €20 million and €50 million in turnover. We also include a dummy variable which is equal to 1 if the firm has experienced an increase in its turnover in the past six months. Further controlling for firm performance is a dummy variable equal to 1 if the firm has seen an increase in its profits over the same period.

The firm's growth opportunities are further controlled for by including its export status and current innovation processes. The exporter variable is a dummy variable equal to 1 if the firm had any foreign sales in the past six months and equal to 0 if all sales were to the domestic market. The innovation dummy is equal to 1 if the firm responded that it had introduced any new (or significantly improved) products or services or had developed any new methods of production or major changes in business practices over the six month period referred to by the survey.

Financial pressure on the firm is proxied by a repayment problem variable, which is defined as the firm having missed any payment on its loans in the survey period. We would expect this to be negatively related to the growth performance of the firm and to reduce the likelihood that they would be able to purchase new assets if this relied on credit availability. This variable is not included in the financial distress regressions as it forms part of the index. Finally, as mentioned in the previous section, we include a dummy variable for whether or not the firm was rejected for credit in the period prior to the survey wave to capture the effect of past rejections on current performance.

4.   Results

This section discusses the results of our various specifications for the effect of debt burdens on the employment and investment performance of SMEs following a financial crisis. We also look at how debt affects the probability of the firm encountering a range of indicators of financial distress. Linking debt overhang to firm performance is important in developing our understanding of the recovery paths for corporates following systemic financial crises.

4.1 Debt overhang and employment

Table 4 presents the baseline estimates for the ordered probit for a change in employment over the previous six months. The first column presents the results for the full sample while columns 2, 3 and 4 present the results of separate regressions for micro, small and medium-sized enterprises respectively. Employment is linked to our indicator of financial distress, the debt to turnover ratio, and a range of other covariates. Focusing on our main indicator of cyclical fragility, debt-to-turnover (D/Y), the estimations indicate a significant negative impact on firm employment growth. This holds overall and for small and medium-sized enterprises. The negative consequences of debt overhang can be clearly seen: the presence of excessive debt relative to the scale of the firm's operations has a hampering effect on employment growth.

The outstanding debt stock of the firm at the beginning of the period is found to have a positive and significant association with the probability of unchanged or increasing employment over the survey reference period. It may also be the case that larger firms are more likely to increase employment and the volume of debt is highly correlated with firm size. We find evidence therefore that higher debt does not necessarily generate a drag on firm performance but rather can facilitate firm growth. The level of debt itself is not a good indicator of the affordability of that debt or of financial pressure at the firm.

Table 2 Modelling the Effect of Debt Sustainability on *Employment* – Marginal Effects

	All Firms	Micro	Small	Medium
	(1)	(2)	(3)	(4)
Age 5- 10	0.017	0.069	-0.33	-0.027
	(0.126)	(0.161)	(0.281)	(0.444)
Age 11-20	-0.074	-0.018	-0.269	-0.449
	(0.118)	(0.15)	(0.272)	(0.408)
Age 20 +	-0.107	-0.094	-0.223	-0.534
	(0.114)	(0.146)	(0.268)	(0.387)
Const and RE	-0.055	-0.096	0.18	-0.445*
	(0.105)	(0.152)	(0.189)	(0.259)
Wholesale & Retail	-0.068	-0.062	-0.089	-0.14
	(0.085)	(0.131)	(0.146)	(0.179)
Hotels	-0.186*	-0.339**	0.043	-0.246
	(0.11)	(0.165)	(0.179)	(0.287)
Prof. Services	0.049	-0.03	0.288	0.041
	(0.097)	(0.14)	(0.199)	(0.259)
Other	-0.032	0.087	-0.006	-0.379
	(0.131)	(0.19)	(0.217)	(0.278)
Increase Turnover	0.722***	0.728***	0.665***	0.785***
	(0.058)	(0.085)	(0.100)	(0.140)
Exporter	0.053	0.026	0.116	-0.046
	(0.072)	(0.119)	(0.113)	(0.151)
Innovation	-0.049	0.022	-0.036	-0.275**
	(0.05)	(0.07)	(0.09)	(0.125)
Profit Increased	0.563***	0.512***	0.639***	0.691***
	(0.055	(0.076)	(0.097)	(0.147)
Default	-0.180*	-0.224*	-0.154	0.169
	(0.092	(0.121)	(0.175)	(0.282)
Credit Rejected	-0.219*	-0.507***	0.094	0.379*
	(0.124)	(0.180)	(0.185)	(0.225)
Log Debt t-1	0.045**	0.035	0.261**	0.338**
	(0.02	(0.028)	(0.127)	(0.171)
D/Y	-0.548*	-0.425	-3.771*	-5.567*
	(0.282)	(0.360)	(1.948)	(2.869)
N	2,401	1,329	710	362

Looking at the other firm characteristics, we do not find a significant relationship between firm age and changes in employment. An increase in turnover is positively and significantly related to the likelihood of the firm expanding its workforce as one would expect. No relationship is found between these broad sector indicators and employment growth except

the hotels sector which has a negative coefficient. This is a sector which has been badly hit by reductions in demand since the onset of the Irish crisis so this coefficient is not unexpected.

To provide additional granularity across firm groups, we run regressions on each sector in the data set and on four age groups of enterprises. The results are presented in Tables 5 and 6. Running the regressions on each subsample allows all control variables to have separate influences on the employment growth variable as well as giving each size group a sector or age group specific constant. Focusing first on the sector splits in Table 5, the baseline results showed a strong negative effect of debt burden on the probability of an employment change for the wholesale and retail sector. This sector experienced huge capacity expansion and property-based lending in the Irish boom and has been exposed to the falls in domestic demand that have accompanied the Irish crisis (O'Connell et al., 2013).

Table 3 Modelling the Effect of Debt Sustainability on *Employment by Sector* – Marginal Effects

	Manufacturing	Construction	Hotels	Wholesale and Retail	Other
Increase Turnover	0.680***	0.800***	0.703***	0.825***	0.595***
	(0.128)	(0.166)	(0.100)	(0.163)	(0.139)
Exporter	-0.052	0.009	0.047	0.467**	0.071
	(0.126)	(0.214)	(0.121)	(0.230)	(0.198)
Innovation	-0.033	-0.095	-0.091	-0.098	0.083
	(0.121)	(0.140)	(0.082)	(0.135)	(0.117)
Profit Increased	0.357***	0.903***	0.652***	0.504***	0.526***
	(0.135)	(0.171)	(0.094)	(0.144)	(0.124)
Default	0.041	-0.140	-0.160	-0.145	-0.415**
	(0.248)	(0.244)	(0.153)	(0.243)	(0.201)
Credit Rejected	-0.210	0.008	-0.185	-0.521	-0.155
	(0.220)	(0.310)	(0.179)	(0.378)	(0.332)
Log Debt t-1	0.092	-0.007	0.051	0.141**	0.013
	(0.064)	(0.041)	(0.035)	(0.066)	(0.048)
D/Y	-1.140	0.170	-0.739	-1.675*	-0.100
	(0.946)	(0.497)	(0.480)	(0.866)	(0.692)
N	376	311	901	385	428
Age controls	Yes	Yes	Yes	Yes	Yes
Size controls	Yes	Yes	Yes	Yes	Yes

Table 6 presents the regression results including the marginal effects for each age group. In all regressions, size and sector controls are included but are omitted from the table for brevity. The only enterprises by age that displays a negative and significant relationship between the debt to turnover ratio and employment growth are SMEs between the ages of 11 and 20. Given the date of the survey, these enterprises would have been have been established between the years of 1994 and 2003 which is the period in which credit flows to the Irish economy increased substantially. These are the enterprises that would have been in debt-growth/gearing phase (mid-later development stage as in Berger and Udell, 1998) during the lending boom and are the ones now suffering from the debt overhang. This is an insightful finding and can be linked to the literature on firm debt usage across the lifecycle

(Berger and Udell, 1998; Lawless et al, 2015). Older firms and post crisis start-ups are not affected debt overhang following the crisis.

Table 4 Modelling the Effect of Debt Sustainability on _Employment by Sector_ – Marginal Effects

	Age <5	Age 5- 10	Age 11-20	Age 20 +
Increase Turnover	0.842***	0.689***	0.715***	0.738***
	(0.260)	(0.149)	(0.112)	(0.083)
Exporter	-0.074	0.186	-0.167	0.130
	(0.466)	(0.234)	(0.137)	(0.094)
Innovation	0.484*	0.017	-0.122	-0.075
	(0.272)	(0.139)	(0.097)	(0.068)
Profit Increased	0.665***	0.424***	0.497***	0.625***
	(0.226)	(0.151)	(0.103)	(0.076)
Default	0.116	-0.265	-0.410**	-0.039
	(0.430)	(0.297)	(0.174)	(0.119)
Credit Rejected	0.171	-0.868*	-0.722***	0.054
	(0.646)	(0.483)	(0.249)	(0.147)
Log Debt t-1	-0.037	0.003	0.114***	0.040
	(0.098)	(0.050)	(0.043)	(0.027)
D/Y	1.023	0.106	-1.366**	-0.594
	(1.286)	(0.688)	(0.588)	(0.379)
N	124	313	668	1,296
Size dummies	Yes	Yes	Yes	Yes
Sector controls	Yes	Yes	Yes	Yes

4.2 Debt overhang and investment

This section presents the results of the investment specifications. Our focus is on identifying the impact of SME debt burdens following a financial crisis on the probability to invest (modelled using a probit approach) as well as the volume of investment (applying a tobit model). The results of both models for all firms and for micro, small and medium-sized enterprises are presented in Table 7.

Similar to the results for the employment model, we find a negative effect of the debt to turnover effect on both the probability of investment as well as the level of investment for all enterprises and for micro-sized enterprises. There is also a negative effect in the levels model for medium-sized enterprises. This suggests that the debt burden is limiting the propensity to invest for the smallest enterprises. As we do not have more detailed information on the investment opportunities of the firm in terms of their risk or return potential, it would be overly strong to interpret this negative coefficient on debt-to-income as preventing the firm from being able to take advantage of growth opportunities but it does give an indication that previous credit build-up can restrict the current options open to the firm.

Table 5 Effect of Debt Sustainability on *Investment Propensity and Level of Investment* – Marginal Effects

	Probit Model (Propensity)				Tobit Model (Level Eq)			
	All Firms	Micro	Small	Medium	All Firms	Micro	Small	Medium
Small	0.097***				3.830***			
	(0.023)				(0.861)			
Medium	0.330***				10.821***			
	(0.034)				(1.018)			
Const and RE	-0.032	0.057	-0.040	-0.166*	-1.008	3.597	-1.491	-3.440*
	(0.035)	(0.055)	(0.055)	(0.089)	(1.192)	(3.525)	(1.940)	(1.790)
Wholesale & Retail	-0.073***	-0.031	-0.040	-0.149**	-2.473***	-2.083	-1.523	-3.068**
	(0.027)	(0.044)	(0.043)	(0.064)	(0.880)	(3.139)	(1.448)	(1.196)
Hotels	-0.082**	-0.055	-0.056	-0.151**	-3.021**	-4.744	-2.450	-3.454**
	(0.035)	(0.057)	(0.058)	(0.077)	(1.195)	(4.771)	(2.094)	(1.508)
Prof. Services	0.015	0.076	0.030	-0.143*	0.124	4.017	0.280	-3.076**
	(0.034)	(0.050)	(0.059)	(0.078)	(1.051)	(3.197)	(1.860)	(1.498)
Other	0.040	0.044	0.078	-0.011	1.114	2.257	2.150	-0.010
	(0.044)	(0.089)	(0.069)	(0.087)	(1.256)	(5.214)	(2.076)	(1.617)
Increase Turnover	0.042**	0.072**	0.030	0.037	1.518**	4.382***	1.148	0.845
	(0.019)	(0.029)	(0.032)	(0.043)	(0.623)	(1.653)	(1.075)	(0.841)
Exporter	0.081***	-0.002	0.108***	0.089*	2.609***	0.299	3.614***	1.812*
	(0.024)	(0.040)	(0.038)	(0.053)	(0.738)	(2.719)	(1.165)	(1.008)
Innovation	0.089***	0.031	0.144***	0.095**	3.108***	1.829	5.139***	2.193***
	(0.017)	(0.024)	(0.029)	(0.042)	(0.601)	(1.551)	(1.017)	(0.839)
Profit Increased	0.071***	0.060**	0.068**	0.072	2.268***	3.302**	2.284**	1.510*
	(0.019)	(0.026)	(0.031)	(0.045)	(0.627)	(1.556)	(1.055)	(0.906)
Default	-0.040	-0.012	-0.025	-0.215**	-1.589	-0.836	-1.179	-5.107**
	(0.036)	(0.042)	(0.060)	(0.103)	(1.403)	(2.959)	(2.190)	(2.517)
Credit Rejected	-0.048	-0.010	-0.144**	0.122	-1.216	0.436	-5.242	2.255
	(0.045)	(0.060)	(0.063)	(0.110)	(1.816)	(4.380)	(3.364)	(2.319)
Log Debt t-1	0.026***	0.031***	0.025	0.032	1.015***	2.193***	0.975	0.772
	(0.009)	(0.011)	(0.019)	(0.023)	(0.301)	(0.747)	(0.693)	(0.494)
D/Y	-0.425***	-0.465***	-0.411	-0.543	-16.291***	-31.760***	-15.699	-13.020*
	(0.124)	(0.146)	(0.284)	(0.360)	(4.419)	(9.627)	(10.291)	(7.840)
N	2,401	901	954	546	2401	901	954	546
Age controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Size	Yes	No	No	No	Yes	No	No	Yes

The existing debt stock of the firm is found to actually have a positive, statistically significant, effect on the decision to invest in new fixed assets for all firms and micro enterprises. Other firm characteristics positively associated with investment occurring and its level are the size of the firm, with small and medium firms more likely to invest. Exporters and firms with increased profits in the survey period are also more likely to invest. In contrast to our finding for employment growth, innovation activity has a strong positive coefficient showing a stronger link existing between innovation and capital expenditures than with employment changes.

Table 8 presents the results of the probit model of investment propensity across firm sectors. Focusing on the debt to turnover indicator, there is a negative and significant impact on the probability of investment for the hotels sector and for the other sectors. In particular, the hotels sector in Ireland underwent major leverage funded expansion during the credit

boom. It is unsurprising that debt overhang has a negative impact on the probability of investing in new capital for this sector.

Table 6 Modelling the Effect of Debt Sustainability on _Investment Propensity by Sector_ – Probit Marginal Effects

	Manufacturing	Construction	Hotels	Wholesale and Retail	Other
Increase Turnover	-0.011	-0.017	0.105***	0.076	0.003
	(0.048)	(0.052)	(0.032)	(0.051)	(0.048)
Exporter	0.175***	-0.081	0.106***	0.042	0.181**
	(0.053)	(0.067)	(0.037)	(0.070)	(0.072)
Innovation	0.134***	0.108**	0.091***	0.060	0.122***
	(0.047)	(0.049)	(0.027)	(0.046)	(0.043)
Profit Increased	0.062	0.086	0.078***	0.071	0.107**
	(0.050)	(0.055)	(0.029)	(0.048)	(0.048)
Default	-0.107	0.014	-0.044	-0.086	-0.088
	(0.098)	(0.100)	(0.055)	(0.088)	(0.075)
Credit Rejected	-0.257***	-0.081	0.098	-0.200**	-0.063
	(0.092)	(0.094)	(0.085)	(0.097)	(0.094)
Log Debt t-1	-0.014	0.002	0.035**	0.016	0.077***
	(0.025)	(0.021)	(0.016)	(0.023)	(0.029)
D/Y	0.172	-0.098	-0.537**	-0.312	-1.119***
	(0.361)	(0.297)	(0.243)	(0.311)	(0.429)
N	376	311	901	385	428
Size controls	Yes	Yes	Yes	Yes	Yes
Age controls	Yes	Yes	Yes	Yes	Yes

The effects for the investment levels model are presented in Table 9 and are consistent with the probit model findings.

Table 7 Modelling the Effect of Debt Sustainability on _Investment Level by Sector_ – Probit Marginal Effects

	Manufacturing	Construction	Hotels	Prof. Services	Other
Increase Turnover	-0.595	-0.833	4.241***	2.147	0.243
	(1.247)	(2.136)	(1.216)	(1.457)	(1.431)
Exporter	4.827***	-3.539	4.269***	1.322	4.471***
	(1.433)	(3.191)	(1.295)	(1.872)	(1.672)
Innovation	3.626***	4.088**	4.106***	1.825	3.728***
	(1.261)	(1.948)	(1.176)	(1.393)	(1.297)
Profit Increased	1.480	3.137	3.292***	2.074	3.220**
	(1.352)	(2.095)	(1.210)	(1.471)	(1.431)
Default	-3.258	-0.266	-2.093	-2.922	-3.152
	(3.175)	(4.218)	(2.725)	(3.345)	(2.651)
Credit Rejected	-8.612**	-3.509	5.214	-7.401	-1.878
	(3.956)	(4.794)	(3.463)	(5.663)	(3.099)
Log Debt t-1	-0.124	0.003	1.602**	0.527	2.797***
	(0.687)	(0.912)	(0.730)	(0.642)	(0.923)
D/Y	1.373	-2.951	-24.522**	-9.940	-40.189***
	(10.512)	(12.947)	(10.862)	(8.982)	(13.920)
N	376	311	901	385	428
Size controls	Yes	Yes	Yes	Yes	Yes
Age controls	Yes	Yes	Yes	Yes	Yes

Table 9 presents the impact of debt to turnover on the propability of investment and on the level of investment by age. As was the case with the employment effects, enterprises aged 11-20 are found to display a negative relationship between investment and debt overhang in both the probit and tobit models. A negative and signficant relationship is also identified for enterprises aged 5-10. As noted earlier, these enterprise age groups are those which would have been in the scaling phase during the boom years and took on high leverage levels. The youngest and oldest enterprises appear unaffected.

Table 8 Modelling the Effect of Debt Sustainability on _Investment by Age_ – Marginal Effects

	Probit Model (Propensity)				Tobit Model (Level Eq)			
	Age <5	Age 5- 10	Age 11-20	Age 20 +	Age <5	Age 5- 10	Age 11-20	Age 20 +
Increase								
Turnover	0.021	0.042	0.054	0.052*	0.261	1.623	1.894	1.795**
	(0.078)	(0.051)	(0.037)	(0.027)	(2.455)	(1.725)	(1.250)	(0.869)
Exporter	0.122	0.060	0.121**	0.089***	2.964	1.658	3.958***	2.980***
	(0.136)	(0.076)	(0.047)	(0.033)	(3.503)	(2.290)	(1.434)	(0.996)
Innovation	0.213***	0.100**	0.061*	0.104***	7.587***	3.607**	2.365*	3.488***
	(0.080)	(0.048)	(0.034)	(0.024)	(2.684)	(1.726)	(1.251)	(0.814)
Profit								
Increased	0.054	0.050	0.127***	0.069***	1.978	1.797	4.263***	2.180**
	(0.087)	(0.051)	(0.036)	(0.026)	(2.689)	(1.832)	(1.247)	(0.850)
Default	-0.036	-0.015	-0.044	-0.060	-1.444	-0.259	-2.136	-2.432
	(0.162)	(0.112)	(0.065)	(0.049)	(6.036)	(4.263)	(2.619)	(1.960)
Credit								
Rejected	-0.151	-0.074	-0.037	-0.048	-5.054	-3.515	-1.284	-0.989
	(0.145)	(0.183)	(0.081)	(0.061)	(6.858)	(7.604)	(3.467)	(2.422)
Log Debt t-1	0.004	0.046*	0.048***	0.010	0.267	1.663*	1.681**	0.607
	(0.042)	(0.025)	(0.018)	(0.014)	(1.363)	(0.894)	(0.673)	(0.522)
D/Y	-0.099	-0.656*	-0.628**	-0.237	-4.696	-23.818*	-21.672**	-11.643
	(0.564)	(0.361)	(0.255)	(0.212)	(18.579)	(13.001)	(9.757)	(7.869)
N	124	313	668	1,296	124	313	668	1,296
Size controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector ctrls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

4.3 Debt overhang and financial distress

The final set of results show the effects of debt-to-turnover ratios on the likelihood of a firm experiencing various indicators of financial difficulties. Table 11 shows probit regressions for each of the indicators individually: a) firms that had a credit application rejected b) firms that default c) firms that increase the time to pay accounts outstanding, d) firms that experience increases in the time to receive payment and e) firms that receive a loan adjustment. The debt-to-turnover ratio is a significant factor in increasing the probability of having new credit applications rejected and increasing the probability of missing debt payments. It does not, however, have a significant effect on the cash flow or loan adjustment measures.

Table 9 Financial Performance and Debt Sustainability

	Rejected	Default	Payables Inc.	Receivables Inc	Loan Adjust.
Small	0.013	-0.051***	0.032*	0.051**	-0.033**
	(0.013)	(0.016)	(0.018)	(0.023)	(0.016)
Medium	-0.027*	-0.078***	0.014	0.010	-0.055***
	(0.014)	(0.017)	(0.024)	(0.031)	(0.020)
Const and RE	-0.003	0.018	-0.024	0.065*	0.030
	(0.019)	(0.020)	(0.029)	(0.038)	(0.023)
Wholesale & Retail	-0.014	-0.005	-0.026	-0.015	0.006
	(0.016)	(0.015)	(0.024)	(0.030)	(0.017)
Hotels	0.033	0.066***	-0.020	-0.198***	0.076***
	(0.024)	(0.025)	(0.030)	(0.032)	(0.027)
Prof. Services	-0.003	0.019	-0.006	0.119***	0.017
	(0.019)	(0.019)	(0.030)	(0.037)	(0.022)
Other	-0.011	-0.021	-0.017	-0.036	0.012
	(0.024)	(0.022)	(0.037)	(0.046)	(0.029)
Increase Turnover	-0.007	-0.031***	-0.038**	-0.040**	-0.020
	(0.011)	(0.010)	(0.016)	(0.020)	(0.013)
Exporter	0.011	0.037**	-0.032*	-0.011	-0.004
	(0.015)	(0.018)	(0.019)	(0.025)	(0.017)
Innovation	0.025**	0.018*	0.054***	0.028	0.049***
	(0.010)	(0.010)	(0.014)	(0.019)	(0.012)
Profit Increased	-0.029***	-0.026**	-0.118***	-0.047**	-0.037***
	(0.011)	(0.011)	(0.015)	(0.020)	(0.013)
Log Debt t-1	-0.003	0.001	0.002	-0.003	0.005
	(0.003)	(0.004)	(0.005)	(0.007)	(0.004)
D/Y	0.083*	0.116**	0.063	0.074	0.083
	(0.046)	(0.047)	(0.068)	(0.102)	(0.053)
N	2,401	2,401	2,401	2,401	2,401
Age controls	Yes	Yes	Yes	Yes	Yes

Similar to with the results on employment changes and investment, the level of debt is not a statistically significant factor in explaining credit rejections, default or payment problems. This is unsurprising as its debt fragility must be evaluated relative to the firms' turnover, assets or profitability as these are relevant for the enterprises repayment capacity. The only indicator of financial difficulties where the probability increases with the level of debt is that of an adjustment in the loan arrangement.

Looking at the relationships between other firm characteristics and the indicators of financial difficulty, we see that dummies for small and medium-sized firms have negative and significant coefficients in the regressions for default and loan adjustments, meaning that micro firms are the most likely to experience these outcomes. Innovative enterprises appear to be more likely to be credit constrained, face increases in days payable and to have loan adjustments.

Combining the different indicators of financial difficulty into a single index, Table 12 reports the results of an ordered probit on the index as a whole. We have a similar result to that from our examination of the indicators individually, with the debt-to-turnover ratio having a significant effect on increases in the number of financial difficulty indicators a firm

experiences. There is a positive and statistically significant effect identified for all firms, micro firms and for medium-sized enterprises. The results are significant at the 1 per cent level. This indicates that as the debt burden is higher across firms in a post crisis setting, SMEs are more likely to suffer the symptoms of financial distress.

Table 10 Determinants of Financial Distress (Ordered Probit)

	All Firms	Micro	Small	Medium
Const and RE	0.256	-0.374	0.309	1.229***
	(0.158)	(0.267)	(0.240)	(0.380)
Wholesale & Retail	-0.046	-0.633***	0.079	0.889***
	(0.128)	(0.227)	(0.185)	(0.284)
Hotels	0.083	-0.242	0.206	0.740**
	(0.168)	(0.333)	(0.245)	(0.361)
Prof. Services	0.311**	-0.069	0.170	0.359
	(0.156)	(0.259)	(0.250)	(0.380)
Other	-0.087	-1.230***	-0.059	0.917**
	(0.218)	(0.448)	(0.305)	(0.440)
Increase Turnover	-0.396***	-0.457***	-0.396***	-0.168
	(0.090)	(0.158)	(0.138)	(0.184)
Exporter	0.125	-0.077	0.097	0.559**
	(0.111)	(0.254)	(0.151)	(0.243)
Innovation	0.358***	0.407***	0.358***	0.446**
	(0.082)	(0.132)	(0.129)	(0.191)
Profit Increased	-1.243***	-0.922***	-1.428***	-1.811***
	(0.087)	(0.149)	(0.134)	(0.192)
Log Debt t-1	-0.065*	-0.077	0.045	-0.208**
	(0.039)	(0.061)	(0.031)	(0.083)
D/Y	1.665***	2.161***	-0.104	3.771***
	(0.559)	(0.789)	(0.429)	(1.315)
N	2,401	901	954	546
Age controls	Yes	Yes	Yes	Yes
Size controls	Yes	Yes	Yes	Yes

Table 13 presents the ordered probit regressions by sector. We find a positive and significant effect of debt to turnover for the wholesale and retail sector as well as for the manufacturing sector. The employment regressions presented in Table 6 also identify a negative influence of debt overhang relative to turnover on the wholesale and retail sector suggesting this sector has been particularly hard hit since the onset of the financial crisis.

Table 11 Financial Distress by Sector (Ordered Probit)

	Manufacturing	Construction	Hotels	Wholesale and Retail	Other
Increase Turnover	-0.456**	-0.851***	-0.270*	-0.320	-0.367*
	(0.225)	(0.271)	(0.153)	(0.226)	(0.213)
Exporter	-0.346	0.237	0.385**	0.547*	-0.279
	(0.231)	(0.393)	(0.168)	(0.326)	(0.357)
Innovation	0.630***	0.718***	0.334**	0.236	0.281
	(0.222)	(0.226)	(0.133)	(0.211)	(0.202)
Profit Increased	-1.601***	-0.934***	-1.456***	-0.706***	-1.377***
	(0.236)	(0.267)	(0.141)	(0.213)	(0.213)
Log Debt t-1	-0.143	-0.030	-0.007	-0.370***	0.017
	(0.130)	(0.062)	(0.055)	(0.094)	(0.078)
D/Y	3.249*	1.035	0.715	5.767***	0.682
	(1.917)	(0.833)	(0.788)	(1.275)	(1.108)
N	376	311	901	385	428
Age controls	Yes	Yes	Yes	Yes	Yes
Size controls	Yes	Yes	Yes	Yes	Yes

Finally, table 14 presents the financial distress regressions by firm age group. As was the case with the both the employment effects and the investment effects, enterprises aged 11-20 are found to display higher likelihood of being in financial distress. As noted earlier, these enterprise age groups are those which would have been in the scaling phase during the boom years and took on high leverage levels. The youngest and oldest enterprises do not display any impact of debt sustainability on financial distress.

Table 12 Financial Distress by Age Group

	Age <5	Age 5- 10	Age 11-20	Age 20 +
Increase Turnover	-0.249	-0.072	-0.415**	-0.473***
	(0.414)	(0.242)	(0.180)	(0.123)
Exporter	-1.149	0.534*	0.109	0.130
	(0.743)	(0.322)	(0.216)	(0.146)
Innovation	0.541	0.344	0.319**	0.434***
	(0.436)	(0.238)	(0.158)	(0.112)
Profit Increased	-1.534***	-1.335***	-1.028***	-1.410***
	(0.446)	(0.242)	(0.163)	(0.119)
Log Debt t-1	0.038	0.004	-0.194**	-0.023
	(0.200)	(0.065)	(0.079)	(0.062)
D/Y	-0.058	0.377	3.564***	1.208
	(2.654)	(0.838)	(1.131)	(0.893)
N	124	313	668	1,296
Size controls	Yes	Yes	Yes	Yes
Sector controls	Yes	Yes	Yes	Yes

4.4 Robustness checks

To ensure the robustness of our results to the measurement of debt sustainability through the debt to turnover ratio, we run a number of robustness checks. First, we run a robustness check which includes the debt to asset and debt to profit ratio to capture scaling and an alternative measure of cyclical fragility. The results are presented in Table 15. The debt to

profit captures an alternative aspect of the firms' performance as it captures the revenue minus the cost structure of the enterprises, giving an indication of potential retained earnings. It must be noted however that the profit indicator is already net of the interest or debt servicing cost so using the turnover based indicator will provide a guide to the sustainability before the debt servicing payments are made. Given the survey, these data are only available for a small subset of enterprises for the most recent wave of the survey. However, we run the main models for employment, investment, and financial distress with these indicators included. We find a negative and significant impact of the debt to profit measure on employment and investment. We find a positive relationship between the debt to asset ratio and the indicator of financial distress. These results provide support to those found with the debt to turnover indicator. This highlights the fact that both of our measures of debt sustainability through the fragility of earnings to debt size are providing insight about the impact of debt overhang on SME performance following the crisis.

Table 13 Robustness Check 1 - Alternative Debt Sustainability Measures

	Employment	Invest (probit)	Invest (tobit)	Distress
Increase Turnover	0.739***	0.012	0.725	0.065
	(0.137)	(0.047)	(1.148)	(0.223)
Exporter	0.093	0.043	1.051	0.041
	(0.185)	(0.060)	(1.416)	(0.276)
Innovation	0.060	0.110**	3.235***	0.102
	(0.123)	(0.044)	(1.153)	(0.213)
Profit Increased	0.906***	0.120**	3.114**	-3.570***
	(0.162)	(0.055)	(1.457)	(0.311)
Default	-0.354	0.036	1.029	
	(0.244)	(0.094)	(2.492)	
Debt/Asset	0.290**	0.000	0.197	1.166***
	(0.139)	(0.054)	(1.381)	(0.252)
Debt/Profit	-0.000**	-0.000***	-0.001***	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
N	405.000	406.000	406.000	406.000
Age controls	Yes	Yes	Yes	Yes
Size controls	Yes	Yes	Yes	Yes
Sector controls	Yes	Yes	Yes	Yes

To bolster our results we have also undertaken robustness checks including only the debt to turnover indicator. The results are presented in Table 16 below. The impacts on investment and financial distress hold.

Table 14 Robustness Check 2 – Excluding Debt Level

	Employment	Invest (probit)	Invest (tobit)	Distress
Increase Turnover	0.726***	0.044**	1.588**	-0.400***
	(0.058)	(0.019)	(0.627)	(0.090)
Exporter	0.057	0.086***	2.761***	0.115
	(0.072)	(0.025)	(0.741)	(0.111)
Innovation	-0.045	0.088***	3.116***	0.355***
	(0.050)	(0.018)	(0.604)	(0.082)
Profit Increased	0.570***	0.076***	2.467***	-1.260***
	(0.054)	(0.019)	(0.625)	(0.087)
Default	-0.192**	-0.047	-1.933	
	(0.092)	(0.035)	(1.381)	
Credit Rejected	-0.212*	-0.045	-1.089	
	(0.125)	(0.045)	(1.827)	
D_Y	0.081	-0.058***	-1.790**	0.774***
	(0.059)	(0.021)	(0.705)	(0.094)
Age controls	Yes	Yes	Yes	Yes
Size controls	Yes	Yes	Yes	Yes
Sector controls	Yes	Yes	Yes	Yes
N	2,401	2,401	2,401	2,401

5.   Conclusions

This paper uses firm-level survey data to examine how debt overhang following the financial crisis period affects the subsequent performance of SMEs. We examine the impact of debt overhang using the ratio of debt to turnover. We test how these factors influence the employment and investment decisions of the firm, and the likelihood of encountering financial difficulties in the aftermath of a systemic financial crisis.

We find that higher debt burdens (measured as the ratio of debt to turnover) have significant negative effects on all measures of firm performance, in particular investment, employment and indicators of financial distress.   These findings hold using robustness checks for debt to profits and debt to assets.

We find the effects are greatest for sectors and enterprises most reliant on domestic demand which collapsed following the crisis. The effects are also strongest for enterprises that were in the mid-lifecycle, gearing phase, prior to the crisis. The youngest enterprises, established following the crisis, and the oldest enterprises are unaffected.

There are some aspects of the effects of debt burden that we have been unable to explore due to data limitations but that may be fruitful avenues of further research. As our data was not a panel, we could not observe when and for what purpose the initial debt was incurred which could be an important element of unobserved heterogeneity in our sample firms. We

are also unable to decompose how much of the current negative effects of debt-to-turnover have been caused by declines in sales or changes in the cost or structuring of loans. The results do however demonstrate that debt burdens can have an on-going effect on firm performance and that some level of restructuring may be necessary for long-term effects on economic growth to be avoided.

6.   Bibliography

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Appendix – Additional Summary Statistics

Table A1: Summary Statistics for All Variables

	Overall	Age 0 to 5	Age 6 to 10	Age 11 -20	Age 20 +	Manu	C & RE	W & R	Hotels	Other
Ln Emp	8.75	8.18	8.08	8.31	9.21	11.67	7.26	7.01	12.06	8.81
Employ Change	0.04	0.04	0.08	0.08	0.00	0.05	-0.01	0.02	0.03	0.07
Inv	0.29	0.34	0.26	0.28	0.30	0.42	0.23	0.23	0.30	0.31
Ln(I)	3.08	3.41	2.63	2.95	3.25	4.90	2.42	2.42	3.17	3.23
D/Y	0.48	0.42	0.48	0.47	0.50	0.51	0.45	0.50	0.60	0.43
Ln Debt $_{t-1}$	6.9	5.8	6.7	6.6	7.3	7.5	6.3	7.3	8.5	6.1
Innovation	0.5	0.6	0.6	0.6	0.5	0.6	0.4	0.5	0.5	0.5
Export	0.2	0.2	0.1	0.2	0.2	0.6	0.1	0.2	0.0	0.2
Profit	0.5	0.4	0.6	0.5	0.4	0.5	0.4	0.4	0.5	0.5
Turnover up	0.3	0.4	0.3	0.3	0.3	0.4	0.3	0.3	0.4	0.3
	2087	96	297	584	1109	269	244	669	212	691
Financial Variables										
Credit rejected	0.08	0.05	0.08	0.09	0.07	0.06	0.08	0.07	0.08	0.09
Default (Missed payment)	0.10	0.08	0.09	0.12	0.10	0.08	0.13	0.09	0.14	0.10
Payable Days Increased	0.20	0.25	0.17	0.23	0.18	0.19	0.19	0.21	0.23	0.18
Receivable Days Increased	0.32	0.23	0.29	0.28	0.35	0.36	0.40	0.33	0.13	0.33
Loan Adjustments	0.15	0.10	0.13	0.13	0.16	0.14	0.15	0.14	0.20	0.14
	2059	91	294	579	1094	258	208	685	260	648

Source: Authors' calculations using Department of Finance Survey

Table A2: Employment and Investment Estimates on Sample with Zero Debt Firms Excluded

	Ln Employees (FGLS)	Employment Change (OP)	Extensive Margin (Probit)	Intensive Margin (Tobit)
Age 5- 10	-0.916	-0.001	-0.104	-3.400
Age 11-20	-1.012	0.021	-0.066	-2.205
Age 20 +	-0.548	-0.018	-0.110*	-3.674*
Small	4.132***	-0.004	0.120***	5.522***
Medim	5.806***	0.068	0.348***	12.407***
Const and RE	-1.320**	0.010	0.021	1.017
Wholesale & Retail	-2.324***	-0.010	-0.020	-1.226
Hotels	2.651***	-0.020	-0.010	-0.488
Other	0.105	0.014	0.004	0.102
Increase Turnover	-0.022	0.199***	0.013	0.752
Exporter	1.191***	0.000	0.124***	4.253***
Innovation	0.295	-0.005	0.054**	2.087**
Profit Increased	0.639**	0.134***	0.087***	3.354***
Default	-1.751***	-0.028	-0.044	-2.161
Credit Rejected	-0.683	-0.056**	-0.052	-2.341
Log Debt t-1	2.044***	0.013**	0.022*	1.045**
D/Y	-14.671***	-0.159*	-0.513***	-20.961***
N	1,136	1,139	1,146	1,139

Robust standard errors in parentheses, *** indicates significance at % level, ** at 5% and * at 10%.

Table 15 Debt Sustainability and Financial Factors: Marginal Effects with Group Interactions

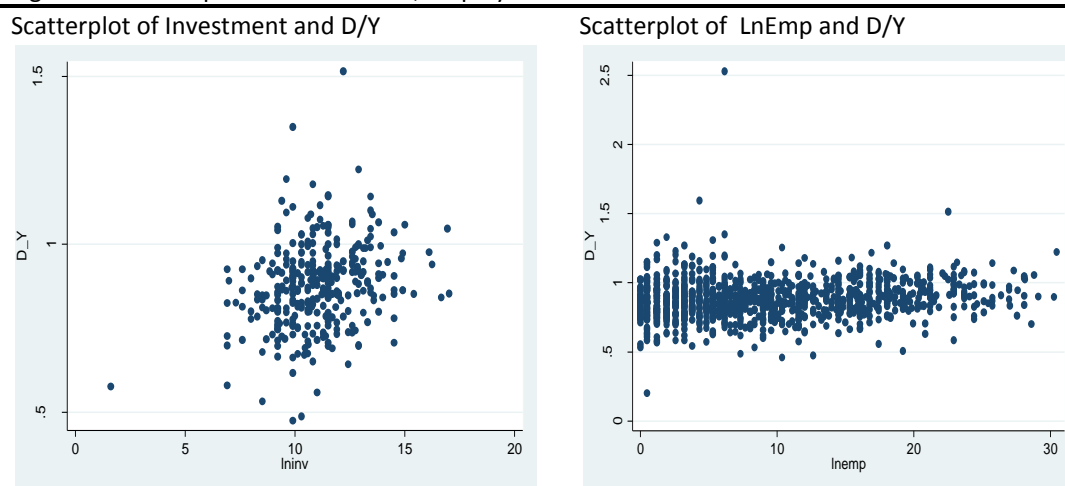| Below D/Y x	Credit Rejected	Loan Adjustments	Default	Receivable Days Increased	Payable Days Increased
Age 0-5	0.097	0.003	0.025	0.190	0.076
Age 6 -10	0.092	0.269***	0.122*	0.149	0.044
Age 11-20	0.120*	0.094	0.247**	0.202	0.171*
Age 20 +	0.097*	0.057	0.161**	0.211	0.098
Micro	0.111**	0.122*	0.271***	0.197	0.097
Small	0.078	0.002	0.085*	0.101	0.047
Medium	0.095	0.082	0.165***	0.169	0.056
Non-Exporter	0.097*	0.075	0.145**	0.182	0.106
Exporter	0.103	0.105	0.168*	0.136	0.109
No Innovation	0.091*	0.048	0.140**	0.207	0.097
Innovation	0.110*	0.138**	0.194***	0.132	0.085
Manufacturing	0.080	0.143*	0.157*	0.286*	0.161*
Const and RE	0.080	0.081	0.179**	0.266*	0.044
Wholesale & Retail	0.077	0.070	0.109**	0.197	0.087
Hotels	0.133	0.110	0.294**	0.080	0.029
Other	0.152**	0.067	0.202***	0.221	0.153*
	2087	2087	2087	2087	2087

Robust standard errors in parentheses, *** indicates significance at % level, ** at 5% and * at 10%.

Table 16 Debt Sustainability and Financial Distress – Relative Risk Ratios

	Multinomial Logit				Ordered Probit
	FD = 1	FD = 2	FD =3	FD = 4	Coeff
Age 5- 10	-0.284	-0.564	-0.112	13.312***	-0.211
Age 11-20	-0.193	-0.411	-0.033	13.814***	-0.084
Age 20 +	0.029	-0.199	0.325	13.717***	0.085
Small	0.051	-0.220	0.111	-0.545	-0.079
Medim	-0.051	-0.276	-0.074	-0.337	-0.128
Const and RE	0.247	0.391	0.411	0.937	0.284
Wholesale & Retail	0.164	0.180	0.134	0.671	0.147
Hotels	-0.182	0.482	0.566	0.202	0.279
Other	0.103	0.254	0.340	1.098	0.238
Increase Turnover	-0.130	-0.394**	-0.351	-1.166**	-0.288***
Exporter	0.122	0.453**	0.219	0.513	0.248**
Innovation	0.123	0.429***	0.345	1.459***	0.329***
Profit Increased	-0.677***	-1.474***	-2.520***	-3.289***	-1.195***
Log Debt t-1	-0.139**	-0.125*	-0.160	-0.034	-0.094
D/Y	2.594***	3.092***	4.094***	4.843***	2.421***
	2087	2087	2087	2087	2087

Robust standard errors in parentheses, *** indicates significance at % level, ** at 5% and * at 10%.

Figure A1: Scatterplots of Investment, Employment and Debt Burden

Scatterplot of Investment and D/Y   Scatterplot of LnEmp and D/Y

Source: Authors' calculations using Department of Finance Survey