FIRMS' LEVERAGE AND INVESTMENT

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INTRODUCTION AND SUMMARY

In the years leading up to the financial crisis, Danish firms built up high leverage and substantially reduced their investment during the crisis. This article presents an analysis of the relationship between the pre-crisis leverage ratios of individual firms and the development in their investment during the crisis. The analysis is based on firm-level data covering the period from 2000 to 2012.

The analysis shows that a limited proportion of the reduction in Danish firms' gross investment is attributable to the build-up of excessive leverage in the pre-crisis years followed by deleveraging by a number of firms. In 2007, about one-fifth of Danish firms had a leverage ratio of at least 80 per cent of total assets. During the crisis, these firms reduced their investment more than firms with lower leverage ratios. This is also true when taking into consideration that firms with a high leverage ratio that had made considerable leveraged investment before the crisis naturally may have had smaller investment needs in subsequent years (a 'regression to the mean' effect). The analysis also takes into account the differences between highly leveraged firms and less leveraged firms in a number of respects (including age and size).

The higher reduction in investment among more leveraged firms is also seen within subsamples of firms defined by geography, the age of the firm, industry, liquidity, etc. This indicates that the relationship is relatively robust and not driven by individual industries or types of firms. Small and medium-sized enterprises, in particular, reduced their investment during the crisis, and, conse-

quently, the relationship between the pre-crisis leverage ratios and the development in investment during the crisis is most obvious for these firms.

Based on the analysis, it is possible to construct a rough estimate of the development in investment during the financial crisis if highly leveraged firms had had a lower leverage ratio. This indicates that high leverage of some firms can explain approximately 15-20 per cent of the reduction in investment in the period from 2007 to 2012.

Although lack of demand rather than build-up of leverage was the primary driver of the contraction in investment, the large build-up of leverage in the years leading up to the financial crisis thus, to some extent, contributed to the subsequent contraction in investment. In light of the crisis, highly leveraged firms wanted to deleverage in part to increase their resilience to shocks to the economy and in part to retain flexibility in future financing choices. Moreover, the crisis may have reduced corporate confidence in the banking sector's ability to always meet the demand for credit and liquidity in an economic downturn. This may also have contributed to the wish of some firms to consolidate. Finally, a high leverage ratio may have reduced the access to finance during the crisis. However, the findings of the analysis indicate that credit constraints did not play any major part in the development in investment. The leverage ratio had a negative impact on the level of investment during the crisis – both for firms with good and poor liquidity.

Results indicate that high leverage may reinforce the reduction in investment during periods of crisis. Consequently, there may be strong

arguments for seeking to contain the build-up of leverage during economic upswings. The credit conditions of banks were too loose in the pre-crisis years, but since then they have implemented the necessary tightening of credit standards. Moreover, regulators have introduced a number of regulatory initiatives to reduce the risk of unsustainable credit growth in future. On the other hand, viewed in isolation, the Danish tax advantage of debt financing over equity financing does not improve the solvency ratios of Danish firms. Subject to certain restrictions, firms can deduct in-

terest expenses on their income statements in line with other operating expenses, while the equity remuneration is non-deductible.

BACKGROUND

The development in investment activity in European countries since the onset of the financial crisis is attributable mainly to weak economic activity and increased uncertainty about the future state of the economy, cf. e.g. Banerjee et al. (2015)

Firms' build-up of debt and savings surplus   Chart 1
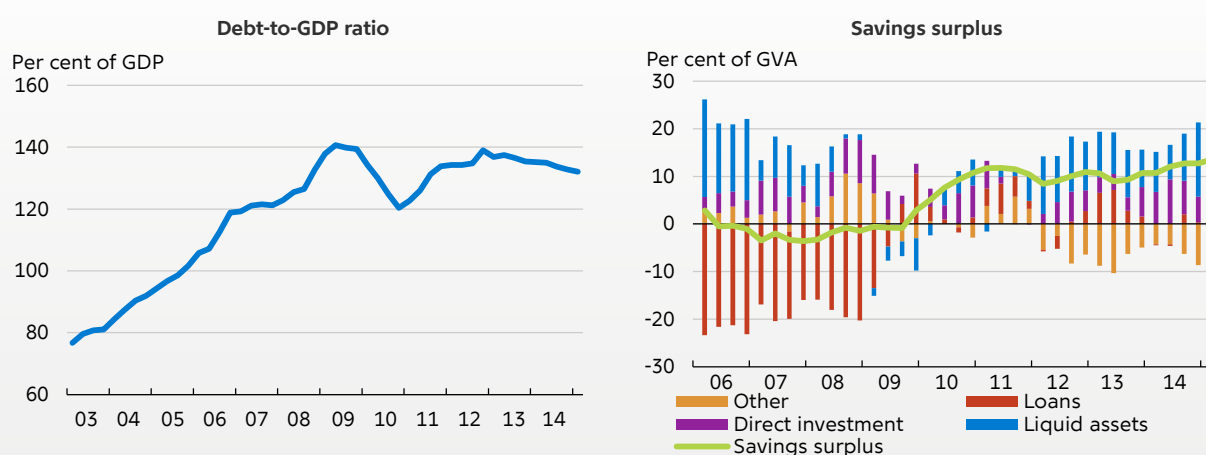
Note: Left-hand chart: Data from the financial accounts of the national accounts. Debt is defined as total financial liabilities, except equity securities, stated at market value. Right-hand chart: 4-quarter moving averages of financial transactions and gross value added, GVA, for non-financial corporations in the national accounts and the FDI statistics. "Liquid assets" are cash, deposits, bonds, portfolio shares, etc. "Foreign direct investment (FDI)" is Danish outward FDI less Danish inward FDI. "Loans" are stated net. "Other" includes insurance technical reserves, trade credits and other due unpaid outstanding accounts.
Source: Statistics Denmark and Danmarks Nationalbank.

Analysis data   Box 1

The data consists of accounting data for virtually all Danish firms except firms in the primary industries, the financial sector, energy and water supply and parts of the transport industry (ports, etc., railway and bus transport). Data has been complied by Statistics Denmark for its "Firm Accounts Database" covering all private non-primary and non-financial firms in the period 2000-12. Data is based on questionnaires and tax reportings. In addition, Statistics Denmark has imputed data for some of the variables for firms that are not included in the questionnaire survey. For key variables of investment and leverage ratio, the quality of the data is assessed to be relatively high although investment is subject to some uncertainty.
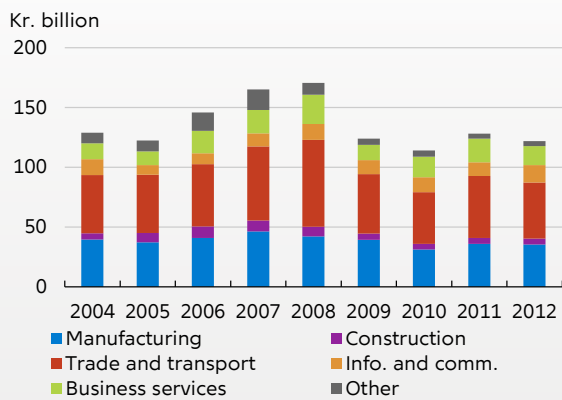
Sole proprietorships are excluded from the analysis. The reason is that the owner's private finances are not sufficient-

ly separated from those of the firm to enable a comparison with larger firms. Moreover, data on investment is incomplete for these firms. Firms in the sub-industry "renting of non-residential buildings" have also been excluded due to data quality issues. Finally, inactive firms, firms registered with no assets and firms that ceased to exist in the period 2006-12 are excluded. In the econometric analysis, the most extreme observations are also excluded to ensure that results are not driven solely by these observations, cf. Kuchler (2015).

Despite these restrictions and different calculation methods, the development in investment in the dataset applied is relatively comparable with the development in the national accounts calculation of gross fixed investment for non-financial corporations.

**Investment development
in Danish non-primary industries** — Chart 2

Kr. billion

- Manufacturing
- Construction
- Trade and transport
- Info. and comm.
- Business services
- Other

Note: Firms in the sub-industry "renting of non-residential buildings" are excluded due to data quality issues.
Source: Statistics Denmark.

up their liquidity reserves, cf. Kramp and Pedersen (2015). These factors may help to explain why investment rates and lending activity have been weak since the beginning of the financial crisis despite highly accommodative monetary policies.

In the pre-crisis years, non-financial corporations built up a relatively high gross leverage ratio, increasing from about 80 per cent of the gross domestic product, GDP, in 2003 to around 140 per cent in 2009, cf. Chart 1 (left). Before the financial crisis, firms increased their holdings of liquid assets considerably and built up a high degree of leverage, cf. Chart 1 (right). Since mid-2009, gross savings have exceeded real investment, resulting in a substantial corporate savings surplus (positive net lending). On a net basis, the savings surplus has been used primarily for repayment of loans, investment in liquid portfolios and foreign direct investment.

and IMF (2015). However, other factors may also have had an impact. In some countries, firm debt grew strongly in the pre-crisis years, and firms subsequently needed to deleverage. The crisis has therefore been referred to as a 'balance sheet recession', see e.g. Koo (2008). The financial crisis may also have reduced corporate confidence in the banking sector's ability to always meet the demand for credit and liquidity in an economic downturn. This may have prompted firms to build
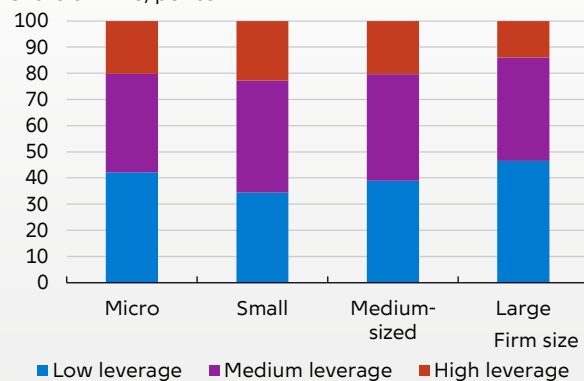
RELATIONSHIP BETWEEN LEVERAGE AND INVESTMENT

Below, investment in the private non-primary sector is examined based on register data for Danish firms, see Box 1 for a description of data. The method and results are discussed and documented in a recent working paper, cf. Kuchler (2015).
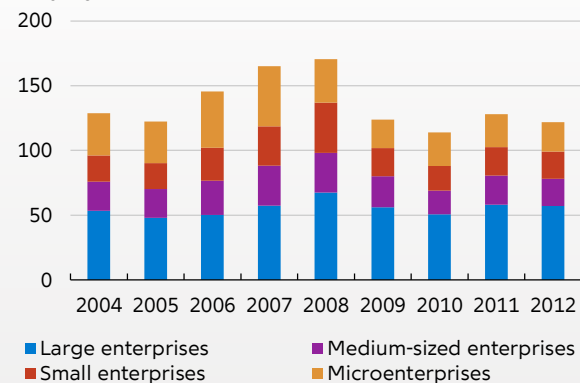
Firms by leverage ratio (2007) and development in investment by firm size — Chart 3

Share of firms, per cent

Kr. billion

- Low leverage
- Medium leverage
- High leverage
- Large enterprises
- Medium-sized enterprises
- Small enterprises
- Microenterprises

Note: Breakdown by leverage ratios: Low leverage: Leverage ratio (debt as a ratio of total assets) up to 60 per cent, Medium leverage: Leverage ratio of more than 60 per cent and up to 80 per cent, High leverage: Leverage ratios of more than 80 per cent. Firm sizes: Micro: < 10 employees, Small: 10-49 employees, Medium-sized: 50-249 employees, Large: 250 ≥ employees. Employee numbers are stated on a full-time basis.
Source: Own calculations based on firm-level data from Statistics Denmark.

The reduction in investment during the crisis was more pronounced in some industries than in others, cf. Chart 2. While firms in the construction industry saw a substantial reduction in investment, firms in the information and communications industry increased their aggregate investment. Firms in large industries such as manufacturing and trade and transport on average reduced their investment by close to one-third from 2007 to 2010. The substantial industry variation in investment reflects, inter alia, differences in demand and economic outlook.

Compared with large firms, a greater proportion of small firms had a high leverage ratio (ratio of debt to total assets) in the period leading up to the crisis, cf. Chart 3 (left). One reason is that most large firms are older than small firms. The contraction in investment during the crisis was driven mainly by microenterprises and small and medium-sized enterprises, cf. Chart 3 (right). The investment level of large firms in 2011 was in line with 2007.

The relationship between firms' leverage in the period leading up to the crisis and the development in their investment during the crisis is indicated by a comparison of the development in investment for firms with high leverage ratios and firms with low leverage ratios. Firms with high pre-crisis leverage ratios reduced their investment rates (gross investment relative to value added) more than less leveraged firms, cf. Chart 4. The relationship is most pronounced for microenter-

Relationship between leverage and development in investment   Chart 4
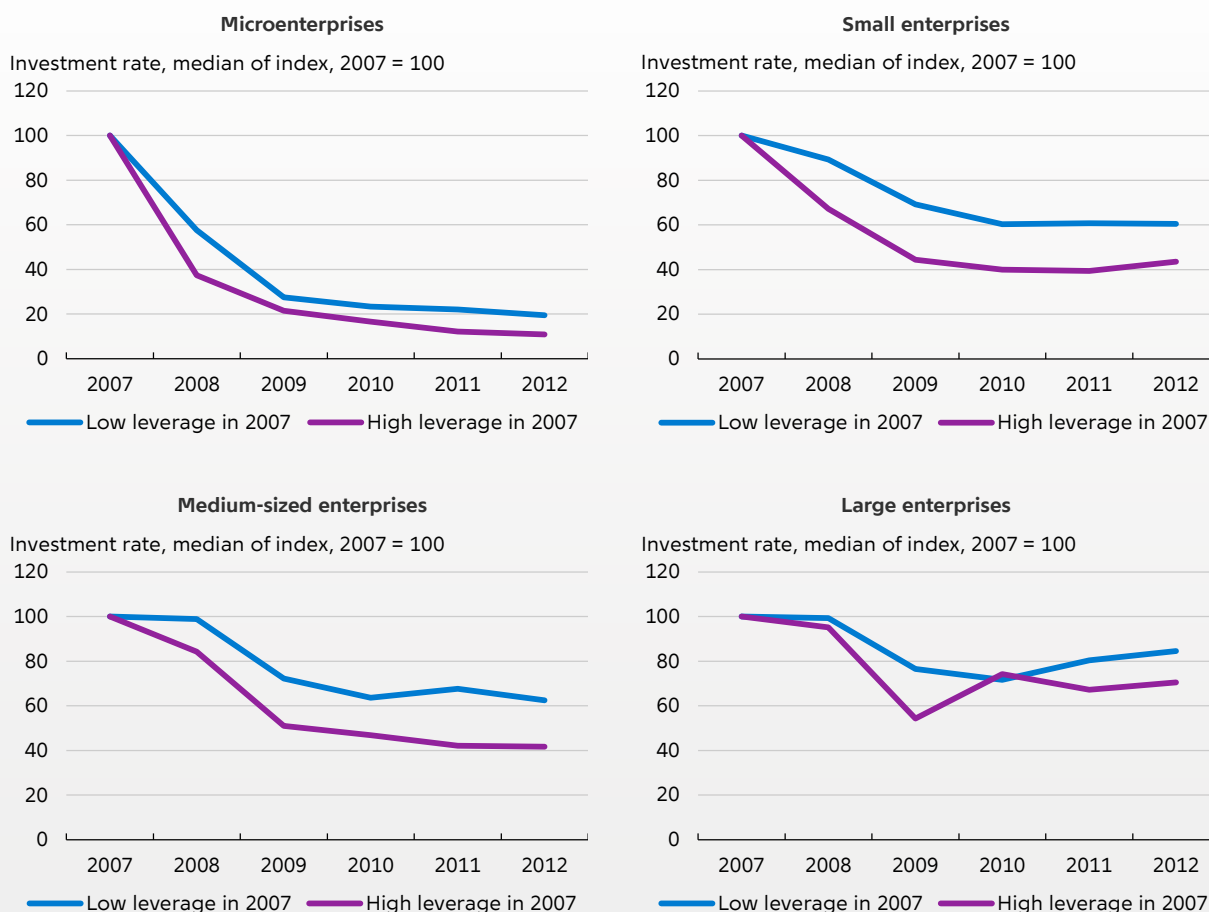
Note: Low leverage refers to leverage ratios of up to 60 per cent, while high leverage refers to leverage ratios of more than 80 per cent. The charts are constructed as follows: First, for each firm and each year, the investment rate is calculated as investment divided by value added. Then, the firm's investment rate in the year in question is indexed relative to the firm's investment rate in 2007. Finally, for each year and each leverage group, the median of this index is calculated. Firm sizes: Micro: < 10 employees, Small: 10-49 employees, Medium-sized: 50-249 employees, Large: 250 ≥ employees.

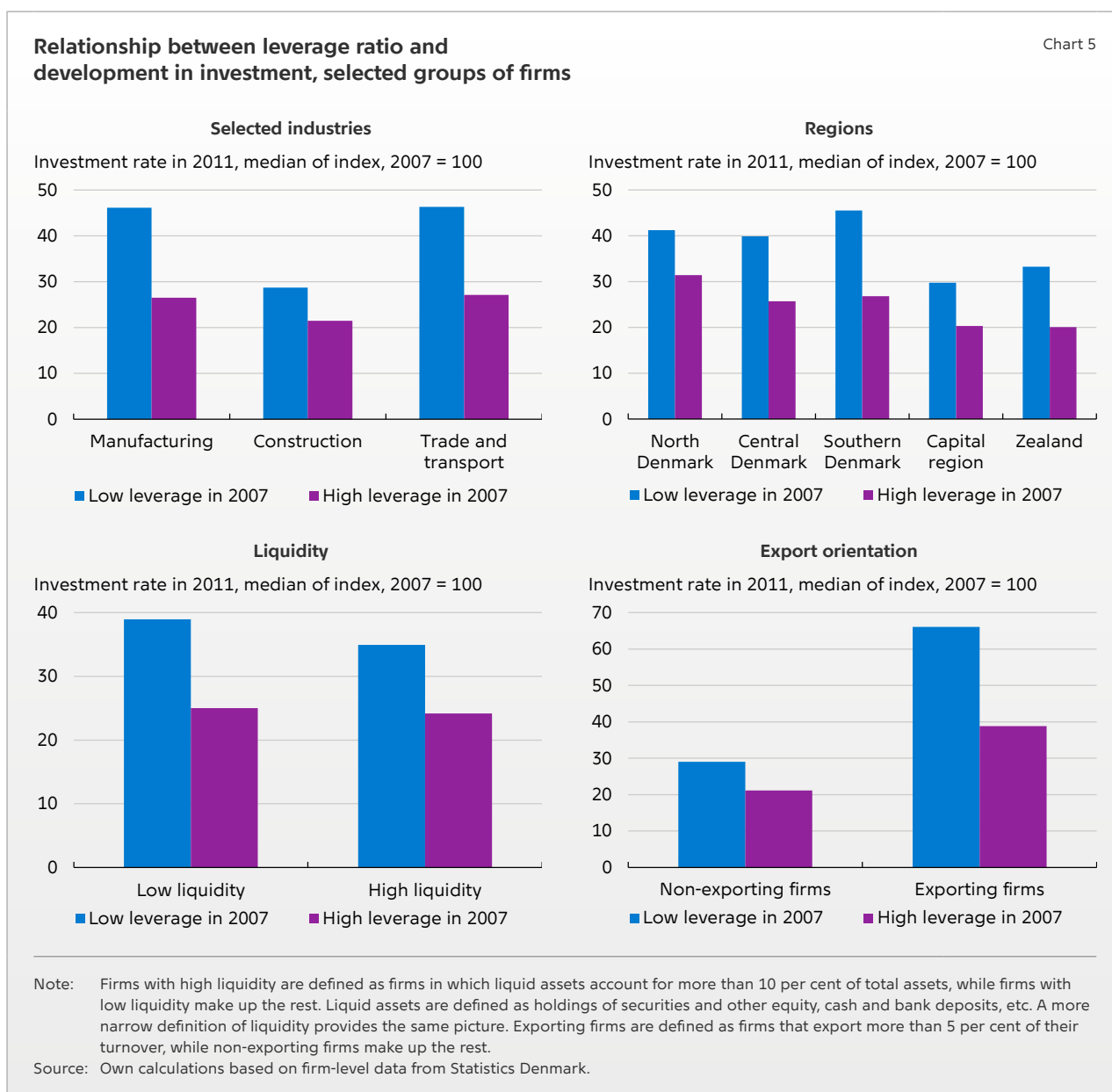Source: Own calculations based on firm-level data from Statistics Denmark.

prises and small and medium-sized enterprises, while it is present, but less pronounced, for large firms with more than 250 employees.

The relationship between the pre-crisis leverage ratio and the development in investment during the crisis is also evident if firms are subdivided using other characteristics, cf. Chart 5. This indicates that the relationship is relatively robust and not driven by individual industries or types of firms.

Kuchler (2015) performs a formal econometric analysis of the relationship between leverage ratio and investment, cf. Box 2. The most important finding of the analysis is that even if firm characteristics other than the leverage ratio are taken into account, firms with high pre-crisis leverage

ratios reduced their investment rates significantly more than comparable firms with lower leverage ratios. The estimation method takes into account that highly leveraged firms that had made considerable leveraged investment before the crisis naturally may have had smaller investment needs in subsequent years (a 'regression to the mean' effect).

The greater reduction in investment during the crisis observed for more leveraged firms can be seen in several alternative specifications and robustness checks and within more homogeneous groups of firms, defined by geography, industry, liquidity, export orientation and sales growth. The effect is most clear for small and medium-sized enterprises with up to 250 full-time employees.

Relationship between leverage ratio and development in investment, selected groups of firms

Chart 5

Selected industries

Investment rate in 2011, median of index, 2007 = 100

■ Low leverage in 2007 ■ High leverage in 2007

Regions

Investment rate in 2011, median of index, 2007 = 100

■ Low leverage in 2007 ■ High leverage in 2007

Liquidity

Investment rate in 2011, median of index, 2007 = 100

■ Low leverage in 2007 ■ High leverage in 2007

Export orientation

Investment rate in 2011, median of index, 2007 = 100

■ Low leverage in 2007 ■ High leverage in 2007

Note: Firms with high liquidity are defined as firms in which liquid assets account for more than 10 per cent of total assets, while firms with low liquidity make up the rest. Liquid assets are defined as holdings of securities and other equity, cash and bank deposits, etc. A more narrow definition of liquidity provides the same picture. Exporting firms are defined as firms that export more than 5 per cent of their turnover, while non-exporting firms make up the rest.
Source: Own calculations based on firm-level data from Statistics Denmark.

Econometric analysis of the relationship between leverage ratio and investment Box 2

The following regression model is estimated to shed light on the relationship between firms' leverage and the development in investment:

$$\Delta I_{i;s;r;2007-t} = \alpha + \delta_M M_{i;s;r;2007} + \delta_H H_{i;s;r;2007} + \beta \chi_{i;s;r;2007}$$

$$+ \theta \Delta I_{i;s;r;2006-2007} + \sum_{s=1}^{6} Y_s S_s + \sum_{r=1}^{4} Y_r R_r + \varepsilon_{i;s;r;t}$$

where $\Delta I_{i;s;r;2007-t}$ represents the change in the investment rate (investment relative to value added) from 2007 to year $t \in (2008, 2009, \dots, 2012)$. The subscripts refer to firm i in industry s, region r and year t. M and H are dummy variables referring to firms having medium leverage (debt to total assets 60-80 per cent) and high leverage (more than 80 per cent), respectively, so that the coefficients δ_M and δ_H express the difference in the change in investment rates for

two firms that are identical except that one has low leverage and the other has medium or high leverage, respectively. In the vector of control variables, $\chi_{i;s;r;2007}$, variables that are typically included in investment models are included. Sales growth, implicit interest rate on the firm's debt, return on assets, export share, equity relative to value added, firm age and the logarithm of the number of employees are included. Moreover, the model controls for industry and geographical affiliation. To allow for the fact that firms are likely to have smaller investment needs after a period of large investment (a 'regression to the mean' effect), the variable $\Delta I_{i;s;r;2006-2007}$, is included which denotes the change in the investment rate from 2006 to 2007. In supplementary analyses, several similar variables are included from a longer period, but results are not substantially impacted.

Result of model estimation

Dependent variable: Change in investment rate from 2007 to	2008	2009	2010	2011	2012
Medium leverage (2007)	-2.328***	-3.764***	-2.443***	-2.245***	-2.058***
	(0.280)	(0.298)	(0.263)	(0.251)	(0.261)
High leverage (2007)	-3.877***	-5.321***	-3.710***	-3.267***	-2.946***
	(0.387)	(0.405)	(0.379)	(0.374)	(0.391)
Observations	35,658	34,814	34,341	33,954	33,602
R^2	0.085	0.108	0.022	0.018	0.022

Note: The investment rate is defined as gross investment relative to value added. Control variables included (see above). Significance: *** p<0.01, ** p<0.05, * p<0.10. Robust standard errors in parentheses.
Source: Kuchler (2015).

The results of the estimation are presented in the table. As an example of interpretation, the development in investment rates from 2007 to 2009 can be observed. According to the model, highly leveraged firms reduced their investment rates by an average of 5.3 percentage points more from 2007 to 2009 than similar firms with low leverage. Firms with medium leverage reduced their investment rates by 3.8 percentage points more than similar firms with low leverage. As the median investment rate for all firms in 2007 was 6.3 per cent, the effect is quite sizeable for the individual firm.

A number of robustness checks have been performed and additional model specifications have been estimated, cf. Kuchler (2015). Moreover, the models are estimated

separately for a number of subsamples of firms defined by industry, firm size, liquidity, export orientation, sales growth and geography. Results are robust for all of these alternative specifications except the estimation based only on large firms with more than 250 employees for which results point in the same direction, but are not statistically significant. This subsample is more heterogeneous than other firms, and the number of observations is limited.

Moreover, additional model estimations show that the effect of high leverage on the change in firms' investment rates is present not only in periods of crisis; however, the effect is notably stronger in these periods.

The effect is not statistically significant for large firms. The explanation is that the largest firms did not reduce investment as much as small firms during the crisis. Moreover, large firms constitute a smaller and more heterogeneous group than small firms.

In other words, the individual firm's pre-crisis leverage ratio was thus significant for the development in the firm's investment during the crisis. To assess whether the effect also has substantial macroeconomic implications, the model can be used to construct a rough estimate of how investment would
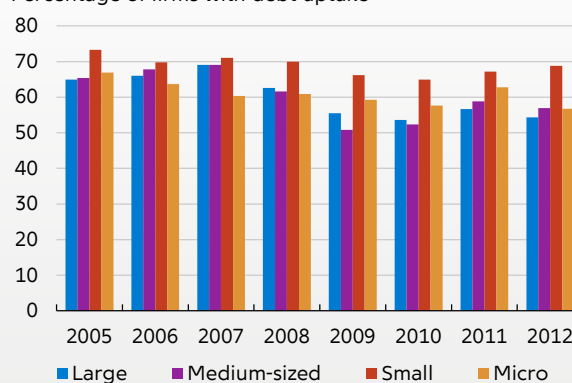
Debt uptake before and during the crisis

Chart 6

Percentage of firms with debt uptake
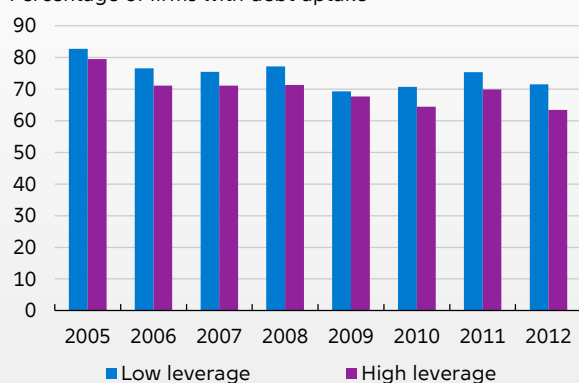
Percentage of firms with debt uptake

Note: Debt uptake is defined as an increase in outstanding debt (excluding trade credits) of at least 5 per cent relative to the previous year.
Firm sizes: Micro: < 10 employees, Small: 10-49 employees, Medium-sized: 50-249 employees, Large: 250 ≥ employees.
Source: Own calculations based on firm-level data from Statistics Denmark.

have developed during the financial crisis if highly leveraged firms (with a leverage ratio of more than 80 per cent) had instead had a medium leverage ratio (60-80 per cent). Using this method, it can be estimated that the high leverage of some firms can explain approximately 15-20 per cent of the reduction in aggregate investment in the period from 2007 to 2012. The contraction in investment during the crisis, and the continued low investment rate, is probably mainly the result of weak demand and increased uncertainty, cf. Kramp and Pedersen (2015), but the results above indicate that the build-up of leverage in the period leading up to the crisis contributed to the reduction.

WHAT DOES THE RELATIONSHIP EXPRESS?

There may be several explanations for the relationship between firms' pre-crisis leverage and the development in investment during the crisis. Firstly, firms that were highly leveraged in the years leading up to the crisis naturally had smaller investment needs in subsequent years (a 'regression to the mean' effect). However, the econometric analysis specifically takes into account the possibility of a regression to the mean effect

as the analysis controls for the development in investment in the pre-crisis years.

Secondly, more leveraged firms may have been constrained by more limited access to credit during the crisis, and thus may have found it more difficult to raise the necessary capital for investment projects. But the effect of a high leverage ratio on the development in firms' investment during the crisis is also evidenced in subsamples of firms for which the effect would not be expected if the explanation was credit constraints only. For instance, the relationship is also clear if only firms with high liquidity are observed, cf. Chart 5. This is also the case when the analysis controls for other firm characteristics, cf. Kuchler (2015).

During the crisis, credit institutions tightened their loose pre-credit credit standards. Other things being equal, highly leveraged firms pose a greater credit risk for banks due to their higher probability of default, cf. e.g. Abildgren and Damgaard (2012). This undoubtedly helps to explain why the proportion of highly leveraged firms that raised new debt in any given year, both before, during and after the crisis, was lower than the corresponding proportion of firms with low leverage, cf. Chart 6 (left). The chart also indicates that credit standards were not tightened disproportionately for highly leveraged firms during the crisis.[1] The effect of high leverage

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1   However, during the crisis banks began to attach importance to factors such as profit and liquidity in the assessment of loan applications, cf. Abildgren et al. (2013).

on the probability of uptake of debt in any given year was largely similar before and during the crisis, cf. Kuchler (2015). Thus, this does not indicate that the greater reduction in investment by highly leveraged firms was caused by disproportionate tightening of credit standards for these firms.

Moreover, the proportion of small firms that raised new debt in any given year decreased only a little during the crisis, while the corresponding proportion of large firms fell substantially, cf. Chart 6 (right). Given that small firms reduced their investment more than any other firms, this result also does not indicate that credit constraints were a major explanation for the contraction in investment during the crisis.

A more likely explanation of why investment was reduced more by highly leveraged firms is that, in response to the crisis, they wanted to consolidate their balance sheets to increase their resilience to future shocks to the economy and retain flexibility in future financing choices. Weaker demand, increased uncertainty and general crisis awareness are likely to have contributed to this wish among some firms. Moreover, the crisis may have reduced the corporate sector's confidence that the banking system will always be able to meet their liquidity requirements, cf. Kramp and Pedersen (2015).

CORPORATE CAPITAL STRUCTURE AND MACROECONOMIC STABILITY

Previous analyses have shown that there are no costs for individual firms in the form of lower profitability (before tax) or weaker productivity with a capital structure with a large equity capital buffer compared with a highly leveraged capital structure, cf. Abildgren et al. (2014). But a high solvency ratio gives firms more flexibility regarding financing options and makes them more resilient to shocks to the economy, cf. e.g. Abildgren et al. (2013). Danmarks Nationalbank's failure-rate model clearly demonstrates that the lower the leverage of a firm, the lower its risk of failure. This also applies if the model controls for firm size, return on assets, form of ownership, age, geography, industry and the macroeconomic situation, cf. Lykke et al. (2004) and Abildgren and Damgaard (2012). Thus, a capital structure with a large capital buffer supports financial stability.

The results of this analysis indicate that high leverage may reinforce the reduction in investment typically seen during a recession. Generally, a number of other countries have also seen examples that in the wake of a financial crisis, firms have been forced to engage in major deleveraging for many years, cf. e.g. Koo (2008) and ECB (2012). Thus, a weakly capitalised corporate sector may contribute to higher macroeconomic volatility. Consequently, there may be strong arguments for seeking to contain the build-up of leverage during economic upswings.

The credit standards of banks were too loose in the pre-crisis years, but since then they have implemented the necessary tightening. Moreover, regulators have introduced a number of regulatory initiatives to reduce the risk of unsustainable credit growth in future. On the other hand, viewed in isolation, the Danish tax advantage of debt financing over equity financing does not improve the solvency ratios of Danish firms. Subject to certain restrictions, firms can deduct interest expenses on their income statements in line with other operating expenses, while the equity remuneration (e.g. shareholder dividends) is non-deductible. Other things being equal, a high leverage ratio thus reduces the firm's tax payments. Since the late 1980s, the tax advantages of debt have been reduced through lower corporation tax rates. As a result, solvency in manufacturing firms has increased, cf. Abildgren et al. (2014). Corporation tax rates will be reduced further in 2015 and 2016. This is yet another step towards tax equality of equity and debt. However, debt financing still offers substantial advantages over equity financing in the Danish tax system. This has prompted the Economic Councils (2008) and the Danish Productivity Commission (2014) to table proposals for harmonisation of the tax treatment of the various types of financing.

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