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### 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.

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

## 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). 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 ongoing basis (Elmeskov and Sutherland, 2012; Brown and Lane, 2011).

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-level 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). One noticeable exception is Davis and Stone (2004) who looked at a number of financial crises between 1970 and 1999, finding that investment declines are highly correlated with the debt-to-equity ratio following this type of crises.

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. We investigate how debt overhang affects the performance of micro, small-and medium-sized enterprises (SMEs) following the recent 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.

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. Exploring the effects of these increases in leverage on the post-crisis firm performance should provide important insight 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 local 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). 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. Their model suggests underinvestment associated with debt overhang is more severe as investment opportunities are lower as opportunities improve.

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 dataset 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 uses the leverage ratio (debt-to-assets). Here 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.

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 finance 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 appropriate in the context of financial crises. Firstly, firm assets are priced to book values on the balance sheet and these do 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 and hence its current performance.

A number of findings emerge. While the level of debt is generally associated with positive firm performance (higher employment growth and investment), higher debt burdens

measured as the level of debt relative to turnover, on the contrary, have significant negative effects on all measures of firm performance. This suggests that 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.

These effects are non-uniformly distributed across the economy and are different for employment and investment channels. For employment growth, we find that the effects are higher for small and micro firms with medium sized firms unaffected. Looking across sectors, we find that the wholesale and retail sector is the most affected. For investment, the effects are greatest for older firms, medium-sized firms and those in the manufacturing sector. For both investment and employment outcomes, we find that exporters are more affected than non-exporters.

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, 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 six months, had a formal adjustment/arrangement made to their current loans, and whether or not the timing on their accounts receivable and payables changed.

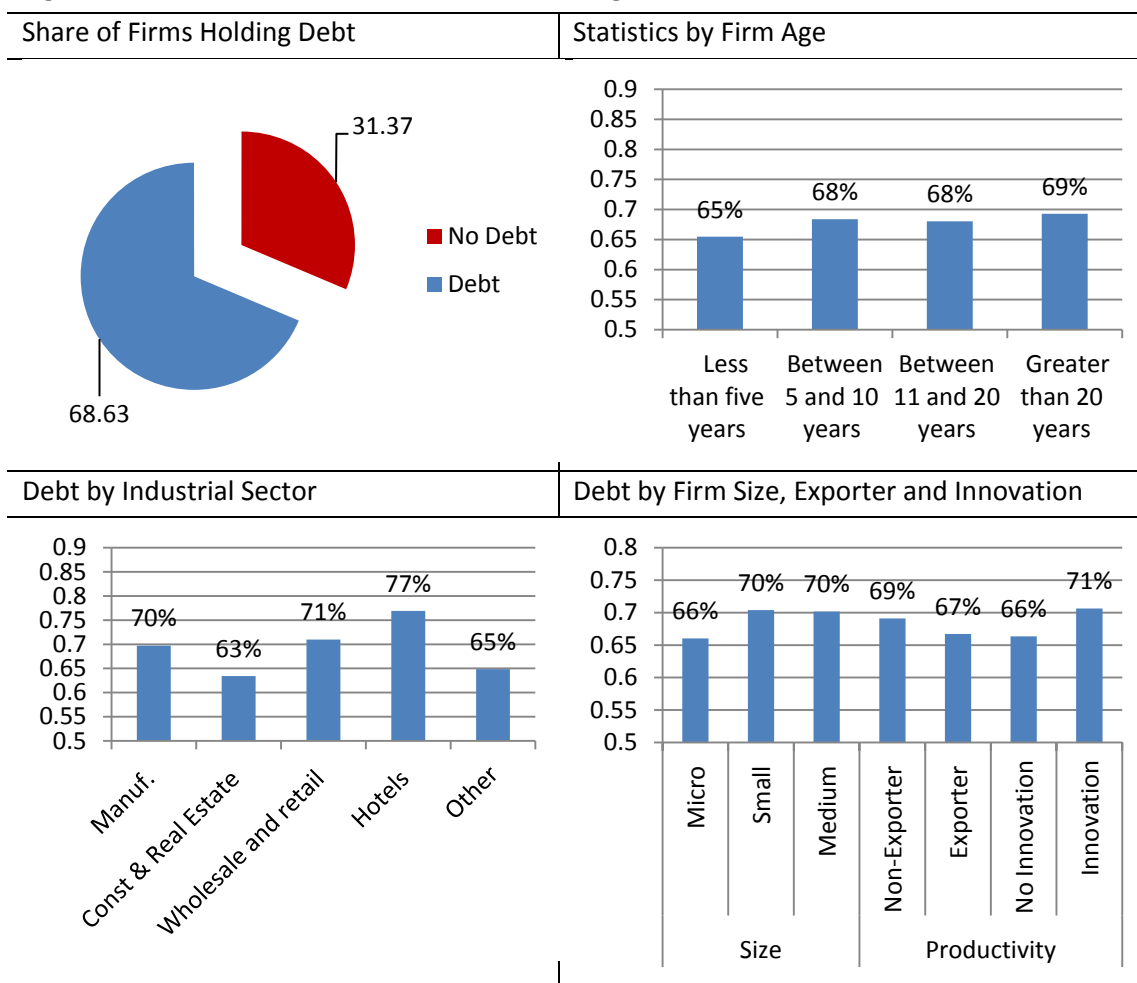
The Irish economy since the 2008 financial crisis provides an interesting case study in which to test the effect of debt overhang on firm performance. In the period prior to 2007 Irish corporate balance sheets expanded significantly. With the onset of the banking crisis and its knock-on effects on the 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 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 two survey waves in the periods: from October 2012 to March 2013 and also from April 2013 to September 2013. The outstanding debt data refers to total liabilities on the firm's balance sheet and cannot be separated by term structure or source.

In evaluating the effects of debt overhang on SME performance, it is firstly informative to review the distribution of debt holders across the sample. Figure 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.

Figure 1 Table Distribution of Debt Holders Amongst Irish SMEs



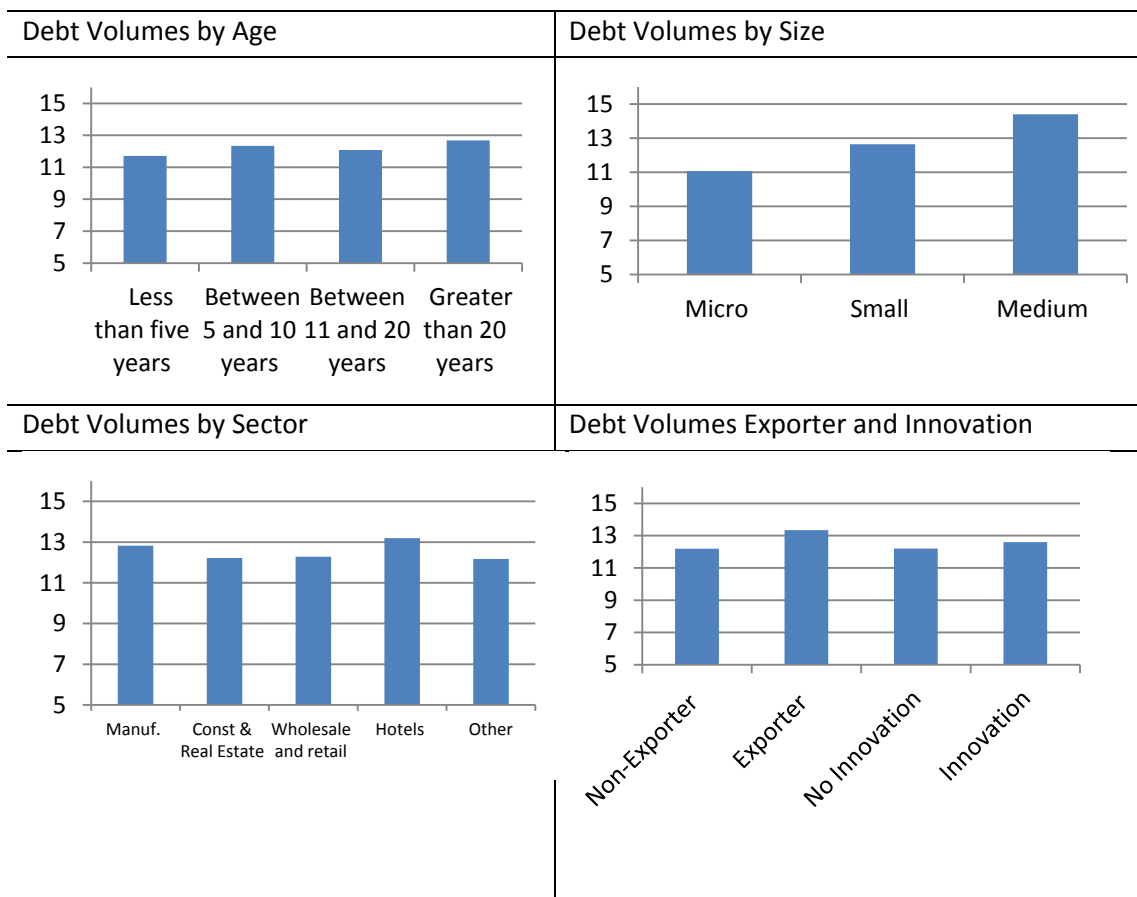
Source: Department of Finance Survey

About 69 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 65 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.

Figure 2 Debt Volumes (Log) by Firm Groups for Irish SMEs

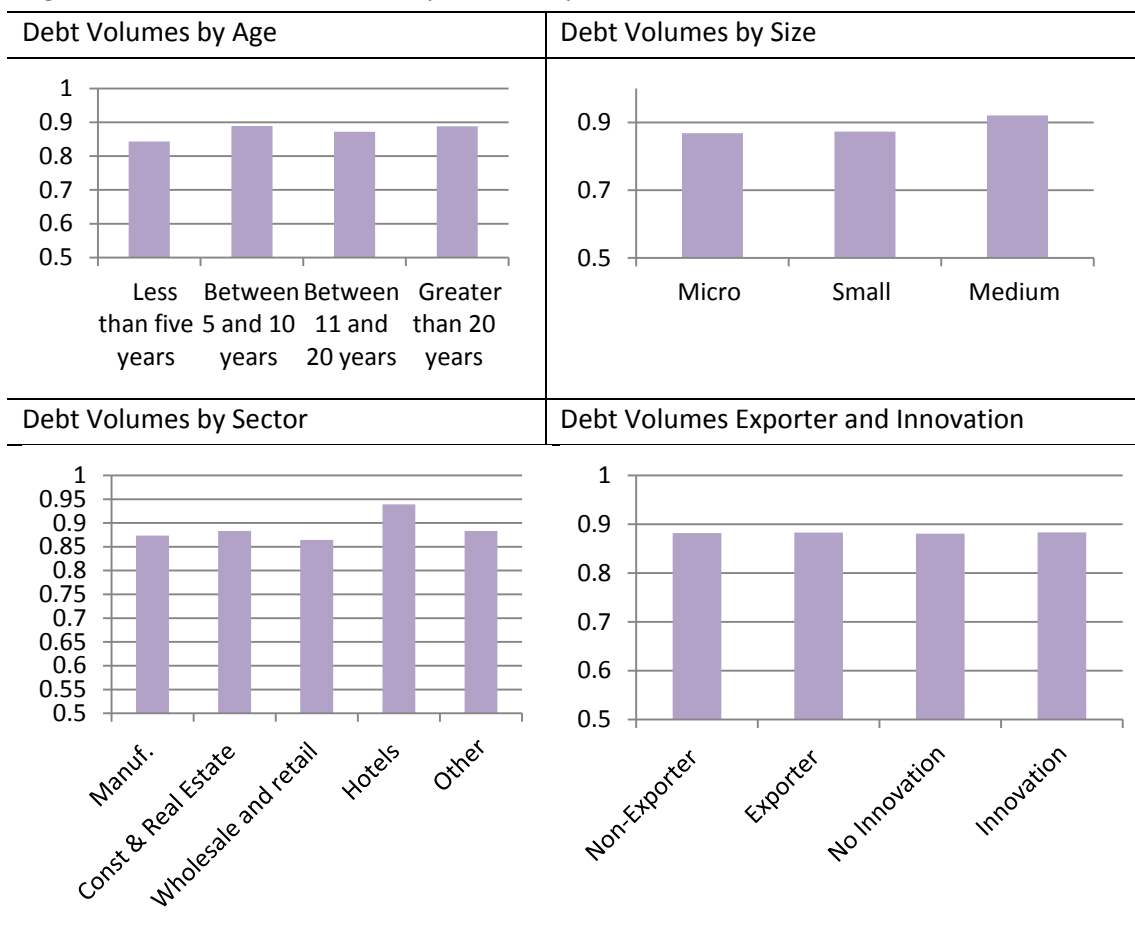


Source: Department of Finance Survey

Figure 2 presents the intensive margin of debt volumes for Irish firms using the sample of firms with positive debt. 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.<sup>1</sup>

Our main research question is to investigate whether debt overhang from the financial crisis in 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.

Figure 3 Debt-to-Turnover Ratio by Firm Groups for Irish SMEs



Source: Department of Finance Survey

<sup>1</sup> 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.



The average values of the debt-to-turnover ratio across firm groups are presented in Figure 3. 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 therefore unlikely that they have property legacy debt. 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 positive turnover “Turnover Up”, 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 1. Additional summary statistics are presented in table A1 in Annex 1. The total sample size is approximately 2,087. 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.

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, 14 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.

Table 1 Summary Statistics For Main Variables

	(1)	(2)	(3)	(4)
	Overall	Mean if Debt	Mean if Debt >	T-stat ((2) =
	Mean	= 0	0	(3))
Turnover up	0.30	0.29	0.32	-1.43
Export	0.20	0.21	0.21	-0.06
Innovation	0.53	0.50	0.56	-2.62 ***
Profit	0.44	0.47	0.45	1.08
Loss	0.22	0.18	0.23	-2.68 ***
Past rejection	0.06	0.03	0.07	-4.77 ***
Credit rejected	0.07	0.04	0.08	-4.14 ***
Receivable Days Increased	0.31	0.29	0.33	-2.07 **
Payable Days Increased	0.17	0.10	0.20	-6.16 ***
Less than five years	0.05	0.05	0.04	0.99
Between 5 and 10 years	0.14	0.14	0.14	0.26
Between 11 and 20 years	0.28	0.29	0.27	0.81
Greater than 20 years	0.53	0.52	0.54	-1.33
Micro	0.39	0.43	0.36	3.02 ***
Small	0.39	0.36	0.40	-1.93 *
Medium	0.22	0.21	0.23	-1.27
Manuf.	0.12	0.12	0.14	-1.22
Const & Real Estate	0.11	0.13	0.11	1.37
Wholesale and retail	0.32	0.30	0.34	-2.04 **
Hotels	0.11	0.08	0.12	-2.68 ***
Other	0.33	0.37	0.30	3.69 ***

Source: Authors' analysis using Department of Finance survey data: N = 2,087.

On the financial distress variables, we observe that circa 7 percent of firms are credit constrained (rejections of formal loan applications). Nearly 45 percent of firms posted a profit while 22 percent posted losses. Over 30 percent of firms experienced an increase in the number of days that suppliers pay them for goods provided on credit while 17 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.

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 2.

The index values indicate that over 44 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 2 Financial Distress Index – Summary Statistics**

	Index Value (0 = no indication of stress, 4 = max)					N
	0	1	2	3	4	
Overall	44.42	32.01	16.05	5.65	1.87	2087
Micro	41.33	32.6	18.08	5.78	2.21	813
Small	44.29	33.25	14.89	6.08	1.49	806
Medium	50	28.85	14.53	4.7	1.92	468
Age < 5	40.63	32.29	21.88	5.21	0	96
Age 5 -10	51.52	28.62	13.47	4.71	1.68	297
Age 11-20	47.35	30.26	15.21	4.96	2.22	585
Age 20 +	41.3	33.81	16.68	6.31	1.89	1109
Manu	46.47	31.97	15.24	5.2	1.12	269
C & RE	40.57	34.43	16.8	6.15	2.05	244
W & R	41.85	34.23	16.44	5.53	1.94	669
Hotels	45.33	24.3	20.56	8.41	1.4	214
Other	47.18	31.4	14.33	4.92	2.17	691

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 their financial distress. To measure employment performance, we use 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:

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

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. However, 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 we hope mitigates 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 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.

### 3.3 Results

This section discusses the results of our various specifications for the effect of outstanding debt and debt burdens on the employment and investment performance of SMEs. 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 an important aspect in developing our understanding of the recovery paths for corporate following systemic financial crises.

#### *Debt overhang and employment – overall effects*

Table 3 presents the baseline estimates for the ordered probit for a change in employment over the previous six months. The outstanding debt stock of the firm at the beginning of the period is found to have a positive and significant effect on the probability of unchanged or increasing employment over the survey reference period. 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 3 Modelling the Effect of Debt Sustainability on Employment – Marginal Effects

	Employment Change (Ordered Probit)
Age 5- 10	0.005
Age 11-20	0.018
Age 20 +	-0.021
Turnover – mid	0.002
Turnover - high	0.014
Const and RE	-0.001
Wholesale & Retail	0.017
Hotels	-0.006
Other	0.029
Increase Turnover	0.192***
Exporter	0.021
Innovation	-0.008
Profit Increased	0.111***
Default	-0.041*
Credit Rejected	-0.032
Log Debt t-1	0.014**
D/Y	-0.199**
N	2,018

We therefore look to our measure of firm debt burden – the ratio of debt to firm turnover – to give us a better indication of whether the firm is over-extended. This is found to have a significant negative impact on firm employment growth. The negative consequences of debt

overhang can be clearly seen, but it is the presence of excessive debt relative to the scale of the firm's operations that have the hampering effect and not the level of debt itself that has this effect.

Looking at the other firm characteristics, we do not find a significant relationship between firm age and changes in employment. Higher turnover categories are not found to have any effect on the probability of the firm increasing or decreasing employment in the current period. However, 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 the increase or decrease in employment over the prior six month period.

### *Debt overhang and employment – effects by firm group*

The baseline results showed a strong negative effect of debt burden on the probability of an employment change. We next look at a number of interactions of the debt-to-turnover ratio with other firm characteristics to investigate if these effects vary across different firm groups. Table 4 shows the results of these interactions, where each panel is a separate specification also controlling for all of the firm characteristics reported in Table 3. The coefficients reported are the combined marginal effects taking into account the direct effect of the debt-to-turnover as well as the interaction effect.

Table 4 Modelling the Effect of Debt Sustainability on Employment – Marginal Effects (for Ordered Probit)

	Employment Change (OP)
Effects by Age	
D/Y x Age 0-5	-0.205**
D/Y x Age 6-10	-0.193**
D/Y x Age 11 -20	-0.201***
D/Y x Age 20 +	-0.196**
Effects by Sector	
D/Y x Manufacturing	-0.170*
D/Y x Const and RE	-0.150
D/Y x Wholesale & Retail	-0.217***
D/Y x Hotels	-0.195**
D/Y x Other	-0.193**
Effects by Size	
D/Y x Micro	-0.171**
D/Y x Small	-0.181*
D/Y x Medium	-0.065
Exporting	
D/Y x Non-Exporter	-0.207**
D/Y x Exporter	-0.221**
Innovation	
D/Y x No Innovation	-0.200***
D/Y x Innovation	-0.194**
N	2,018



For almost all interactions, the effect is negative and significant. The most notable interactions are that we find a larger effect for exporters indicating that they may be particularly constrained by the presence of outstanding debt burdens but there is no evidence of different effects for innovating compared to non-innovating firms.

The effects on a change in employment of debt burdens do not show any particular variation when interacted with firm age categories, although in this case we do see some differences across firm size groups. Medium firms are one of the only groups that have an insignificant total effect when combined with the debt burden measure. The negative effect remains significant however for both micro and small firms.

The sample can also be split by sector to examine if the greater credit expansion in some sectors during the boom, particularly in Construction and Real Estate, can be linked to a greater effect of debt-to-income ratios relative to other sectors. The effect of the debt-to-income ratio is significantly negative for all sectors with the one exception being Construction. The effect is largest for firms in the Wholesale and Retail sector.

#### *Debt overhang and investment*

Table 5 presents the result of the investment specifications, with column (1) showing the probit results for if the firm invests or not and column (2) showing results for the Tobit regressions on investment amounts. 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 and on the amount invested. As in the employment results, the level of existing debt appears to be picking up positive business opportunities and facilitating firm growth rather than acting as a brake as one might have expected from a debt overhang interpretation.

However, debt affordability operates in the opposite direction. The ratio of existing debt to firm turnover has a significantly negative effect on both the decision to invest and on the volume if investment occurs. 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 Modelling the Effect of Debt Sustainability on *Investment* – Marginal Effects

	Extensive Margin (Probit)	Intensive Margin (Tobit)
	b/se	b/se
Age 5- 10	-0.091*	-2.786
Age 11-20	-0.080*	-2.626*
Age 20 +	-0.083*	-2.549
Small	0.120***	5.478***
Medium	0.343***	12.085***
Const and RE	-0.019	-0.465
Wholesale & Retail	-0.045	-1.869*
Hotels	-0.044	-1.597
Other	0.013	0.333
Increase Turnover	0.042**	1.481**
Exporter	0.129***	4.372***
Innovation	0.064***	2.507***
Profit Increased	0.044**	1.853***
Default	-0.057	-2.625
Credit Rejected	-0.058	-2.507
Log Debt t-1	0.025**	1.135***
D/Y	-0.382**	-16.825***
N	2,087	2,073

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

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 and to invest larger amounts than micro firms. 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 for both investment specifications, showing a stronger link existing between innovation and capital expenditures than with employment changes.

Table 6 reports the results of the total effects of debt burden combined with its interaction with a range of firm characteristics as we did above in the employment specification. The negative effects of debt burdens on investment probability and volume are similar across firm age groups, with the oldest firms being slightly more strongly affected than younger firms. Looking at sectors, although the effect is negative and significant for all, the magnitude of the effect is largest for manufacturing firms. The probability of investing is most strongly affected by debt burdens for medium sized firms, but the effect on investment volumes is similar across all size groups.

### *Debt overhang and investment - effects by firm group*

Table 6 Modelling the Effect of Debt Sustainability on *Investment* – Marginal Effects

	Extensive Margin (Probit)	Intensive Margin (Tobit)
<b>Effects by Age</b>		
D/Y x Age 0-5	-0.415**	-16.319**
D/Y x Age 6-10	-0.392**	-17.304***
D/Y x Age 11 -20	-0.337**	-15.109**
D/Y x Age 20 +	-0.432***	-18.730***
<b>Effects by Sector</b>		
D/Y x Manufacturing	-0.457***	-19.221***
D/Y x Const and RE	-0.336**	-15.177**
D/Y x Wholesale & Retail	-0.334**	-16.582***
D/Y x Hotels	-0.301*	-14.761**
D/Y x Other	-0.444***	-18.450***
<b>Effects by Size</b>		
D/Y x Micro	-0.322**	-17.006***
D/Y x Small	-0.454**	-17.364**
D/Y x Medium	-0.556**	-17.336**
<b>Exporting</b>		
D/Y x Non-Exporter	-0.386***	-17.192***
D/Y x Exporter	-0.498***	-18.329***
<b>Innovation</b>		
D/Y x No Innovation	-0.344**	-16.113***
D/Y x Innovation	-0.425***	-17.649***
N	2,087	2,073

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

### *Debt overhang and financial distress*

The final set of results show the effects of outstanding debt levels and debt-to-turnover ratios on the likelihood of a firm experiencing various indicators of financial difficulties. Table 7 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.

Table 7 Marginal Effects of Probit Model: Debt sustainability and firm financial performance

	Credit rejected	Default	Payable Days Inc	Receivable Days Inc	Loan Adjustments
Age 5- 10	0.007	0.006	-0.030	0.026	-0.022
Age 11-20	0.021	0.017	-0.013	0.020	0.004
Age 20 +	0.017	0.013	-0.050	0.073	0.013
Small	0.014	-0.058***	-0.014	0.031	-0.053***
Medim	-0.003	-0.080***	0.002	-0.003	-0.064***
Const and RE	0.022	0.026	0.001	0.060	0.025
Wholesale & Retail	0.006	0.013	0.010	0.023	0.001
Hotels	0.047*	0.080***	0.028	-0.186***	0.074**
Other Increase	0.035**	0.026*	-0.012	0.033	0.018
Turnover	0.001	-0.018*	-0.003	-0.037	-0.010
Exporter	0.019	0.029*	-0.015	0.023	-0.001
Innovation	0.018*	-0.001	0.049***	0.031	0.029**
Profit Increased	-0.022*	-0.016	-0.125***	-0.025	-0.029**
Log Debt t-1	-0.003	0.003	-0.000	-0.011	0.009**
D/Y	0.103*	0.152**	0.103	0.196	0.076
N	2,087	2,087	2,087	2,087	2,087

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

Perhaps surprisingly, but in line 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. The only indicator of financial difficulties where the probability increases with the level of debt is that of an adjustment in the loan arrangement. The debt-to-turnover ratio, on the other hand, 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.

Looking at the relationships between other firm characteristics and the indicators of financial difficulty, we see that 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. The other measures were not affected by firm size and none were significantly affected by firm age. However, when we interact firm size and age categories with debt burden in the following set of regressions (reported in Table 8) we do find some variation across these characteristics.

Table 8 Debt Sustainability and Financial Factors: Marginal Effects with Group Interactions

	Credit	Loan		Receivable		
Below D/Y x	Rejected	Adjustments	Default	Days	Payable	Days
				Increased	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%.

The combined effects of debt burden with the firm characteristics show that older firms with high debt-to-income ratios are among the most credit constrained and also somewhat more likely to default. This is in contrast to other papers finding that younger firms are more likely to be credit constrained but this is because these specifications are also including the direct effect coming from older firms being more likely to have larger outstanding debts and effect of higher debt-to-turnover ratios is therefore higher for these firms.

Smaller firms have the largest combined effect of size and debt burden in increasing their probability of encountering credit rejections, loan adjustments and default. Differences between exporting and non-exporting firms are only evident when looking at the probability of default, with exporters being more at risk than non-exporters if they have high debt burdens. A similar pattern applies to the difference between innovative and non-innovative firms.

Table 9 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%.

Combining the different indicators of financial difficulty into a single index, Table 9 reports the results of two different specifications. The first is a multinomial logit, which reports separate coefficients for each value of the index all of which are relative to the base category of encountering none of the indicators. The second specification is 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.

#### 4. 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 both the effects of the level of outstanding debt and the debt burden (measured as the ratio of debt to turnover). We test how these factors influence the employment and investment decisions of the firm, and the firm's likelihood of encountering financial difficulties in the aftermath of a systemic financial crisis.

Our results show that the level of debt is not in fact an inhibitor of firm performance, but conversely that it is generally associated with positive firm performance, indicating that debt financing has an important role to play in firms by facilitating investment. However, credit overhang has significant negative effects if there has been a decline in the firm's ability to

service its outstanding debt from its current levels of turnover. We show that using an indicator of debt burden (debt relative to turnover) picks up significant negative effects on all firm performance outcomes, suggesting that this measure picks up potential problems with debt sustainability and overstretching of earlier credit commitments.

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 dataset 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 ongoing effect on firm performance and that some level of restructuring may be necessary for negative long-term effects on economic growth to be avoided.

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## Appendix – Additional Summary Statistics

Table A1: Summary Statistics for All Variables

	Overall	Age to 5	0Age to 10	6Age -20	11Age +	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 <sub>t-1</sub>	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

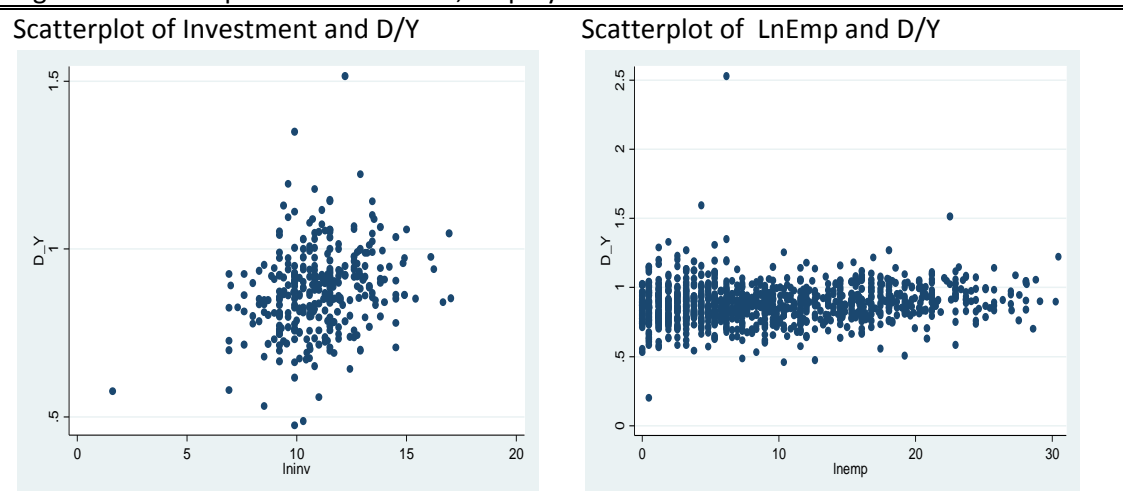
Source: Authors' calculations using Department of Finance Survey

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%.

Figure A1: Scatterplots of Investment, Employment and Debt Burden



Source: Authors' calculations using Department of Finance Survey

Year	Number	Title/Author(s) ESRI Authors/Co-authors <i>Italicised</i>
2014	490	Examining the Relationship between employee Resistance to changes in job conditions and Wider Organisational Change: Evidence from Ireland Hugh Cronin and <i>Seamus McGuinness</i>
	489	Estimating Building Energy Ratings for the Residential Building Stock: Location and Occupancy <i>John Curtis, Niamh Devitt, Adele Whelan</i>
	488	Gaming in the Irish Single Electricity Market and Potential Effects on Wholesale Prices <i>Darragh Walsh and Laura Malaguzzi Valeri</i>
	487	Household Formation and Tenure Choice: Did the great Irish housing bust alter consumer behaviour? <i>David Byrne, David Duffy and John FitzGerald</i>
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