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CORPORATE CAPITAL STRUCTURE AND PROFITABILITY, PRODUCTIVITY AND ACCESS TO FINANCE

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Danmarks Nationalbank

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RESUME

Vi foretager en empirisk analyse af sammenhængen mellem danske ikke-finansielle virksomheders kapitalstruktur og deres lønsomhed, produktivitet og adgang til finansiering baseret på branche- og virksomhedsspecifikke regnskabsdata for perioden 2000-2011. Analysen indikerer, at kapitalstrukturen ikke har betydning for virksomhedernes lønsomhed eller produktivitet. En virksomheds kapitalstruktur har derimod betydning for virksomhedens fleksibilitet i valget mellem alternative finansieringskilder og sikkerheden for at opnå den ønskede finansiering. Vores analyse indikerer, at små og mellemstore virksomheder med en høj soliditet har større sandsynlighed for at få accepteret en ansøgning om banklån end tilsvarende virksomheder med lav polstring mod underskud. Der er også en tendens til, at børsnoterede aktieselskaber er mere solide end unoterede aktieselskaber. Endelig sammenligner vi danske ikke-finansielle virksomheders kapitalstruktur med kapitalstrukturen hos virksomheder i andre EU-lande baseret på aggregerede finansielle statuskonti. Det overordnede finansieringsmønster for danske virksomheder er meget lig den, der findes i de øvrige europæiske lande. Der er dog en tendens til, at danske virksomheder i mindre grad anvender markedsbaseret finansiering såsom børsnoterede aktier og virksomhedsobligationer, hvilket kan afspejle et stort og velfungerende marked for danske realkreditobligationer og udbredelsen af erhvervsdrivende fonde i Danmark.

ABSTRACT

We take a closer look at the links between corporate capital structure and productivity, profitability and access to finance based on Danish industry-level and firm-level accounting data from the period 2000-2011. Our results indicate that the capital structure has no significant impact on the firms' profitability or productivity. However, the capital structure is important in relation to the range of financing options available to the firm and its funding and refinancing risks. Our analysis shows that small and medium-sized enterprises with high solvency ratios tend to have a higher acceptance rate when they apply for bank loans than corresponding firms with low solvency ratios. We also find that firms issuing exchange-traded stocks have higher solvency ratios than unquoted public firms. Finally we compare the corporate capital structure in Denmark with other EU countries based on aggregated financial accounts statistics. The overall funding pattern of Danish firms is quite similar to the one found in the other European countries. However, the Danish firms tend to a somewhat lesser extent to use market based funding such as quoted shares and corporate bonds which might reflect a large and well-functioning Danish market for mortgage bonds and the prevalence of industry foundations in Denmark.

KEY WORDS

Financial structure; Productivity; Profitability; Firm-level data.

JEL CLASSIFICATION

D24; G32.

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1. INTRODUCTION AND SUMMARY

In the paper at hand we take a closer look at the links between corporate capital structure and productivity, profitability and access to finance. We analyse if the overall capital structure (i.e. the mixture of debt and equity financing) has an influence on industry- or firm-level productivity and profitability based on Danish industry-level and firm-level accounting data from the period 2000-2011.

Our results indicate that the overall capital structure has no significant impact on profitability or productivity, neither at an industry level nor at a firm level. We find no significant correlation between a firm's debt-to-assets ratio and its return on assets, growth in labour productivity or growth in total factor productivity. This finding is consistent with Modigliani and Miller (1958) who showed that the value of a firm is independent of its capital structure subject to certain idealised assumptions. A suggested implication of this irrelevance theorem is that a firm's return on assets or productivity is independent of its capital structure. The capital structure matters only for the distribution of the return on assets among different creditors and equity holders but not for the size of the return on assets or the level of productivity or productivity growth.

However, the mix between equity and debt financing is usually considered to be important in relation to financial stability. Firms with high solvency ratios are more robust to adverse macroeconomic shocks than firms with low solvency ratios. Since corporate customers constitute a large share of the lending portfolio in the banking sector, the financial system will all else equal be more robust the higher the solvency ratios are in the non-financial business sector. Furthermore, high solvency ratios give firms a larger range of financing options to choose from and thereby lower funding and refinancing risks. Our analysis based on Danish firm-level data for small and medium-sized enterprises (SMEs) shows that firms with high solvency ratios tend to have a higher acceptance rate when they apply for bank loans than corresponding firms with low solvency ratios. We also find that firms that issue exchange-traded stocks have higher solvency ratios than unquoted public firms.

Our empirical results suggest that there are no "costs" (before tax) for firms in terms of lost profitability or productivity by increasing the equity ratio to achieve this greater resilience to shocks to the economy and greater financial flexibility and safety. After tax, however, there may be a cost due to the bias in favor of debt financing over equity in the Danish tax system.

Furthermore, our results indicate that the credit-rating system in the Danish banking system after the financial crisis seems to allocate the loan capital to the most solid, profitable and productive businesses. This is an important and necessary condition for the banking system to function as an efficient provider of loan capital. Prior to the financial crisis there was no significant relationship between banks' acceptance of loan applications and corporate customers' profitability and productivity.

Finally, we compare the corporate capital structure in Denmark with other EU countries based on aggregated financial accounts statistics. The overall funding pattern of Danish firms is quite similar to the one found in the other European countries. However, the Danish firms tend to a somewhat lesser extent to use market based funding such as quoted shares and corporate bonds with might reflect a large and well-functioning Danish market for mortgage bonds and the prevalence of industry foundations in Denmark.

The rest of this paper is organised as follows: Section 2 considers the links between corporate capital structure, profitability and productivity growth using industry-level data. Section 3 presents a similar analysis using firm-level data. Section 4 analyses the role played by solvency, productivity and profitability in getting access to loan financing. Section 5 considers market based versus non-market based financing based on financial accounts data and firm-level data. Finally, section 6 offers some concluding remarks.

2. CAPITAL STRUCTURE, PROFITABILITY AND PRODUCTIVITY – INDUSTRY-LEVEL EVIDENCE

2.1 DATA

As a first explorative analysis we take a closer look at capital structures in the Danish business sector at a detailed industry level based on Statistics Denmark's Firm Accounts Statistics from 2000-2011. Furthermore, we aim to shed some light on the links between corporate capital structure and profitability and productivity growth. Regarding productivity we rely on Statistics Denmark's National Accounts Statistics (ESA95 basis) from 2000-2009 at a detailed industry level.

Statistics Denmark's Firm Accounts Statistics covers the non-financial private business sector excluding agriculture *etc.*, energy and water supply and parts of the transport sector (ports *etc.* and transport via railways and busses). The statistics is mainly based on directly reporting from around 2,000 firms which accounts for around 70 per cent of the total turnover. The rest of the firms are covered by information drawn from the firms' reporting to the Danish tax authorities and from VAT Statistics, cf. section 3 and Statistics Denmark (2011) for further details on the Firm Accounts Statistics.

We make use of the Firm Accounts Statistics at a 5-digit NACE classification level which contains 93 industries. As part of our data cleaning – and in order to have a balanced sample – we excluded 11 industries with missing observations or possible data errors. As a starting point we thus base our analysis on data from 82 industries, cf. the list in annex 2.A.

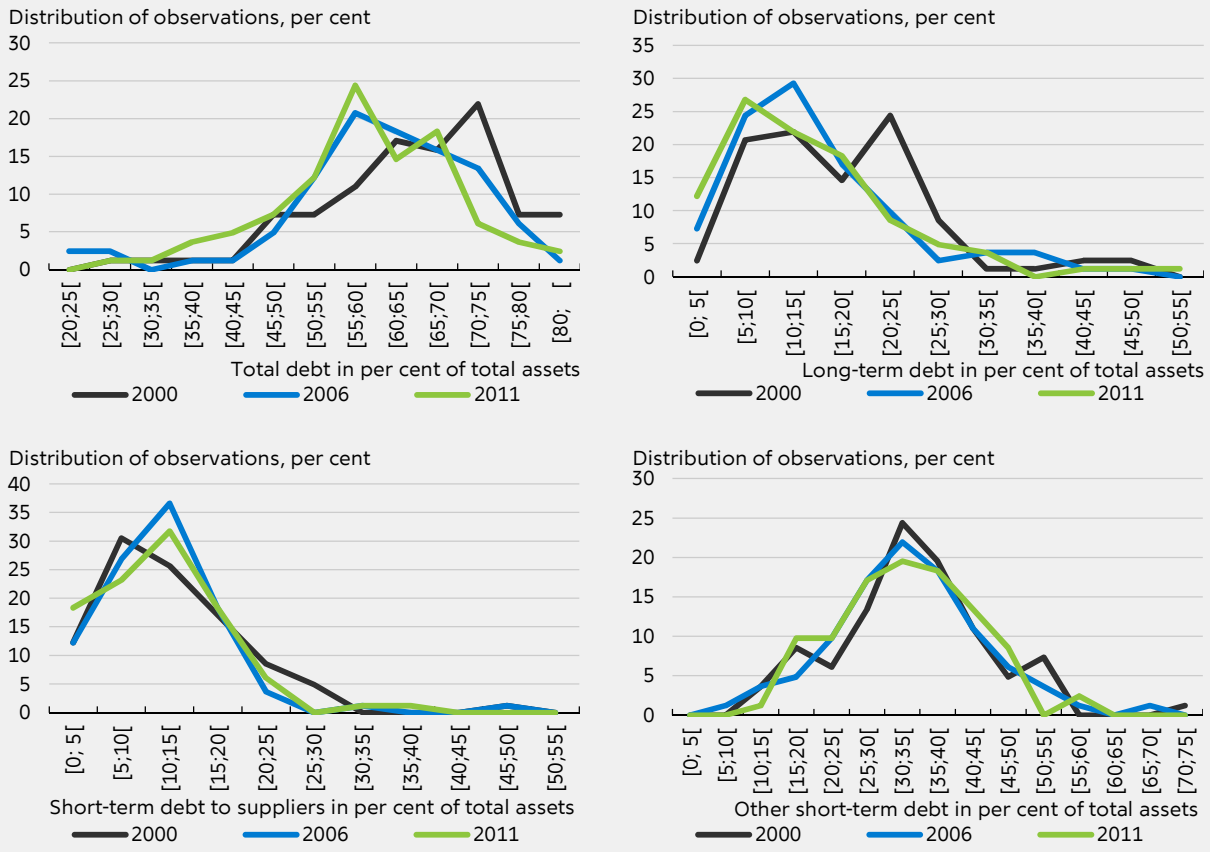
Statistics Denmark compiles figures for annual growth in labour productivity (at a 117 industry level) and total factor productivity (at a 69 industry level) as an integrated part of the National Accounts Statistics, cf. Bonde and Sørensen (2005). We are able to combine the data for labour productivity and the data regarding the non-financial firms' capital structures at a level of 62 industries, cf. annex 2.B. In relation to total factor productivity we had to use a level of 36 industries in order to merge the data sets, cf. annex 2.C.

As with all analysis of productivity based on national-account figures a word of caution is in order due to difficulties related to e.g. statistical measurement of quality improvements. It should furthermore be noted that the figures from the Firm Accounts Statistics are based on firms as legal units (e.g. limited-liability corporations, sole traders, partnerships, *etc.*) whereas the national accounts statistics is based on firms as local production units. As a result, the combination of figures from the Firm Accounts Statistics and the National Accounts Statistics introduces a certain amount of uncertainty since a legal unit might have several local production units located in different industries.

2.2 BALANCE-SHEET STRUCTURE OF NON-FINANCIAL FIRMS

Debt is typically the largest source of finance in the Danish non-financial business sector. At the end of 2011 total debt amounted on average to 59 per cent of total assets at book values. There is, however, considerable heterogeneity across the 82 industries in our data set, cf. Chart 2.1. 12 per cent of the industries had in 2011 debt-to-asset ratios of more than 70 per cent, for instance manufacturing of leather and footwear, travel agent activities and restaurants. At the other end of the spectra – with debt-to-asset ratios below 40 per cent – we find e.g. manufacturing of pharmaceuticals and business consultancy activities. About 6 per cent of the industries had debt-to-asset ratios below 40 per cent in 2011. Overall, the distributions of the various debt ratios seem to have been fairly stable since the mid-2000s, although with a tendency towards lower total debt ratios.

Frequency distribution of debt ratios – selected years 2000-2011 Chart 2.1



Note: Distributions of observations for 82 industries, cf. annex 2.A. Long-term debt is debt with a maturity of more than one year. Short-term debt is debt with a maturity of up to one year. Total debt equals the sum of long-term debt, short-term debt to suppliers and other short-term debt.
Source: Own calculations based on data from Statistics Denmark.

Long-term debt – defined as debt with a maturity of more than one year – amounted on average to 14 per cent of the total assets at the end of 2011. No industries had a long-term debt ratio of more than 55 per cent.

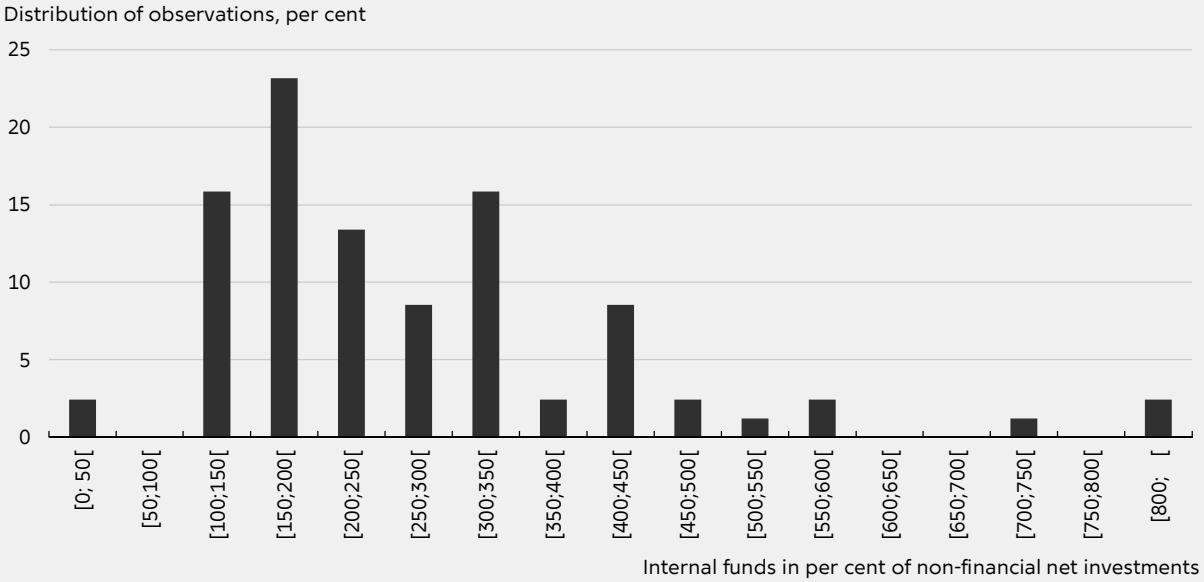
On average short-term debt to suppliers accounted for 12 per cent of the total assets at the end of 2011. In 9 per cent of the industries debt to suppliers accounted for

more than 20 per cent of the total assets, for instance in the case of retail sale of consumer electronics.

Other short-term debt accounted for 33 per cent of the total assets on average at the end of 2011. 11 per cent of the industries had a ratio of other short-term debt of more than 45 per cent of the total assets, for instance manufacturing of leather and footwear and travel agent activities.

Internal funds have traditionally played a significant role in the financing of the Danish non-financial business sector, cf. Petersen and Risbjerg (2009) and Abildgren (2009). Chart 2.2 confirms that Danish firms have a large potential for internal funding. "Internal funds" are here calculated as profit after tax plus value adjustments (i.e. consumption of fixed capital). According to this definition internal funds can thus be used for financial and non-financial investments as well as for dividends. Over the period 2000-2011 internal funds amounted to 277 per cent of non-financial net investments on average. For 7 per cent of the industries this share was higher than 500 per cent.

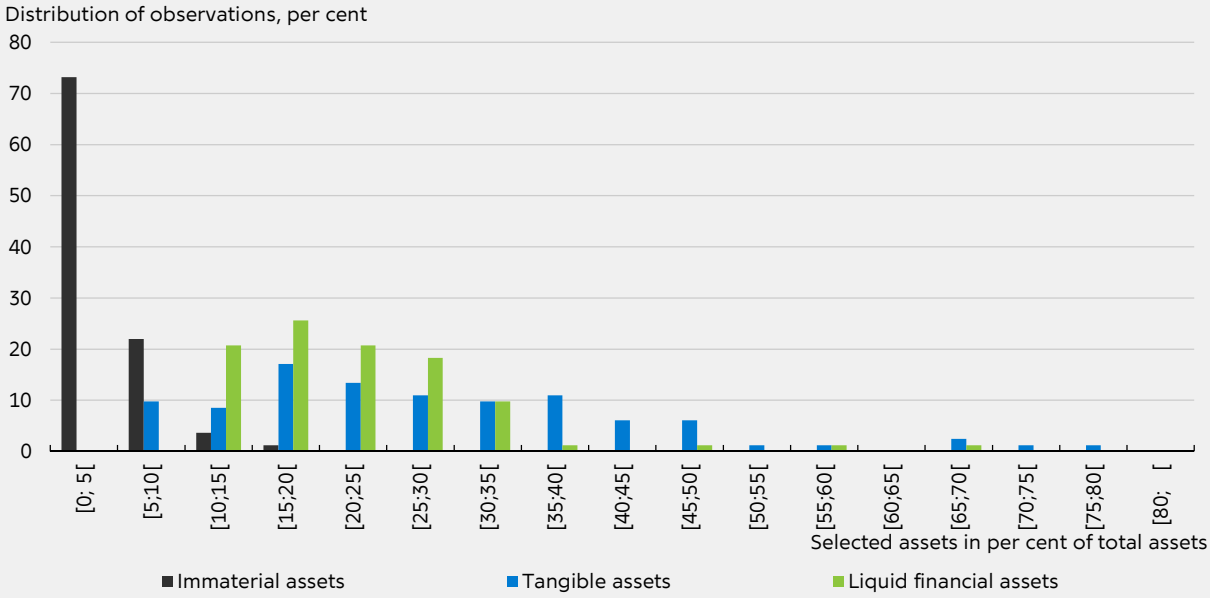
Frequency distribution of internal funds relative to non-financial net investments Chart 2.2



Note: Averages over the period 2000-2011. Distribution of observations for 82 industries, cf. annex 2.A. Internal funds are calculated as value adjustments (consumption of fixed capital) plus profit after tax.
Source: Own calculations based on data from Statistics Denmark.

Tangible assets – such as land, buildings, machinery *etc.* – accounted over the period 2000-2011 for 28 per cent of the total assets on average, cf. Chart 2.3. The distribution indicates a high degree of heterogeneity. 20 per cent of the industries had a ratio of tangible assets to total assets of 40 per cent or more, including restaurants, renting of real estate and hotels.

Frequency distribution of selected assets relative to total assets Chart 2.3



Note: Averages over the period 2000-2011. Distributions of observations for 82 industries, cf. annex 2.A. Tangible assets consist of land, buildings, machinery etc. Liquid financial assets (broad definition) consist of securities, cash, liquid bank deposits *etc.* (excluding debts receivable from customers; including other receivables, prepayments and accruals; and including ongoing work in progress since 2002).
Source: Own calculations based on data from Statistics Denmark.

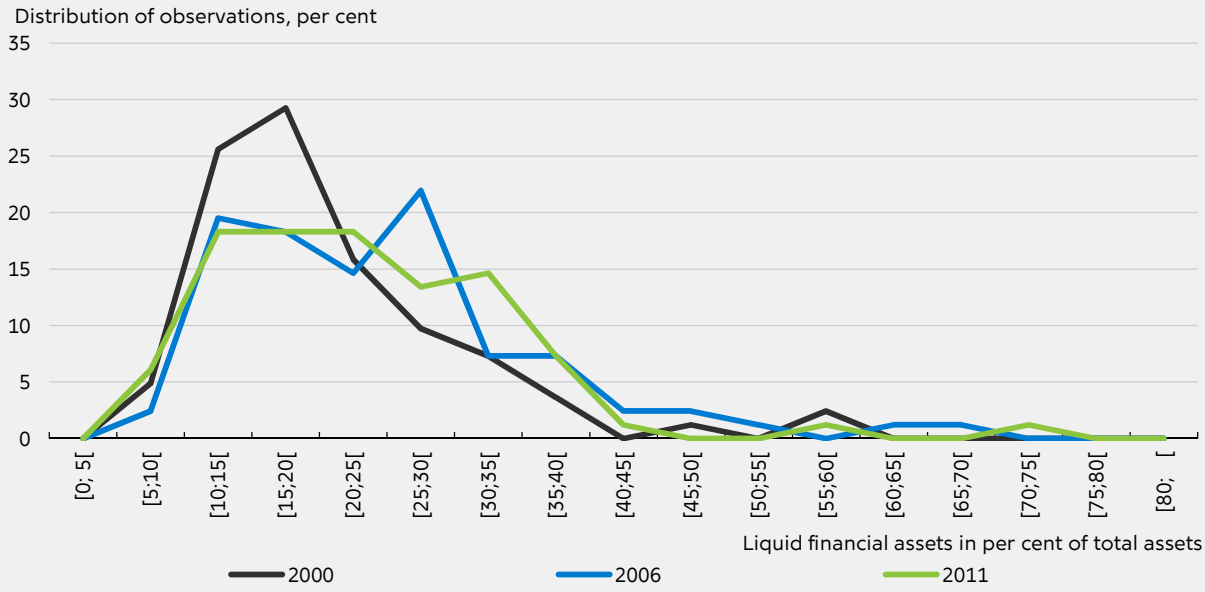
Immaterial assets accounted only for 4 per cent of the total assets on average over the period 2000-2011 and no industries had a share of immaterial assets of more than 20 per cent of total assets. Information technology service activities and accounting and bookkeeping activities are among those industries with the largest shares of immaterial assets.

Liquid financial assets – consisting of securities, cash, liquid bank deposits *etc.* (excluding debts receivable from customers) – accounted for 23 per cent of total assets on average. No industries had below 10 per cent liquid financial assets. 5 per cent of the industries had a liquid-financial-asset ratio of more than 35 per cent, including publishing of computer games and other software, legal activities and travel agent activities.

As indicated by Chart 2.4 liquid financial assets seem to have constituted a fairly stable share of total assets over time, although with a tendency towards increased liquidity holdings prior to the recent financial crisis. European Central Bank (2013) also finds an increase in short-term financial assets in the run-up to the most recent financial crisis among non-financial corporations in the euro area.

Frequency distribution of liquid-financial-asset ratios – selected years 2000-2011

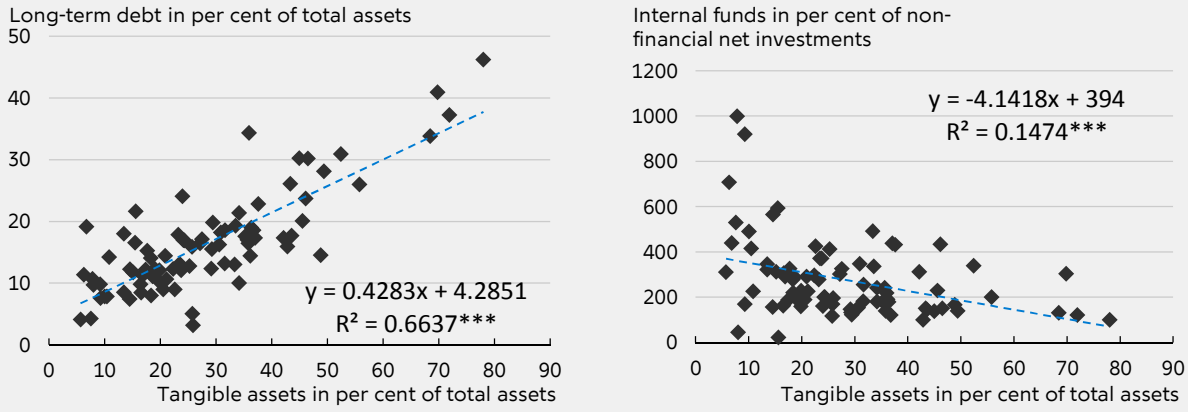
Chart 2.4



Note: Distribution of observations for 82 industries, cf. annex 2.A. Liquid financial assets consist of securities, cash, liquid bank deposits etc. (excluding debts receivable from customers).
Source: Own calculations based on data from Statistics Denmark.

Tangible assets versus long-term debt and internal funds

Chart 2.5



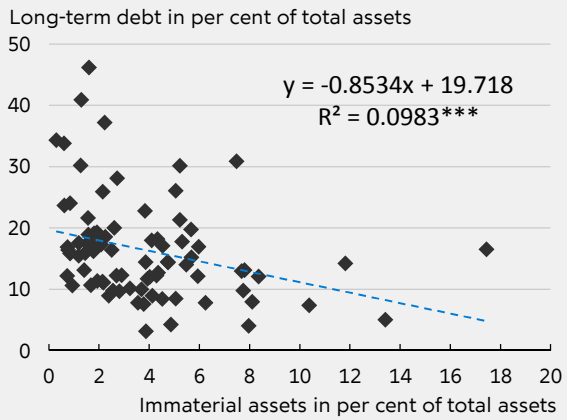
Note: Averages over the period 2000-2011. Distribution of observations for 82 industries, cf. annex 2.A. Tangible assets consist of land, buildings, machinery *etc.* Internal funds are calculated as value adjustments (consumption of fixed capital) plus profit after tax. Stars in relation to R^2 refer a double-sided test for significance of the estimated slope parameter. The null hypothesis is that the parameter is equal to zero. *, ** and *** indicates rejection of the null hypothesis at a significance level of respectively 10, 5 and 1 per cent.
Source: Own calculations based on data from Statistics Denmark.

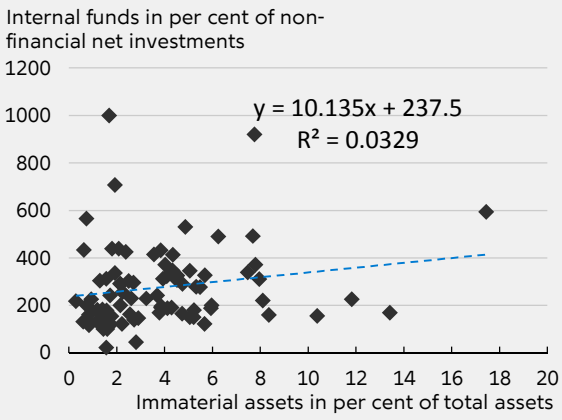
There seems to be a clear positive correlation between long-term debt-to-asset ratios and the proportion of total assets in tangible form, cf. Chart 2.5 (left). Similar results have been found in a recent firm-level study for the euro area countries, cf. European Central Bank (2013). The positive correlation might reflect that tangible assets serves as collateral in relation to long-term loans. Furthermore, tangible assets are relatively liquid in the event of bankruptcy which all else equal might make it easier to raise long-term debt.

As indicated by Chart 2.5 (right) there seems to be a negative correlation between industries with a large share of tangible assets relative to total assets and the amount of internal funds relative to non-financial net investments. This might reflect that industries with large shares of tangible asset have easier access to external funding using tangible assets as collateral and thereby rely less on internal funding.

The ratio of immaterial assets seems to be negatively correlated with long-term debt-to-asset ratios, cf. Chart 2.6 (left). The scope for long-term debt financing is probably lower for firms with a large share of immaterial assets since such types of assets are more illiquid than more generally applicable tangible assets (property, cars etc.) in the event of bankruptcy, cf. also Jensen and Meckling (1976) and Aghion *et al*. (2004). Chart 2.6 (right) might indicate that industries with relative large immaterial assets rely more on internal funds. This could reflect that industries with large immaterial assets have more restricted access to external funding. However, the correlation is not significantly different from zero at conventional significance levels.

Immaterial assets versus long-term debt and internal funds Chart 2.6





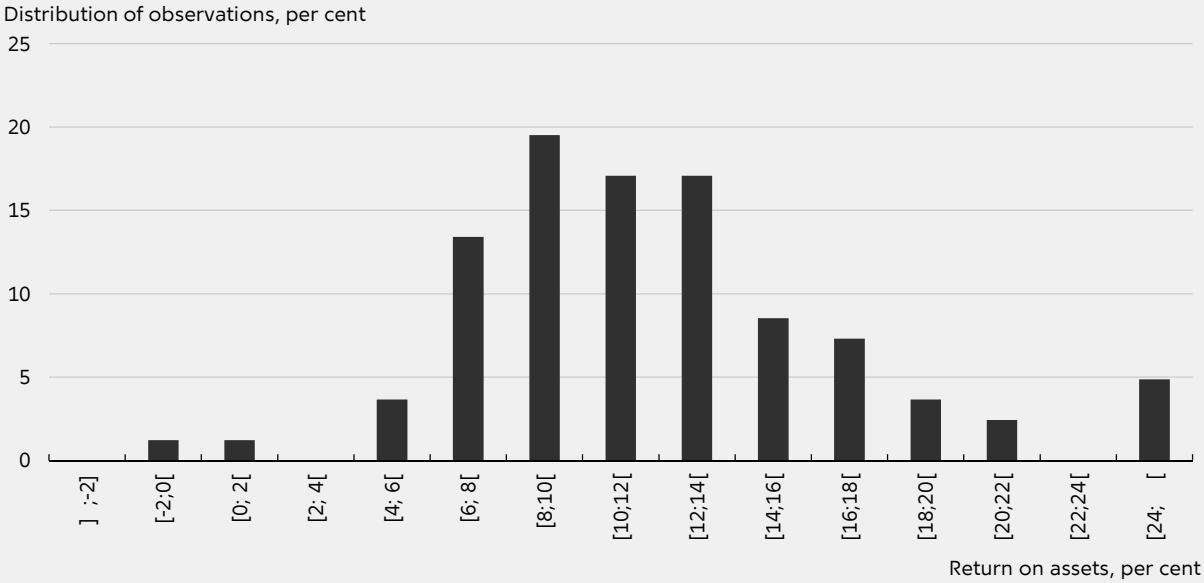
Note: Averages over the period 2000-2011. Distributions of observations for 82 industries, cf. annex 2.A. Internal funds are calculated as value adjustments (consumption of fixed capital) plus profit after tax. Stars in relation to R^2 refer a double-sided test for significance of the estimated slope parameter. The null hypothesis is that the parameter is equal to zero. *, ** and *** indicates rejection of the null hypothesis at a significance level of respectively 10, 5 and 1 per cent.
Source: Own calculations based on data from Statistics Denmark.

2.3 BALANCE-SHEET STRUCTURES AND PROFITABILITY

Across the 82 industries the annual return on assets has on average been around 12.5 per cent per annum over the period 2000-2011, cf. Chart 2.7. We have defined the return on assets as profit before tax plus financial expenses in per cent of the total assets end of year. We add financial expenses in order to get a clean figure for the gross return on assets without subtracting parts of the remuneration of the funding sources.

Frequency distribution of annual return on assets

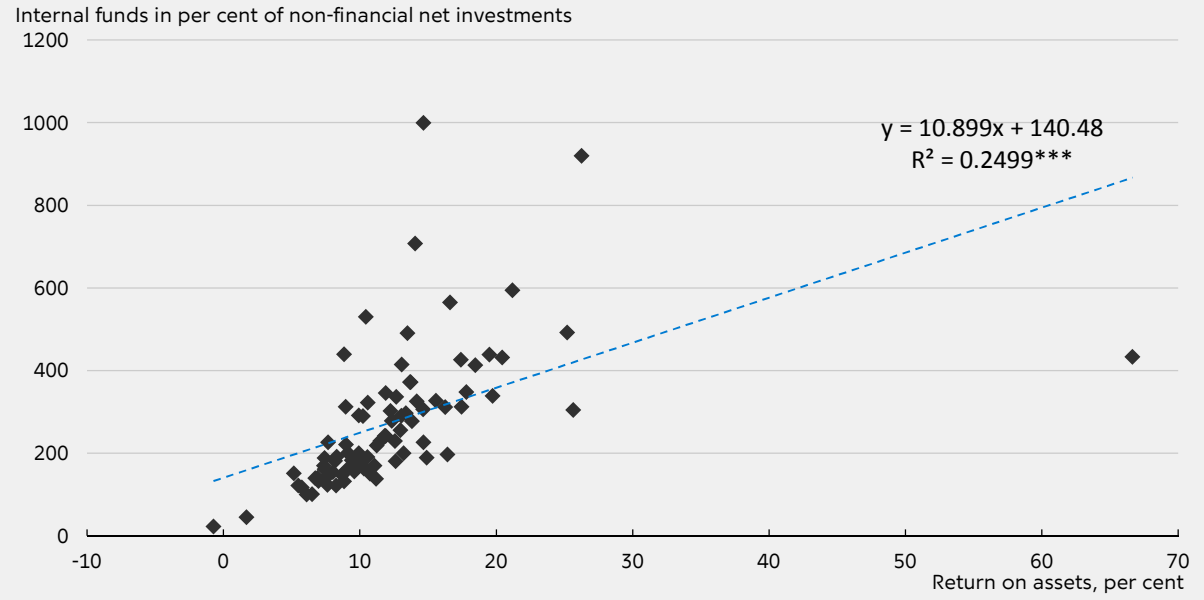
Chart 2.7



Note: Averages over the period 2000-2011. Distribution of observations for 82 industries, cf. annex 2.A. The return on assets is calculated as profit before tax plus financial expenses in per cent of the total assets end of year.
Source: Own calculations based on data from Statistics Denmark.

Return on assets versus internal funds

Chart 2.8



Note: Averages over the period 2000-2011. Distribution of observations for 82 industries, cf. annex 2.A. The return on assets is calculated as profit before tax plus financial expenses in per cent of the total assets end of year. Internal funds are calculated as value adjustments (consumption of fixed capital) plus profit after tax. Stars in relation to R^2 refer a double-sided test for significance of the estimated slope parameter. The null hypothesis is that the parameter is equal to zero. *, ** and *** indicates rejection of the null hypothesis at a significance level of respectively 10, 5 and 1 per cent.
Source: Own calculations based on data from Statistics Denmark.

Again, we find considerable heterogeneity across the 82 industries. In 11 per cent of the industries the return on assets has exceeded 18 per cent per annum on average,

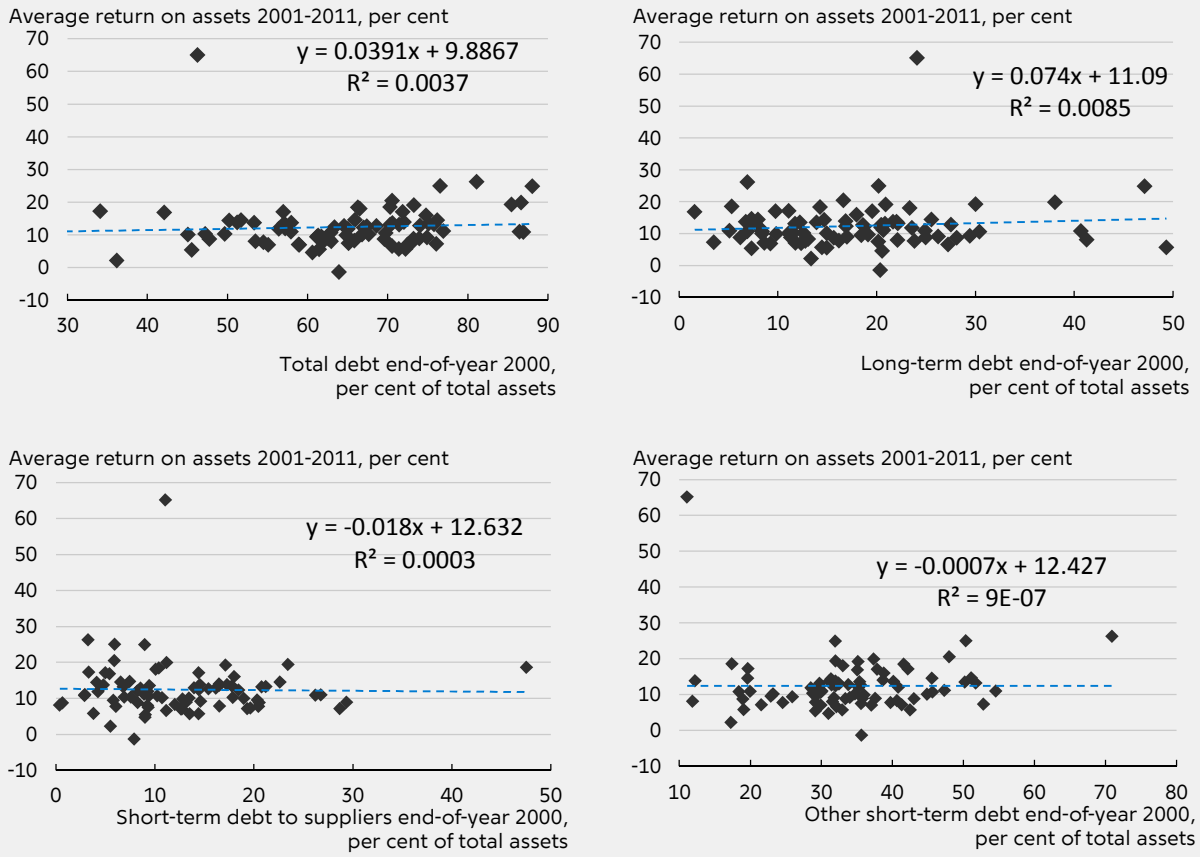
for instance in legal activities, extraction of oil and gas and restaurants. At the other end of the spectrum – average annual return on assets below zero per cent – we find manufacture of ships and other transport equipment.

All else equal firms with high profitability are expected to generate more internal funds than firms with low profitability and thereby have the potential to finance a larger share of their non-financial investments via internal funds. The Danish industry-level data shows a positive correlation between return on assets and internal funding, cf. Chart 2.8, but there is naturally an issue regarding causality.

Based on industry-level data there seems not to be any significant correlation between the firms' total debt-to-assets ratio at the end of year 2000 and their return on assets during the period 2001-2011, cf. Chart 2.9. The same is the case regarding the long-term debt ratio, the ratio of debt to suppliers and the ratio of other short-term debt.

Return on assets versus debt ratios

Chart 2.9



Note: Distribution of observations for 82 industries, cf. annex 2.A. The return on assets is calculated as profit before tax plus financial expenses in per cent of the total assets end of year. Stars in relation to R^2 refer a double-sided test for significance of the estimated slope parameter. The null hypothesis is that the parameter is equal to zero. *, ** and *** indicates rejection of the null hypothesis at a significance level of respectively 10, 5 and 1 per cent.

Source: Own calculations based on data from Statistics Denmark.

These findings are in line with Modigliani and Miller (1958) who showed that the value of a firm is independent of its capital structure subject to certain idealised assumptions (including competitive and complete markets, no taxes or transaction costs, no bankruptcy costs and no informational asymmetries). Under these assumptions the

value of a firm is equal to the value of its assets. A suggested implication of this irrelevance theorem is that a firm's return on assets is independent of its capital structure, including the choice of leverage. The capital structure matters for the distribution of the return on assets among different creditors and shareholders but not for the size of the return on assets. However, as will be discussed in more details later the size of the return on assets in various industries will among other things in principle depend on the level of business risk within the relevant industry and the level of return on assets in similar industries abroad.

Parts of the literature have challenged the validity of the implications of the Modigliani–Miller proposition and the assumptions behind it.

Some studies contain arguments for a positive correlation between debt-to-asset ratio and return on assets and that the causality runs from capital structure to profitability, cf. Jensen (1986). One argument could be that free cash flow reduces cost control incentives and that the interest-payment obligation resulting from a high debt ratio reduces the amount of free cash flow that might find its way to less productive uses in a firm. According to this line of thought debt is viewed as a disciplining device originating from the obligation to service the creditors on time. Nickell and Nicolitsas (1999) found for instance a positive impact from ratio of interest payments to cash flow on total factor productivity for UK firms over the period 1972-1986. If one considers after-tax returns an alternative argument could be possible tax advantages of debt since firms in many countries can deduct interest expenses on their tax returns, but not dividend to shareholders *etc*., cf. Modigliani and Miller (1963) and De Mooij and Ederveen (2008). A high leverage ratio all else equal reduces the total tax payments to the central government and thereby gives higher profitability after tax.[1]

Other studies argue that the causality runs from profitability to capital structure. According to the "pecking order" theory informational asymmetries between the firm and external creditors make external financing more expensive than internally generated funds, cf. Myers (1984). Profitable firms with large internal funds might therefore prefer internal funding rather than external debt finance which results in a negative relationship between debt-to-asset ratio and return on assets. Based on firm-level data from the Japanese machinery industry 1981-2011, Tsuji (2013) found a negative relationship between various indicators for profitability and leverage ratio. This is consistent with an earlier study by Barton and Gordon (1988) that also found a relationship between high profitability and low debt levels based on US firm-level data from 1970-1974. Chittenden *et al*. (1996) found a negative relation between short-term debt and profitability based on UK micro data for small and medium-sized enterprises (SMEs) in the early 1990s. In contrast no strong association was found between long-term debt and profitability.

A key assumption behind the results of the analysis in Modigliani and Miller (1958) is that firms are homogeneous and belong to the same "class". The exact definition of "class" is not specified, but Modigliani and Miller, *op. cit*., argues that the industry can be seen as a proxy for the "class":

> "Our concept of a class, while not identical to that of the industry is at least closely related to it. Certainly the basic characteristics of the probability distributions of the returns on assets will depend to a significant extent on the

[1] However, as argued in Miller (1988), the Modigliani–Miller propositions should strictly speaking also hold to a wide extent in a world with taxes if Ricardian Equivalence is assumed.

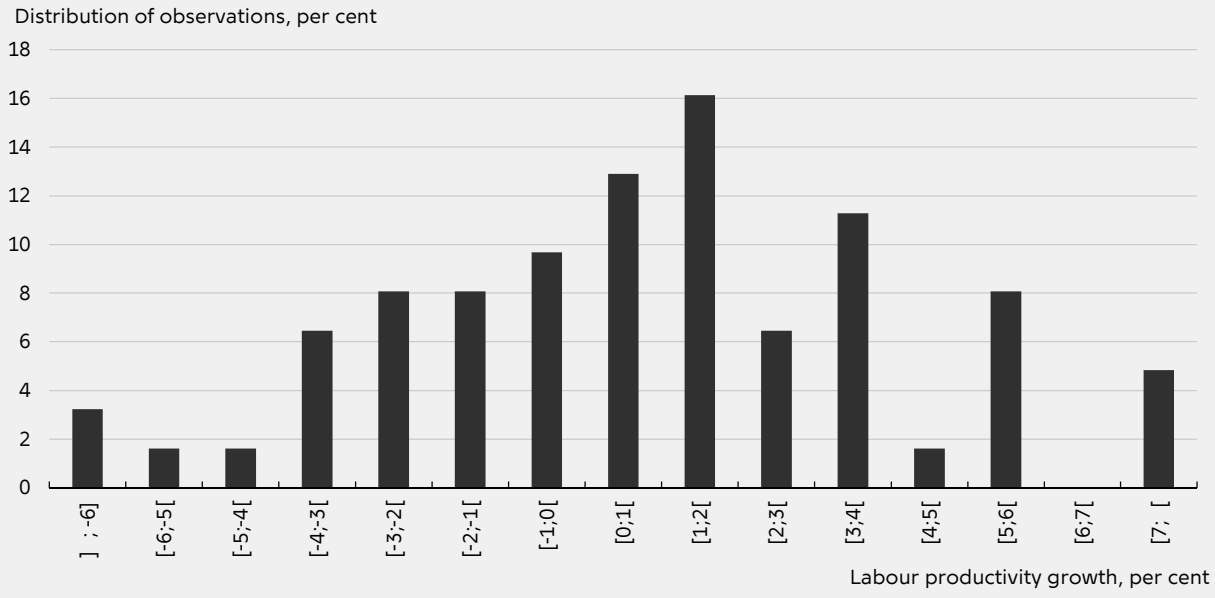
product sold and the technology used" (page 267 in Modigliani and Miller, 1958).

It could therefore be argued that industry-level data are not well suited for a proper analysis of corporate capital structures since differences in business risks across industries might be reflected in return on assets. In section 3 we use firm-level data to assess the robustness of the findings for Denmark above based on industry-level data.

2.4 BALANCE-SHEET STRUCTURES AND GROWTH IN LABOUR PRODUCTIVITY

As shown in Chart 2.10, the annual growth in labour productivity has on average been around 1.1 per cent per annum over the period 2000-2009 across the 62 industries covered by our data. In 15 per cent of the industries the growth rate has exceeded 4 per cent per annum on average, for instance within manufacturing of engines, windmills and pumps, manufacturing of medical instruments, *etc.* and manufacturing of computers and communication equipment *etc.* We find average annual growth rates in labour productivity below -2 per cent within e.g. manufacturing of leather and footwear.

Frequency distribution of annual labour productivity growth Chart 2.10

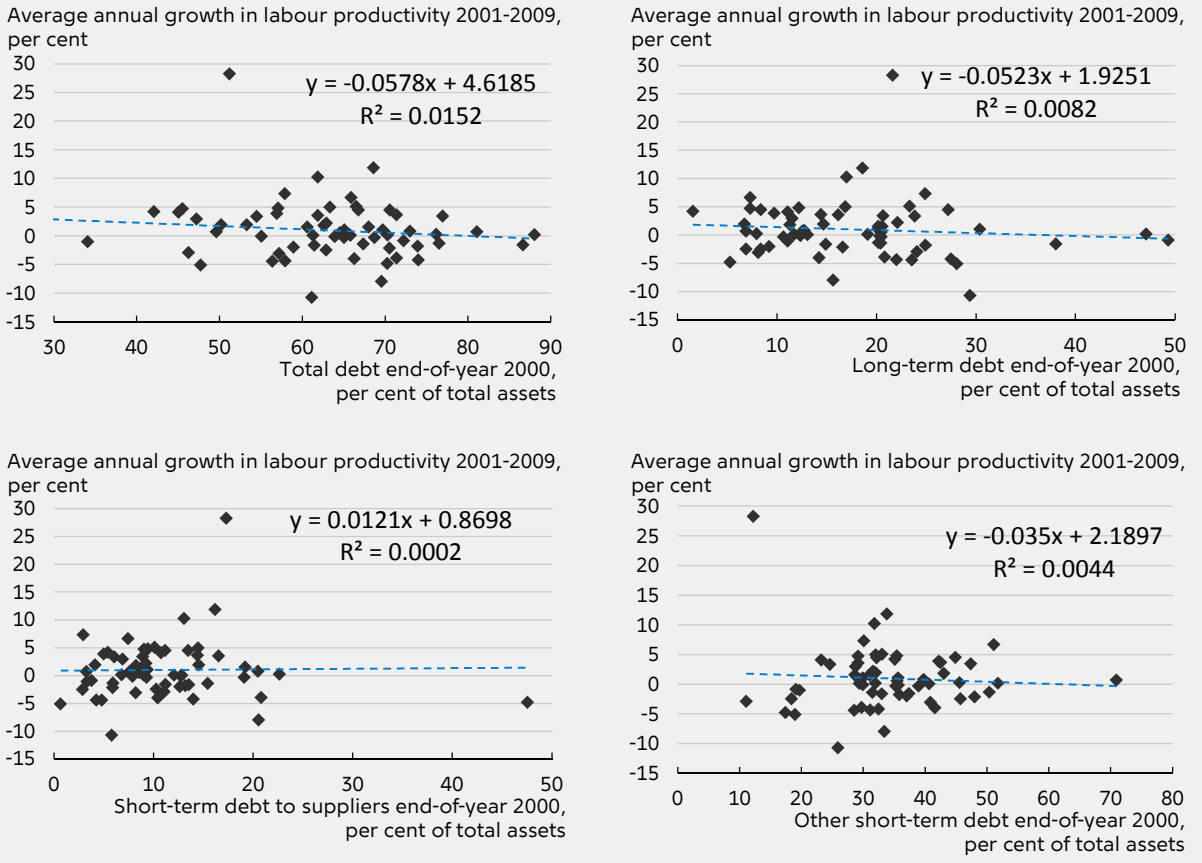


Note: Averages over the period 2000-2009. Distribution of observations for 62 industries, cf. annex 2.B. Labour productivity is calculated as value added in constant prices per man-hour employed.
Source: Own calculations based on data from Statistics Denmark.

Based on industry-level data there seems not to be any significant correlation between the firms' total debt-to-assets ratio at the end of year 2000 and their growth in labour productivity during the period 2001-2009. The same is the case regarding the

long-term debt ratio, the ratio of debt to suppliers and the ratio of other short-term debt, cf. Chart 2.11.

Labour productivity growth versus debt ratios Chart 2.11



Note: Distribution of observations for 62 industries, cf. annex 2.B. Labour productivity is calculated as value added in constant prices per man-hour employed. Stars in relation to R^2 refer a double-sided test for significance of the estimated slope parameter. The null hypothesis is that the parameter is equal to zero. *, ** and *** indicates rejection of the null hypothesis at a significance level of respectively 10, 5 and 1 per cent.
Source: Own calculations based on data from Statistics Denmark.

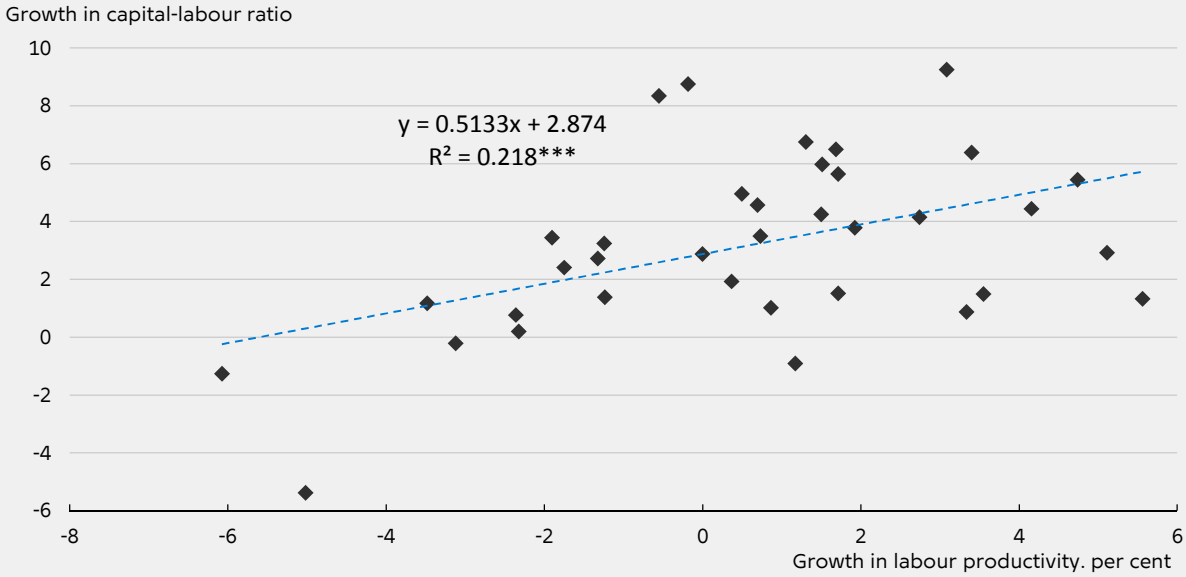
One might argue that this result is in line with the line of reasoning in the Modigliani-Miller-proposition: Labour productivity might depend of a range of factors – cf. Section 2.5 below on the links between capital-labour ratios and labour productivity – but not how the claims to assets are distributed among creditors and shareholders.

However, some strands of the literature have suggested that there might be links between capital structure and productivity. A high equity ratio might e.g. facilitate investment in riskier projects, which might enhance productivity, cf. Myers (1977). Active shareholders with close monitoring of the firm's management might also foster productivity, cf. Pushner (1995). In section 3 we use firm-level data to assess the robustness of the conclusions from industry-level data regarding capital structures and growth in labour productivity.

2.5 BALANCE-SHEET STRUCTURES AND GROWTH IN TOTAL FACTOR PRODUCTIVITY

Growth rates in capital-labour ratios varies across industries and are usually highly correlated with growth rates in labour productivity, cf. Chart 2.12. It might therefore be useful to explore the relationship between capital structures and growth in total factor productivity. Growth in total factor productivity measures the growth in real value added that cannot be attributed to an increased input of capital and labour.

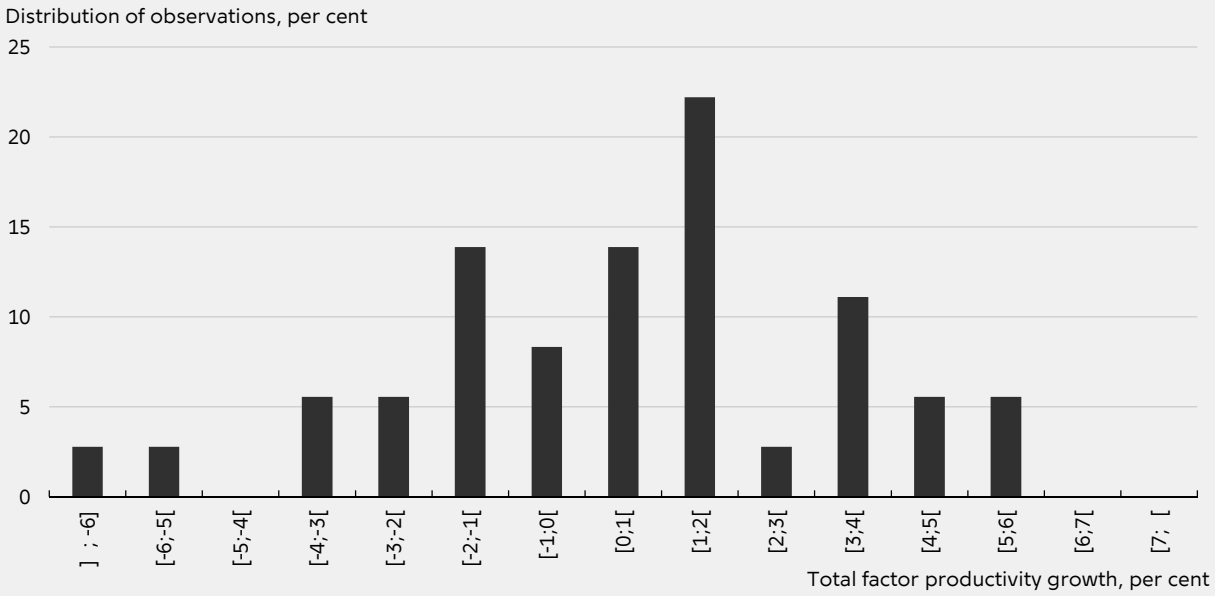
Labour productivity growth versus growth in capital-labour ratio Chart 2.12



Note: Annual average growth rates over the period 2000-2009. Distribution of observations for 36 industries, cf. annex 2.C. Labour productivity is calculated as value added in constant prices per man-hour employed. Capital-labour ratio is calculated as fixed capital in million kroner (2005 prices) per hour worked. Stars in relation to R^2 refer a double-sided test for significance of the estimated slope parameter. The null hypothesis is that the parameter is equal to zero. *, ** and *** indicates rejection of the null hypothesis at a significance level of respectively 10, 5 and 1 per cent.
Source: Own calculations based on data from Statistics Denmark.

The annual increase in total factor productivity has on average been around 0.6 per cent over the period 2000-2009 across the 36 industries for which we have information in our sample, cf. Chart 2.13. High growth rates (more than 3 per cent per annum) have e.g. occurred within manufacturing of chemicals and manufacturing of electronic components.

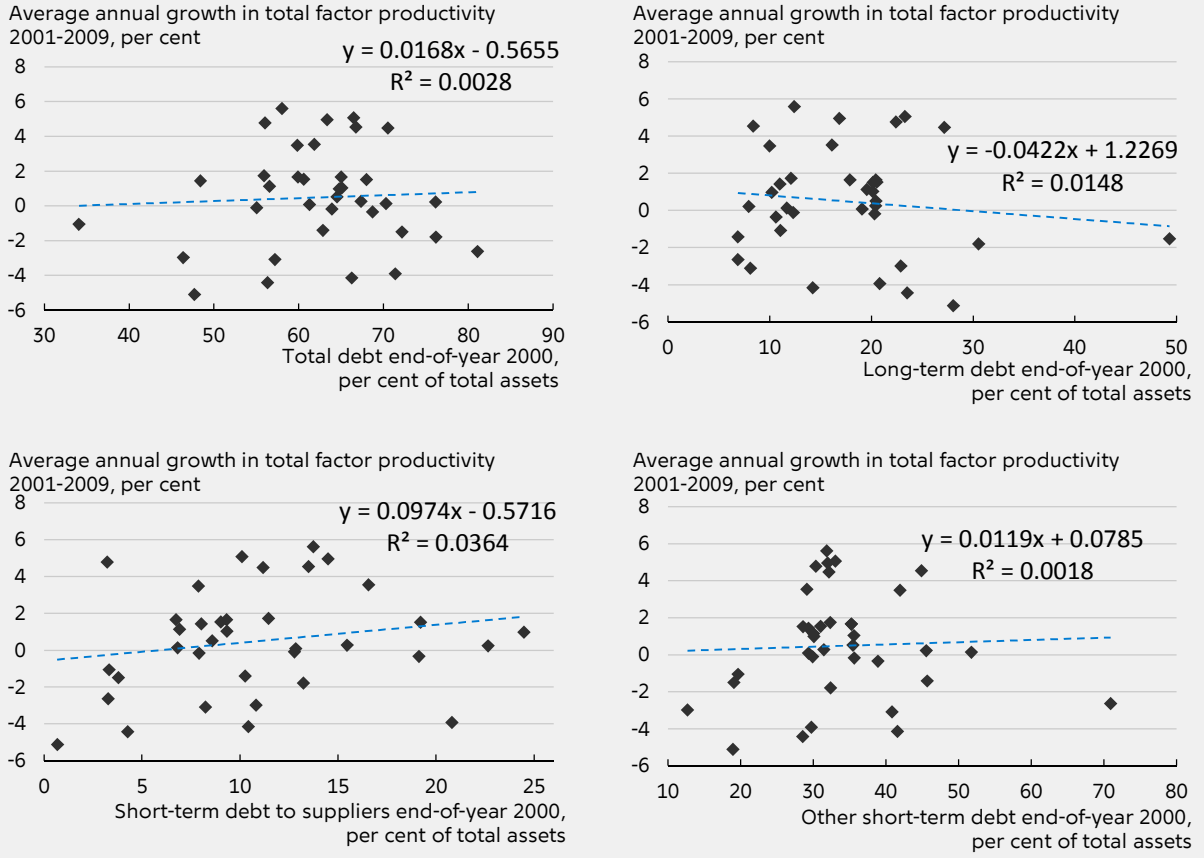
Frequency distribution of annual growth in total factor productivity Chart 2.13



Note: Averages over the period 2000-2009. Distribution of observations for 36 industries, cf. annex 2.C.
Source: Own calculations based on data from Statistics Denmark.

Based on our industry-level data there seems not to be any significant correlation between the total debt-to-assets ratio at the end of 2000 and growth in total factor productivity over the period 2001-2009, cf. Chart 2.14. The same is the case regarding the long-term debt ratio, the ratio of debt to suppliers and the ratio of other short-term debt. At an industrial level we thus find a result consistent with the Modigliani-Miller proposition: The total factor productivity growth of an industry seems to be independent of its financial structure, including the choice between debt and equity financing.

Growth in total factor productivity versus debt ratios Chart 2.14



Note: Distribution of observations for 36 industries, cf. annex 2.C. Stars in relation to R^2 refer a double-sided test for significance of the estimated slope parameter. The null hypothesis is that the parameter is equal to zero. *, ** and *** indicates rejection of the null hypothesis at a significance level of respectively 10, 5 and 1 per cent.
Source: Own calculations based on data from Statistics Denmark.

In the last two decades or so a couple of empirical firm-level studies have explored the relationship between corporate capital structure and total factor productivity. In a study based of Italian firms 1982-1998 Nucci *et al*. (2005) found that firms with higher equity ratio (lower leverage) had higher investments in R&D and a higher level of total factor productivity than other firms. Pushner (1995) also found a negative relationship between leverage and total factor productivity among Japanese firms during the period 1976-1989. In contrast, in most industries Brogaard and Staal (2011) found no significant relationship between capital structure and total factor productivity using data from Købmandstandens Oplysningsbureau (Experian) for Danish firms in the period 1997-2004. Coricelli *et al*. (2011) found a non-linear hump-shaped relationship between leverage and productivity growth based on firm-level data from Central and Eastern European countries over the period 1999-2008. The results from the empirical literature thus seem to be quite mixed. In Section 3 we therefore use firm-level data to assess the robustness of the findings for Denmark above regarding total factor productivity based on industry-level data.

3. CAPITAL STRUCTURE, PROFITABILITY AND PRODUCTIVITY – FIRM-LEVEL EVIDENCE

In the last section we saw that, overall, profitability and productivity are not significantly correlated with the capital structure of the firms based on industry-level data. In this section we analyze whether this conclusion is robust to employing data at the firm level.

3.1 DATA AND SAMPLE SELECTION

We use firm-level data from Statistics Denmark's accounts statistics for the Danish business sector in the period 2000-2011. The primary industries, the financial sector and the public sector are not included in the available data. A firm is identified at the enterprise level, i.e. the legal unit.

The accounts statistics is primarily based on a survey, but some data is available for all active firms in the business sector. For all firms Statistics Denmark has information on employment. For the vast majority of firms Statistics Denmark has basic accounting data (including turnover, result before tax, capital and total assets) obtained from the Danish tax authorities. For the remaining firms (corresponding to only around 13 per cent of total turnover) this basic accounting data is imputed by Statistics Denmark using information on similar firms (i.e. firms within the same industry, of the same size, *etc.*). All accounting data, both the basic accounting data mentioned above and the remaining accounting data, is available for the firms participating in the survey. These firms corresponded to around 70 per cent of total turnover. For the firms not participating in the survey Statistics Denmark has imputed the remaining accounting data (including total debt and value added) using both survey data and data from the tax authorities.

We disregard inactive firms (defined as firms with less than 0.5 full-time employed per year) and firms from very capital intensive industries, e.g. mining and quarrying. These industries are not very comparable to the remaining firms in terms of production technologies, *etc*. Furthermore, sole proprietorships *etc*. are not included. For these firms the owner's pay, which constitutes a large fraction of the (implied) costs, is not subtracted when calculating e.g. profit, and therefore the return on assets is not directly comparable to that of other firms. We follow the Danish Productivity Commission (2013) and exclude firms with negative value added (in current prices), both in the specific year, the year before, and the year after. Furthermore, firms with extreme value added, i.e. above the 99.9 percentile, are excluded. We also exclude firms with obvious errors in the accounting data, e.g. non-positive capital stock and energy consumption. The final dataset includes more than 44,000 firms per year. In total we have 598,335 firm-year observations.

Return on assets will be used as a measure for profitability, and similar to the previous section we define the return on assets as profit before tax plus interest expenses in per cent of the total assets. Since no convincing single productivity measure exists, we will consider a range of measures. In particular, we consider both labour productivity

and total factor productivity (TFP), where the latter is estimated using the Levinsohn and Petrin (2003) method, cf. below.

In the main analysis, we define labour productivity as value added per full-time employed. As noted above value added is reported by the firms participating in the survey (corresponding to around 70 per cent of total turnover) and imputed by Statistics Denmark for the remaining firms. For robustness check we also employ an alternative labour productivity measure, namely turnover per full-time employed which is available for most firms without any imputations.

To ensure comparability over time, we deflate relevant variables. Turnover, value added, and the capital stock are all deflated using implicit deflators obtained from the national accounts, whereas energy consumption, cf. below, is deflated using implicit deflators from the energy accounts compiled by Statistics Denmark. The deflators are obtained at the most detailed industry level provided by Statistics Denmark, at which the economy as a whole consists of 69 industries. After the sample selection explained above we have firms allocated to 42 different industries in our final data set, see annex 3.A for a list of industries.

3.1.1 ESTIMATING TOTAL FACTOR PRODUCTIVITY

This subsection explains how we estimate total factor productivity (TFP). A natural starting point when estimating TFP is a production function of the following (Cobb-Douglas) form

$$Y = AL^{\beta_L}K^{\beta_K}$$

where Y could be output or value added, $\beta_L \in (0,1)$, $\beta_K \in (0,1)$, L is labour input, K is the capital stock, and A is total factor productivity.

In practice, one would set up the following regression model

$$y_{it} = \beta_0 + \beta_L l_{it} + \beta_K k_{it} + \epsilon_{it}$$

where $x \equiv ln(X)$ for $x \in \{y, l, k\}$. TFP for firm i in period t can then be obtained residually as

$$TFP_{it} = exp\left(y_{it} - \hat{\beta}_L l_{it} - \hat{\beta}_K k_{it}\right)$$

where $\hat{\beta}$ denotes the estimate of β.

However, simple OLS estimation of this regression model would cause a variety of endogeneity problems, cf. Syverson (2011). Most important is the so-called simultaneity problem (or input endogeneity problem), i.e. there is correlation between the error term and the input factors. For example, firms that have a large positive productivity shock may respond by using more inputs. Olley and Pakes (1996) suggested a novel way to control for the correlation between the input levels and unobserved firm-specific productivity shocks, that is by using investment as a proxy for this covariation. The basic idea is that the investment variable captures the part of the unobserved firm-specific productivity shocks, which is correlated with the firm's inputs.

Levinsohn and Petrin (2003) suggested a different proxy for the covariation between input levels and unobserved firm-specific productivity, namely intermediate inputs such as materials or energy consumption. Investments are required to be non-zero in the

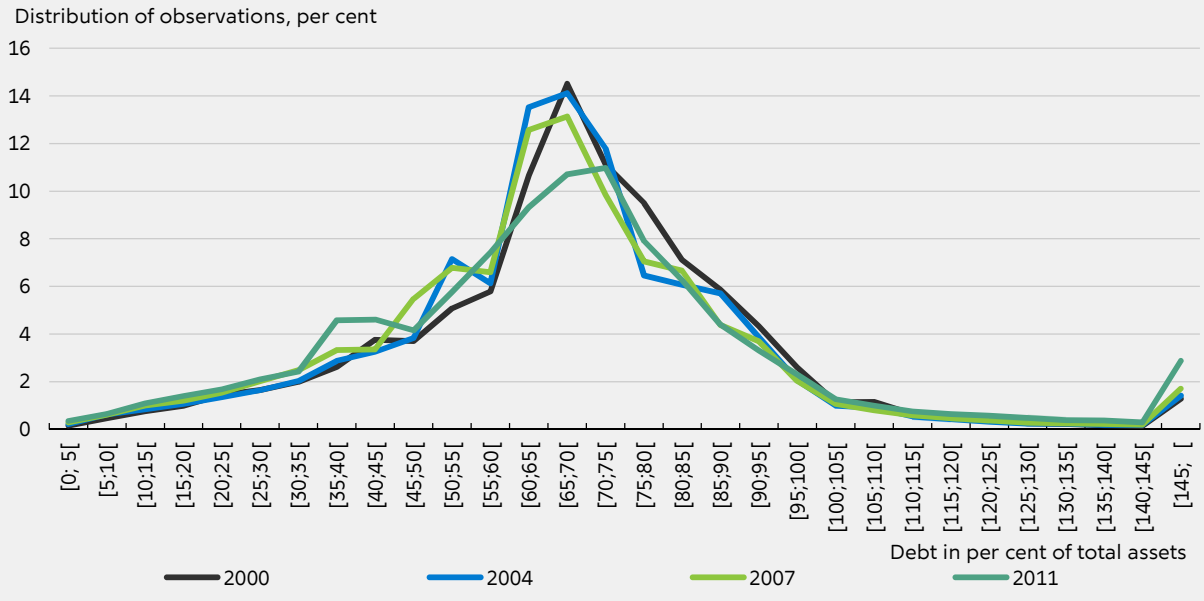
Olley and Pakes (1996) method (due to a monotonicity condition), which is often not fulfilled in practice. Furthermore, intermediate inputs often evolve more smoothly than investment. In short, the Levinsohn-Petrin method is a two-step procedure, where labour is considered to be a free variable that can adjust rapidly, whereas the capital stock is assumed to be a state variable determined in the previous period.

Our TFP estimation follows the Levinsohn-Petrin procedure.[2] We estimate the production function for each of the 42 industries separately, use energy consumption as a proxy, and we include time dummies in the estimation to control for industry wide shifts over time. As labour input we use the number of full-time employed,[3] and the (end-of-year) capital stock is measured by the sum of tangible and intangible fixed assets. Similar TFP estimation techniques have been used in a Danish context by e.g. the Danish Economic Councils (2010), the Ministry of Business and Growth (2012), and the Danish Productivity Commission (2013).

3.1.2 DESCRIPTIVE STATISTICS

In this subsection we present a range of descriptive statistics from our firm-level data set. The distribution of debt ratios, i.e. total debt in percent of total assets at book values, across firms has been fairly stable over time, cf. Chart 3.1. This is in line with the debt ratios across industries, cf. Chart 2.1 in the previous section. The most frequently observed debt ratio is approximately 70 per cent.

Frequency distribution of debt ratios – selected years 2000-2011 Chart 3.1



Note: Total debt in per cent of total assets.
Source: Own calculations based on firm-level data from Statistics Denmark.

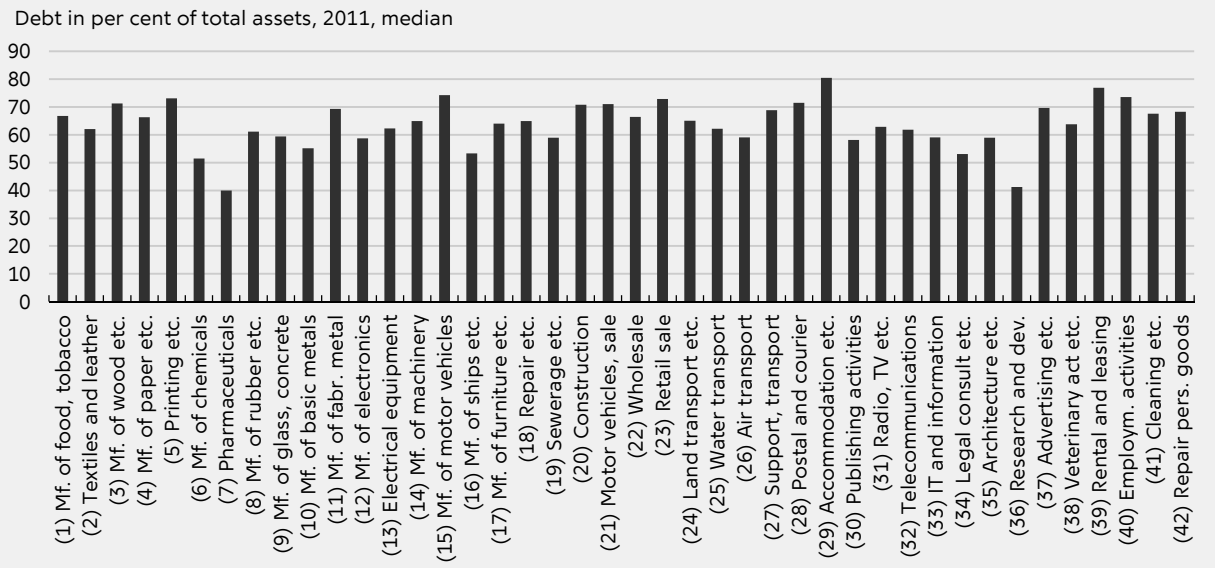
There is a large variation in the debt ratios across different industries, cf. Chart 3.2. Some industries are characterised by rather high levels of debt relative to total assets,

2 In contrast to the two-step procedure, Wooldridge (2009) proposes a one-step estimation implemented in a generalized method of moments framework. This method is not to the same extent suffering from potential collinearity problems pointed out by e.g. Ackerberg *et al.* (2006). However, Galuschák and Lízal (2012) find that estimated TFP does not differ much across the two methods.

3 In principle, the labour input should be quality adjusted. However, in the dataset at hand we do not have background information on the employees of the firms, and therefore we cannot make such an adjustment.

e.g. the accommodation and food industry, whereas other industries have somewhat lower debt ratios, e.g. pharmaceuticals.

Debt ratios across industries Chart 3.2



Note: The list of industries can be found in annex 3.A.
Source: Own calculations based on firm-level data from Statistics Denmark.

However, the distribution of the return on assets does not seem to differ much between firms with low, medium and high debt-to-assets ratios, although it is clear that there are some bad performing firms with very high debt relative to total assets, cf. Chart 3.3. This seems to be the case for all considered industries (the chart shows six selected industries).

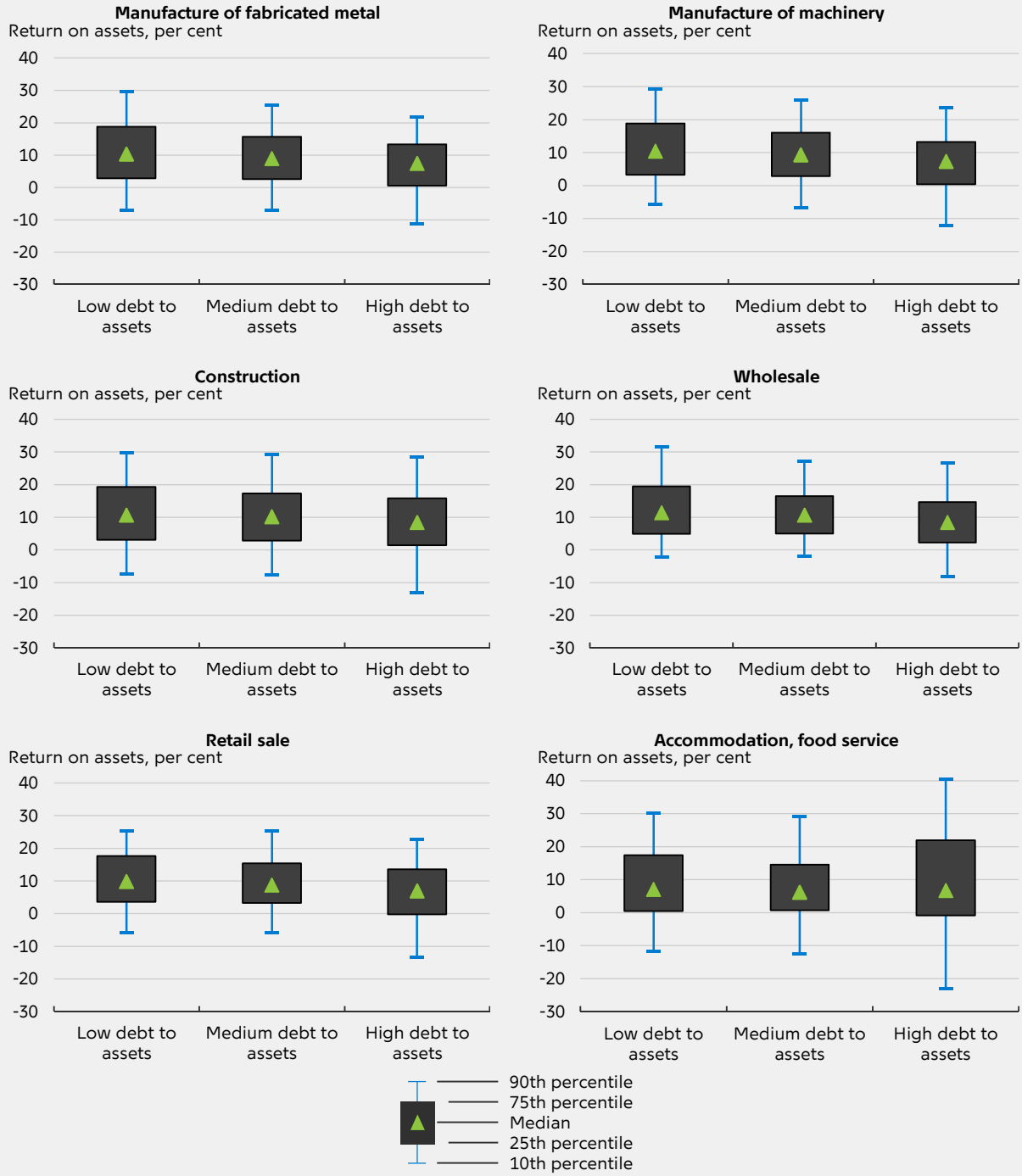
The distribution of labour productivity growth does not seem to be significantly different among firms with high debt-to-assets compared to firms with lower debt-to-assets, cf. Chart 3.4. This seems to be the case for all considered industries.

Similarly, capital structure and productivity growth seems to be unrelated when considering total factor productivity instead of labour productivity, cf. Chart 3.5.

When looking at the *level* of labour productivity and total factor productivity, instead of the *growth*, the correlation between productivity and debt-to-assets seems to be slightly negative, cf. Charts 3B.1 and 3B.2 in annex 3.B.

Boxplots of return on assets for different debt levels, selected industries

Chart 3.3

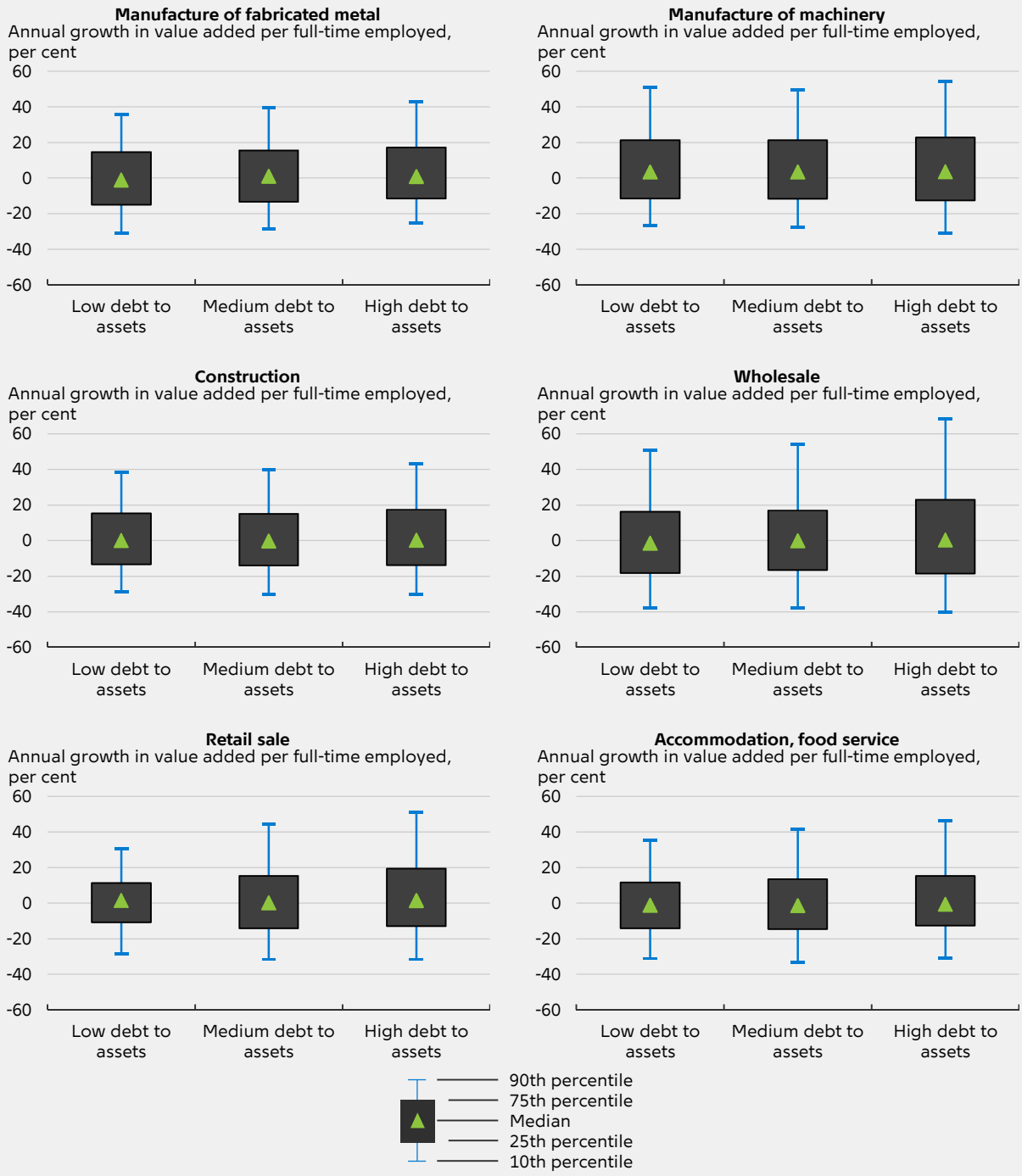


Note: The debt level refers to debt in per cent of total assets in the previous year. Low debt to assets is defined as a debt ratio below 60 per cent, medium is 60-80 per cent, while high is above 80 per cent.

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

Boxplots of annual growth in labour productivity for different debt levels, selected industries

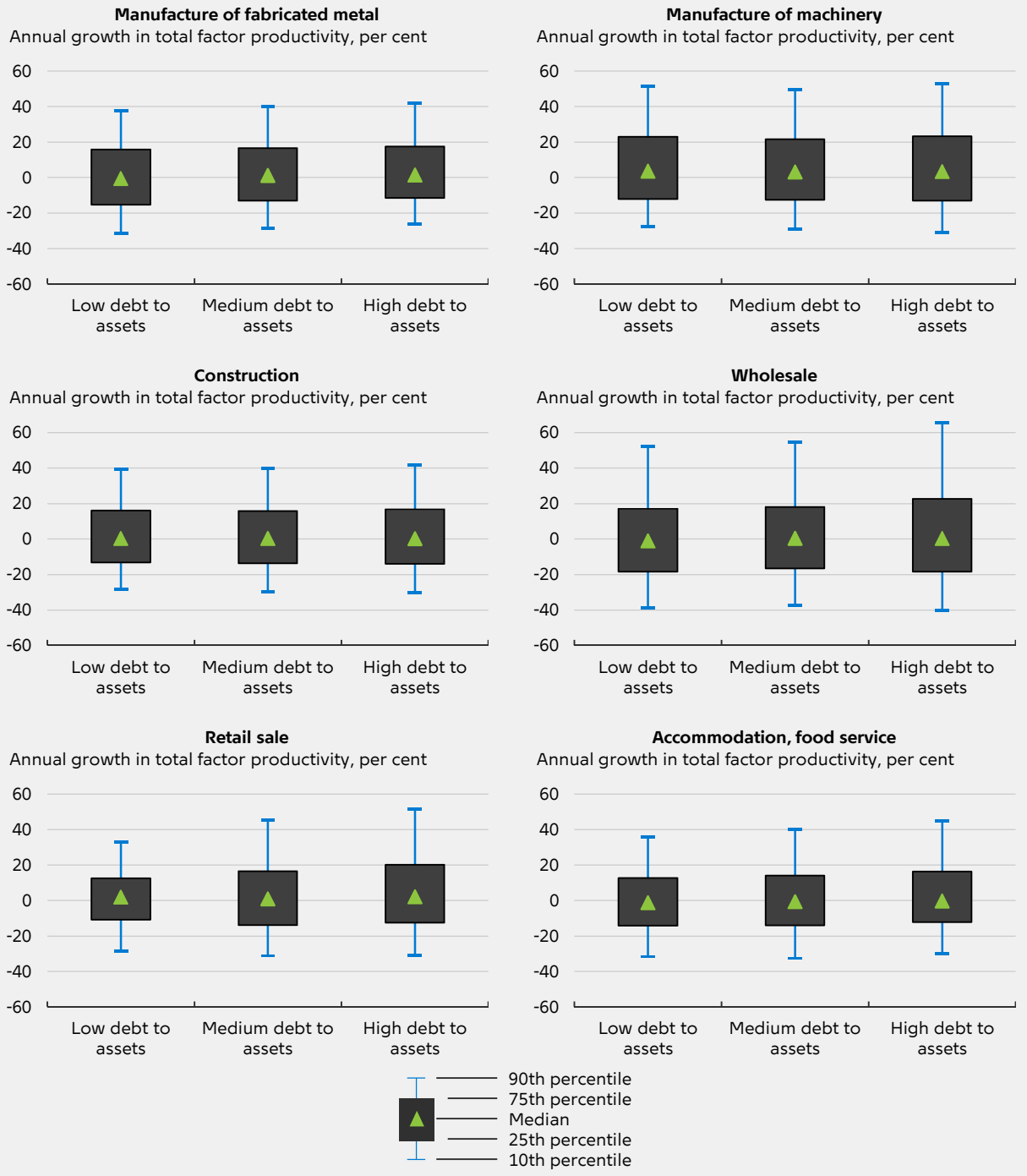
Chart 3.4



Note: The debt level refers to debt in per cent of total assets in the previous year. Low debt to assets is defined as a debt ratio below 60 per cent, medium is 60-80 per cent, while high is above 80 per cent.
Source: Own calculations based on firm-level data from Statistics Denmark.

Boxplots of annual growth in total factor productivity for different debt levels, selected industries

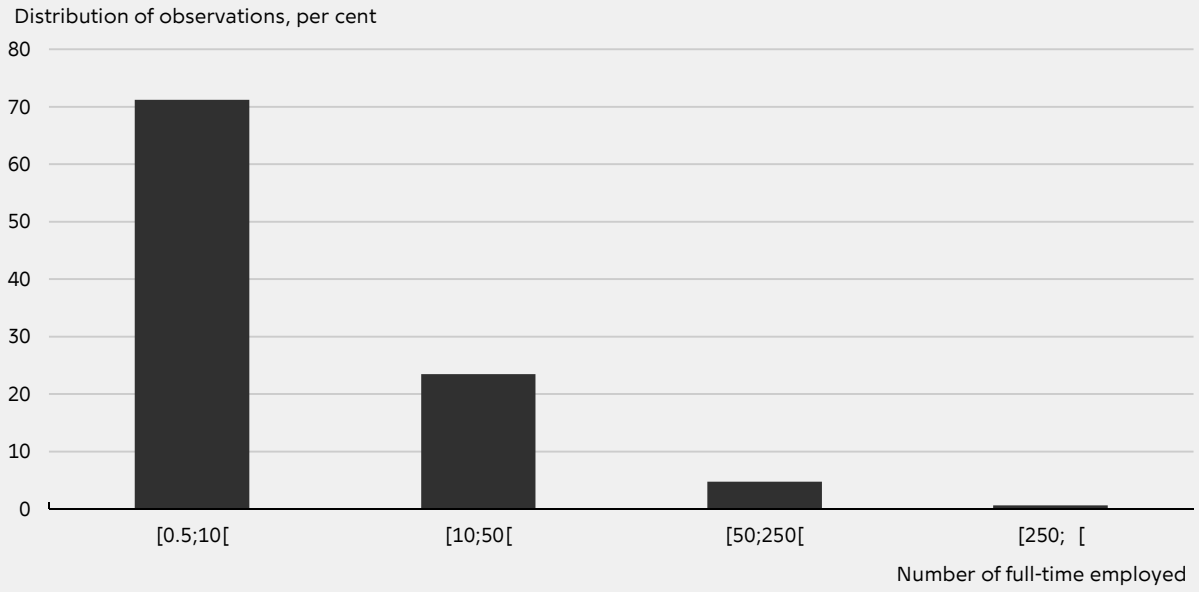
Chart 3.5



Note: The debt level refers to debt in per cent of total assets in the previous year. Low debt to assets is defined as a debt ratio below 60 per cent, medium is 60-80 per cent, while high is above 80 per cent.
Source: Own calculations based on firm-level data from Statistics Denmark.

However, other factors may be important when discussing firm profitability and productivity. An obvious control variable is firm size, since it has long been claimed that productivity and firm size are strongly related. Most firms in the Danish business sector have very few employees, cf. Chart 3.6.

Percentage distribution of the numbers of firms broken down by number of employees Chart 3.6

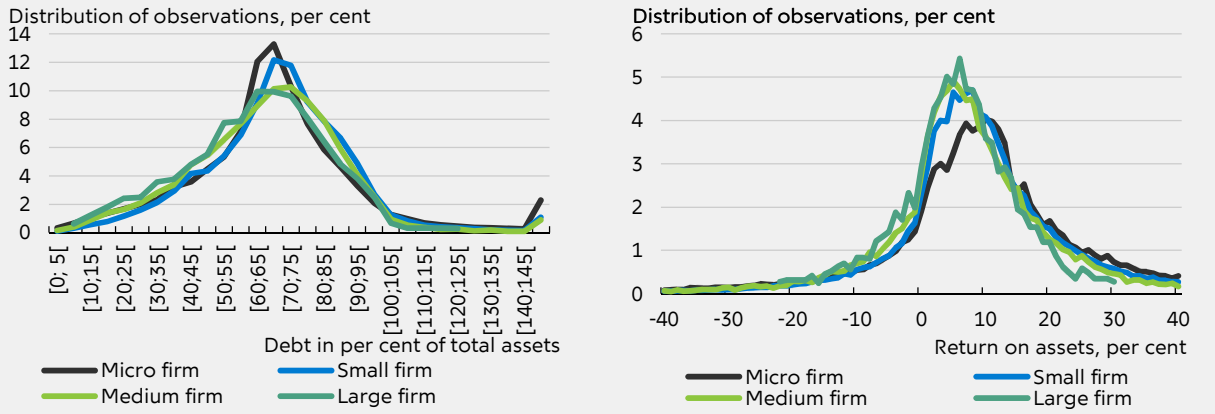


Note: Employment is measured by the number of full-time employees in the firm per year. Sole proprietorships etc. are not included, cf. section 3.1.
Source: Own calculations based on firm-level data from Statistics Denmark.

For descriptive purposes in the charts below we divide the firms into four groups. Following Eurostat, micro firms are defined as having less than 10 full-time employees, small firms have between 10 and 50, medium-sized firms have between 50 and 250, while large firms have 250 or more. There seems to be less variation in debt ratios among micro firms compared to the variation among other firms, cf. Chart 3.7 (left panel). However, there is no clear indication of whether smaller firms in general have more or less debt relative to total assets. In general, profitability (return on assets) seems to be slightly smaller for medium-large firms compared to smaller firms, cf. Chart 3.7 (right panel).

Distribution of debt ratios (left panel) and return on assets (right panel) for different firm sizes

Chart 3.7



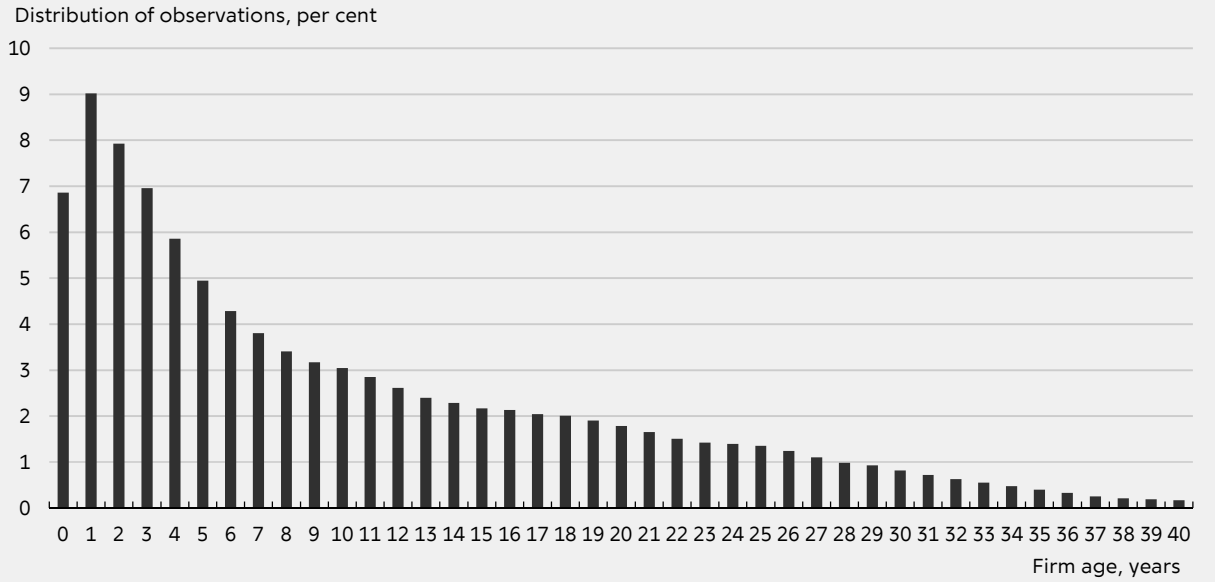
Note: A micro firm is defined as having less than 10 full-time employees, a small firm has between 10 and 50, medium firms have between 50 and 250, whereas large cover firms with more than 250 full-time employees. Note that firm size is lagged one year compared to the return on assets in the right panel.

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

Recent research has shown that firm size might not be as important for growth as previously thought. Instead, Haltiwanger, Jarmin and Miranda (2013) suggest that it is firm age that matters (for job creation), since it is mostly young firms which create new jobs. They find no systematic relationship between firm size and employment growth, once they control for firm age. Ibsen and Westergaard-Nielsen (2011) have made similar findings in a Danish context. One explanation could be that age to a larger extent reflects where the firm is in its growth cycle.

Therefore, we also include firm age as a control variable in the regression analyses below. The firm age distribution among firms look somewhat similar to the firm size distribution, cf. Chart 3.8.

Firm age distribution among firms Chart 3.8

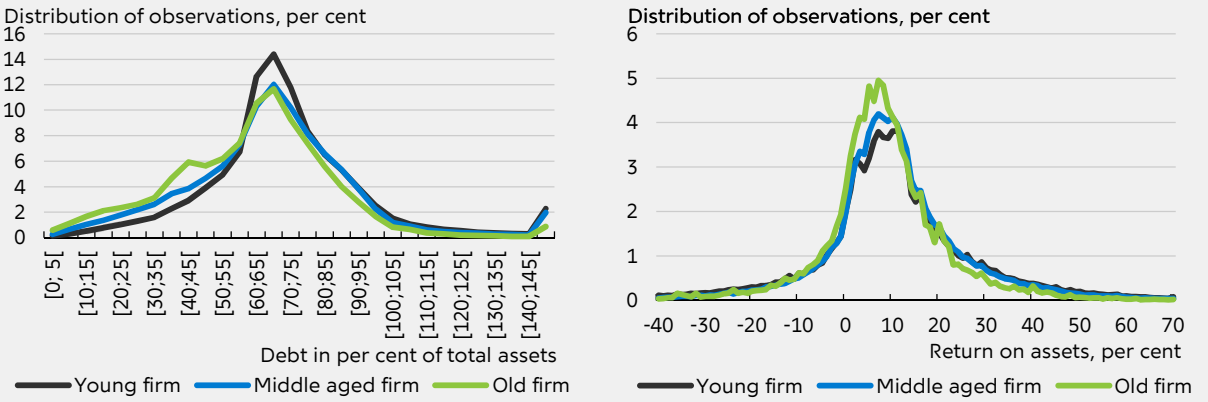


Source: Own calculations based on firm-level data from Statistics Denmark.

For descriptive purposes in the charts below we divide the firms into three groups. Young firms are defined as being less than 5 years old, middle aged firms are between 5 and 25 years old, while old firms are 25 years old or more. There seems to be less variation in debt ratios among young firms compared to the variation among older firms, cf. Chart 3.9 (left panel). However, there is no clear indication of whether younger firms in general have more or less debt relative to total assets. These findings are similar to that for small vs. large firms, cf. above. In general, old firms seem to deliver slightly smaller return on assets than younger firms, cf. Chart 3.9 (right panel).

Distribution of debt ratios (left panel) and return on assets (right panel) for different firm sizes

Chart 3.9



Note: A young firm is defined as being less than 5 years old. Middle aged firms are between 5 and 25 years old, whereas old firms are more than 25 years old. Note that firm age is lagged one year compared to the return on assets in the right panel.
Source: Own calculations based on firm-level data from Statistics Denmark.

3.2 EMPIRICAL METHOD AND RESULTS

In this subsection we make a more formal empirical analysis of the relationship between profitability/productivity and the capital structure, i.e. the ratio of debt to total assets.

3.2.1 EMPIRICAL METHOD

In the profitability analysis we estimate the following regression model for each industry separately

$$ROA_{i,t} = \alpha + \gamma \cdot DR_{i,t-1} + \theta \cdot ln\left(SIZE_{i,t-1}\right) + \eta \cdot AGE_{i,t-1} + \sum_{t=2001}^{2011} \delta_t \cdot T_t + \varepsilon_{i,t} \qquad (1)$$

where DR is the debt ratio (the ratio of the firm's debt to total assets), $SIZE$ is the firm's size (measured as the number of full-time employees), AGE is the firm's age (in years), and T denotes time dummies, which we include to control for industry wide shifts over time. Finally, ROA is our measure for profitability, i.e. return on assets. The reason we include lagged values of both the variable of interest (the debt ratio) and the control variables (firm size and age) is to address the endogeneity problem caused by simultaneity. In the main profitability analysis we estimate equation (1) using Ordinary Least Squares (OLS) method.

In the main productivity analysis, on the other hand, we estimate the following model for each industry separately

$$\frac{Z_{i,t+1}-Z_{i,t}}{Z_{i,t}} = \alpha + \gamma \cdot DR_{i,t-1} + \theta \cdot ln\left(SIZE_{i,t-1}\right) + \eta \cdot AGE_{i,t-1} + \sum_{t=2001}^{2011} \delta_t \cdot T_t + \mu_i + \varepsilon_{i,t} \qquad (2)$$

where Z is productivity (labour productivity or total factor productivity), i.e. the left-hand side denotes productivity growth from year t to year $t+1$. Compared to equation (1) we include a firm fixed effect, μ_i, on the right-hand side. Thereby, we control for the time invariant part of the unobservable heterogeneity across firms. As a robustness check we also estimate equation (2) with simple OLS, but we include a firm fixed effect in the main analysis. Without a fixed effect, estimation of (2) would probably be subject to a catching up effect, i.e. firms with low growth in the past would tend to have higher growth rates in the present as they can profit from some of the technology advances made by high growth firms in previous years.

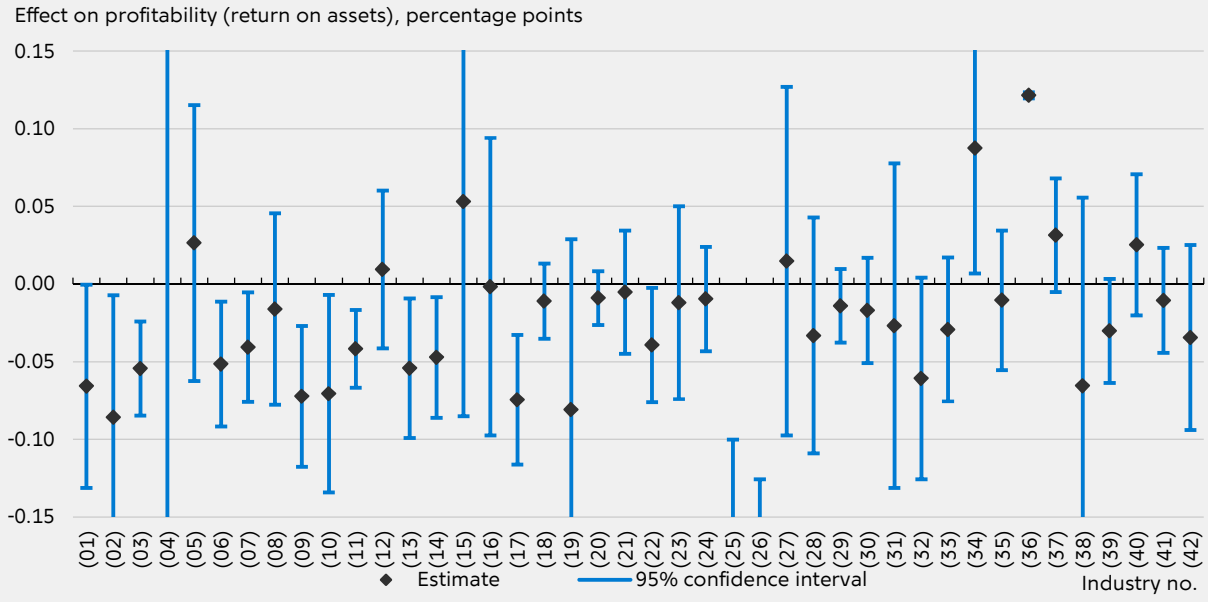
It should be noted that including lagged right-hand side variables does not solve all problems with endogeneity. As an example, there might exist an unobserved factor, which correlates with both performance and debt ratio, e.g. if the firm has a patent affecting both its assets and its access to finance. However, to our knowledge, there exists no obvious instrument, which can be used to solve this problem.

3.2.2 MAIN RESULTS

Looking across all industries there is no clearly signed relationship between profitability and capital structure (debt ratio), cf. Chart 3.10. In 14 of the 42 industries, however, there is a significantly negative relationship between the two, whereas there is a significantly positive relationship in 2 industries. Overall, the results from our micro data analysis seem to be in line with the findings from the industry level analysis, cf. Chart 2.9 in the previous section. These findings are consistent with the view that capital structure matters only for the distribution of the return on assets among different creditors and shareholders *etc.* but not for the size of the return on assets.

Effect on profitability (return on assets) of a 1 percentage point increase in debt-to-assets, OLS regression

Chart 3.10

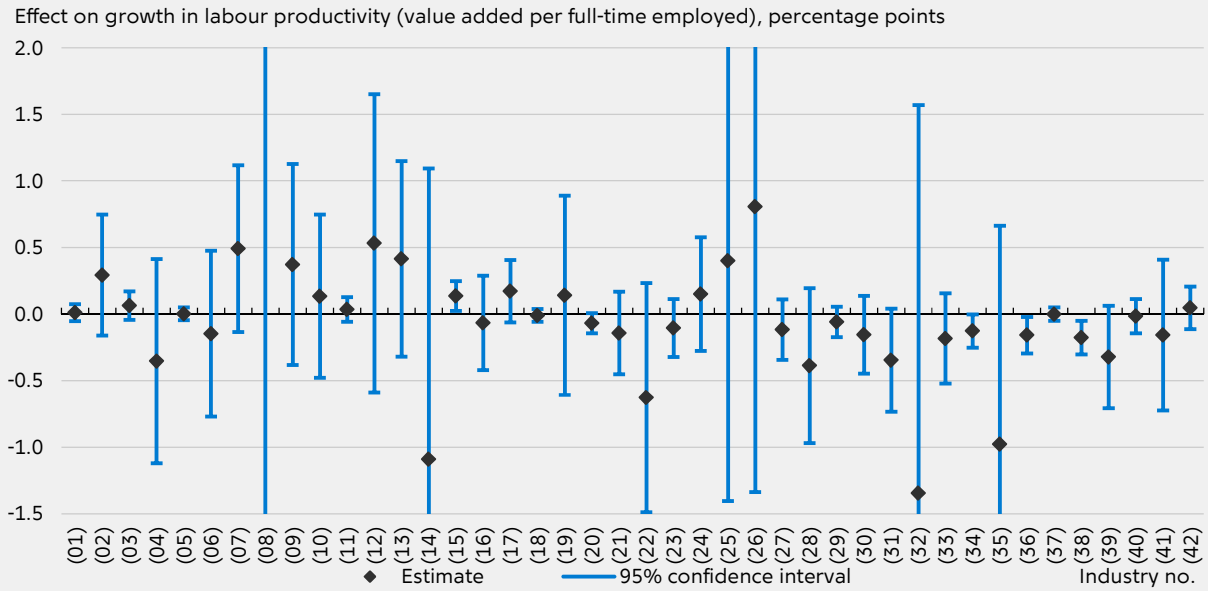


Note: The figure depicts the parameter estimates and resulting 95 per cent confidence intervals from running the regression in equation (1) separately for each of the 42 industries. The list of industries can be found in annex 3.A. Standard errors are clustered at the firm level.
Source: Own calculations based on firm-level data from Statistics Denmark.

The correlation with capital structure is even weaker when turning to productivity growth instead of profitability. In 38 of the 42 industries there is no significant relationship between the firm's debt ratio and its growth in labour productivity, cf. Chart 3.11. Again the results are very much in line with the conclusions drawn from the industry level analysis, cf. Chart 2.11 in the previous section.

Effect on growth in labour productivity (value added per full-time employed) of a 1 percentage point increase in debt-to-assets, fixed effects estimation

Chart 3.11

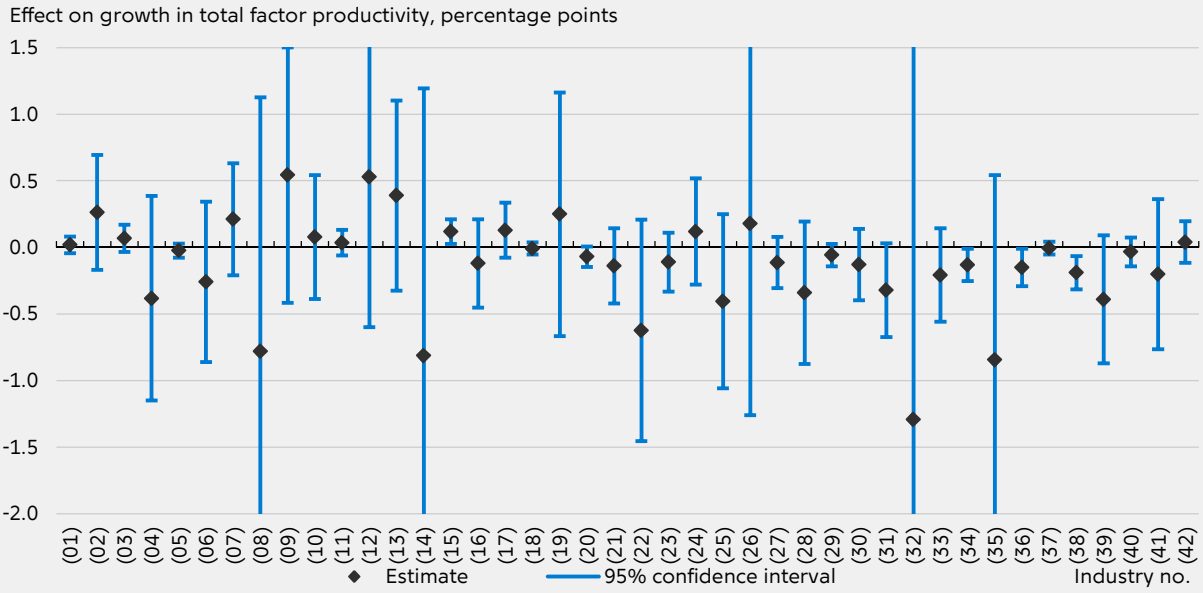


Note: The figure depicts the parameter estimates and resulting 95 per cent confidence intervals from running the regression in equation (2) separately for each of the 42 industries. The list of industries can be found in annex 3.A. Standard errors are robust.
Source: Own calculations based on firm-level data from Statistics Denmark.

Changing the dependent variable from growth in labour productivity to growth in total factor productivity does not alter the main conclusion. In 38 of the 42 industries there is no significant relationship between the firm's debt ratio and its growth in total factor productivity, cf. Chart 3.12. Hence, firms with low debt-to-assets do not seem to perform differently (neither worse nor better) compared to firms with higher debt ratios. Once again, the micro data analysis delivers results similar to the industry level analysis, cf. Chart 2.14 in the previous section.

Effect on growth in total factor productivity of a 1 percentage point increase in debt-to-assets, fixed effects estimation

Chart 3.12



Note: The figure depicts the parameter estimates and resulting 95 per cent confidence intervals from running the regression in equation (2) separately for each of the 42 industries. The list of industries can be found in annex 3.A. Standard errors are robust.
Source: Own calculations based on firm-level data from Statistics Denmark.

3.2.3 ROBUSTNESS

In this subsection we investigate whether our main results from above are robust to different empirical specifications. All charts referred to in this subsection can be found in annex 3.B.

As mentioned above, our empirical strategy does not rule out all endogeneity issues. For example, our results so far might suffer from a survivor bias, since firms who perform badly and experience lower solvency ratios are more likely to close down during our sample period. One way to address this issue is to focus exclusively on firms who do not close down during our sample period. However, this sample restriction does not change our main conclusions.[4] Also, the main conclusions have shown to be robust against including more lags of the debt ratio on the right-hand side of (1) and (2), against performing the estimations in different sub-periods (2000-2007 and 2008-2011) and against performing the estimations in sub-samples divided by firm size (respectively below 10, 10-50 and above 50 employees at a full time basis). Furthermore, the main conclusions are robust against using a different definition of the debt ratio, i.e. debt net of liquid assets in per cent of total assets.

One robustness check is to include firm fixed effects in the profitability analysis. This turns out to reverse the results as the relationship between return on assets and the debt ratio is significantly positive in 24 of the 42 industries, and significantly negative in 2 industries, cf. Chart 3B.3.

[4] On the contrary, when restricting the sample to firms that survive until the end of our sample period, the relationship between return on assets and the debt ratio is insignificant in 28 of the 42 industries; the relationship between growth in labour productivity and the debt ratio is insignificant in 39 of the 42 industries; and the relationship between growth in total factor productivity and the debt ratio is also insignificant in 39 of the 42 industries.

In the analyses with productivity growth as the dependent variable we have also tried to estimate the model using simple OLS. In general, the OLS estimates are higher than the fixed effects estimates. The relationship between the debt ratio and labour productivity growth is now significantly positive in 10 of the 42 industries, whereas it is no longer significantly negative in any of industries, cf. Chart 3B.4. Similarly, for growth in total factor productivity the link with debt relative to total assets is now significantly positive in 8 industries and not significantly negative in any, cf. Chart 3B.5. These findings suggest that the OLS estimates of the relationship between the debt ratio and productivity growth are positively biased. This could, among other things, be explained by the catching up effect mentioned above, i.e. firms differ in a systematic, but unobservable, way since some firms have easier access to new technology, e.g. firms with low productivity growth in the past who may benefit from technological developments made by firms with higher productivity growth in the past. Therefore, we include firm fixed effects in our main productivity analysis above.

Another robustness check is to consider the productivity *level* instead of productivity *growth*. Overall, OLS estimates of the link between the debt ratio and the productivity level tends to be significantly negative, whereas fixed effects estimation delivers insignificant or significantly positive estimates, cf. Charts 3B.6-3B.9. This suggests that the OLS estimates suffer from a negatively signed bias, because unobservable (but time invariant) firm characteristics differ systematically between firms with low debt relative to total assets and firms with higher debt.

Our final robustness check is to consider a different measure of labour productivity, i.e. turnover (instead of value added) per full-time employed as explained above. This alternative measure does not change the overall picture, cf. Charts 3B.10-3B.13. There is, however, a slight tendency towards more insignificant estimates with this measure in the estimations with the productivity level.

3.2.4 SUMMARY OF MAIN FINDINGS

Our results from analysis of firm-level data indicate that the overall capital structure is not important for profitability and productivity at a firm level. A hypothesis that a financial system dominated by debt rather than equity – or vice versa – should be more supportive for productivity and thereby economic growth than other financial systems is therefore not backed by our data, although uncertainty due to potential endogeneity problems restrain us from making too firm conclusions.

However, the mix between equity and debt financing is usually considered to be important in relation to financial stability. Firms with high solvency ratios are more robust to adverse macroeconomic shocks than firms with low solvency ratios, cf. Abildgren and Damgaard (2012). Since corporate customers constitute a large share of the lending portfolio in the banking sector, the financial system will all else equal be more robust the higher the solvency ratios are in the non-financial business sector. Furthermore, Abildgren *et al*. (2013) and Danmarks Nationalbank and the Ministry of Economy and Business Affairs (2006) found that firms with high solvency ratios have a significantly higher probability of having their application for bank loans accepted or having access to the capital markets than firms with low solvency ratios. High solvency ratios thus gives firm a larger range of financing options to choose from and thereby lower funding and refinancing risks.

The empirical results in this section suggest that there are no "costs" (before tax) for firms in terms of lost profitability or productivity by increasing the equity ratio to

achieve this greater resilience to shocks to the economy and greater financial flexibility and safety. After tax, however, there may be a cost due to the bias in favor of debt financing over equity in the Danish tax system. All else equal the Danish tax system provides the firms with an incentive to use debt financing rather than equity financing since firms may deduct interest expenses in their income statement in line with other operating costs, while the cost of equity financing may not be deducted. The Danish Productivity Commission (2014) has recently drawn attention to the different tax treatment of the costs of debt financing versus equity financing.

4. CAPITAL STRUCTURE AND ACCESS TO BANK LOANS – FIRM-LEVEL EVIDENCE

It is crucial that the financial system at a micro level ensures a sufficient allocation of funds to firms with high productivity and profitability. Abildgren *et al.* (2013) analysed the relationship between the banks' loan acceptance rates and the creditworthiness of the banks' corporate customers in 2007 and 2009/10 based on Danish firm- and bank-level data for small and medium-sized enterprises (SMEs). They found that firms with higher profit ratios, solvency ratios and liquidity ratios had a significantly higher probability of having their loan application accepted than firms with poor economic performance. However, Abildgren *et al.*, *op. cit.*, did not analyse the effect of productivity on the access to bank loans. The study by Albareto and Finaldi (2012) based on Italian firm-level data for the period 2005-2010 indicates that firms with high growth in value added per employee have easier access to credit than other firms. In this section we therefore analyse the role played by profitability as well as productivity of the individual firm on the probability of having an application for a bank loan accepted.

The main data source for this part of our paper is a survey conducted by Statistics Denmark concerning the access to finance for small and medium-sized enterprises (Statistics Denmark, 2010). The survey is merged with accounting data from Statistics Denmark's accounts statistics, see the description in Section 3.

The participants in the survey were drawn from a population consisting of firms who had between 5 and 249 employees in 2005 and above 5 employees in 2009. The population only includes firms within manufacturing, construction, trade and transport *etc.*, information and communication, real estate, or other business services.

Table 4.1 shows how the sample is selected, and of the 2,265 firms who responded to the survey, 1,699 remain in the final sample. Of these, 304 firms applied for bank loans in 2009/2010.

Sample selection in the analysis of firms' bank loan applications Table 4.1

Description	Number of observations	Percentage of total
Responses to survey	2,265	100
In the accounts statistics	2,244	99
Excluding sole proprietorships etc.	1,893	84
In one of the 42 considered industries	1,840	81
Fulfilling technical requirements[1]	1,699	75

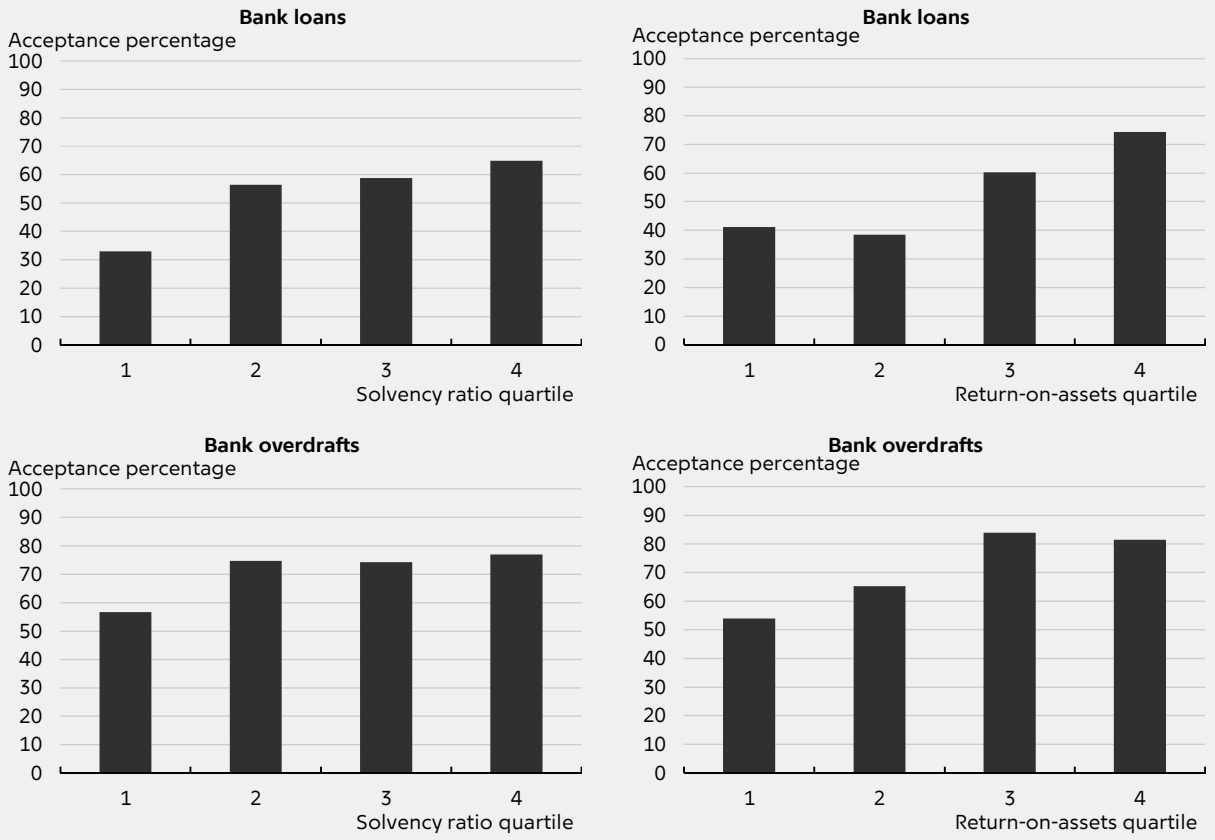
Source: Own calculations based on firm-level data from Statistics Denmark.
1. The technical requirements include restrictions on value added and that the capital stock and energy consumption must be positive, cf. Section 3.

The bank loan acceptance percentage is higher for firms with higher solvency and profitability,[5] cf. Chart 4.1. Similarly, the chart shows that the acceptance percentage for bank overdrafts is higher for more profitable and solid firms.

5 Since our sample only covers 1,699 firms we cannot analyse each industry separately. As argued above, it makes little sense to compare, for example, return on assets and labour productivity across industries. Therefore, we make an industry-adjustment for solvency, profitability and productivity, i.e. for each industry and each year we subtract the industry median of the particular varia-

Acceptance percentages for bank loans and bank overdrafts for different levels of solvency and profitability, 2009/2010

Chart 4.1



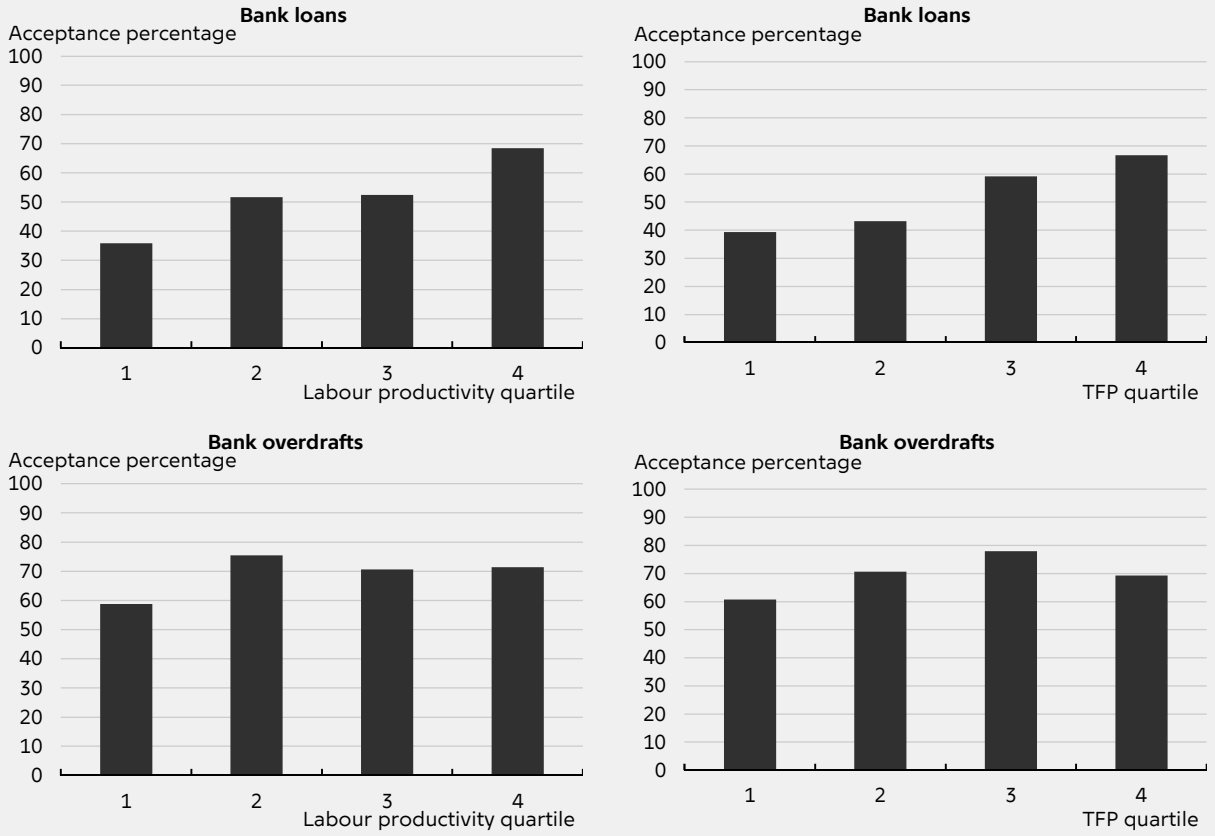
Note: Solvency and profitability are measured in end-2008, and profitability has been industry-adjusted.
Source: Own calculations based on firm-level data from Statistics Denmark.

As mentioned, it has not previously been investigated on Danish data whether the probability of a having a loan application accepted is higher for more productive firms. Chart 4.2 shows that the bank loan acceptance percentage is increasing in the productivity level, both labour productivity and total factor productivity. In general, the acceptance percentage for bank overdrafts is also smaller for low-productivity firms.

ble. Our results are, however, not sensitive to this adjustment, since a robustness check reveals that none of the conclusions are altered if we suppress the industry-adjustment.

Acceptance percentages for bank loans and bank overdrafts for different levels of productivity, 2009/2010

Chart 4.2



Note: Productivity has been industry-adjusted and is measured in end-2008.
Source: Own calculations based on firm-level data from Statistics Denmark.

The above charts are merely indications of a positive relationship between the probability of getting a bank loan application accepted and solvency, profitability, productivity. In order to analyse this question more formally, we set up a binary response model. Specifically, we estimate the following probit model

$$\Pr(d_i = 1|\boldsymbol{x}_i) = \Pr(d_i^* > 0|\boldsymbol{x}_i) = \Pr(\boldsymbol{x}_i\boldsymbol{\beta} + \omega_i > 0|\boldsymbol{x}_i) = \Phi(\boldsymbol{x}_i\boldsymbol{\beta})$$

where d_i^* is a latent variable, which is per definition unobserved. Instead, the binary variable d_i is observed, and it is assumed to take on the value 1 when $d_i^* > 0$ and 0 otherwise. $d_i = 1$ implies that the firm's bank loan is granted fully in 2009/2010. The latent variable is assumed to be linear in the vector of observables $\boldsymbol{x}_i$, which include solvency, profitability, productivity and background characteristics (firm size, age and industry), and the error term ω_i. The background variables are all measured in the previous year, i.e. end-2008. Finally, $\Phi(\cdot)$ refers to the standard normal cumulative distribution function.

Table 4.2 confirms the positive relationship between the probability of getting an application for a bank loan accepted and our four measures of firm performance, solvency, profitability, labour productivity and total factor productivity.

Probit estimation of the probability of acceptance of bank loan applications, 2009/2010 Table 4.2

	(1)	(2)	(3)	(4)	(5)
Solvency ratio	0.0062**				0.0027
	(0.0028)				(0.0031)
	[0.0025]				[0.0011]
Return on assets (industry adjusted)		0.0182***			0.0117**
		(0.0051)			(0.0058)
		[0.0073]			[0.0047]
Labour productivity (industry adjusted)			0.0004**		0.0001
			(0.0002)		(0.0003)
			[0.0002]		[0.0000]
Total factor productivity (industry adjusted)				0.0025***	0.0016*
				(0.0007)	(0.0009)
				[0.0010]	[0.0006]
log(employment)	-0.1140	-0.0960	-0.0959	-0.1477*	-0.1398
	(0.0833)	(0.0835)	(0.0828)	(0.0852)	(0.0872)
	[-0.0454]	[-0.0382]	[-0.0382]	[-0.0588]	[-0.0556]
Age	-0.0001	0.0031	0.0013	0.0025	0.0031
	(0.0057)	(0.0057)	(0.0056)	(0.0056)	(0.0058)
	[-0.0000]	[0.0012]	[0.0005]	[0.0010]	[0.0012]
Construction	0.1065	0.1072	0.1156	0.0845	0.0977
	(0.2212)	(0.2238)	(0.2212)	(0.2238)	(0.2257)
	[0.0422]	[0.0425]	[0.0458]	[0.0335]	[0.0387]
Trade and transport	0.0234	-0.0197	0.0118	0.0006	0.0003
	(0.1907)	(0.192)	(0.1905)	(0.1918)	(0.1936)
	[0.0093]	[-0.0079]	[0.0047]	[0.0003]	[0.0001]
Information, communication and	0.0364	0.0572	0.0533	-0.0224	0.0219
other business services	(0.2133)	(0.217)	(0.2137)	(0.2167)	(0.2211)
	[0.0145]	[0.0227]	[0.0212]	[-0.0089]	[0.0087]
Constant	0.2731	0.3559	0.3305	0.4393	0.3758
	(0.3220)	(0.3226)	(0.3201)	(0.3243)	(0.3302)
No. of observations	304	304	304	304	304

Note: *, ** and *** denote significance at the 10, 5 and 1 per cent level, respectively. Standard errors in parentheses. Marginal effects in square brackets. The marginal effects show the impact of a one unit increase in the explanatory variable on the probability of acceptance of bank loan applications. For dummy variables, however, the marginal effect show change in probability of acceptance when the dummy variable changes from 0 to 1. The marginal effects are evaluated at the mean of the explanatory variables. The benchmark industries are manufacturing and other industries.
Source: Own calculations based on firm-level data from Statistics Denmark.

When solvency, return on assets and both productivity measures are included simultaneously only return on assets and total factor productivity turn out to have a significant direct impact on the probability of getting the bank loan application accepted. However, an F-test with a null hypothesis of no effect of all four measures is rejected at the 1 per cent significance level. Thus, the four measures are jointly significant. The fact that solvency and the productivity measures are hardly significant individually, but strongly significant jointly, suggests that including all measures simultaneously causes near multicolinearity. This comes as no surprise, since the measures are highly dependent, cf. how they are calculated.

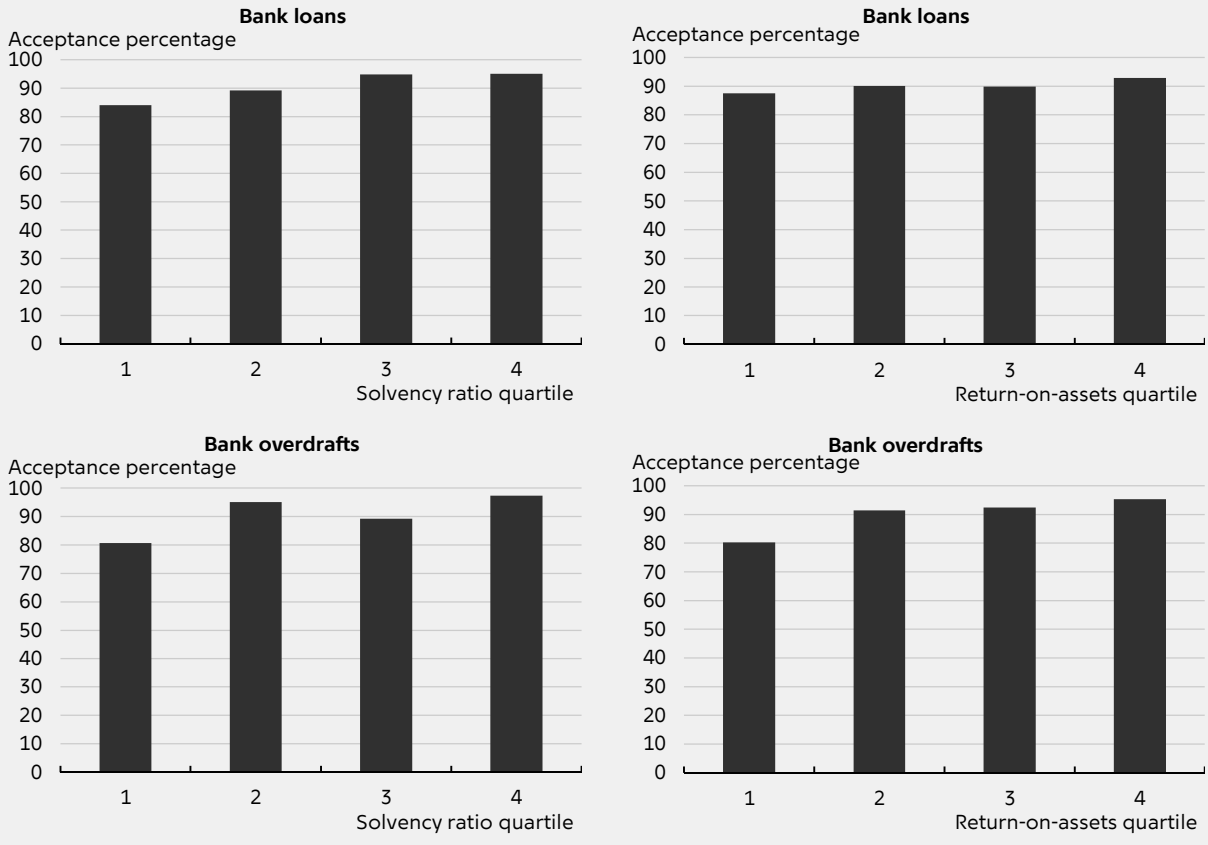
It should be noted that the simple probit estimations do not take selection into account, i.e. it is not random which firms apply for a bank loan. The main conclusion is, however, robust to taking selection into account in a way similar to Abildgren *et al.* (2013).[6]

4.1 PRE-CRISIS RESULTS

In the survey conducted by Statistics Denmark there is also information on the firms' access to finance in 2007. The results should be interpreted carefully since the information was not gathered until 2009/2010. First of all, the average acceptance percentages were much higher in 2007 than in 2009/2010, which indicates that access to loan financing was much easier pre-crisis, cf. Chart 4.3. Pre-crisis there was a much weaker relationship between bank loan acceptance percentage and solvency. The same applies for bank overdraft applications. Similarly, the relationship between loan acceptance percentage and profitability was almost non-existing prior to the financial crisis.

Acceptance percentages for bank loans and bank overdrafts for different levels of solvency and profitability, 2007

Chart 4.3



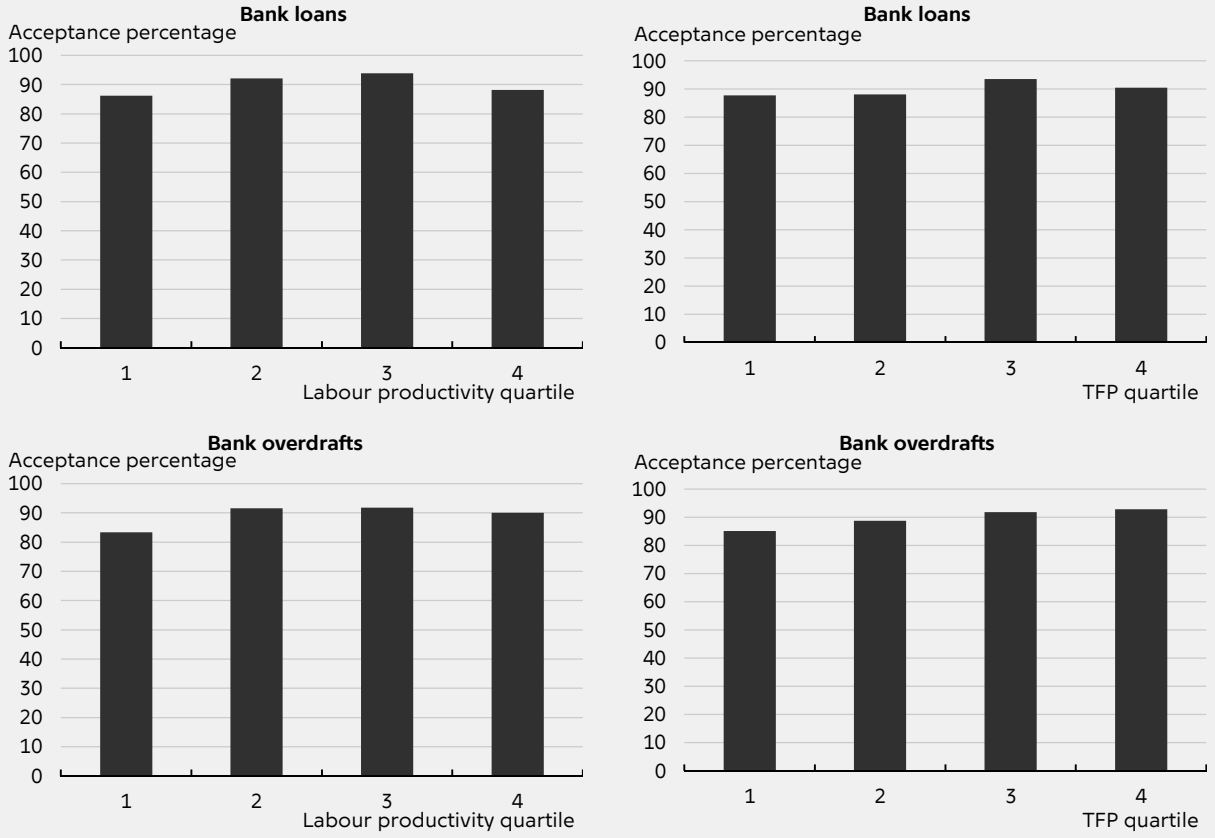
Note: Solvency and profitability are measured in end-2006, and profitability has been industry-adjusted.
Source: Own calculations based on firm-level data from Statistics Denmark.

6 In particular, employing a probit version of the two-step Heckman selection model yields joint significance at the 1 per cent level when all four measures are included simultaneously.

Chart 4.4 shows that high-productivity firms did not have significantly easier access to loan financing in 2007 compared to low-productivity firms.

Acceptance percentages for bank loans and bank overdrafts for different levels of productivity, 2007

Chart 4.4



Note: Productivity has been industry-adjusted and is measured in end-2006.
Source: Own calculations based on firm-level data from Statistics Denmark.

A formal empirical analysis confirms that in 2007 there was no significant relationship between productivity and the probability of getting an application for a bank loan accepted, cf. Table 4.3. This same applies to return on assets. However, it was the case that a higher solvency ratio significantly increased the probability of acceptance of bank loan applications. When all four measures are included simultaneously, an F-test reveals that the null hypothesis of no joint significance cannot be rejected at the 5 per cent level, but can only be rejected at the 10 per cent level. Although this estimation is likely to suffer from problems due to near multicolinearity, it illustrates that the relationship between bank loan acceptance percentage and firm performance was weaker prior to the financial crisis.

Probit estimation of the probability of acceptance of bank loan applications, 2007 Table 4.3

	(1)	(2)	(3)	(4)	(5)
Solvency ratio	0.0207***				0.0202***
	(0.0071)				(0.0077)
	[0.0032]				[0.0031]
Return on assets (industry adjusted)		0.0107			-0.0002
		(0.0088)			(0.0101)
		[0.0018]			[0.0000]
Labour productivity (industry adjusted)			0.0005		0.0005
			(0.0006)		(0.0009)
			[0.0001]		[0.0001]
Total factor productivity (industry adjusted)				0.0004	-0.0004
				(0.0009)	(0.0012)
				[0.0001]	[-0.0001]
log(employment)	-0.1358	-0.1020	-0.1244	-0.1309	-0.1321
	(0.1217)	(0.1208)	(0.1189)	(0.1183)	(0.1248)
	[-0.0207]	[-0.017]	[-0.0207]	[-0.0219]	[-0.02]
Age	0.0058	0.0072	0.0070	0.0067	0.0061
	(0.0087)	(0.0086)	(0.0087)	(0.0087)	(0.0087)
	[0.0009]	[0.0012]	[0.0012]	[0.0011]	[0.0009]
Construction	-0.0014	-0.0018	-0.0522	-0.0618	0.0004
	(0.3076)	(0.3058)	(0.2994)	(0.2989)	(0.3136)
	[-0.0002]	[-0.0003]	[-0.0089]	[-0.0106]	[0.0001]
Trade and transport	0.4264	0.3617	0.3892	0.3629	0.4438
	(0.2766)	(0.2677)	(0.2715)	(0.2678)	(0.2801)
	[0.0611]	[0.0574]	[0.0613]	[0.0579]	[0.0631]
Information, communication and	0.1291	0.1812	0.1496	0.1279	0.1479
other business services	(0.3135)	(0.3114)	(0.3084)	(0.3088)	(0.3207)
	[0.0186]	[0.028]	[0.0233]	[0.0203]	[0.021]
Constant	1.0452**	1.3926***	1.4481***	1.4827***	1.0367**
	(0.4719)	(0.4482)	(0.4421)	(0.4396)	(0.4725)
No. of observations	281	281	281	281	281

Note: *, ** and *** denote significance at the 10, 5 and 1 per cent level, respectively. Standard errors in parentheses. Marginal effects in square brackets. The marginal effects show the impact of a one unit increase in the explanatory variable on the probability of acceptance of bank loan applications. For dummy variables, however, the marginal effect show change in probability of acceptance when the dummy variable changes from 0 to 1. The marginal effects are evaluated at the mean of the explanatory variables. The benchmark industries are manufacturing and other industries.

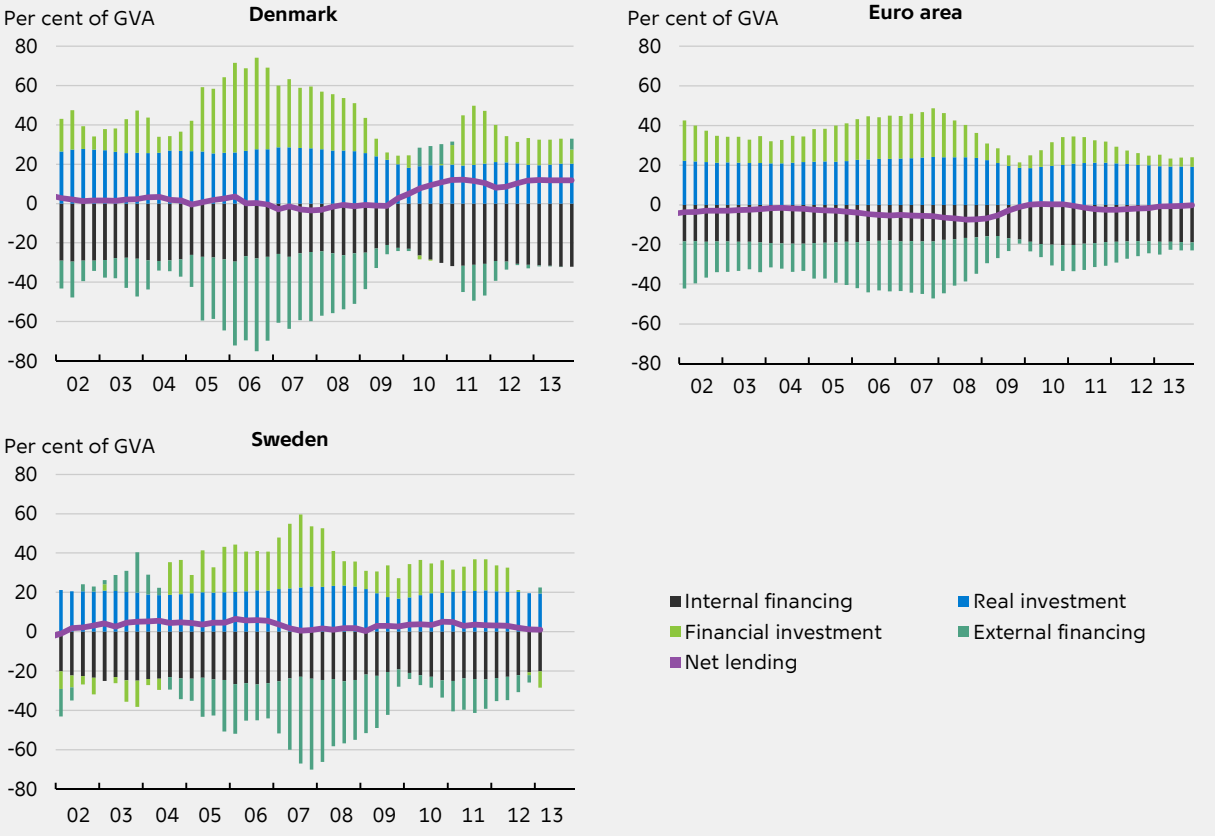
Source: Own calculations based on firm-level data from Statistics Denmark.

5. MARKET BASED VERSUS NON-MARKET BASED FINANCING

In this section we compare the financing structure of Danish non-financial corporations with the one in other European countries. We then analyse whether Danish market based funded firms, i.e. quoted public companies, differ from unquoted public companies regarding solvency, profitability and productivity. The non-financial corporations can finance their real and financial investments through internal funding via accumulated savings, and through external funding which consists of loans and issuance of new shares, other equity (such as ownership interests in cooperative societies and limited partnerships) and bonds.

Compared to Swedish firms and firms in the euro area internal funds are somewhat more prevalent as a source of financing for Danish non-financial corporations, cf. Chart 5.1.

Firms investment and financing Chart 5.1



Note: Based on transactions in per cent of non-financial corporations' gross value added (GVA). 4-quarter moving averages. The most recent observations are from 4th quarter 2013 for Denmark and the euro area and 1st quarter 2013 for Sweden.
Source: Statistics Denmark, ECB and Danmarks Nationalbank.

The savings surplus also referred to as the net lending of non-financial corporations is the difference between firms' internal financing and their real investments. Hence, a positive net lending indicates that overall the firms have a net placement requirement. Contrarily, a negative net lending reflects a net financing requirement. The net lending

usually varies with the business cycle. The firms tend to increase investments in a cyclical upturn and on the other hand decrease them during an economic downturn. Petersen and Risbjerg (2009) find that during a business cycle expansion the Danish firms often first turn to internal funds for expanding the capital equipment and only at a later stage of the financial upturn as the internal funds gradually are exhausted the firms use external funding such as loans.

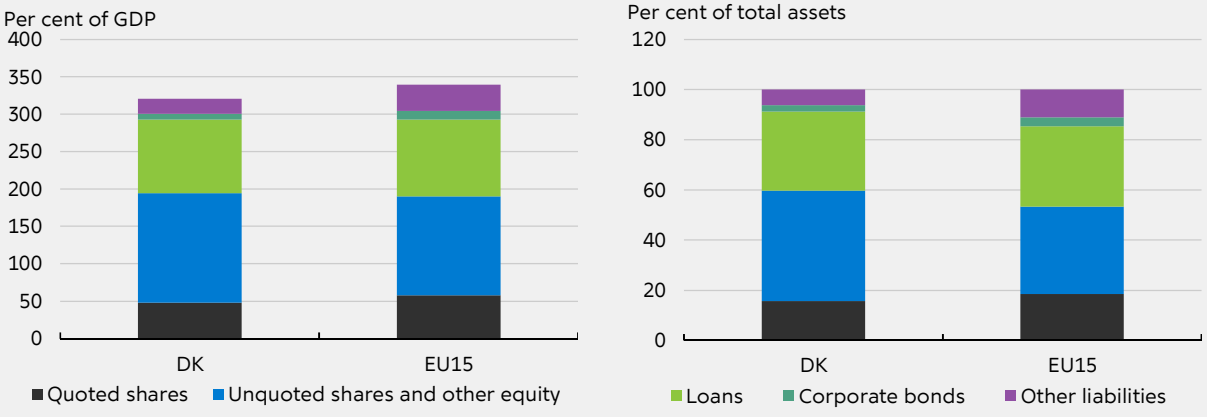
There was a significant expansion of the Danish firms' balance sheets prior to the outbreak of the financial crisis in the autumn 2008. This to some extent reflects that external funding was used for financial investments. The increase in financial investments for instance comprises purchase of shares and other equity.[7] In the euro area the expansion of the non-financial corporations' balance sheets was not as pronounced as in Denmark and Sweden, cf. Chart 5.1. Since the outbreak of the financial crisis the tendency to gross build-up of balance sheets has decreased significantly both in Denmark, Sweden and the euro area.

5.1 DANISH FIRMS' USE OF MARKET BASED AND NON-MARKET BASED FINANCING

The Danish non-financial corporations' funding structure to a large extent reassembles the one of the other EU countries. As a share of GDP the total funding on average make up for around 300 per cent both in Denmark and the EU15 countries, cf. Chart 5.2. The same picture emerges when one considers the firms' funding types in per cent of total assets.

External funding of non-financial corporations in Denmark and EU15 in per cent of GDP and in per cent of firms' total assets, average for end-of-year 1999-2013

Chart 5.2



Note: Market value. Data for Ireland, Luxembourg and the Netherlands does not cover the entire period. Data for Ireland starts in 1st quarter 2002 and for Luxembourg and the Netherlands in 1st quarter 2005. Other liabilities for instance cover trade credit.
Source: Bundesbank, Oesterreichische Nationalbank, Central Bank of Ireland, ECB and Eurostat.

Decomposition of the funding structure shows that the most prevalent source of funds both in Denmark and in the EU15 is unquoted shares and other equity which for Danish firms make up for 41 per cent of the firms' total assets seen as an average over the

7 External funding and financial investments have fluctuated more for Denmark than the euro area, due to a relatively strong impact from one-off major M&A transactions, cf. Christensen, Friis and Kabatchenko (2010).

years 1999-2013. In EU15 the corresponding figure was 35 per cent. Subsequently, loan financing make up for around 30 per cent of the funding in both Denmark and the EU15. Finally, funding by issuance of quoted shares and corporate bonds is a little more employed by the European firms compared to the Danish firms but in both Denmark and the EU15 corporate bonds is of relative little significance for the firms total funding.

The non-financial corporations' funding can be divided into market based and non-market based. The market based financing refers to issuance of quoted shares and quoted corporate bonds whereas the non-market based financing mainly covers loans and issuance of unquoted shares, other equity and unquoted corporate bonds.[8]

5.1.1 QUOTED SHARES

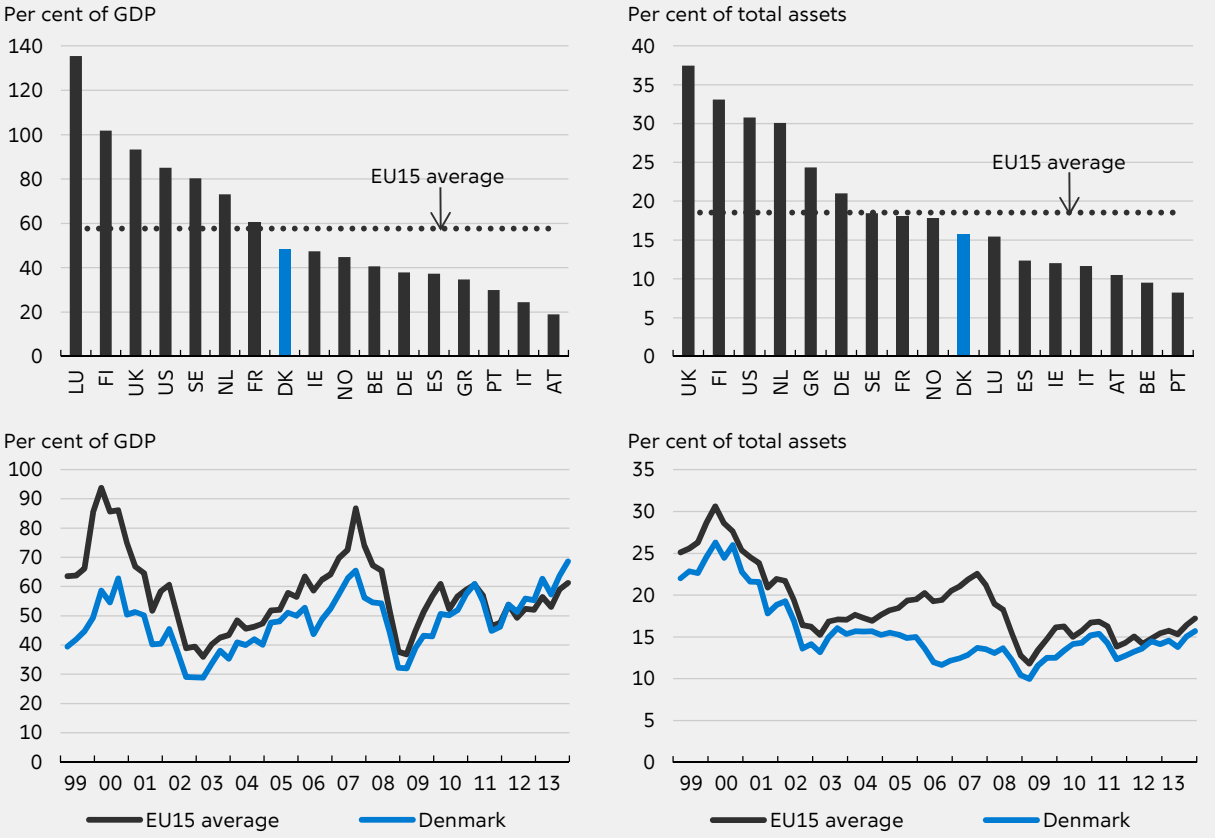
From 1999 to 2013 quoted shares on average have made up for a little less of the total assets (also measured relative to GDP) among Danish firms compared to firms in other European countries, cf. Chart 5.3. However, the prevalence of quoted shares as a funding source varies a great deal from country to country within the EU. Firms in the UK, Finland and the Netherlands rely the most on quoted shares.

Looking at the development, the proportion of Danish firms' quoted shares to GDP has been a little below the average for the EU15 countries from 1999 to 2011. During the most recent years the share of quoted shares in Denmark has increased relative to the EU15. As the quoted shares are stated at market value this reflects the fact that stock prices have increased more in Denmark than in Europe seen as one. Comparing stock prices indexed to 100 in 1999, the price in Denmark reached 340 by 2013 and 180 in Europe. The development in stock prices suggests that for a period the issuance of quoted shares has been lower in Denmark compared to the EU15. This is confirmed by looking at net transactions in quoted shares. In Denmark the accumulated transactions have been negative during the last decade while overall positive in the EU15. This is in line with the fact that the number of Danish quoted issuers have dropped from around 140 in early-2003 to 115 in January 2014. However, there have been a couple of large IPOs in the first half of 2014.

8 In cross-country comparable data it is difficult to separate quoted and unquoted corporate bonds. Therefore all outstanding corporate bonds will be treated as market based financing for the remaining part of this chapter. For Danish corporate bonds it is a fair assumption as 98 per cent of the bonds registered at VP SECURITIES were quoted at end-2013 and VP registered bonds make up for 96 per cent of all outstanding corporate bonds.

Quoted shares in per cent of GDP and total assets, 1999-2013

Chart 5.3



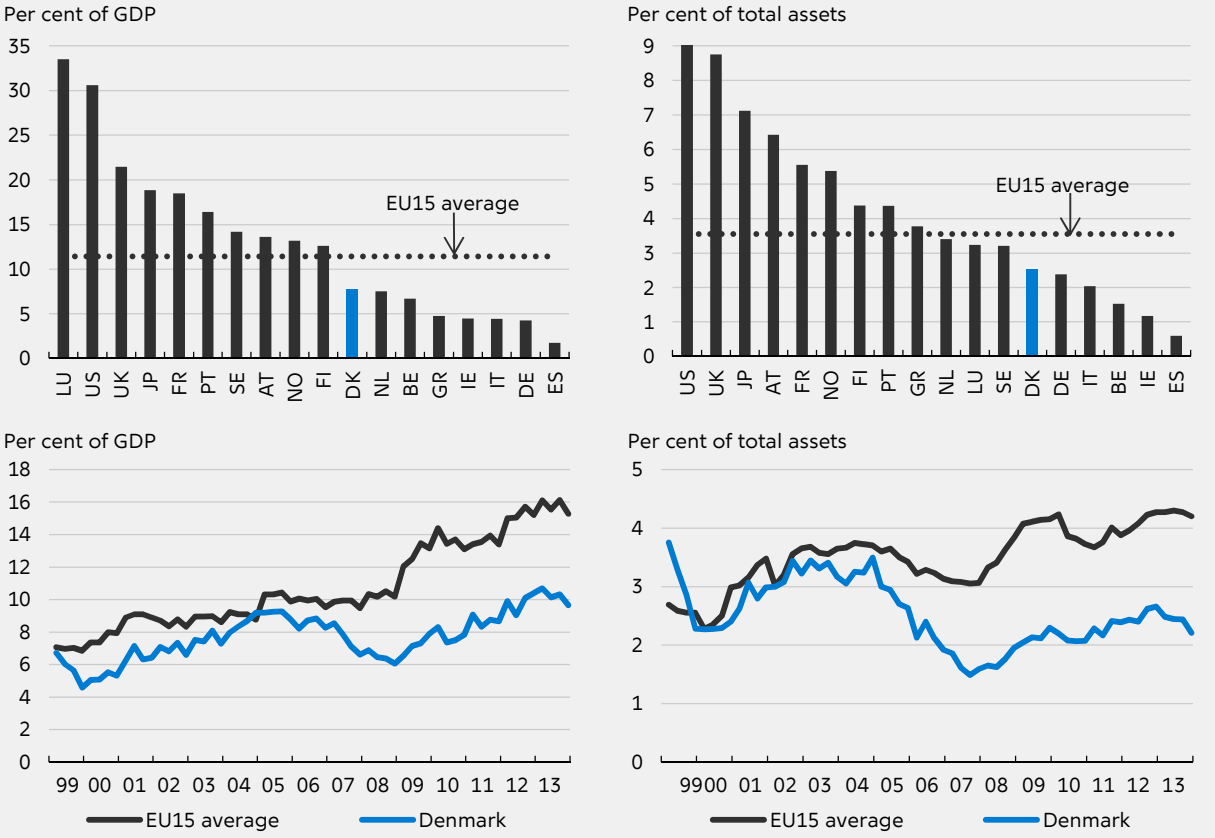
Note: Quoted shares at market prices. GDP at current prices and not seasonally adjusted. The upper charts show the average of 1st quarter 1999 to 4th quarter 2013. Data for Ireland, Luxembourg and the Netherlands does not cover the entire period. Data for Ireland starts in 1st quarter 2002 and for Luxembourg and the Netherlands in 1st quarter 2005. Data for United States and Norway is based on annual national accounts covering the period 1999-2012. Details on quoted and unquoted shares are not available for Japan.

Source: Bundesbank, Oesterreichische Nationalbank, ECB, OECD and Eurostat.

5.1.2 Corporate bonds

Compared to the average of the EU15 countries in 1999 to 2013 Danish firms to a lesser extent used corporate bonds to finance their investments. As a share of GDP Danish firms' corporate bonds amounted to 8 per cent whereas the average for the EU15 was 11 per cent. Also as a share of the firms' total assets the Danish firms funding through corporate bonds was below the EU15 average, cf. Chart 5.4. In the aftermath of the financial crisis the Danish firms' issuance of corporate bonds rose markedly. This development was also observed in other European countries.

Corporate bonds in per cent of GDP and total assets, 1999-2013 Chart 5.4

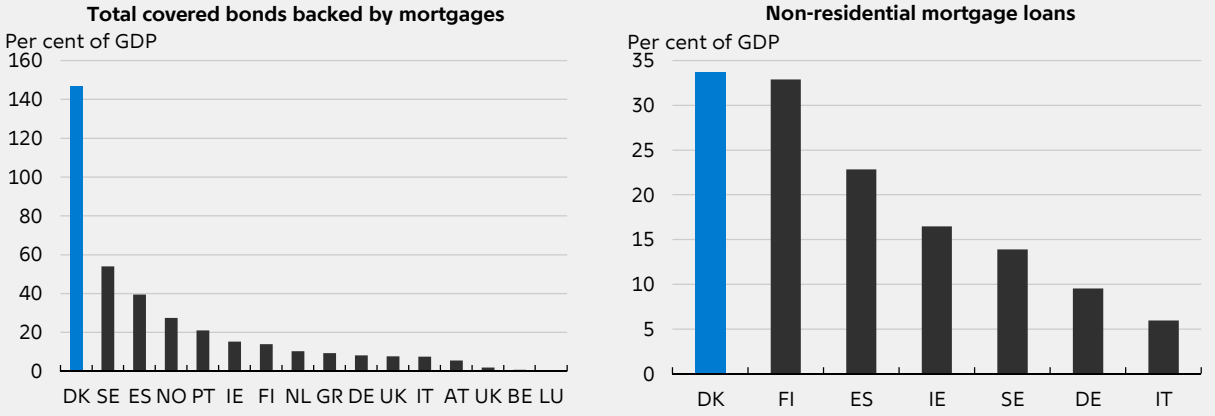


Note: Securities other than shares at market prices. GDP at current prices and not seasonally adjusted. The upper charts show the average of 1st quarter 1999 to 4th quarter 2013. Data for Ireland, Luxembourg and the Netherlands does not cover the entire period. Data for Ireland starts in 1st quarter 2002 and for Luxembourg and the Netherlands in 1st quarter 2005. Data for United States, Japan and Norway is based on annual national accounts covering the period 1999-2012.
Source: ECB, Oesterreichische Nationalbank, OECD and Eurostat.

One explanation for the more limited use of corporate bonds as a funding source among Danish non-financial corporations could be the well-developed market for mortgage bonds in Denmark. The loans from mortgage banks to a wide extent fill in the need for firms to issue their own bonds. The total outstanding volume in covered bonds is considerable in Denmark compared to many other countries, cf. Chart 5.5 (left). Also when signaling out the mortgage loans backed by non-residential property, the Danish loans are considerable in size, cf. Chart 5.5 (right).

Total outstanding covered bonds backed by mortgages and total outstanding non-residential mortgage loans in 2012

Chart 5.5



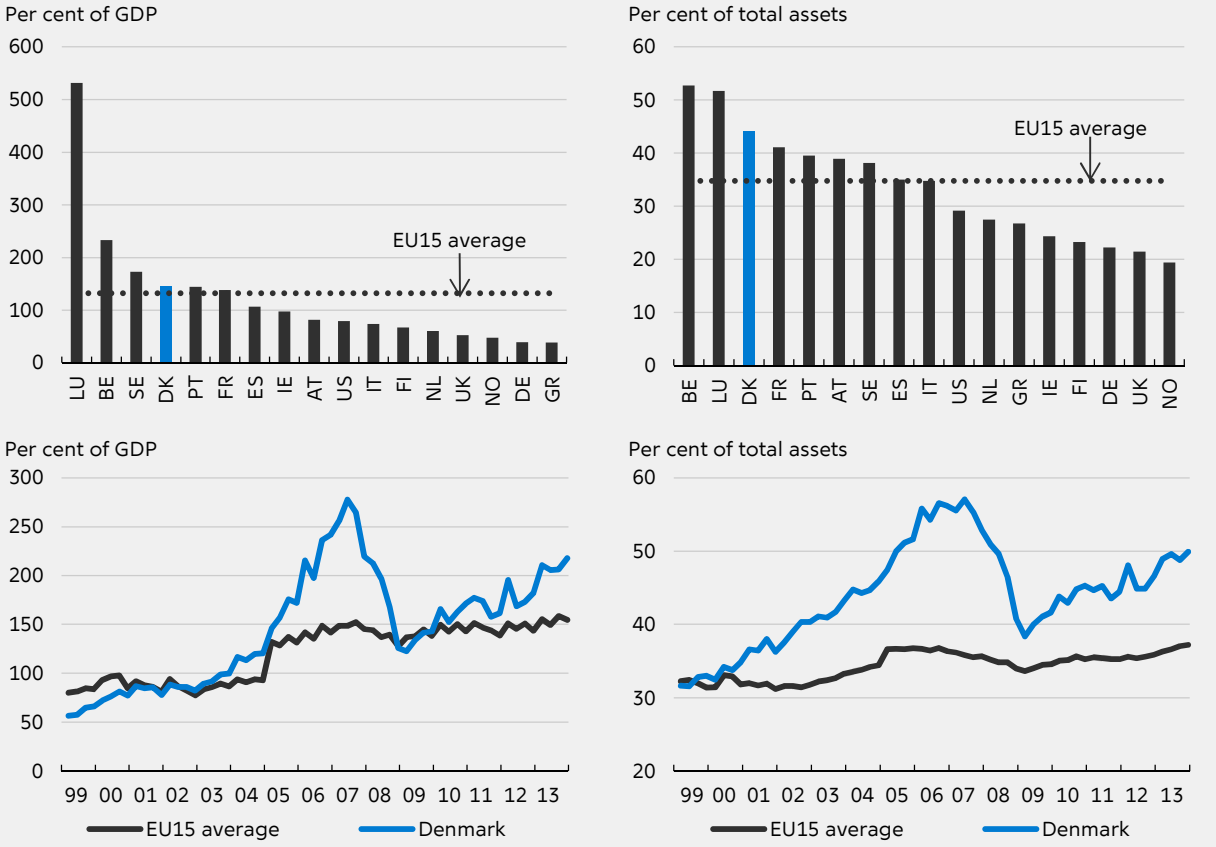
Note: The non-residential mortgage loans in Sweden are estimated as the loans from housing credit institutions to non-financial corporations.
Source: European Mortgage Federation (2013), Statistics Sweden and Eurostat.

5.1.3 Unquoted shares

Because of differences in the valuation of unquoted shares[9] and prevalence of different types of equity one should always be cautious when comparing unquoted shares across countries. However, taken at face value the Danish firms' use of unquoted shares is more common than in the other EU countries seen as one. This holds both when looking at unquoted shares in per cent of GDP and as a percentage of total assets. Only firms in Luxembourg, Belgium and Sweden have a higher outstanding amount of unquoted shares stated at market value, cf. Chart 5.6.

9 In the remaining part of the paper unquoted shares also cover other equity in the form of issued papers that entitle the holder to a share of the firms' profits. Other equity can for instance be in the form of owner-ship interests in cooperative societies or limited partnerships.

Unquoted shares and other equity in per cent of GDP and total assets, 1999-2013 Chart 5.6



Note: Unquoted shares at market prices when available. Otherwise, net asset value or book value is used. GDP at current prices and not seasonally adjusted. The upper charts show the average of 1st quarter 1999 to 4th quarter 2013. Data for Ireland, Luxembourg and the Netherlands does not cover the entire period. Data for Ireland starts in 1st quarter 2002 and for Luxembourg and the Netherlands in 1st quarter 2005. Data for United States and Norway is based on annual national accounts covering the period 1999-2012. Details on quoted and unquoted shares are not available for Japan.

Source: Bundesbank, Oesterreichische Nationalbank, Central Bank of Ireland, ECB, OECD and Eurostat.

In the period 1999 to 2013 the value of Danish firms' stock of unquoted shares has been higher than the average for the EU15 countries in most quarters. As for quoted shares the development in unquoted shares mainly reflects price changes although there has been an increase in newly issued unquoted shares since mid-2010.

The more extensive use of unquoted shares as part of firms' external funding in Denmark, however, may be explained by the prevalence of company owned foundations. This is also reflected in the firms' assets where Danish non-financial corporations tend to hold more unquoted shares compared to firms in other European countries. The phenomenon of companies owned by foundations or the so-called industry foundations is more prevalent in Northern Europe, especially in Denmark and the other Nordic countries. One explanation could be that the rates of taxation, particularly wealth taxes, historically have been relatively high in these countries, cf. Thomsen and Rose (2004). Before 1987 the industry foundations experienced more favorable taxation rules than other company types in Denmark. In the case of transfer of ownership under an estate planning procedure it was possible to diminish the taxation by donating the shares to a foundation instead of directly leaving them by will to the descendants. Since 1987 the foundations are with few exemptions met with taxation rules that match the ones of quoted firms. According to the Danish securities statistics that co-

vers papers registered at VP SECURITIES (the Danish central securities depository) industry foundations owned 35 per cent of Danish non-financial corporations' quoted shares and 70 per cent of unquote shares in December 2013. Examples of completely or partly foundation-owned Danish firms are Novo Nordisk, Carlsberg, Danfoss, A.P. Møller and Grundfos.

Foundations are independent meaning that its' profits can only be used to develop and operate the firm and potentially to charitable purposes if stated in the charter. This leaves the board of the foundation with no direct economic interest in the performance of the firm on short term. In theory this means that at worst the foundation-owned companies could be facing managerial agency problems and at best the foundation-owned companies have more patient owners than other firms. This may also explain why Danish firms' to larger extent are able to finance their investments internally through retained earnings, cf. Petersen and Risbjerg (2009). Nevertheless, studies based on micro data have shown that foundation-owned Danish firms do not, in terms of return on assets, perform worse than firms with other funding structures, see for example Thomsen and Hansmann (2013), Thomsen and Rose (2004) and Bjørn and Hovard (2001). According to Herrmann and Franke (2002) the same holds for German foundation-owned companies. When it comes to investment performance Dzansi (2012) shows that Swedish foundation-owned companies are as efficient as companies with other corporate structures.

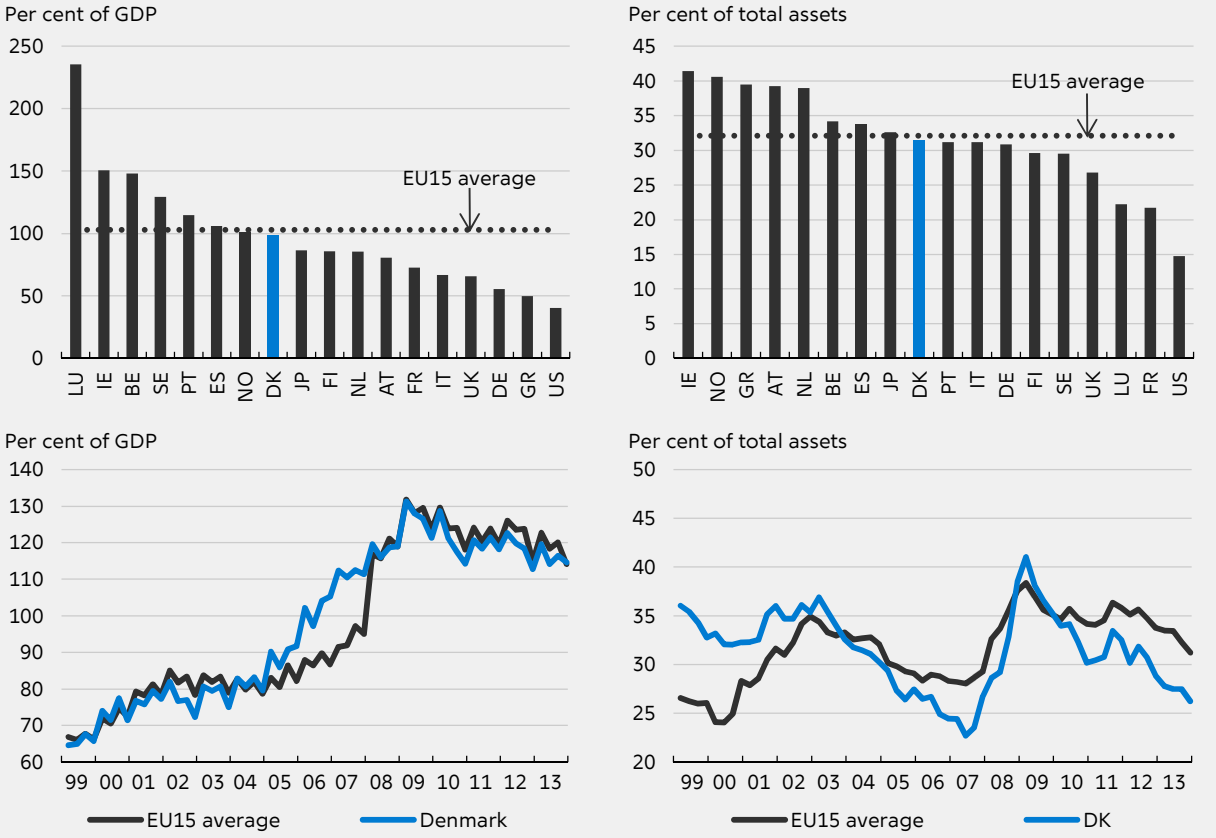
5.1.4 Loans

In 1999-2013 the Danish non-financial corporations' loans on average made up for slightly more than 30 per cent of the total assets which is roughly in line with the use of loans among firms in EU15. The same conclusion is reached when turning to loans in per cent of GDP, cf. Chart 5.7.

The non-financial corporations' loans comprise both foreign loans and domestic loans which can be divided into MFI loans and loans from other sectors including other non-financial corporations (sector loans). There is a tendency that Danish firms have obtained relatively more loans from MFIs while their loans from other sectors excluding non-financial corporations are lower than in EU15. The application of sector internal loans i.e. loans from one non-financial corporation to another non-financial corporation varies from country to country. The sector internal loans also covers intercompany loans and may therefore depend on the complexity of the corporate structure in the countries. In Denmark the sector internal loans make up for just below 40 per cent of GDP which is broadly in line with the use of sector financing in Sweden. The Danish firms' loans are mainly short-term loans with a maturity up to or equal to 1 year. The share of short term loans is larger for Denmark than the average in EU15, which may be surprising considering the bulk of long-term mortgage bank financing in Denmark. However, Danish bank loans are with shorter maturity than in most other EU countries.

Loans in per cent of GDP and total assets, 1999-2013

Chart 5.7



Note: GDP at current prices and not seasonally adjusted. The upper charts show the average of 1st quarter 1999 to 4th quarter 2013. Data for Ireland, Luxembourg and the Netherlands does not cover the entire period. Data for Ireland starts in 1st quarter 2002 and for Luxembourg and the Netherlands in 1st quarter 2005. Data for United States, Japan and Norway is based on annual national accounts covering the period 1999-2012.

Source: ECB, Oesterreichische Nationalbank, OECD and Eurostat.

5.2 FACTORS BEHIND FIRMS' CHOICES BETWEEN MARKET BASED AND NON-MARKET BASED FINANCING

The overall funding pattern of Danish non-financial corporations is quite similar to the one found in the other European countries. However, the Danish firms tend to a somewhat lesser extent to use market based funding such as quoted shares and corporate bonds.[10] Other than the already mentioned reasons – a well-functioning mortgage credit market and the prevalence of industry foundations – there might be several other possible suggestions to why the Danish firms do not use more market based funding.

Petersen and Risbjerg (2009) found that during the period 1995 to 2007 non-financial corporations' cost of financing via shares and other equity where significantly higher than debt financing via banks. On average the cost of financing through shares was 10 per cent per year whereas the cost of debt financing was 5 per cent per year. This is confirmed in more recent figures, cf. Box 5.1.

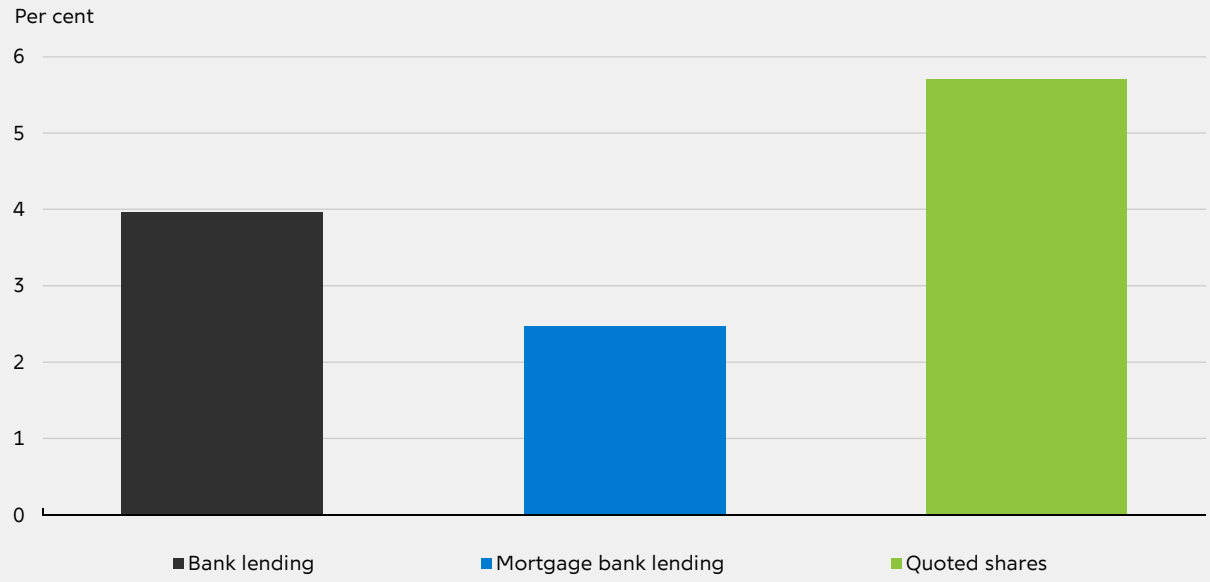
[10] According to the World Bank (2007) economic research point to that whether a financial system is primarily bank-based or market-based does not matter for the long-term economic growth of the economy.

The cost of financing for Danish firms

Box 5.1

We have calculated the cost of financing through quoted shares. The cost is affected by the dividend payouts which have been increasing since 2005 but the number of dividend paying firms has dropped which indicate that it is primarily the largest firms that have paid dividends to the shareholders. With these reservations the calculation shows that cost of financing through quoted shares was 5.7 per cent in end-2013. The yield to maturity on corporate bonds issued by Danish non-financial corporations was approximately 2 per cent[1] while the average effective lending rate on outstanding loans to non-financial corporations was 4 per cent for bank loans and 2.5 for mortgage loans, cf. the chart below. Comparing this to firms in the euro area, it is also the case that financing through quoted shares is the most expensive funding source. Meanwhile, recent trends show that the cost of financing through corporate bonds have declined in the euro area which also coincides with increasing issuance of corporate bonds by euro area firms, cf. European Central Bank (2014). When comparing the cost of financing it must be kept in mind that the certain parts of the costs are not included, cf. the paragraph below this box. Furthermore the cost of different funding sources also varies with the level of risk associated for the investors, hence financing through shares will tend to be more expensive than loan financing via mortgage banks because mortgage loans are collateralized.

Cost of external financing, end-2013



Note: The cost of financing through quoted shares is calculated under the assumption that the long term growth rate in the economy is 3.3 per cent based on the average growth in nominal GDP until 2080 which is consistent with the projections of real GDP growth and average consumer prices by the Ministry of Finance. The calculation follows the discounted dividend model and includes extraordinary dividend payouts. All costs are stated before taxes.
Source: The Danish Ministry of Finance, Danmarks Nationalbank and own calculations.

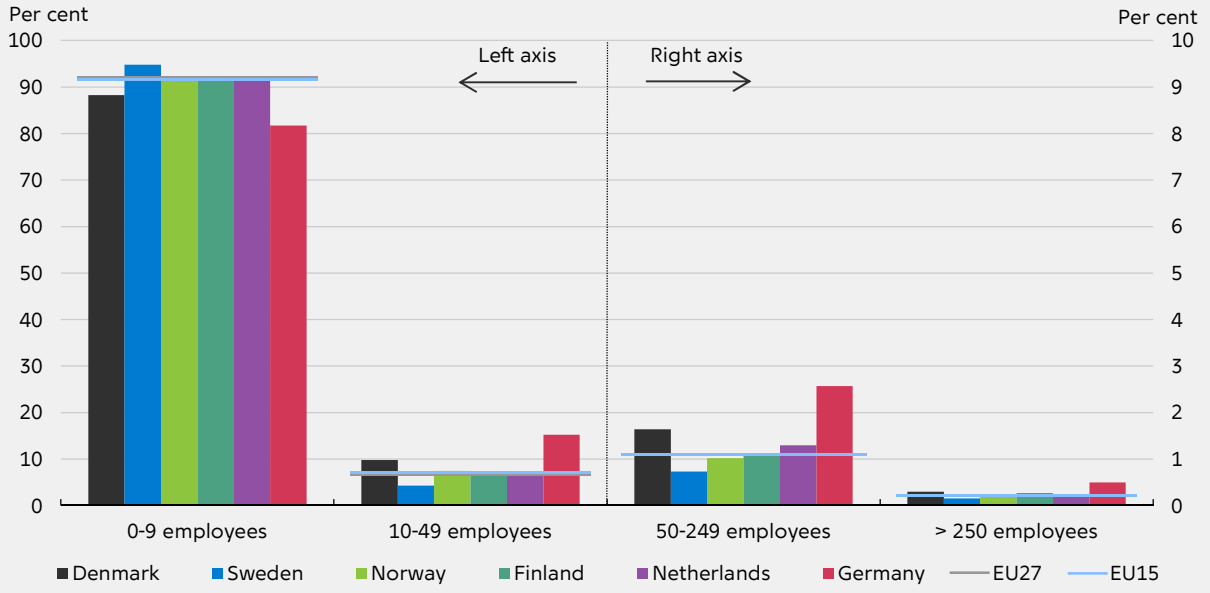
[1] The yield on corporate bonds is based on data from Reuters EIKON covering over 80 per cent of the corporate bonds registered at VP SECURITIES (the Danish central securities depository). The yield is calculated based on prices in mid-September for outstanding bonds at end-July.

In the calculations in the box the initial cost of funding through issuance of shares and bonds are not included. According to Danmarks Nationalbank and the Ministry of Economy and Business Affairs (2006) and the Ministry of Economy and Business Affairs (2012) the initial costs of market based financing are comprehensive. In addition the firms who issue quoted shares must also cover continuous costs regarding mandatory information sharing about the financial statement of the firm to the shareholders. Bond issuing firms may also face additional substantial costs if they wish to have their bonds

rated by a rating agency. Danmarks Nationalbank and the Ministry of Economy and Business Affairs (2006) show that, if a firm issues quoted shares for kr. 500 million it will face a cost of around kr. 13 million the first year and subsequently the yearly cost will approximate to kr. 1 million. According to the Ministry of Economy and Business Affairs (2012), Sveriges Riksbank has calculated that the cost of having a bond programme is around kr. 3 million per year. Therefore the funding need of a firm must exceed kr. 160 million in order for it to be viable to issue bonds. Hence, the firms that issue quoted shares and bonds have to be of a certain size and presumably operating in certain capital-demanding sectors. Looking at the size distribution of Danish firms it is not obvious that the structure differentiate significantly from that of the other European countries. This holds both when looking at the number of firms, the number of persons employed and the gross value added, cf. Chart 5.8 and 5.9. For data on individual EU countries see tables in annex 5.A. Although the Danish share of firms with more than 250 employees is in line with the EU15 average there might be a significant variation from country to country regarding the size of the largest firms. For instance in Germany during the last 10 years there were between 10 and 50 new non-financial corporations issuing bonds each year and the median number of employees for a bond issuing firm in 2013 was 106,000, cf. Deutsche Bank Research (2014). In comparison there are extremely few Danish firms with more than 100,000 employees. The median bond issuing firm in the Netherlands had 18,000 employees. In Denmark there are 50-60 firms of comparable size.

Percentage distribution of the numbers of enterprises broken down by number of employees, 2012

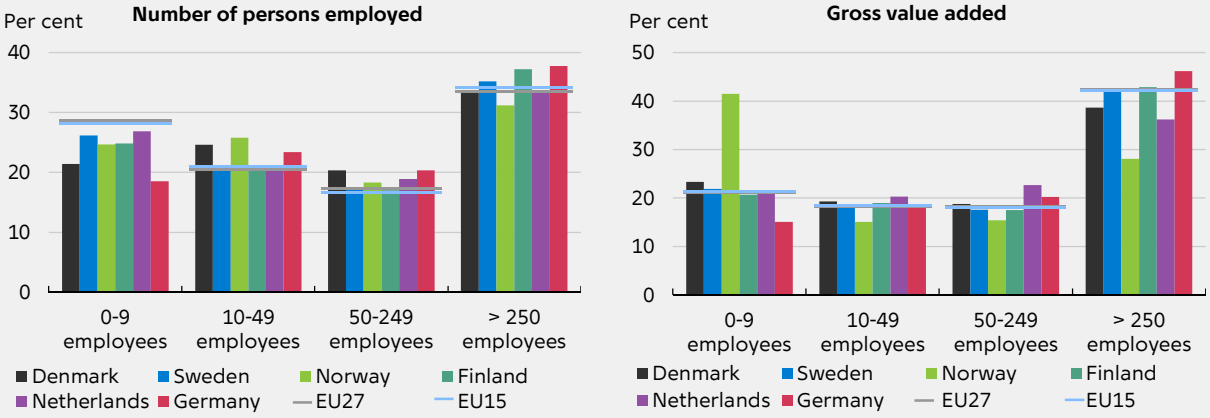
Chart 5.8



Note: Based on the following Nace Rev. 2 sectors: B-J and L-N.
Source: European Commission, SME Performance Review 2013.

Percentage distribution of number of persons employed and gross value added broken down by number of employees, 2012

Chart 5.9

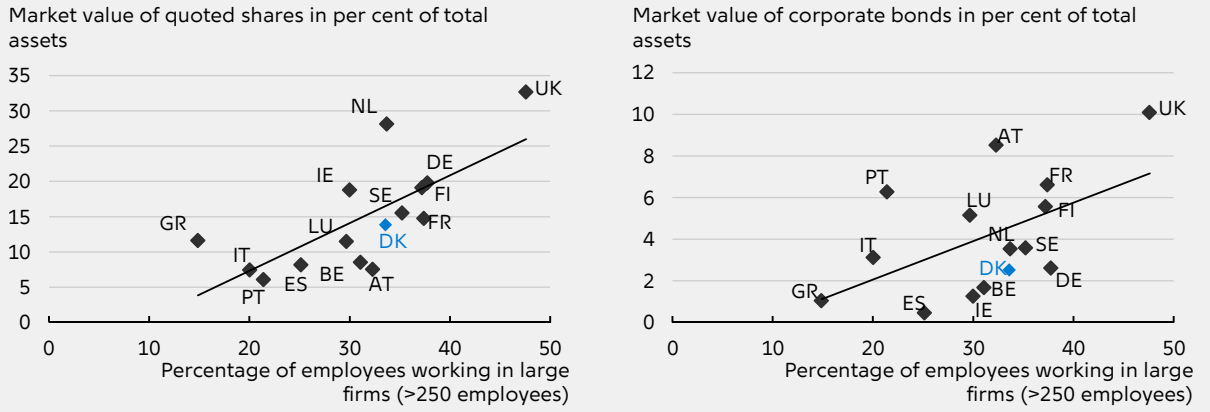


Note: Based on the following Nace Rev. 2 sectors: B-J and L-N.
Source: European Commission, SME Performance Review 2013.

Across the EU15 it seems to be true that a higher proportion of large firms tend to correlate with more extensive use of market based financing in the form of issued quoted shares and corporate bonds, cf. Chart 5.10.

Correlation between countries' proportion of large firms and the market value of quoted shares and corporate bonds in per cent of total assets, 2012

Chart 5.10



Source: Bundesbank, Oesterreichische Nationalbank, Central Bank of Ireland, ECB, Eurostat and European Commission, SME Performance Review 2013.

Another factor might be the size of the aggregated potential market for quoted shares and bonds which may influence on the prevalence of market based financing among firms. The Danish economy and hence potential market is smaller than many of the European countries we compare the funding pattern to, e.g. Sweden. A smaller market is associated with lack of economies of scale for investors. The cost of monitoring and making oneself acquainted with a smaller market comes with a cost which may reflect in the return the investors demand.

One way of coping with the size of the market for the Danish firms could be to issue quoted shares and corporate bonds on other exchanges than Nasdaq OMX Copenha-

gen which the firms already do. The introduction of MiFID[11] has contributed to subvert trade barriers and align terms for security trading across European countries, cf. London Economics (2010) and Davies (2008). Furthermore, a look at the owner distribution of shares and corporate bonds issued by Danish firms does not suggest that the securities should be less attractive for foreigners when compared to the owner distribution in other comparable European countries.

Besides the factors already mentioned there can be other reasons to why Danish firms tend to hold back on using market based financing. One is the lack of experience and/or tradition for market based financing. According to Danmarks Nationalbank and the Ministry of Economy and Business Affairs (2006) about 80 per cent of the difference between the use of quoted shares among Finnish and Danish firms can be explained by a greater tendency for Finnish firms to list their shares. A survey among Danish firms has shown that a large part of the firms are concerned about having to share private information with market participants when issuing quoted shares and corporate bonds, cf. KPMG (2012). Another issue for some smaller firms is less flexibility when using market based financing compared to bank financing in the form of overdrafts. If tap issuance is not a possibility the cost of issuance leads to less and large issues which is accompanied by the need for asset management if the capital is not needed for investment all at once.

5.3 PERFORMANCE OF DANISH NON-FINANCIAL QUOTED FIRMS

In Section 4 we saw that solid, profitable and productive firms have easier access to loan financing. In this subsection, we analyse whether solid, profitable and productive firms are also more likely to use market based financing in the form of quoted shares. We therefore take a closer look at the performance of Danish non-financial firms with access to market based financing via the issuance of exchange traded shares as compared to firms that use non-market based financing in the form of unquoted shares.

We apply firm-level data from Statistics Denmark's accounts statistics for the Danish business sector, cf. Section 3. These data are supplemented with firm-level data from the Danmarks Nationalbank's statistics on Danish securities based on information from VP SECURITIES in the period 2000-2011.[12] Quoted firms are identified as firms with a positive outstanding amount of quoted share capital. To ensure comparability between quoted and unquoted firms we restrict the sample to only including limited companies with more than 100 full-time employees. Our final sample includes 14,250 firm-year observations, of which 483 are quoted firms.

In comparing performance between quoted and unquoted firms, we concentrate on four main indicators: solvency, return on assets, labour productivity and total factor productivity. We industry-adjust our measures for profitability and productivity by subtracting the sample median in each industry and each year.

Quoted firms seem to be much more solid than unquoted firms, cf. Chart 5.11. Median solvency for quoted firms has substantially exceeded that of unquoted firms in the entire period 2000-2011. Equity appears to have constituted a fairly stable fraction of

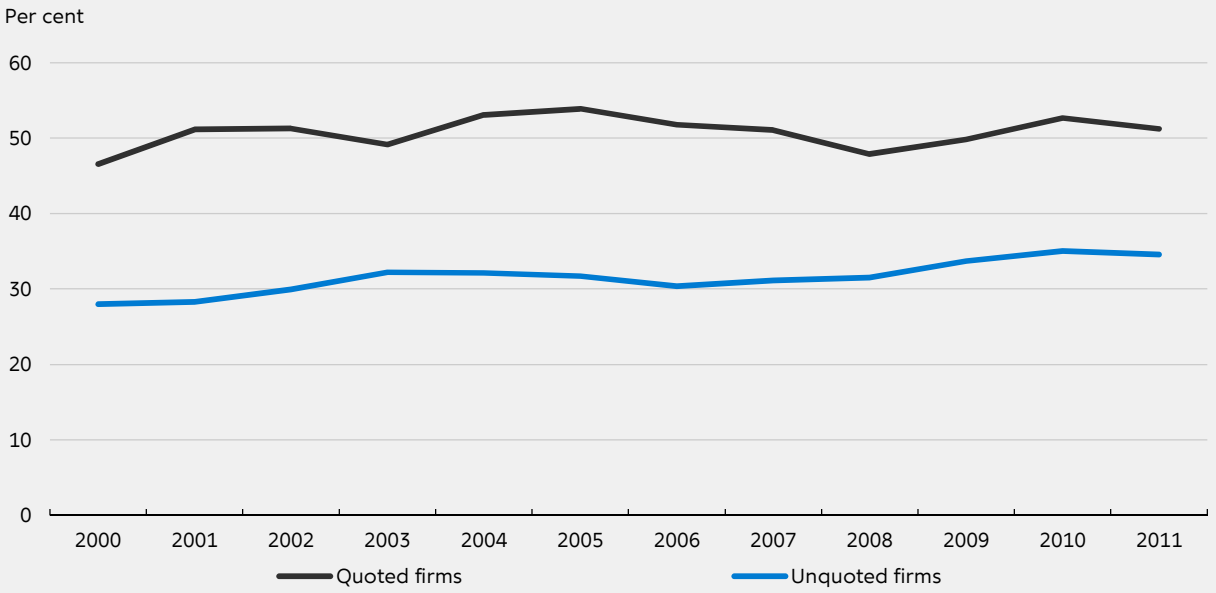
[11] The Markets in Financial Instruments Directive, MiFID, is an European Union legislation effective from 2007. The law seeks to harmonise the regulation for investment services across the EU-countries.

[12] It should be noted that for around 50 per cent of the observations on quoted firms we were unable to create a link between Danmarks Nationalbank's statistics on Danish securities and Statistics Denmark's accounts statistics. However, the quoted firms present in our sample are nonetheless well-distributed across different industries.

total assets in quoted firms over the last decade, at around 50 per cent, whereas it has been below 35 per cent for unquoted firms in all years. Similar results have been found by Danmarks Nationalbank and the Ministry of Economy and Business Affairs (2006), which find a positive correlation between the firm's solvency ratio and the probability of having access to market based funding in the form of shares. Also, Capasso *et al.* (2007) find that Italian firms listed on the stock market use less financial leverage compared to unlisted companies, while Schoubben and Van Hulle (2004) find similar results among Belgian companies.

Solvency ratio, median

Chart 5.11

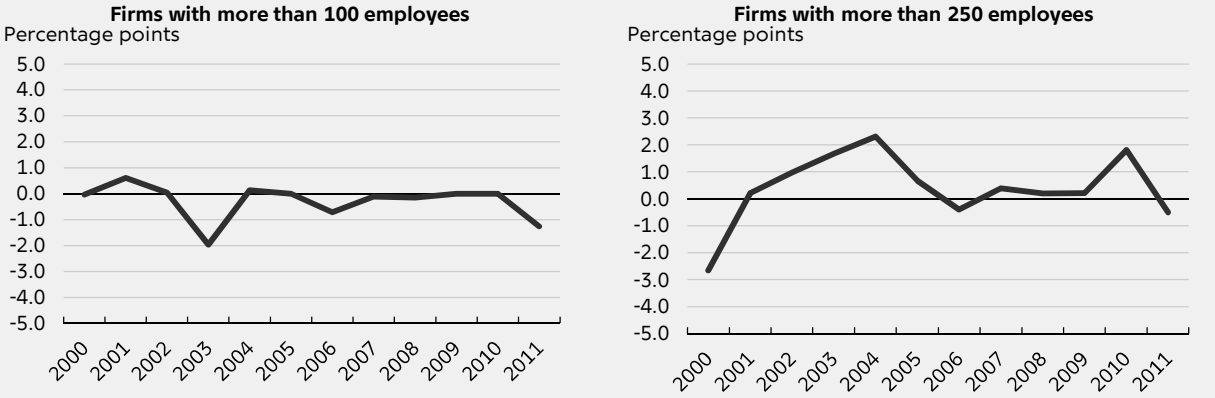


Note: Solvency ratio is defined as equity in per cent of the firm's total assets. Only limited companies with more than 100 full-time employees are included in the sample.
Source: Own calculations based on firm-level data from Statistics Denmark and Danish securities statistics from Danmarks Nationalbank.

Profitability, measured by return on assets, does not differ significantly between quoted and unquoted firms, cf. Chart 5.12. In the sample with limited companies with more than 100 full-time employees there is a slight tendency towards better performance for unquoted firms. However, restricting attention to large firms with more than 250 full-time employees reverts this picture. This illustrates that it is crucial to ensure comparability between the two groups (quoted and unquoted) when comparing their performance. It would, of course, be beneficial to perform a more formal regression analysis taking various observable differences between the firms into account, as done in previous sections of this paper. However, the limited number of observations restrain us from doing this.

Excess return on assets for quoted firms relative to unquoted firms, difference in medians

Chart 5.12

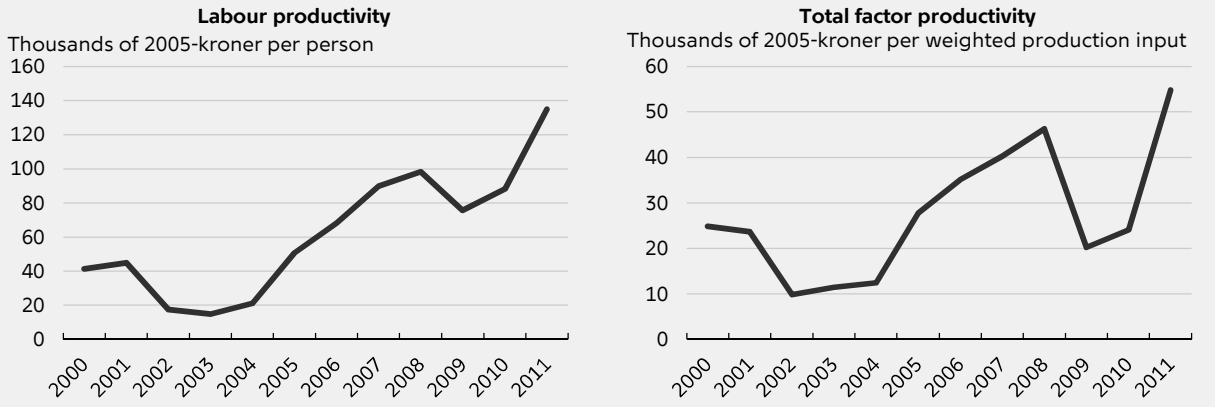


Note: The chart shows the difference between the median return on assets among quoted firms and the median return on assets among unquoted firms. Return on assets is defined as profit before tax plus interest expenses in per cent of total assets, and has been industry-adjusted. Only limited companies with more than 100 (or 250) full-time employees are included in the sample. The sample used in the left-hand chart includes 14,250 firm-observations, of which 483 are quoted firms, while the sample used in the right-hand chart includes 4,890 firm-observations, of which 338 are quoted firms.

Source: Own calculations based on firm-level data from Statistics Denmark and Danish securities statistics from Danmarks Nationalbank.

On the other hand, it is a clear tendency that quoted firms have higher productivity than unquoted firms, both in terms of labour productivity and in terms of total factor productivity, cf. Chart 5.13. Danmarks Nationalbank and the Ministry of Economy and Business Affairs (2006) found a positive relation between productivity and the likelihood of stock market launch (IPO).

Excess productivity for quoted firms relative to unquoted firms, difference in medians Chart 5.13



Note: The chart shows the difference between the median productivity level among quoted firms and the median productivity level among unquoted firms. Labour productivity is defined as value added per full-time employed. Both productivity measures are industry-adjusted. Only limited companies with more than 100 full-time employees are included in the sample.
Source: Own calculations based on firm-level data from Statistics Denmark and Danish securities statistics from Danmarks Nationalbank.

Thus, the main finding from this sub-analysis is that quoted firms on average have higher solvency ratios and are more productive than unquoted firm. For profitability, however, we did not find any significant difference between quoted and unquoted firms. Overall, this indicates that more solid and productive firms have larger financial flexibility.

6. CONCLUDING REMARKS

In the paper at hand we have taken a closer look at the links between corporate capital structure and firm-level productivity, profitability and access to finance based on Danish industry-level and firm-level accounting data from the period 2000-2011.

Our results indicate that the capital structure has no significant impact on the firms' profitability or productivity.

However, the capital structure is important in relation to the range of financing options available to the firm and its funding and refinancing risks. Our analysis shows that small and medium-sized enterprises with high solvency ratios tend to have a higher acceptance rate when they apply for bank loans than corresponding firms with low solvency ratios. We also find that firms that issue exchange-traded stocks have higher solvency ratios than unquoted public firms.

Finally we have compared the corporate capital structure in Denmark with other EU countries based on aggregated financial accounts statistics. The overall funding pattern of Danish firms is quite similar to the one found in the other European countries. However, the Danish firms tend to a somewhat lesser extent to use market based funding such as quoted shares and corporate bonds with might reflect a large and well-functioning Danish market for mortgage bonds and the prevalence of industry foundations in Denmark.

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ANNEX 2.A: LIST OF 82 INDUSTRIES FROM STATISTICS DENMARK'S ACCOUNTS STATISTICS

06000 Extraction of oil and gas
08009 Extraction of gravel and stone
09000 Mining support service activities
10001 Production of meat and meat products
10002 Processing and preserving of fish
10004 Manufacture of grain mill and bakery products
10005 Other manufacture of food products
11000 Manufacture of beverages
13000 Manufacture of textiles
14000 Manufacture of wearing apparel
15000 Manufacture of leather and footwear
16000 Manufacture of wood and wood products
17000 Manufacture of paper and paper products
18000 Printing etc.
20001 Manufacture of basic chemicals
20002 Manufacture of paints and soap etc.
21000 Pharmaceuticals
22000 Manufacture of rubber and plastic products
23001 Manufacture of glass and ceramic products
23002 Manufacture of concrete and bricks
24000 Manufacture of basic metals
25000 Manufacture of fabricated metal products
26001 Manufacture of computers and communication equipment etc.
26002 Manufacture of other electronic products
27001 Manufacture of electric motors, etc.
27002 Manufacture of wires and cables
27003 Manufacture of household appliances, lamps, etc.
28001 Manufacture of engines, windmills and pumps
28002 Manufacture of other machinery
29000 Manufacture of motor vehicles and related parts
30000 Manufacture of ships and other transport equipment
31000 Manufacture of furniture
32001 Manufacture of medical instruments, etc.
32002 Manufacture of toys and other manufacturing
33000 Repair and installation of machinery and equipment
383 Materials recovery
41000 Construction of buildings
42000 Civil engineering
43001 Construction installation activities
43002 Building completion and finishing
43009 Bricklaying and other specialized construction activities and site preparation activities
45001 Sale of motor vehicles
45002 Repair and maintenance of motor vehicles etc.
46001 Wholesale on a fee or contract basis
46002 Wholesale of cereals and feeding stuffs
46003 Wholesale of food, beverages and tobacco
46004 Wholesale of textiles and household goods
46005 Wholesale of IT-equipment
46006 Wholesale of other machinery
46007 Other specialized wholesale
47001 Supermarkets and department stores, etc.
47002 Retail sale of food in specialized stores
47003 Retail sale of automotive fuel
47004 Retail sale of consumer electronics
47005 Retail sale of textiles and household equipment, etc.
47006 Retail sale of cultural and recreation goods, etc.
47007 Retail sale of wearing apparel
47008 Retail sale via Internet, mail order, etc.
49002 Transport by suburban trains, buses and taxi operation, etc.
49003 Freight transport by road and via pipeline
52000 Support activities for transportation
55000 Hotels and similar accommodation
56000 Restaurants
58001 Publishing
58002 Publishing of computer games and other software
62000 Information technology service activities
68001 Buying and selling of real estate
68002 Renting of real estate

68003 Renting of non-residential buildings
69001 Legal activities
69002 Accounting and bookkeeping activities
70000 Business consultancy activities
71000 Architectural and engineering activities
72000 Scientific research and development
73000 Advertising and market research
74000 Other technical business services
78000 Employment activities
79000 Travel agent activities
80000 Security and investigation activities
81000 Services to buildings, cleaning and landscape activities
82000 Other business service activities
95000 Repair of personal goods

ANNEX 2.B: LIST OF 62 INDUSTRIES WITH INFORMATION ON LABOUR PRODUCTIVITY

06000 Extraction of oil and gas
08009 Extraction of gravel and stone
09000 Mining support service activities
10001 Production of meat and meat products
10002 Processing and preserving of fish
10004 Manufacture of grain mill and bakery products
10005 Other manufacture of food products
11000 Manufacture of beverages
13000 Manufacture of textiles
14000 Manufacture of wearing apparel
15000 Manufacture of leather and footwear
16000 Manufacture of wood and wood products
17000 Manufacture of paper and paper products
18000 Printing etc.
20001 Manufacture of basic chemicals
20002 Manufacture of paints and soap etc.
21000 Pharmaceuticals
22000 Manufacture of rubber and plastic products
23001 Manufacture of glass and ceramic products
23002 Manufacture of concrete and bricks
24000 Manufacture of basic metals
25000 Manufacture of fabricated metal products
26001 Manufacture of computers and communication equipment etc.
26002 Manufacture of other electronic products
27001 Manufacture of electric motors, etc.
27002 Manufacture of wires and cables
27003 Manufacture of household appliances, lamps, etc.
28001 Manufacture of engines, windmills and pumps
28002 Manufacture of other machinery
29000 Manufacture of motor vehicles and related parts
30000 Manufacture of ships and other transport equipment
31000 Manufacture of furniture
32001 Manufacture of medical instruments, etc.
32002 Manufacture of toys and other manufacturing
33000 Repair and installation of machinery and equipment
383 Materials recovery
42000 Civil engineering
45001 Sale of motor vehicles
45002 Repair and maintenance of motor vehicles etc.
46000 Wholesale trade
47000 Retail trade
49002 Transport by suburban trains, buses and taxi operation, etc.
49003 Freight transport by road and via pipeline
52000 Support activities for transportation
55000 Hotels and similar accommodation
56000 Restaurants
58001 Publishing
58002 Publishing of computer games and other software
62000 Information technology service activities
68001 Buying and selling of real estate
68003 Renting of non-residential buildings
69001 Legal activities
69002 Accounting and bookkeeping activities
70000 Business consultancy activities

71000 Architectural and engineering activities
73000 Advertising and market research
74000 Other technical business services
78000 Employment activities
80000 Security and investigation activities
81000 Services to buildings, cleaning and landscape activities
82000 Other business service activities
95000 Repair of personal goods

ANNEX 2.C: LIST OF 37 INDUSTRIES WITH INFORMATION ON TOTAL FACTOR PRODUCTIVITY

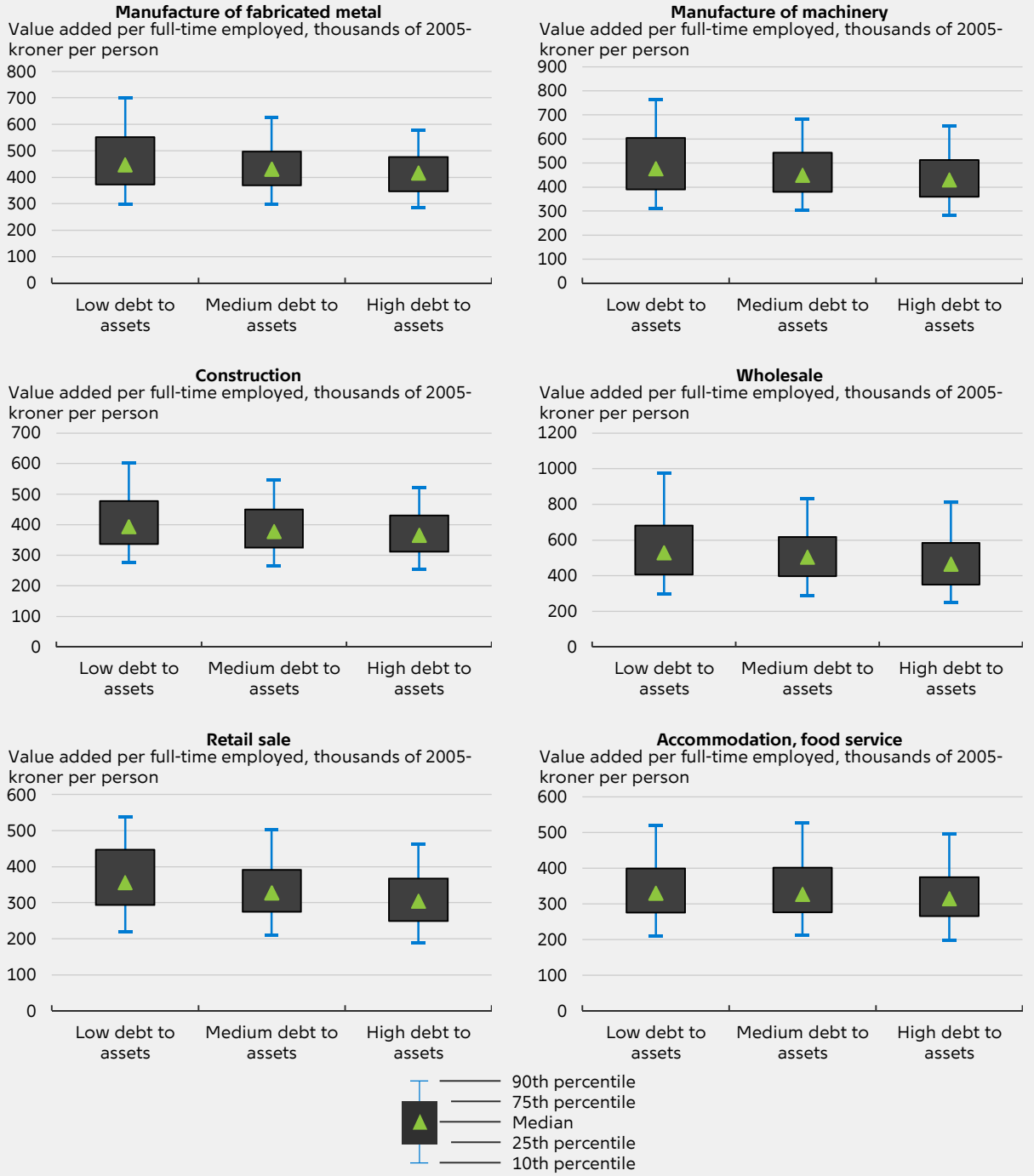
06090 Mining and quarrying
10120 Manufacture of food products, beverages and tobacco
13150 Textiles and leather products
16000 Manufacture of wood and wood products
17000 Manufacture of paper and paper products
18000 Printing etc.
20000 Manufacture of chemicals
21000 Pharmaceuticals
22000 Manufacture of rubber and plastic products
23000 Manufacture of other non-metallic mineral products
24000 Manufacture of basic metals
25000 Manufacture of fabricated metal products
26000 Manufacture of electronic components
27000 Electrical equipment
28000 Manufacture of machinery
29000 Manufacture of motor vehicles and related parts
30000 Manufacture of ships and other transport equipment
31320 Manufacture of furniture and other manufacturing
33000 Repair and installation of machinery and equipment
45000 Wholesale and retail trade and repair of motor vehicles and motorcycles
46000 Wholesale
47000 Retail sale
49000 Land transport and transport via pipelines
52000 Support activities for transportation
55560 Accommodation and food service activities
58000 Publishing activities
62630 IT and information service activities
68100 Buying and selling of real estate
68300 Renting of non-residential buildings
69700 Legal and accounting activities; activities of head offices; management consultancy
71000 Architectural and engineering activities
73000 Advertising and market research
74750 Other professional, scientific and technical activities; veterinary activities
78000 Employment activities
80820 Security and investigation; services to buildings and landscape; other business's
95000 Repair of personal goods

ANNEX 3.A: LIST OF 42 INDUSTRIES IN THE FIRM-LEVEL ANALYSIS

(01) Manufacture of food, tobacco
(02) Textiles and leather products
(03) Manufacture of wood etc.
(04) Manufacture of paper etc.
(05) Printing etc.
(06) Manufacture of chemicals
(07) Pharmaceuticals
(08) Manufacture of rubber etc.
(09) Manuf.of glass, concrete etc.
(10) Manufacture of basic metals
(11) Manufact. of fabricated metal
(12) Manufacture of electronics
(13) Electrical equipment
(14) Manufacture of machinery
(15) Manuf. of motor vehicles etc.
(16) Mf. of ships, transport equip.
(17) Manuf.of furniture,other manuf
(18) Repair, inst. of machinery etc
(19) Sewerage,waste collection etc.
(20) Construction
(21) Sale, repair of motor vehicles
(22) Wholesale
(23) Retail sale
(24) Land transport, pipelines
(25) Water transport
(26) Air transport
(27) Support activities for transp.
(28) Postal and courier activities
(29) Accommodation, food service
(30) Publishing activities
(31) Radio,TV.Movie,video,sound pub
(32) Telecommunications
(33) IT and information service
(34) Legal, account.,cons.activit.
(35) Architecture and engineering
(36) Research and development
(37) Advertising, market research
(38) Oth.techn.serv.,veterinary act
(39) Rental and leasing activities
(40) Employment activities
(41) Cleaning, other business serv.
(42) Repair of personal goods

ANNEX 3.B: FURTHER FIGURES – FIRM-LEVEL ANALYSIS OF OVERALL CAPITAL STRUCTURE

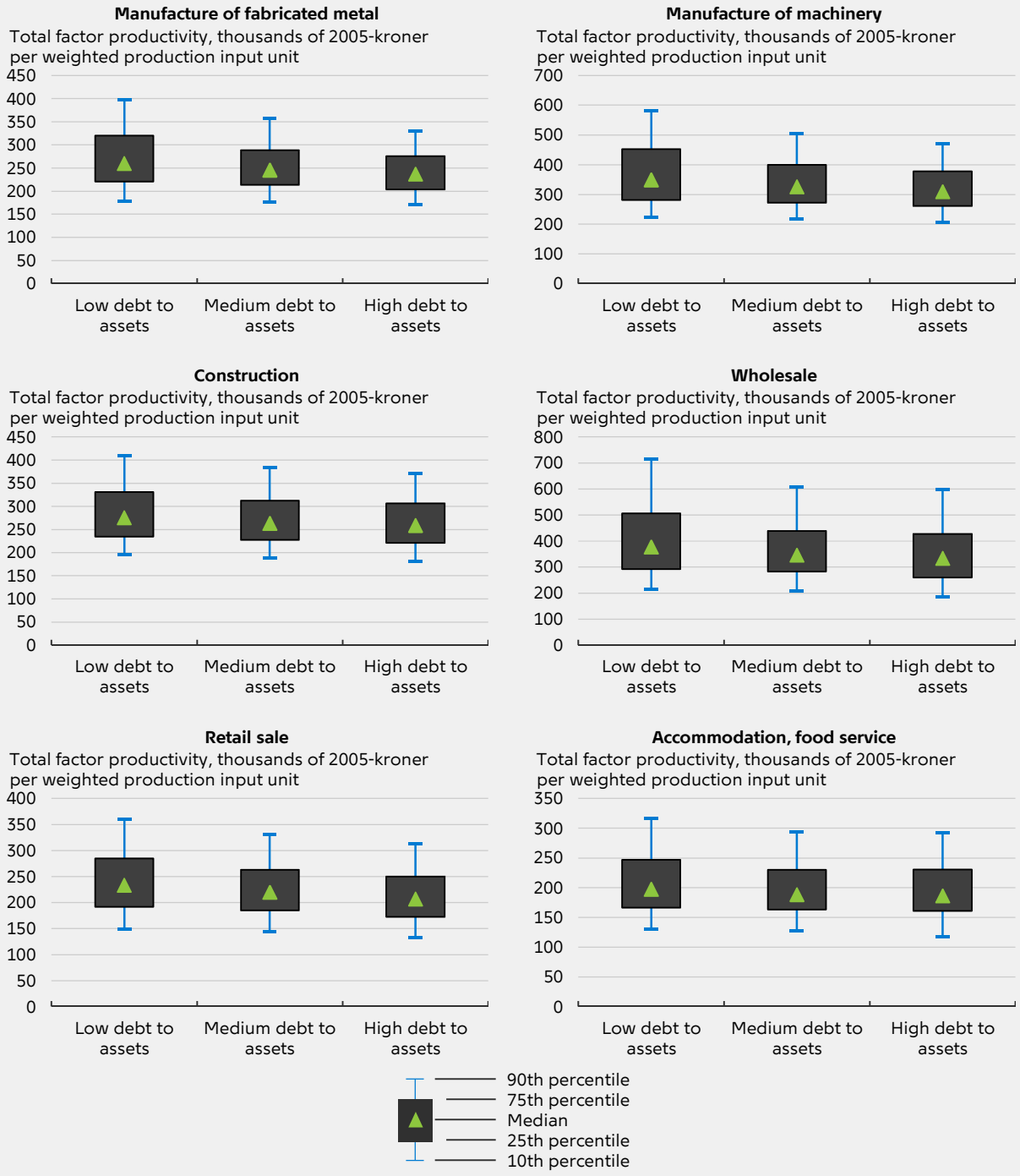
Boxplots of labour productivity for different debt levels, selected industries Chart 3B.1



Note: The debt level refers to debt in per cent of total assets in the previous year. Low debt to assets is defined as a debt ratio below 60 per cent, medium is 60-80 percent, while high is above 80 percent.
Source: Own calculations based on firm-level data from Statistics Denmark.

Boxplots of total factor productivity for different debt levels, selected industries

Chart 3B.2

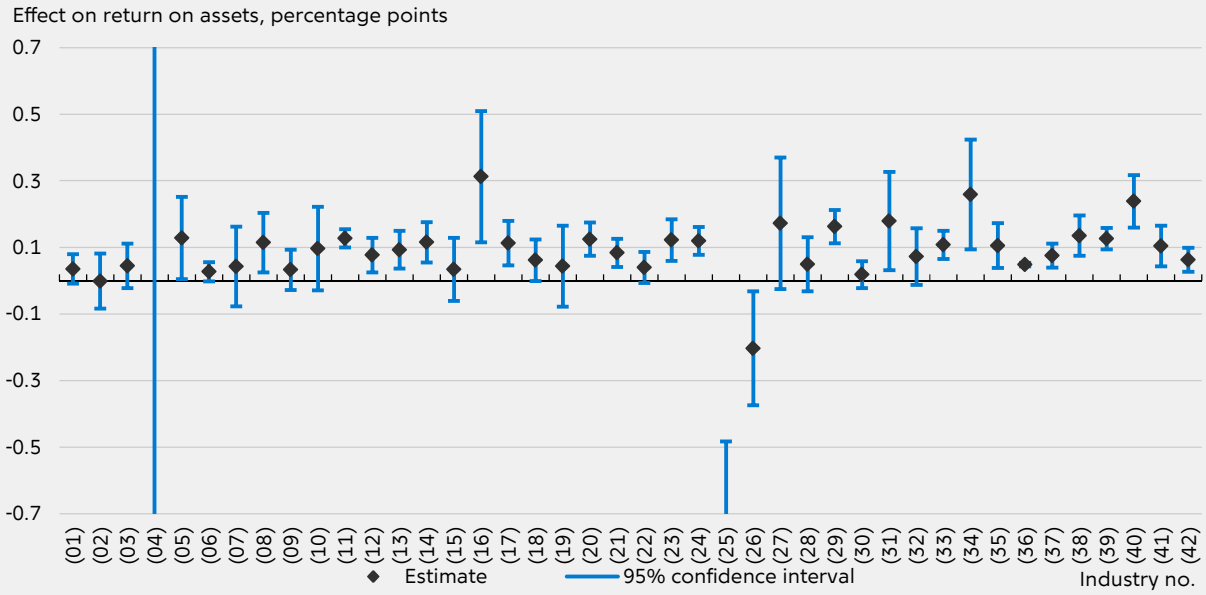


Note: The debt level refers to debt in per cent of total assets in the previous year. Low debt to assets is defined as a debt ratio below 60 per cent, medium is 60-80 percent, while high is above 80 percent.

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

Effect on profitability (return on assets) of a 1 percentage point increase in debt-to-assets, fixed effects estimation

Chart 3B.3

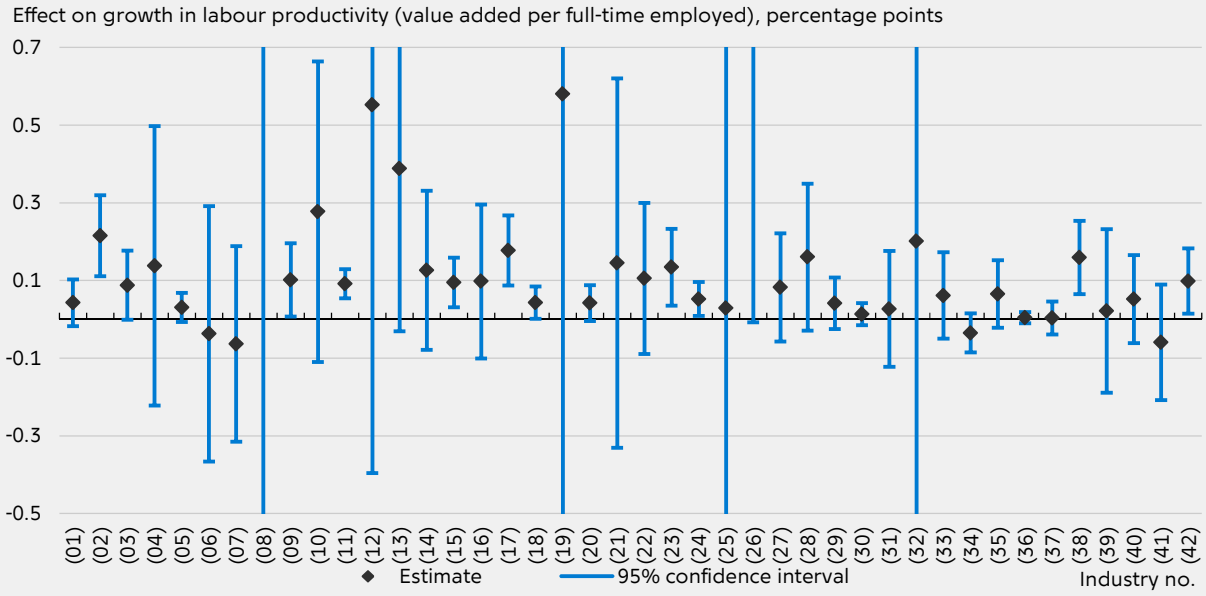


Note: The figure depicts the parameter estimates and resulting 95 per cent confidence intervals from running the regression in equation (1), added firm fixed effects, separately for each of the 42 industries. The list of industries can be found in annex 3.A. Standard errors are robust.

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

Effect on growth in labour productivity (value added per full-time employed) of a 1 percentage point increase in debt-to-assets, OLS regression

Chart 3B.4

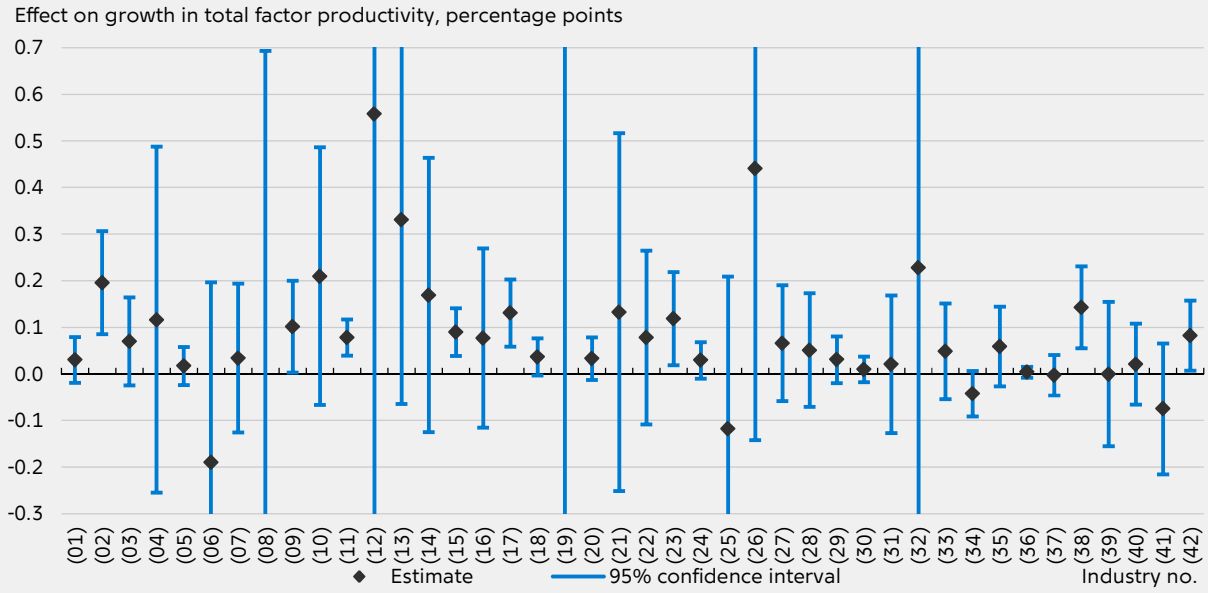


Note: The figure depicts the parameter estimates and resulting 95 per cent confidence intervals from running the regression in equation (2), without the firm fixed effect, separately for each of the 42 industries. The list of industries can be found in annex 3.A. Standard errors are clustered at the firm level.

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

Effect on growth in total factor productivity of a 1 percentage point increase in debt-to-assets, OLS regression

Chart 3B.5

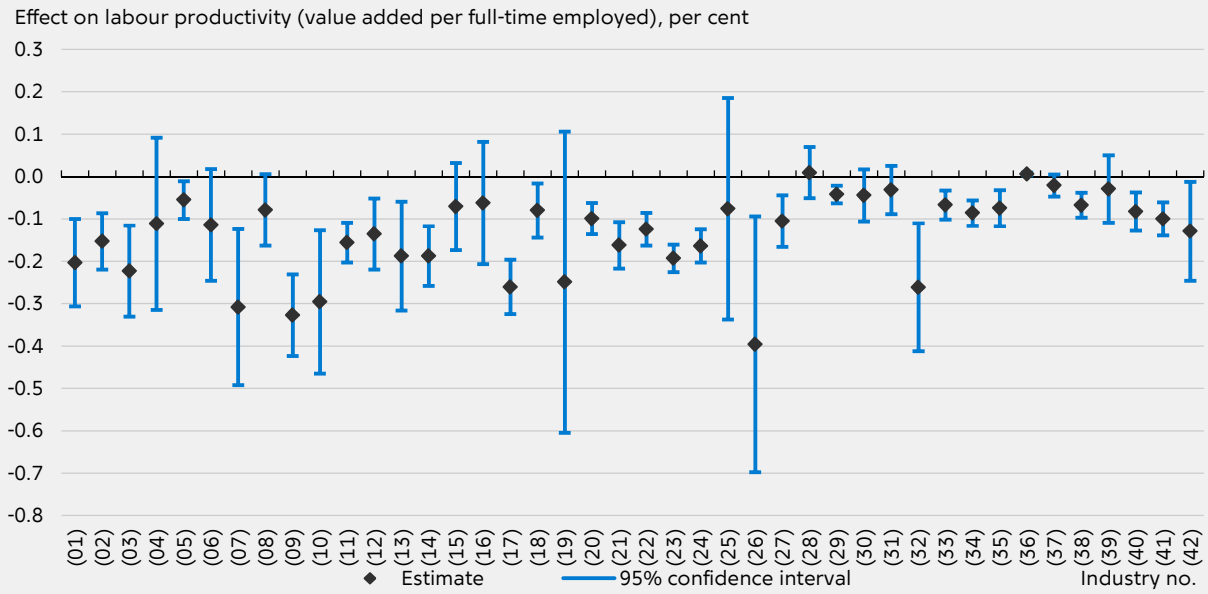


Note: The figure depicts the parameter estimates and resulting 95 per cent confidence intervals from running the regression in equation (1), without the firm fixed effect, separately for each of the 42 industries. The list of industries can be found in annex 3.A. Standard errors are clustered at the firm level.

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

Effect on labour productivity (value added per full-time employed) of a 1 percentage point increase in debt-to-assets, OLS regression

Chart 3B.6

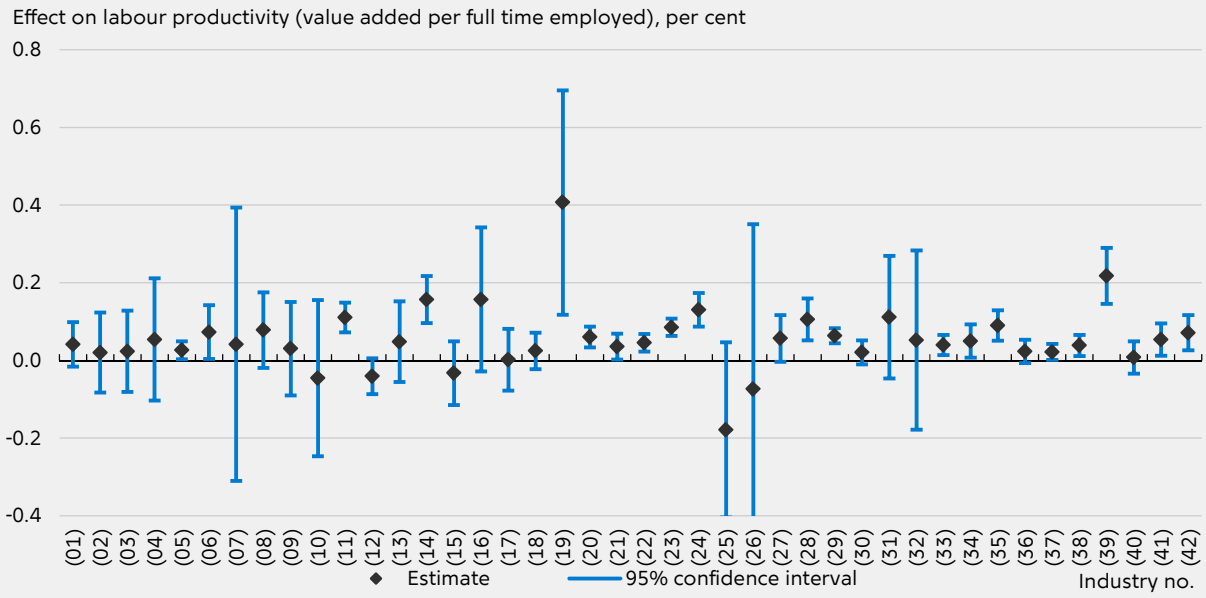


Note: The figure depicts the parameter estimates and resulting 95 per cent confidence intervals from running the regression in equation (2), with the natural logarithm to the productivity level (instead of growth) on the left-hand-side and without the firm fixed effect, separately for each of the 42 industries. The parameter estimates have been converted to percentages. The list of industries can be found in annex 3.A. Standard errors are clustered at the firm level.

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

Effect on labour productivity (value added per full-time employed) of a 1 percentage point increase in debt-to-assets, fixed effects estimation

Chart 3B.7

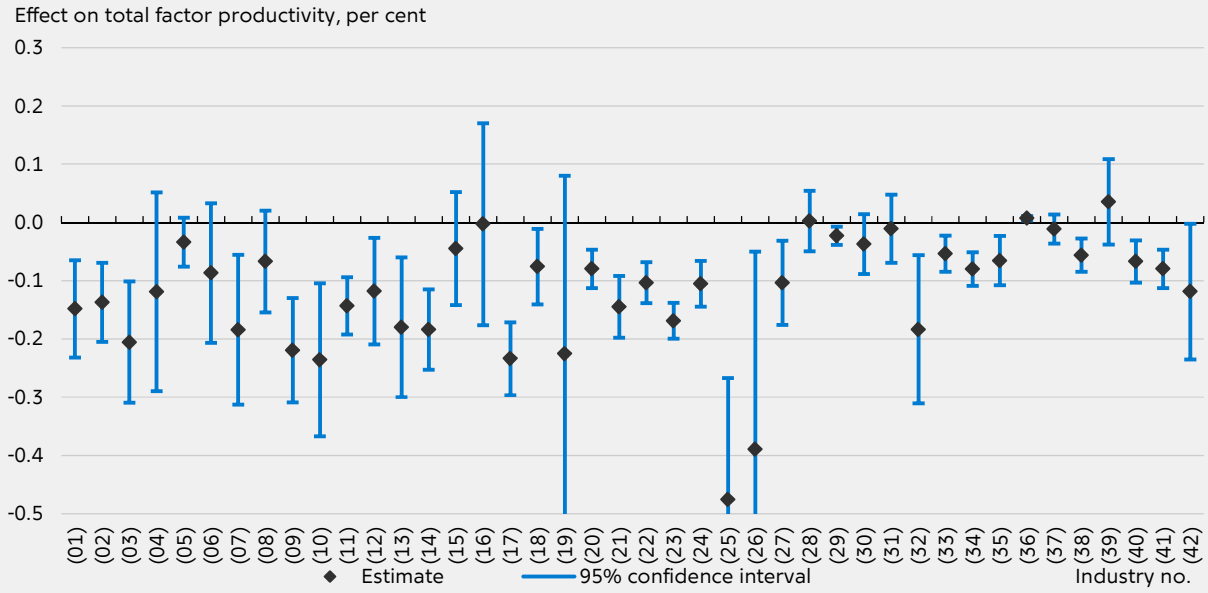


Note: The figure depicts the parameter estimates and resulting 95 per cent confidence intervals from running the regression in equation (2), with the natural logarithm to the productivity level (instead of growth) on the left-hand-side, separately for each of the 42 industries. The parameter estimates have been converted to percentages. The list of industries can be found in annex 3.A. Standard errors are robust.

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

Effect on total factor productivity of a 1 percentage point increase in debt-to-assets, OLS regression

Chart 3B.8

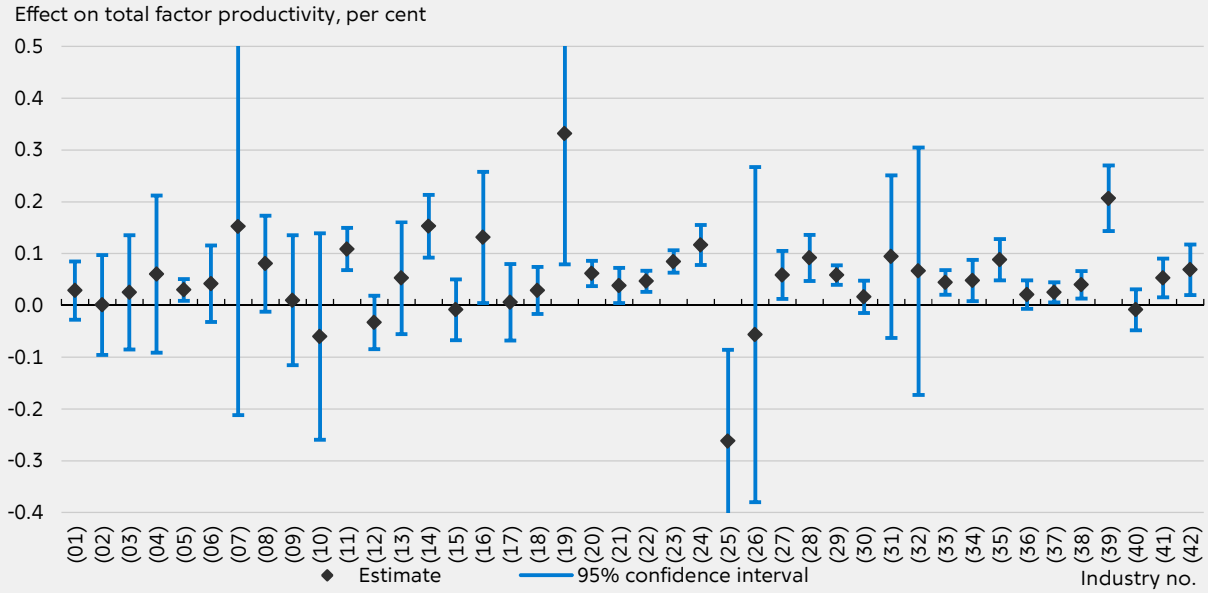


Note: The figure depicts the parameter estimates and resulting 95 per cent confidence intervals from running the regression in equation (2), with the natural logarithm to the productivity level (instead of growth) on the left-hand-side and without the firm fixed effect, separately for each of the 42 industries. The parameter estimates have been converted to percentages. The list of industries can be found in annex 3.A. Standard errors are clustered at the firm level.

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

Effect on total factor productivity of a 1 percentage point increase in debt-to-assets, fixed effects estimation

Chart 3B.9

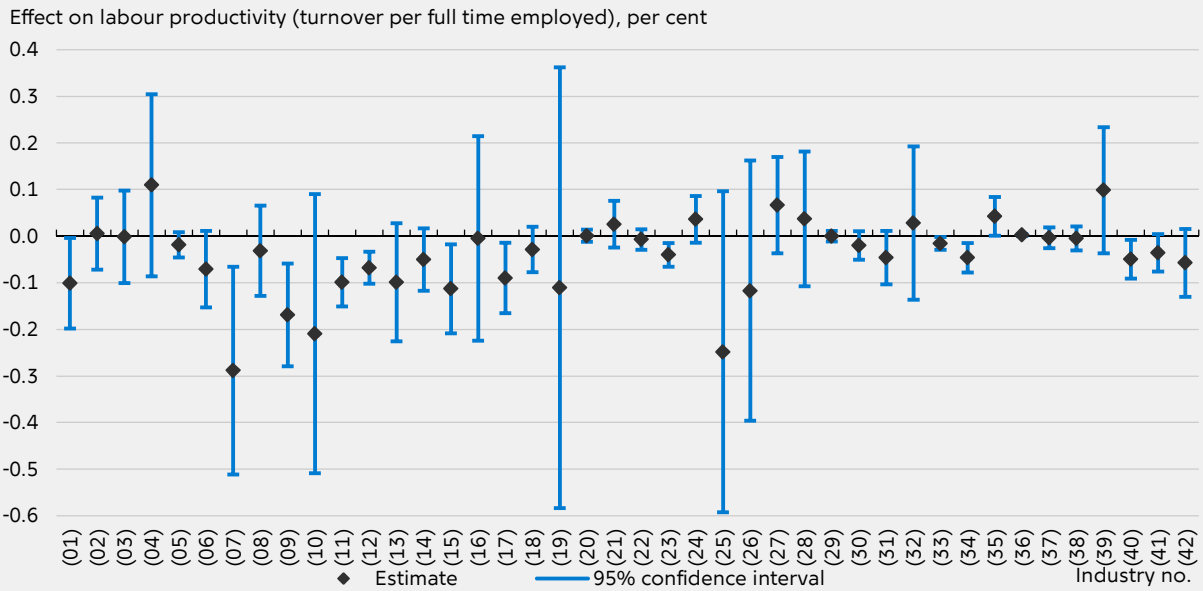


Note: The figure depicts the parameter estimates and resulting 95 per cent confidence intervals from running the regression in equation (2), with the natural logarithm to the productivity level (instead of growth) on the left-hand-side, separately for each of the 42 industries. The parameter estimates have been converted to percentages. The list of industries can be found in annex 3.A. Standard errors are robust.

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

Effect on labour productivity (turnover per full-time employed) of a 1 percentage point increase in debt-to-assets, OLS regression

Chart 3B.10

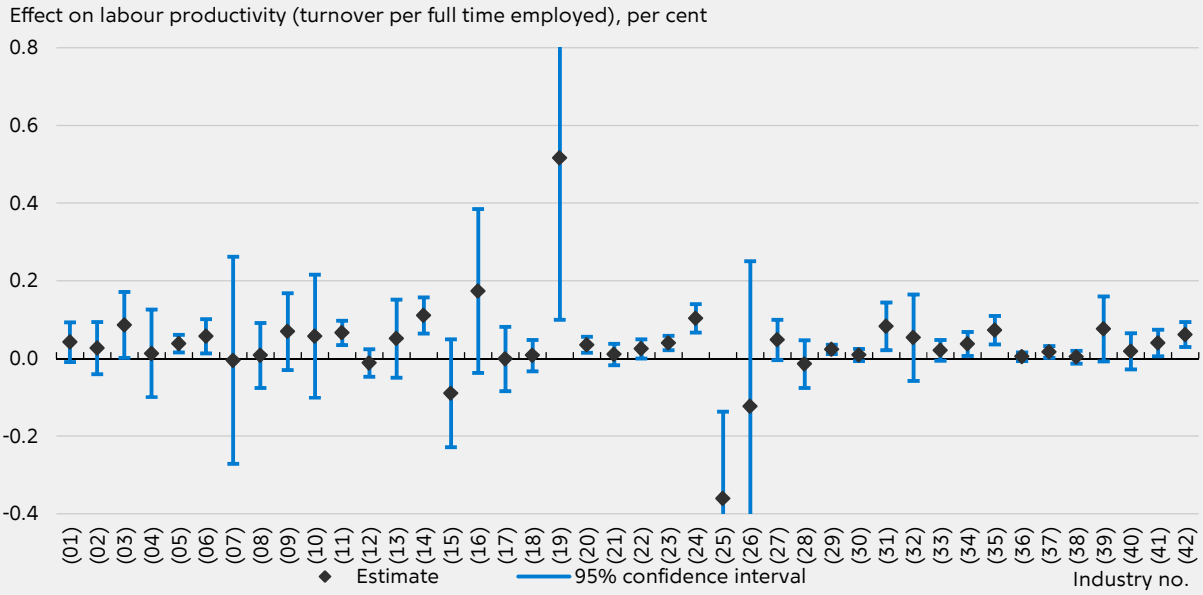


Note: The figure depicts the parameter estimates and resulting 95 per cent confidence intervals from running the regression in equation (2), with the natural logarithm to the productivity level (instead of growth) on the left-hand-side and without the firm fixed effect, separately for each of the 42 industries. The parameter estimates have been converted to percentages. The list of industries can be found in annex 3.A. Standard errors are clustered at the firm level.

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

Effect on labour productivity (turnover per full-time employed) of a 1 percentage point increase in debt-to-assets, fixed effects estimation

Chart 3B.11

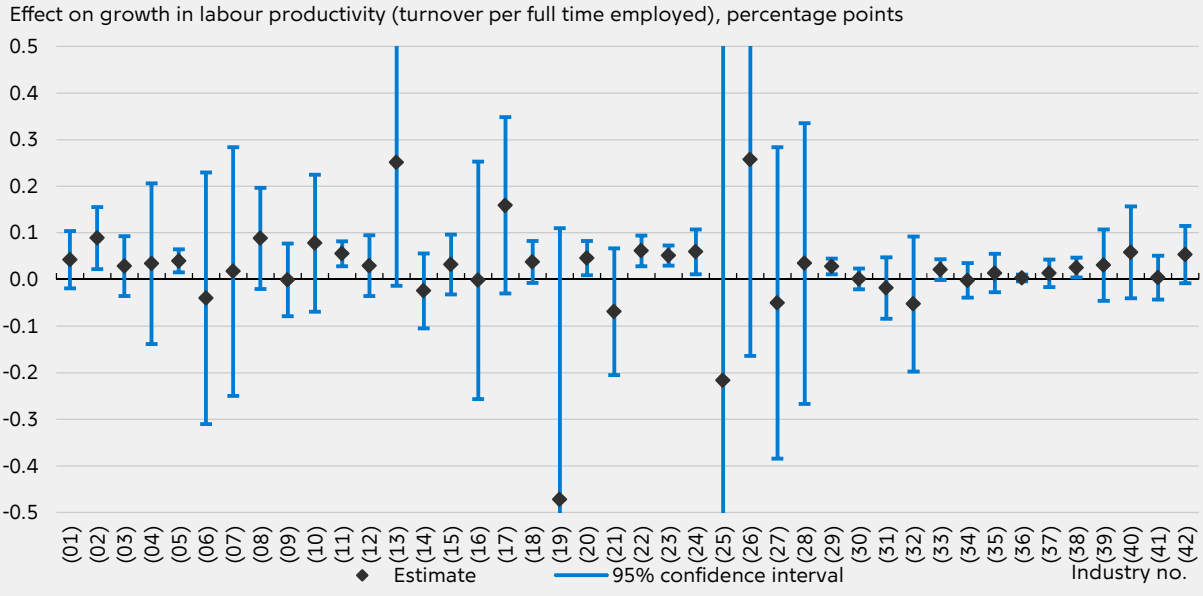


Note: The figure depicts the parameter estimates and resulting 95 per cent confidence intervals from running the regression in equation (2), with the natural logarithm to the productivity level (instead of growth) on the left-hand-side, separately for each of the 42 industries. The parameter estimates have been converted to percentages. The list of industries can be found in annex 3.A. Standard errors are robust.

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

Effect on growth in labour productivity (turnover per full-time employed) of a 1 percentage point increase in debt-to-assets, OLS regression

Chart 3B.12

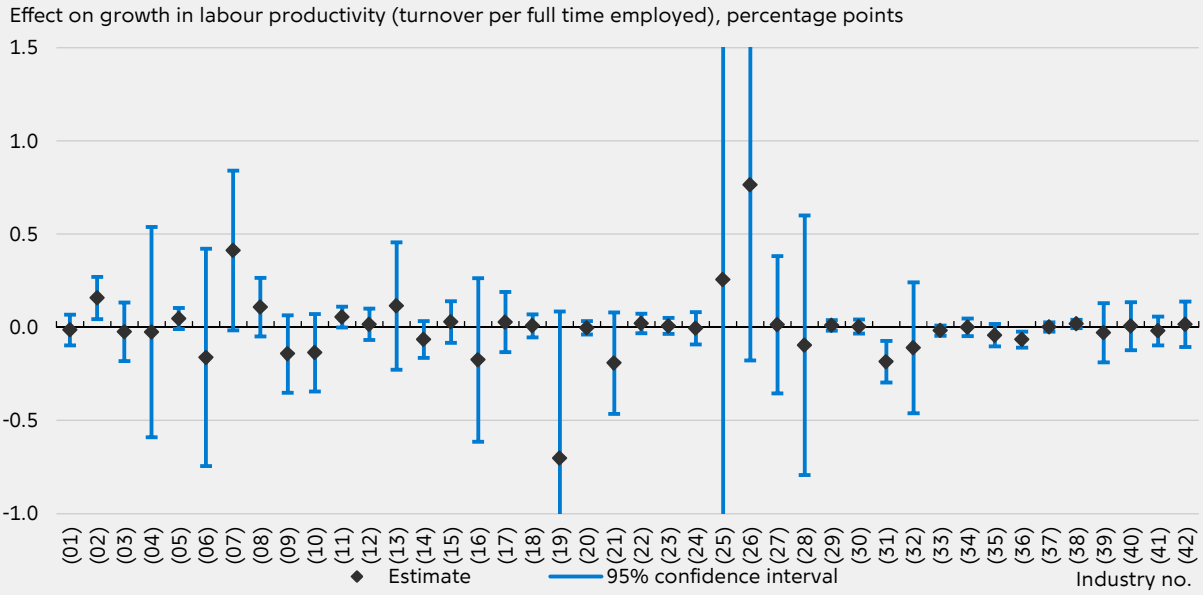


Note: The figure depicts the parameter estimates and resulting 95 per cent confidence intervals from running the regression in equation (2), with the natural logarithm to the productivity level (instead of growth) on the left-hand-side and without the firm fixed effect, separately for each of the 42 industries. The list of industries can be found in annex 3.A. Standard errors are clustered at the firm level.

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

Effect on growth in labour productivity (turnover per full-time employed) of a 1 percentage point increase in debt-to-assets, fixed effects estimation

Chart 3B.13



Note: The figure depicts the parameter estimates and resulting 95 per cent confidence intervals from running the regression in equation (2), with the natural logarithm to the productivity level (instead of growth) on the left-hand-side, separately for each of the 42 industries. The list of industries can be found in annex 3.A. Standard errors are robust.

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

ANNEX 5.A: FIRM SIZE

Number of firms broken down by number of employees in the firm, 2012

Table 5A.1

	Number of firms				Per cent			
Number of employees	0-9	10-49	50-249	>250	0-9	10-49	50-249	>250
EU27	18.783.480	1.349.730	222.628	43.454	92,1	6,6	1,1	0,2
EU15	14.578.112	1.130.321	173.974	34.155	91,6	7,1	1,1	0,2
Austria	263.585	32.250	4.897	1.041	87,3	10,7	1,6	0,3
Belgium	480.906	26.572	4.248	840	93,8	5,2	0,8	0,2
Bulgaria	252.137	22.871	4.325	676	90,0	8,2	1,5	0,2
Cyprus	43.156	2.815	512	85	92,7	6,0	1,1	0,2
Czech Republic	897.895	34.339	6.815	1.463	95,5	3,7	0,7	0,2
Denmark	179.843	20.037	3.347	604	88,2	9,8	1,6	0,3
Estonia	45.697	5.151	1.025	146	87,8	9,9	2,0	0,3
Finland	204.295	14.822	2.433	605	92,0	6,7	1,1	0,3
France	2.334.664	128.552	20.628	4.470	93,8	5,2	0,8	0,2
Germany	1.763.465	328.593	55.510	10.758	81,7	15,2	2,6	0,5
Greece	141.589	4.226	882	132	96,4	2,9	0,6	0,1
Hungary	521.981	24.883	4.212	800	94,6	4,5	0,8	0,1
Ireland	122.643	14.249	2.479	447	87,7	10,2	1,8	0,3
Italy	3.491.826	183.198	19.265	3.196	94,4	5,0	0,5	0,1
Latvia	61.788	6.900	1.485	184	87,8	9,8	2,1	0,3
Lithuania	61.788	6.900	1.485	184	87,8	9,8	2,1	0,3
Luxembourg	25.854	2.877	548	130	87,9	9,8	1,9	0,4
Malta	24.837	1.244	265	45	94,1	4,7	1,0	0,2
Netherlands	602.149	45.079	8.497	1.514	91,6	6,9	1,3	0,2
Norway	244.911	19.967	2.732	569	91,3	7,4	1,0	0,2
Poland	1.410.335	51.129	16.206	3.313	95,2	3,5	1,1	0,2
Portugal	768.437	36.222	5.415	798	94,8	4,5	0,7	0,1
Romania	389.206	39.928	7.992	1.513	88,7	9,1	1,8	0,3
Slovak Republic	362.026	13.616	2.450	558	95,6	3,6	0,6	0,1
Slovenia	101.272	5.877	1.217	225	93,3	5,4	1,1	0,2
Spain	2.103.390	120.940	15.484	2.728	93,8	5,4	0,7	0,1
Sweden	599.821	27.354	4.615	979	94,8	4,3	0,7	0,2
United Kingdom	1.495.648	145.350	25.727	5.913	89,4	8,7	1,5	0,4

Note: Based on the following Nace Rev. 2 sectors: B-J and L-N.
Source: European Commission, SME Performance Review 2013.

Number of persons employed broken down by number of employees in the firm, 2012

Table 5A.2

	Number of persons employed				Per cent			
Number of employees	0-9	10-49	50-249	>250	0-9	10-49	50-249	>250
EU27	37.494.458	26.704.352	22.615.906	43.787.013	28,7	20,4	17,3	33,5
EU15	29.782.538	22.285.953	17.677.003	36.303.282	28,1	21,0	16,7	34,2
Austria	659.975	619.981	491.152	844.532	25,2	23,7	18,8	32,3
Belgium	841.234	523.931	415.341	802.823	32,6	20,3	16,1	31,1
Bulgaria	532.880	447.581	412.065	451.752	28,9	24,3	22,3	24,5
Cyprus	91.315	53.701	48.952	45.141	38,2	22,5	20,5	18,9
Czech Republic	1.076.383	674.344	696.760	1.127.022	30,1	18,9	19,5	31,5
Denmark	338.957	389.582	321.902	530.904	21,4	24,6	20,4	33,6
Estonia	107.853	99.698	94.294	83.870	28,0	25,8	24,4	21,7
Finland	353.208	296.746	242.377	528.940	24,9	20,9	17,1	37,2
France	4.167.624	2.735.962	2.204.603	5.439.018	28,6	18,8	15,2	37,4
Germany	4.859.923	6.140.520	5.348.282	9.915.234	18,5	23,4	20,4	37,8
Greece	280.416	86.796	87.751	79.487	52,5	16,2	16,4	14,9
Hungary	885.167	472.316	420.215	718.304	35,5	18,9	16,8	28,8
Ireland	265.628	263.233	220.960	321.144	24,8	24,6	20,6	30,0
Italy	6.930.947	3.236.764	1.861.089	3.013.012	46,1	21,5	12,4	20,0
Latvia	143.463	140.963	135.579	114.590	26,8	26,4	25,4	21,4
Lithuania	143.463	140.963	135.579	114.590	26,8	26,4	25,4	21,4
Luxembourg	49.367	58.286	55.036	68.692	21,3	25,2	23,8	29,7
Malta	41.660	25.100	25.942	23.126	36,0	21,7	22,4	20,0
Netherlands	1.438.484	1.102.544	1.012.041	1.804.649	26,8	20,6	18,9	33,7
Norway	361.208	377.414	267.801	456.632	24,7	25,8	18,3	31,2
Poland	3.085.243	1.130.418	1.692.622	2.748.576	35,6	13,1	19,6	31,8
Portugal	1.210.904	683.371	518.744	657.679	39,4	22,3	16,9	21,4
Romania	889.271	804.960	827.897	1.325.085	23,1	20,9	21,5	34,4
Slovak Republic	489.527	243.200	253.654	479.048	33,4	16,6	17,3	32,7
Slovenia	183.511	112.097	125.046	166.094	31,3	19,1	21,3	28,3
Spain	4.318.258	2.297.597	1.513.350	2.731.229	39,8	21,2	13,9	25,1
Sweden	772.944	623.452	518.414	1.041.318	26,1	21,1	17,5	35,2
United Kingdom	3.294.670	3.227.189	2.865.963	8.524.622	18,4	18,0	16,0	47,6

Note: Based on the following Nace Rev. 2 sectors: B-J and L-N.
Source: European Commission, SME Performance Review 2013.