

CORPORATE CAPITAL STRUCTURE, PRODUCTIVITY AND ACCESS TO FINANCE

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INTRODUCTION AND SUMMARY

Private firms' funding sources are debt and equity, including equity derived from retained earnings. The ratio between a firm's debt and equity is often called the capital structure. Abildgren et al. (2014) perform a detailed empirical study of the relationship between the capital structure of firms in the Danish non-financial business sectors excluding agriculture and their profitability, productivity and access to finance. This article summarises the main findings and conclusions of the analysis and discusses aspects of agriculture's debt and access to finance.

The analysis cannot identify one capital structure that supports corporate profitability and productivity better than others do. The capital structure plays a role in the distribution of the return on assets between creditors and owners, but has no influence on corporate profitability or the development in and level of productivity.

A firm's capital structure is important in other respects. All else equal, a firm is more robust to adverse macroeconomic shocks, the higher its equity is as a ratio of total assets. A high solvency ratio reduces the probability that the firm will default. It also reduces the probability that the firm's banks will suffer losses on loans to that firm. Thus, a high solvency ratio among private non-financial corporations has a positive impact on financial stability. Moreover, a high solvency ratio gives the individual firm a wider range of funding sources to choose from and greater certainty of obtaining the desired funding. For firms with a high solvency ratio, applications for bank loans

are more likely to be accepted, compared with firms with low solvency ratios. Hence, the analysis indicates that firms with low solvency ratios gain easier access to bank funding if they change their capital structure towards a higher solvency ratio. This also applies in agriculture, which has seen a growing share of farms with low solvency ratios in recent years. In addition, quoted limited companies tend to be more solvent than unquoted ones.

Increasing the solvency ratio enhances firms' robustness to economic shocks and entails more funding flexibility. The empirical findings in the article indicate that there are no costs associated with a higher solvency ratio in terms of e.g. loss of profitability (before tax) or productivity. After tax, however, profitability may be affected due to the bias in favour of debt financing over equity in the Danish tax system. The reason for this bias is that firms may, subject to certain limitations, deduct interest expenses in their income statements alongside other operating costs, while there is no deductibility for remuneration on equity.

The analysis in this article also indicates that, following the outbreak of the financial crisis, the credit rating system of the Danish banking sector seems to favour allocation of loan capital to the most solvent, profitable and productive firms. This is an important and necessary precondition if the banking system is to function as an efficient provider of loan capital. Before the financial crisis there was no significant relationship between banks' acceptance of loan applications and corporate customers' profitability and productivity.

CORPORATE CAPITAL STRUCTURE

Debt is often the most important funding source for firms in Danish non-financial private business sectors excluding agriculture. In 2011, firms' average debt amounted to around 60 per cent of total assets at book value. However, the debt ratio varies considerably across industries, cf. Chart 1 (left), showing the distribution of debt ratios across 82 industries. For 12 per cent of the industries, debt accounted for more than 70 per cent of total assets. Cases in point are manufacturing of leather and footwear, travel agent activities and restaurants. At the other end of the spectrum are industries such as pharmaceuticals and business consultant activities with debt ratios below 40 per cent. The overall distribution of debt ratios across industries has been almost unchanged since the mid-2000s, but with a tendency towards lower debt ratios after the financial crisis. Debt ratios also vary considerably between firms in the same industry, cf. Chart 1 (right).

All else equal, a firm is more robust to adverse macroeconomic shocks, the higher its equity is as a ratio of total assets. This reduces the probability that the firm will default. It also reduces the probability that the firm's banks will suffer losses on loans to that firm.

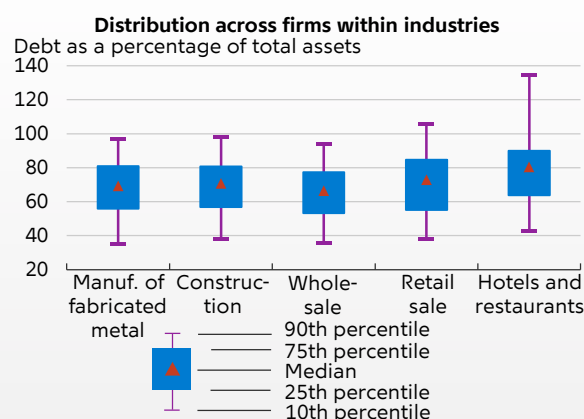
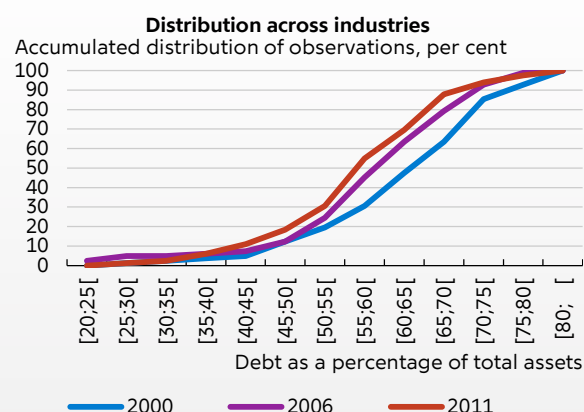
Chart 2 (left) shows the solvency ratios of Danish firms in private business sectors exclud-

ing agriculture in 2011 by number of employees converted into full-time equivalents. If the smallest firms are disregarded, firms with up to 50 employees tend to have smaller equity buffers than large firms. The overall picture was almost the same in 2006. However, small firms with fewer than 10 employees have tended to have smaller buffers after the financial crisis, while the large firms have increased their capitalisation. In 2011, firms with more than 50 full-time employees accounted for around half of total employment and more than half of total value added in the non-financial private sectors excluding agriculture, cf. Chart 2 (right).

Chart 3 (left) illustrates non-financial firms' investment and financing activity. Firms' investment consists of real gross investment in production facilities and inventories as well as financial investment in liquid assets (cash, bank deposits and securities), direct investment abroad, etc. Funding for real and financial investment is raised via external sources (borrowing, issuance of shares, etc.) and internal sources (gross savings). Before the financial crisis, firms increased their holdings of liquid assets considerably and had a high degree of leverage, cf. Chart 3 (right). Since mid-2009, gross savings have exceeded real investment, resulting in a corporate savings surplus (positive net lending) of kr. 459 billion. On a net basis, the savings surplus has been used primarily

Distribution of debt ratio across industries and firms

Chart 1

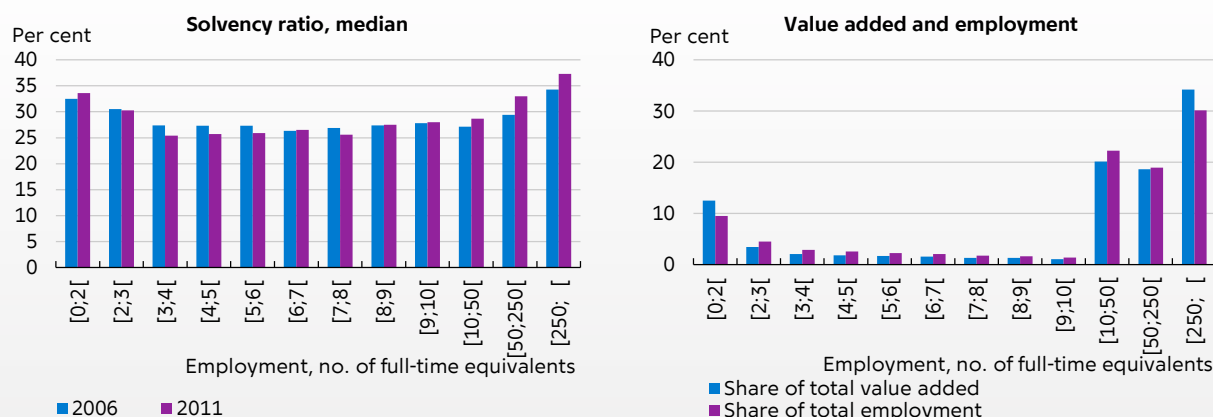


Note: The left-hand chart is based on industry-specific accounts statistics for 82 industries in private non-financial business sectors excluding agriculture. The right-hand chart is based on firm-specific data behind the same accounts statistics for 2011. In accounting terms, equity is negative for the firms with debt of more than 100 per cent of total assets at book value.

Source: Own calculations based on data from Statistics Denmark, cf. Abildgren et al. (2014).

Corporate solvency, value added and employment

Chart 2



Note: Calculations based on firm-specific accounts statistics for private non-financial business sectors excluding agriculture. The solvency ratio is defined as equity as a percentage of total assets. The right-hand chart is based on data for 2011.

Source: Own calculations based on data from Statistics Denmark.

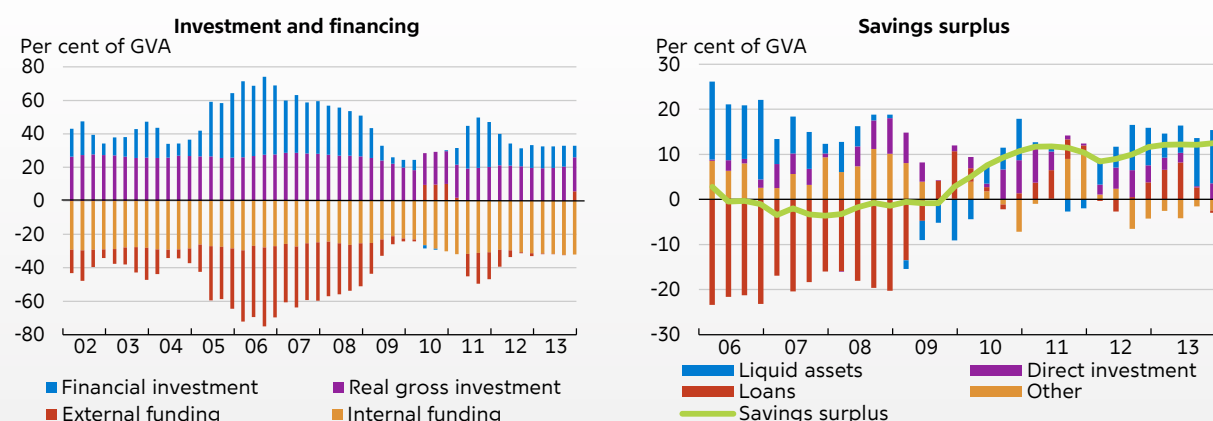
for repayment of loans (kr. 97 billion), placement in liquid portfolios (kr. 306 billion) and direct investment abroad (kr. 166 billion).

The tendency for liquid holdings to constitute a larger share of the balance sheet in the pre-crisis years was seen among firms across size groups and industries, cf. Chart 4. An increase in short-term financial assets was also observed among

firms in the euro area in the pre-crisis years, cf. ECB (2013).

Corporate investment, financing and savings surplus

Chart 3



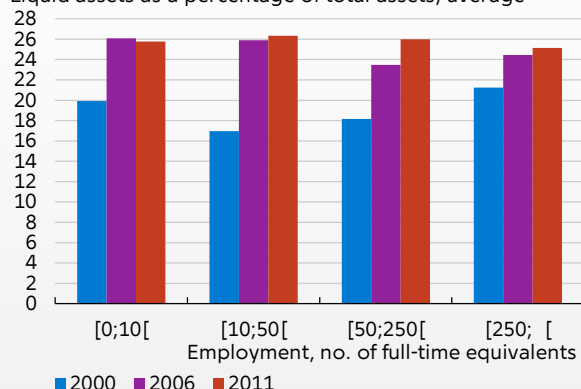
Note: 4-quarter moving averages of financial transactions and gross value added, GVA, for non-financial corporations in the national accounts and the direct investment statistics. "Liquid assets" are cash, deposits, bonds, portfolio shares, etc. "Direct investments" are Danish firms' foreign direct investments less foreign direct investments in Danish firms. "Loans" have been calculated in net terms. "Other" includes insurance technical reserves, trade credits and other receivables, prepayments and accruals.

Source: Statistics Denmark and Danmarks Nationalbank.

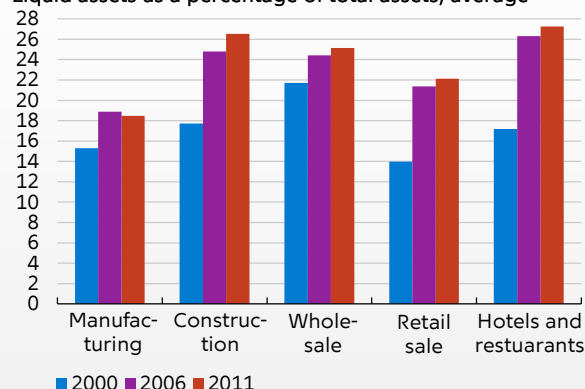
Corporate liquidity ratio by firm size and industry

Chart 4

Liquid assets as a percentage of total assets, average



Liquid assets as a percentage of total assets, average



Note: Calculations on the basis of firm-specific accounts statistics for private non-financial business sectors excluding agriculture. A broad definition of liquid assets is applied: current assets comprising liquid portfolios, holdings of securities and other equity, contract work in progress and other receivables.

Source: Own calculations based on data from Statistics Denmark.

CAPITAL STRUCTURE AND FIRMS' PROFITABILITY AND PRODUCTIVITY GROWTH

A classic result in finance theory is the Modigliani-Miller proposition, cf. Modigliani and Miller (1958). According to the proposition, subject to certain idealised assumptions – including complete and competitive markets, no taxes or transaction costs and no information asymmetries – the value of a firm is independent of its capital structure. The capital structure is only important to the distribution of the return on assets between various creditors and owners, but not to the size of the return on assets or productivity.

Parts of the literature have challenged the practical validity of the implications of the Modigliani-Miller proposition and the assumptions behind it. It can be argued that there is positive causality from debt ratio to return on assets and productivity, cf. Jensen (1986). One argument could be that free cash flow reduces cost control incentives. It is possible that the sizeable debt servicing obligation resulting from a high debt ratio could reduce the amount of free cash flow that might otherwise find its way to less profitable 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, cf. also the classic literature on principal agent problems, e.g. Holmström (1979). Parts of the empirical literature

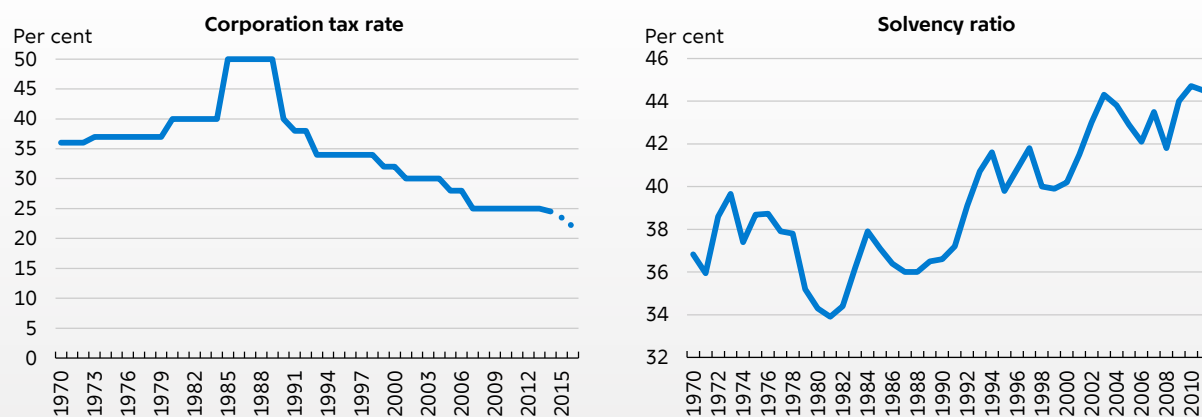
seem to support this. For instance, Nickell and Nicolitsas (1999) found a positive link between interest expenses and total factor productivity for UK firms in the period 1972-86.

An alternative argument could be possible tax advantages of debt financing, 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). All else equal, a high debt ratio reduces the firm's tax payments, resulting in a higher return on assets (after tax). In Denmark, the tax advantage of debt has been reduced since the late 1980s because the corporation tax rate has been lowered, and solvency in manufacturing has increased in this period, cf. Chart 5. The Economic Councils (2008), the Danish Productivity Commission (2014) and the Danish Bankers Association (2014) have previously discussed the bias in favour of debt financing rather than equity financing in the Danish tax system, and they have tabled proposals for harmonisation of the tax treatment of the various types of financing.

However, other parts of the literature argue that there is negative causality from debt ratio to return on assets and productivity. For instance, a high solvency ratio can provide scope for investment in riskier projects, which can enhance productivity, cf. Myers (1977). In a study based on Italian firm-specific data for the period 1982-98, Nucci et al. (2005) found that firms with higher

Corporation tax rate and solvency ratio in manufacturing

Chart 5



Note: The solvency ratio has been calculated as equity as a percentage of total assets.

Source: Own calculations based on data from Statistics Denmark and the Ministry of Taxation.

equity ratios had invested more in research and development and had higher productivity than other firms. Elsewhere it is also argued that active shareholders, by closely supervising the firm's management, improve productivity compared with debt financing from passive creditors. Pushner (1995) thus found a negative relationship between leverage and productivity among Japanese firms during the period 1976-1989.

Some studies point to positive causality between the debt ratio and growth in total factor productivity up to a certain level of debt, where it reverses and becomes negative, e.g. Coricelli et al. (2011), who applied firm-specific data from Central and Eastern Europe for the period 1999-2008. In contrast, Brogaard and Staal (2011) overall found no significant relationship between capital structure and productivity using data from Købmandstandens Oplysningsbureau (Experian) for Danish firms for the period 1997-2004.

Some studies suggest reverse causality, e.g. that profitability may influence the capital structure. According to the "pecking order" theory, external creditors have less information about the firm than the owner of the firm, which makes external financing more expensive than financing via internal sources, cf. Myers (1984). So firms may prefer internal funding rather than external debt financing. This line of thought would result in a negative relationship between the debt ratio and profitability (e.g. measured by the return on assets), which has been found for firms in the Jap-

anese machinery industry 1981-2011 (Tsuji, 2013) and US firms 1970-74 (Barton and Gordon, 1988). Chittenden et al. (1996) also found a negative relationship between debt and profitability for small and medium-sized UK firms in the early 1990s.

In summary, the conclusion is that the literature does not provide clear evidence regarding the relationship between non-financial corporations' capital structure and their profitability and productivity.

Chart 6 shows the relationship between the debt ratio in 2000 and the average return on assets in the years 2001-11 for 82 industries in Danish non-financial private business sectors excluding agriculture. It is seen that there is no clear relationship between capital structure and return on assets.

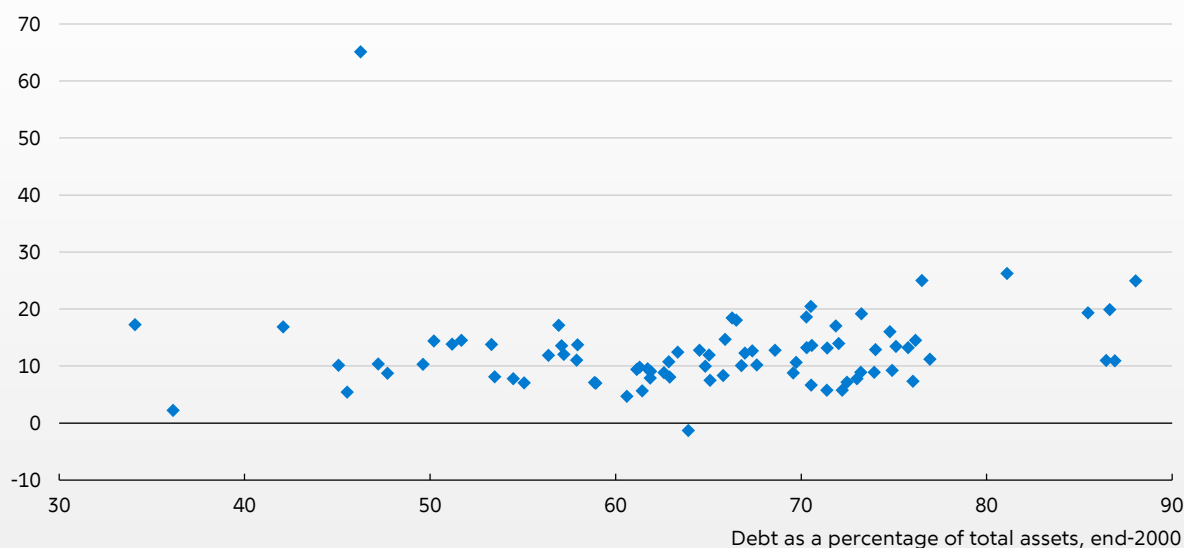
The same applies when looking at the relationship, at industry level, between the debt ratio in 2000 and growth in labour productivity and total factor productivity in the subsequent 10-year period, cf. Chart 7. Assessed on the basis of industry-specific data, it thus seems that the capital structure has no influence on profitability or productivity development in Danish business sectors excluding agriculture.

However, it can be argued that industry-specific data is not very suitable for such an analysis. Business risk and capital input may vary across industries, and all else equal, these differences will be reflected in the return on assets and labour productivity.

Profitability versus debt ratio

Chart 6

Average return on assets 2001-11, per cent



Note: The chart is based on industry-specific accounts statistics for 82 industries in private non-financial business sectors excluding agriculture. The return on assets has been calculated as profit before tax (plus financial costs) as a percentage of total assets.

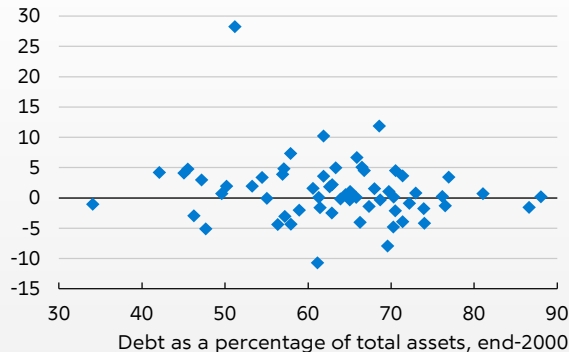
Source: Own calculations based on data from Statistics Denmark, cf. Abildgren et al. (2014).

Productivity versus debt ratio

Chart 7

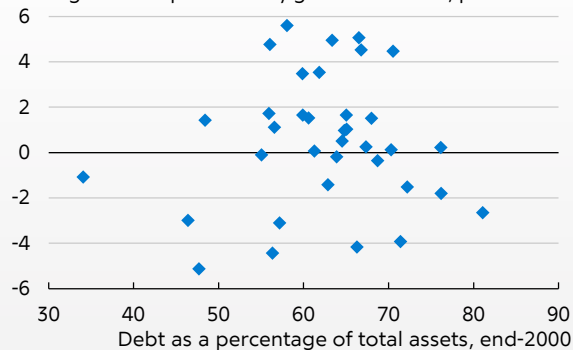
Labour productivity

Average annual productivity growth 2001-09, per cent



Total factor productivity

Average annual productivity growth 2001-09, per cent



Note: The left-hand chart is based on industry-specific accounts statistics and national accounts statistics for 62 industries in private non-financial business sectors excluding agriculture. The right-hand chart is based on the same data, but comprises only 36 industries in private non-financial business sectors excluding agriculture. Growth in labour productivity has been calculated as growth in real value added per hour worked. Growth in total factor productivity denotes the share of growth in real value added that cannot be explained by increased input of capital or labour.

Source: Own calculations based on data from Statistics Denmark, cf. Abildgren et al. (2014).

Consequently, Abildgren et al. (2014) analyse the relationship between the capital structures of Danish non-financial corporations and their profitability and productivity within industries on the basis of firm-specific data.

For instance, in manufacture of fabricated metal and manufacture of machinery, no clear relationship seems to exist between a firm's capital structure and its profitability and productivity growth, cf. Chart 8, but there may be a certain tendency

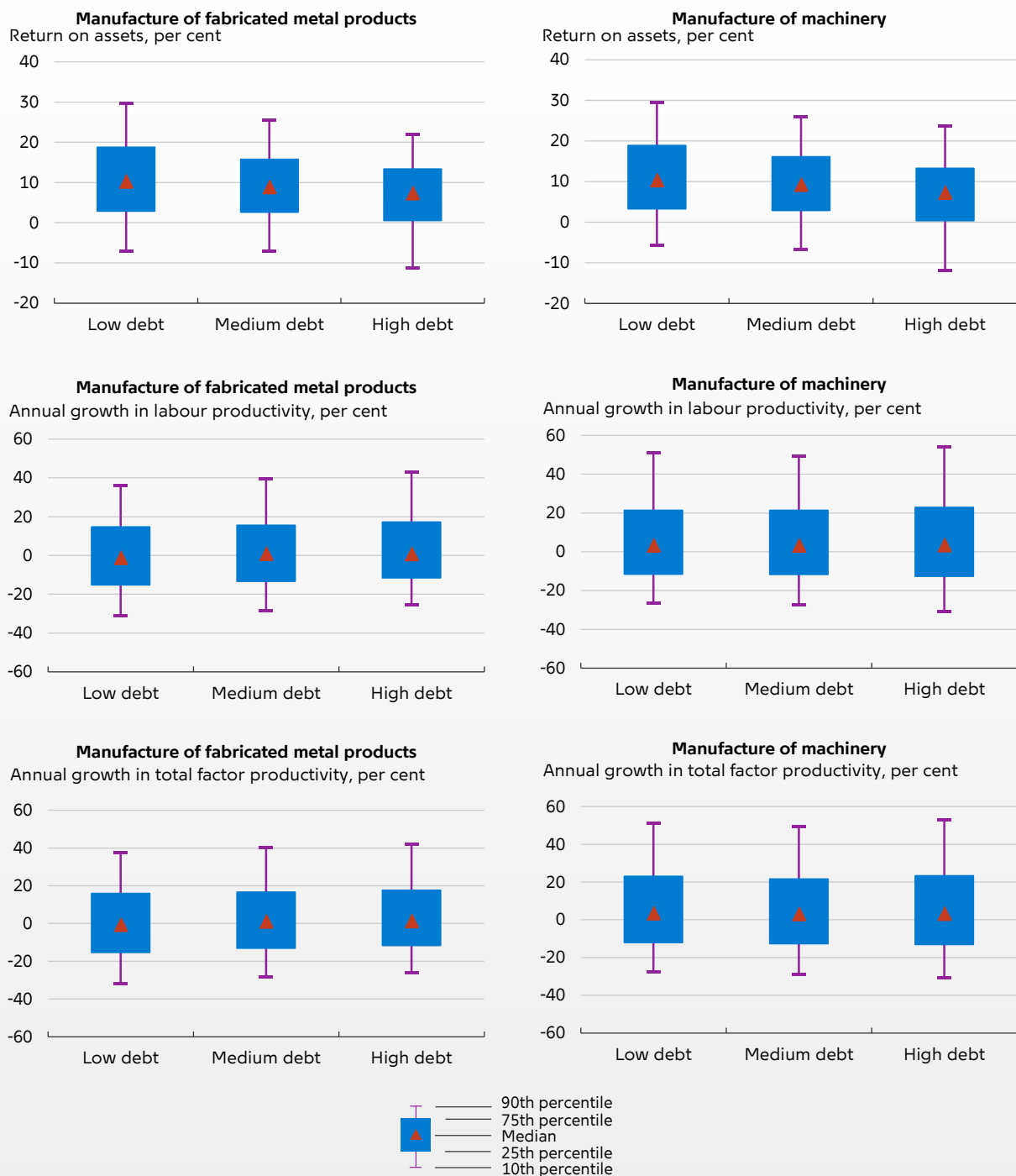
for a high debt ratio to result in a lower return on assets.

However, the above results are purely descriptive and concern only two selected industries.

Abildgren et al. (2014) therefore perform a formal econometric analysis of the relationship between firms' capital structure and their profitability and productivity in 42 industries. The analysis confirms

Profitability and productivity growth for various levels of debt in selected industries

Chart 8



Note: The debt level refers to debt as a percentage of total assets in the previous year. Low debt covers firms with debt ratios of less than 60 per cent, medium debt covers firms with debt ratios of 60-80 per cent, while high debt covers firms with debt ratios of more than 80 pct.

Source: Own calculations based on firm-specific data from Statistics Denmark, cf. Abildgren et al. (2014).

that there is no clear relationship between corporate capital structure and profitability and productivity, cf. Box 1. The same results are obtained if the data is divided into three groups according to firm size (firms with fewer than 10, 10-50 and more than 50 full-time employees, respectively) or into subperiods (2000-07 and 2008-11). Calculating corporate debt net of liquid assets also generates the same results.

Overall, the analysis of both industry-specific and firm-specific data indicates that there is no capital structure that supports profitability and productivity better than others do. The capital structure is important to the distribution of the return on assets between creditors and shareholders, but not to profitability or the level of and development in productivity.

Analysis of the relationship between corporate capital structure and profitability and productivity using firm-specific data

Box 1

The analysis of the relationship between capital structure on the one hand and profitability and productivity on the other is based on firm-specific accounting data from Statistics Denmark's accounts statistics for private business sectors excluding agriculture in the period 2000-11. Agriculture, fisheries, energy and water supply, ports, etc., transport by railway and buses, credit institutions, insurance and pension, non-profit housing associations, public administration, etc., are not included in the data set.

The most important variables in the analysis are the indicators of capital structure, profitability and productivity. Capital structure is measured in terms of the debt ratio, i.e. the firm's debt as a percentage of total assets at book value. Profitability is measured as the return on assets calculated as profit before tax (plus interest costs, etc.) as a percentage of total assets at book value. Productivity is measured in terms of both labour productivity and total factor productivity, TFP. Labour productivity is defined as real value added per full-time employee. TFP denotes the part of real value added that cannot be explained by capital and labour input. When considering TFP, it may be useful to keep the following production function for a given industry in mind:

$$(1) \quad Y = AL^{\beta_L}K^{\beta_K}$$

where Y may be output or value added, $\beta_L \in (0;1)$, $\beta_K \in (0;1)$, L is labour input, K is capital input, and A denotes total factor productivity. The production function may be characterised by decreasing, constant or increasing returns to scale. In practice, estimation of the above equation will, however, entail a number of econometric problems. The analysis therefore applies a method developed by Levinsohn and Petrin (2003), cf. Abildgren et al. (2014) for a more detailed description of data and methodology.

In order to throw light on the relationship between the debt ratio and profitability, the following regression model is estimated for each industry separately:

$$(2) \quad ROA_{i,t} = \alpha + \gamma \cdot DR_{i,t-1} + \theta \cdot \ln(SIZE_{i,t-1}) + \eta \cdot AGE_{i,t-1} + \sum_{t=2001}^{2011} \delta_t \cdot T_t + \varepsilon_{i,t}$$

where ROA is return on assets for firm i in period t and DR is the debt ratio. In addition, adjustment for a number of obvious background variables is performed, where $SIZE$ is firm size (measured as the number of full-time employees), AGE is firm age (number of years), and T denotes time dummies (indicators), which have been included in order to adjust for cyclical effects and structural changes over time in the industry in question. The explanatory right-hand side variables are lagged relative to the left-hand side variable in order to address the obvious problem of endogeneity resulting from the possibility of reverse causality. However, this does not solve all endogeneity problems. For example, there may exist an unobserved factor affecting both profitability and debt ratio, e.g. if the firm has a patent which has influence on its assets, but also its access to finance. There is no obvious instrument to solve this problem.

In order to throw light on the relationship between the debt ratio and productivity growth, the following model is estimated for each industry separately:

$$(3) \quad \frac{Z_{i,t+1} - Z_{i,t}}{Z_{i,t}} = \alpha + \gamma \cdot DR_{i,t-1} + \theta \cdot \ln(SIZE_{i,t-1}) + \eta \cdot AGE_{i,t-1} + \sum_{t=2001}^{2011} \delta_t \cdot T_t + \mu_i + \varepsilon_{i,t}$$

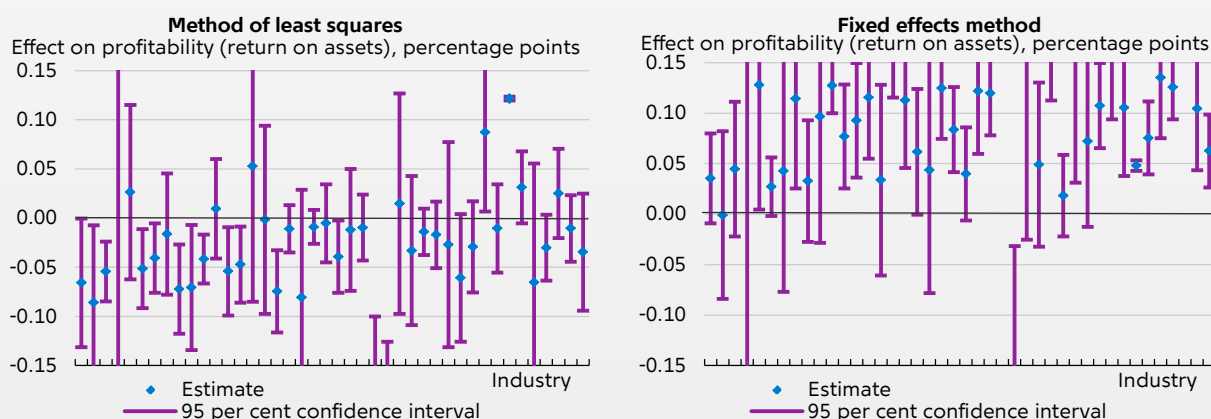
where Z is productivity (labour productivity or TFP), i.e. the left-hand side denotes productivity growth from year t to year $t + 1$. Firm fixed effects, μ_i , are included. This takes into account the time invariant part of the unobservable dispersion of firms in each industry. Otherwise, estimation of equation (3) would probably partly reflect the catching-up effect, i.e. firms with low productivity experience growth because they can utilise the innovation and technological advances of firms with high productivity.

The firms in the final sample have been divided into 42 industries: (1) Manufacture of food, tobacco; (2) Textiles and leather products; (3) Manufacture of wood, etc.; (4) Manufacture of paper, etc.; (5) Printing, etc.; (6) Manufacture of chemicals; (7) Pharmaceuticals; (8) Manufacture of rubber, etc.; (9) Manufacture of glass, concrete, etc.; (10) Manufacture of basic metals; (11) Manufacture of fabricated metal; (12) Manufacture of electronics; (13) Electrical equipment; (14) Manufacture of machinery; (15) Manufacture of motor vehicles, etc.; (16) Manufacture of ships, transport equipment; (17) Manufacture of furniture, other manufacture; (18) Repair, installation 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 transport; (28) Postal and courier activities; (29) Accommodation, food service; (30) Publishing activities; (31) Radio, TV, etc.; (32) Telecommunications; (33) IT and information service; (34) Legal, accounting, consultancy activities; (35) Architecture and engineering; (36) Research and development; (37) Advertising, market research; (38) Other technical service, veterinary activities; (39) Rental and leasing activities; (40) Employment activities; (41) Cleaning, other business service; (42) Repair of personal goods.

A key assumption underlying the findings of Modigliani and Miller (1958) is that firms are homogeneous and belong to the same “class”. In the absence of an exact definition of “class”, Modigliani and Miller state that an industry can be seen as an approximation of “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 product sold and the technology used.” (p. 267 in Modigliani and Miller, 1958). All else equal, differences in business risk and capital input among the industries will be reflected in return on assets and labour productivity. The analysis based on firm-specific data is thus performed for each industry separately.

The analysis based on firm-specific data confirms the conclusions of the analysis based on industry-specific aggregates. No clear relationship between a firm’s capital structure and its profitability seems to exist, cf. the chart below (left). At a 5 per cent significance level, the relationship is insignificant in 26 of the 42 industries. For certain industries there seems to be a tendency for a higher debt ratio to result in a lower return on assets, but this relationship is not robust when other firm-specific differences are taken into account, cf. the chart below (right). This supports the apparent non-existence of a robust relationship between capital structure and profitability.

Effect on profitability of a 1 percentage point increase in the debt ratio, method of least squares and fixed effects method



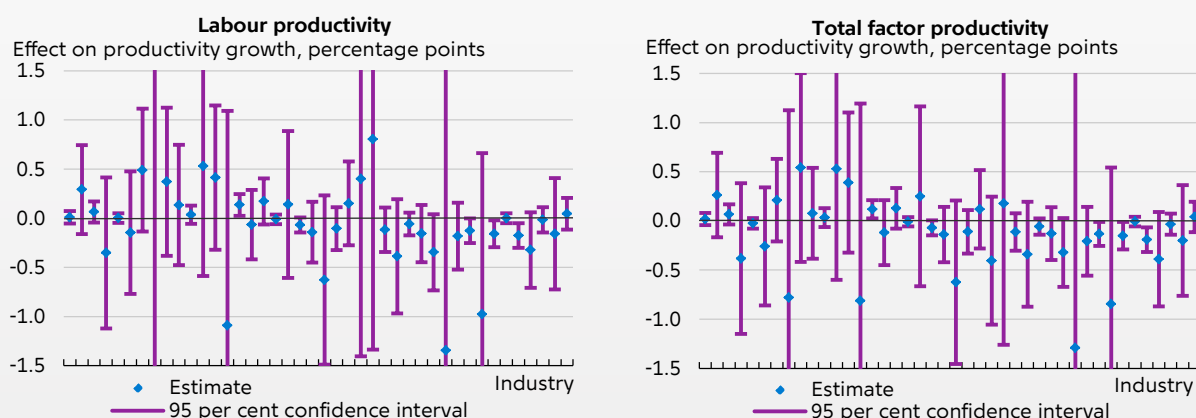
Note: The left-hand chart shows parameter estimates and resultant 95 per cent confidence intervals from running the regression in equation (2) for each of the 42 industries separately. The right-hand chart shows corresponding results of running the regression in equation (2) with added firm fixed effects. The debt ratio is debt as a percentage of total assets. The industries are listed above. Standard errors clustered at the firm level are used in the left-hand chart and robust standard errors in the right-hand chart.

Source: Own calculations based on firm-level data from Statistics Denmark, cf. Abildgren et al. (2014).

The analysis based on firm-specific data does not find any relationship between capital structure and productivity growth either. The relationship between capital structure and labour productivity growth is insignificant in 38 of the 42 industries, calculated at a 5 per cent significance level, cf. the chart below (left). The same applies to the relationship between capital structure and growth in total factor productivity, cf. the chart below (right). The analysis in Abildgren et al. (2014) finds no clear relationship between capital structure and productivity level either.

A number of robustness checks confirm the non-existence of a clear relationship between a firm's capital structure and its profitability and productivity, e.g. including several lags of the debt ratio on the right-hand side of equations (2) and (3), estimations divided into subperiods (2000-07 and 2008-11), estimations by firm size (fewer than 10, 10-50 and more than 50 full-time employees, respectively) and estimation solely for firms surviving until 2011. Finally, the same results are achieved by calculating firm debt net of liquid assets.

Effect on productivity growth of a 1 per cent increase in the debt ratio



Note: The charts show parameter estimates and resultant 95 per cent confidence intervals from running the regression in equation (3) for each of the 42 industries separately and for each productivity measure separately. The debt ratio is debt as a percentage of total assets. The industries are listed above. The standard errors are robust. Labour productivity has been calculated as real value added per full-time employee.

Source: Own calculations based on firm-level data from Statistics Denmark, cf. Abildgren et al. (2014).

ACCESS TO FINANCE FROM DEPOSIT BANKS AND MORTGAGE BANKS

Although a firm's capital structure does not seem to have any impact on its profitability and productivity, the capital structure may be important to the firm's access to finance.

Chart 9 shows the share of firms that in 2009-10 had their applications for bank loans accepted in full, broken down by solvency ratio, profitability and productivity. The chart is based on data from Statistics Denmark's questionnaire survey¹ about access to finance for small and medium-sized enterprises, SMEs, (5-249 employees), coupled with accounts statistics for private business sectors excluding agriculture. The chart shows that it was

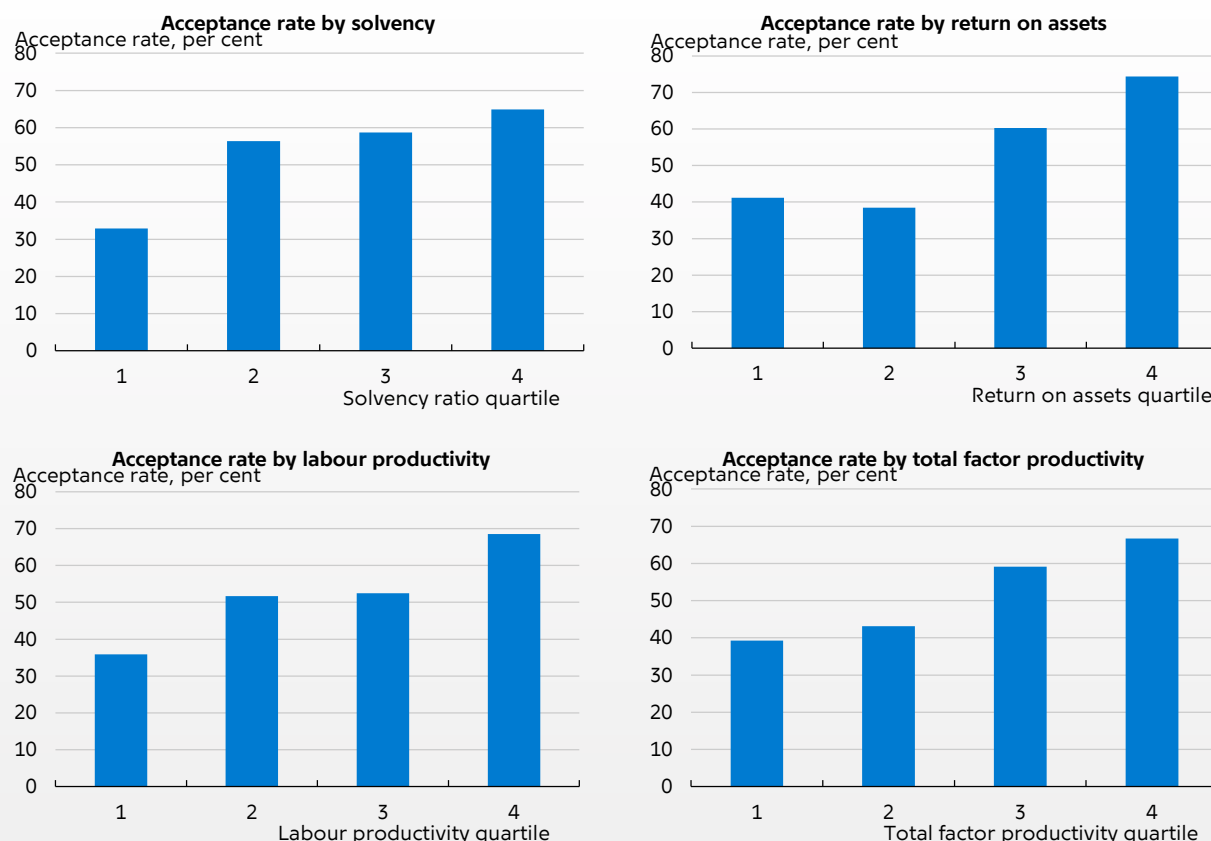
generally easier for profitable firms and firms with high solvency to obtain bank funding than for firms with lower solvency. The same applied to loan financing via various types of overdrafts, cf. also Abildgren et al. (2013).

Moreover, Chart 9 indicates a positive relationship between firms' level of productivity and their access to bank loans. This is confirmed by a more detailed empirical analysis of the relationship between access to bank loans and corporate solvency, profitability and level of productivity, cf. Box 2. The results are unchanged if it is taken into account that the firms applying for bank loans are different from those not applying for bank loans, cf. Abildgren et al. (2014). In a study based on firm-specific data for Italy 2005-10, Albareto and Finaldi (2012) also find that firms with high productivity growth have easier access to credit than other firms.

1 Cf. Statistics Denmark (2010).

Outcomes of firms' applications for bank loans, 2009-10

Chart 9



Note: The charts show the share of firms which had their applications for bank loans accepted in full. The solvency ratio has been calculated as equity as a percentage of total assets. Solvency ratio, profitability and productivity have all been calculated at end-2008. Profitability and productivity have been adjusted for industry-specific differences. The delimitation of the sample is described in more detail in Abildgren et al. (2014).

Source: Own calculations based on firm-specific data from Statistics Denmark, cf. Abildgren et al. (2014).

Statistics Denmark's questionnaire survey also contains information on SMEs' access to finance in 2007. Although the data is subject to certain caveats, as it was not collected until 2010, it is noteworthy that in 2007 no significant relationship existed between outcomes of loan applications and profitability and level of productivity. For 2007 it is thus not possible to find any significant relationship between the access to bank loans and corporate profitability and productivity. This emphasises that credit standards were reduced to an inappropriately low level before the financial crisis. The so-called Rangvid report on the causes of the financial crisis also points to the lenient credit standards before the financial crisis, cf. Ministry of Business and Growth (2013).

The above analysis indicates that firms with low solvency may gain easier access to bank loans

if they change their capital structure towards a higher solvency ratio. Statistics Denmark's survey of SMEs' access to finance covers only non-financial private business sectors excluding agriculture. However, previous analyses have found that many Danish farms have a weak equity base, cf. Buchholst et al. (2014). Moreover, the share of farms with low solvency has been growing in recent years, cf. Chart 10 (top left). This trend has been observed nationwide, especially in the regions of Central Denmark, North Denmark and Southern Denmark, cf. Chart 10 (top right). The tendency towards a weaker equity base has been the same across different farm types (Chart 10, bottom left), but has been most prominent among young and relatively newly established farmers (Chart 10, bottom right).

Analysis of the relationship between access to bank loans and productivity level

Box 2

This box summarises the result of an empirical analysis of the relationship between access to bank loans and firms' solvency, profitability and level of productivity, cf. Abildgren et al. (2014). A regression analysis is performed, where the probability of bank loan acceptance is modelled as a function of solvency ratio, return on assets, productivity level and observable differences in the form of firm size, age and industry. In the table, the probability is reported as numbers between 0 and 1.

The analysis shows that the probability of obtaining debt financing is higher for firms with a high productivity level than for firms with low productivity, cf. the table. Only return on assets and total factor productivity are individually significant when solvency, return on assets and productivity are included simultaneously in the estimation, which should,

however, be seen in the light of the increased number of explanatory variables. On the other hand, the four variables overall are significant at a significance level of 1 per cent.

The model under review is non-linear, and therefore marginal effects are presented. The marginal effects show the effect of an increase of one unit in the explanatory variable on the probability of acceptance of an application for a bank loan. As an example, a 5 percentage point rise in the return on assets will increase the probability of acceptance of a bank loan application by 3.7 percentage points, cf. column (2). Moreover, column (1), for instance, indicates that a 10 percentage point increase in the solvency ratio will increase the probability of acceptance by 2.5 percentage points.

Estimation of the probability of acceptance of a bank loan application, 2009-10

	(1)	(2)	(3)	(4)	(5)
Solvency ratio (per cent)	0.0062** (0.0028) [0.0025]				0.0027 (0.0031) [0.0011]
Return on assets (per cent)		0.0182*** (0.0051) [0.0073]			0.0117** (0.0058) [0.0047]
Labour productivity (thousands, 2005-kroner per capita)			0.0004** (0.0002) [0.0002]		0.0001 (0.0003) [0.0000]
Total factor productivity (thousands, 2005-kroner per weighted production input)				0.0025*** (0.0007) [0.0010]	0.0016* (0.0009) [0.0006]
Number of observations	304	304	304	304	304

Note: The table shows the result of a probit estimation which adjusts for the variables shown as well as number of employees, industry and age, cf. Abildgren et al. (2014). Here, the probability is a number between 0 and 1. *, ** and *** denote significance at the 10, 5 and 1 per cent level, respectively. Standard errors are in round brackets and marginal effects in square brackets. The marginal effects have been evaluated in the average of the explanatory variables. Return on assets and levels of productivity have been adjusted for cross-industry variations by subtracting the industry median in the relevant year.

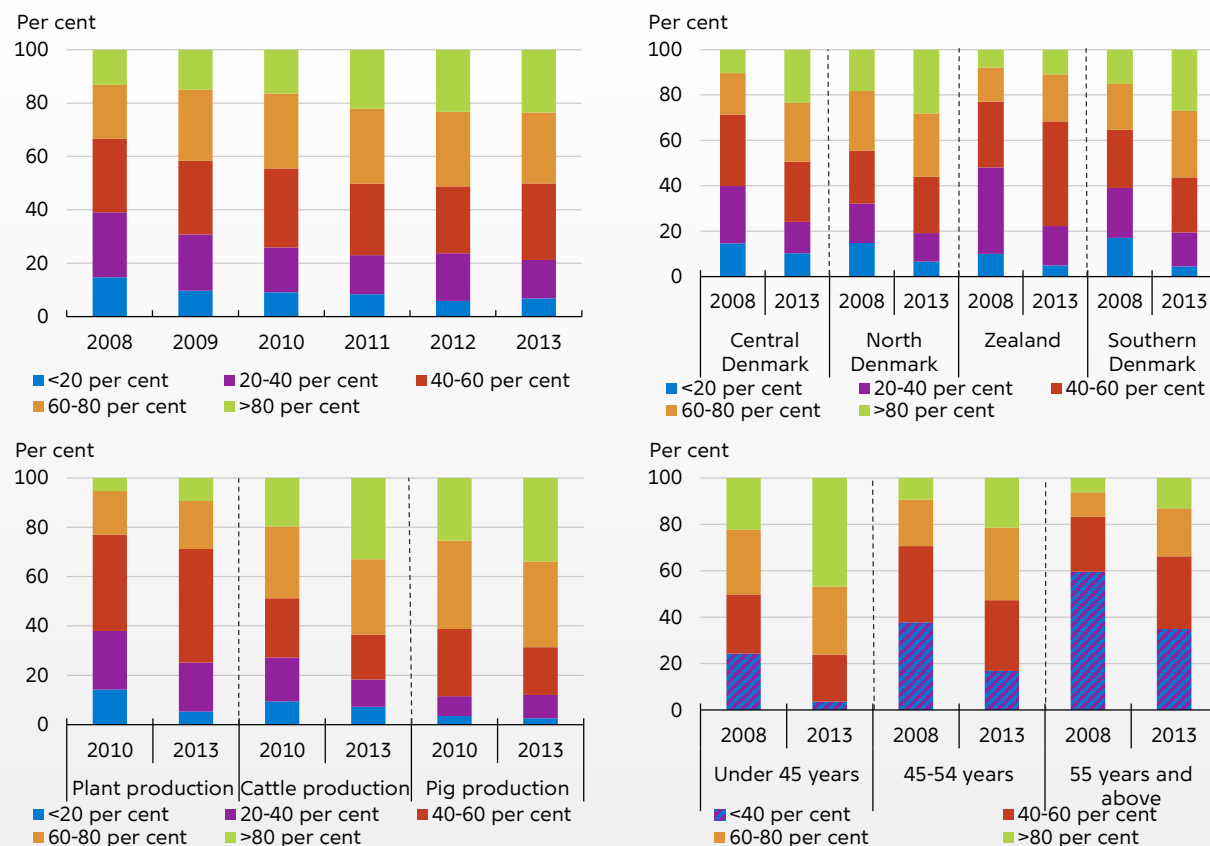
Source: Own calculations based on firm-level data from Statistics Denmark, cf. Abildgren et al. (2014).

Deposit banks and mortgage banks are the most important sources of finance for agriculture. Chart 11 illustrates farms' raising of new loans in 2013. Around 55 per cent of farms with a debt ratio of more than 80 per cent raised loans in 2013. There is a clear tendency for farms with high debt ratios to raise bank loans to a higher degree than farms with lower debt ratios, which either did not need loans or which were able to rely more on mortgage loans, typically at a lower interest rate.

The Knowledge Centre for Agriculture (2012) has previously pointed out that farms with high debt ratios could undoubtedly benefit from aiming for a higher degree of equity financing. The advantages would be access to cheaper credit, lower exposure to economic fluctuations and fluctuations in land prices and easier access to credit in general.

Farms distributed by debt ratio

Chart 10

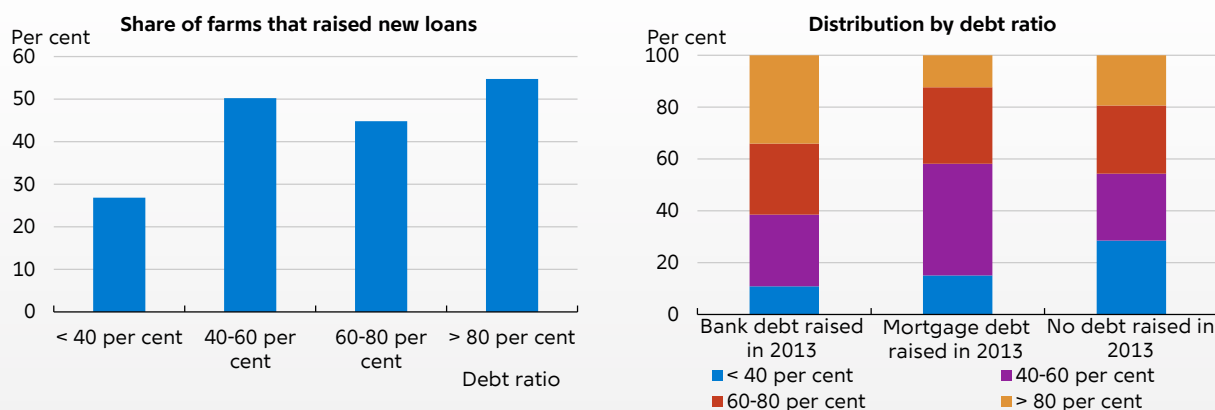


Note: Full-time farms only. The debt ratio shows farm debt as a percentage of total assets. The results have been scaled to population level on the basis of annual samples comprising around 12 per cent of the population. Farms in the Capital Region of Denmark are included in Region Zealand (top right-hand chart). The breakdown of farms by type (bottom left-hand chart) is not available before 2010. Cattle farming in the bottom left-hand chart includes both dairy farms and meat-producing farms. The distribution by age (bottom right-hand chart) is based on the owner's age, and for confidentiality reasons the distribution of farms by debt ratio groups is less detailed than in the other charts.

Source: Own calculations based on farm-specific data from Statistics Denmark.

Farms' raising of new loans in 2013

Chart 11

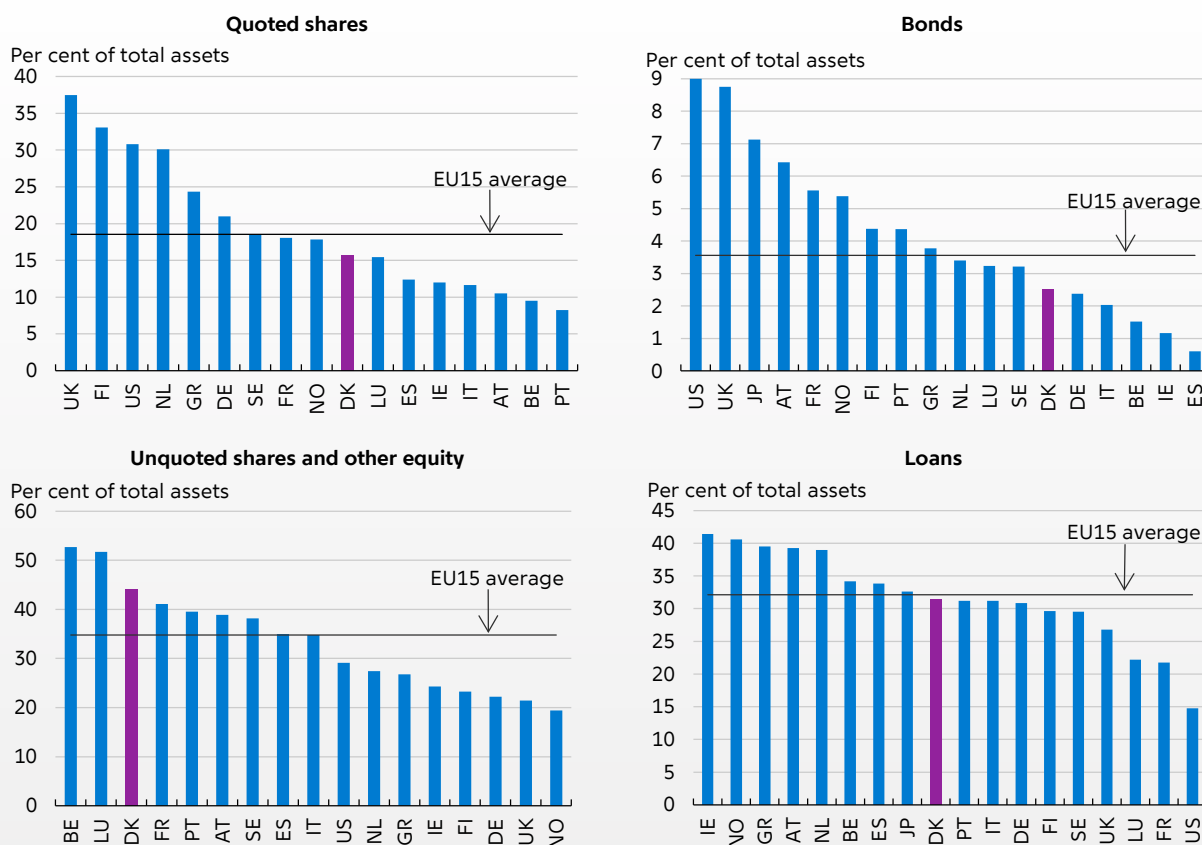


Note: Full-time farms only. Farms raising debt are defined as farms with an increase in outstanding debt to deposit banks and mortgage banks over the year, except for increases due to price changes as regards mortgage debt. A lower threshold of kr. 100,000 has been applied to the increases in deposit bank and mortgage bank debt. Bank debt comprises debt to both Danish and foreign banks, and an increase in bank debt can be attributed to both new borrowing and drawings on existing overdraft facilities. The results have been scaled to population level on the basis of a sample of 1,399 farms (12 per cent of full-time farms in Denmark).

Source: Own calculations based on farm-specific data from Statistics Denmark.

Corporate funding structure in EU15 member states, averages 1999-2013

Chart 12



Note: Averages for the 1st quarter of 1999 to the 4th quarter of 2013. Data for Ireland, Luxembourg and the Netherlands does not cover the whole period. Data for Ireland starts in the 1st quarter of 2002 and for Luxembourg and the Netherlands in the 1st quarter of 2005. The figures for the USA, Japan and Norway are based on annual national accounts for the period 1999-2012. The decomposition into quoted and unquoted shares is not available for Japan.

Source: Own calculations based on sector-specific data from Deutsche Bundesbank, Oesterreichische Nationalbank, Central Bank of Ireland, the ECB, the OECD and Eurostat, cf. Abildgren et al. (2014).

ACCESS TO MARKET-BASED FINANCING

In general, the financing structure of Danish non-financial corporations is in line with the average financing structure for firms in the other EU15 member states, cf. Chart 12. However, Danish firms rely less on bonds and quoted shares and more on unquoted shares and other equity compared with the EU15 average. The greater prevalence of unquoted shares in Denmark possibly reflects the role of company-owned foundations in the Danish business community. Similarly, the less widespread use of corporate bonds in Denmark may reflect the size of the bond-financed Danish mortgage credit sector, which indirectly enables Danish firms to raise loans against real

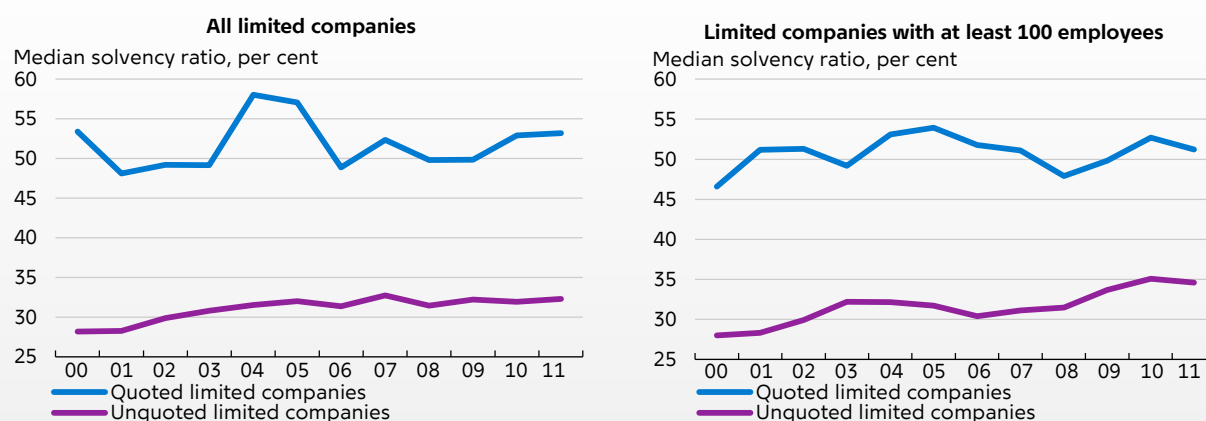
property as collateral on terms resembling bond market terms.

Abildgren et al. (2014) have performed a more detailed analysis of the capital structure, profitability and productivity of Danish non-financial quoted companies compared with unquoted companies. The analysis is based on a combination of firm-specific data from Statistics Denmark's accounts statistics for private business sectors excluding agriculture and firm-specific data from Danmarks Nationalbank's securities statistics.

According to the analysis, quoted companies have larger capital buffers than unquoted companies, cf. Chart 13. That corresponds to the results of a previous survey in this area, cf. Danmarks Nationalbank and Ministry of Economic Affairs and Business (2006), which adjusted for a number

Solvency ratios for Danish limited companies

Chart 13



Note: The solvency ratio has been defined as equity as a percentage of total assets. The data is firm-specific data from Statistics Denmark's accounts statistics for non-financial business sectors excluding agriculture and firm-specific data from Danmarks Nationalbank's securities statistics.

Source: Own calculations based on data from Statistics Denmark and Danmarks Nationalbank, cf. Abildgren et al. (2014).

of factors, including firm size. Quoted companies also tend to have a higher level of productivity than unquoted companies, while there is little difference when it comes to profitability.

CONCLUDING REMARKS

All in all, the analysis shows that firms with a high solvency ratio have a wider range of funding sources to choose from and greater certainty of obtaining the desired funding. If this flexibility is used for debt financing purposes, solvency will decline, all else equal, and must be restored if the firm is to maintain the same level of flexibility as before the debt financing.

The analysis thus indicates that firms with low solvency ratios gain easier access to bank funding if they change their capital structures towards a higher solvency ratio.

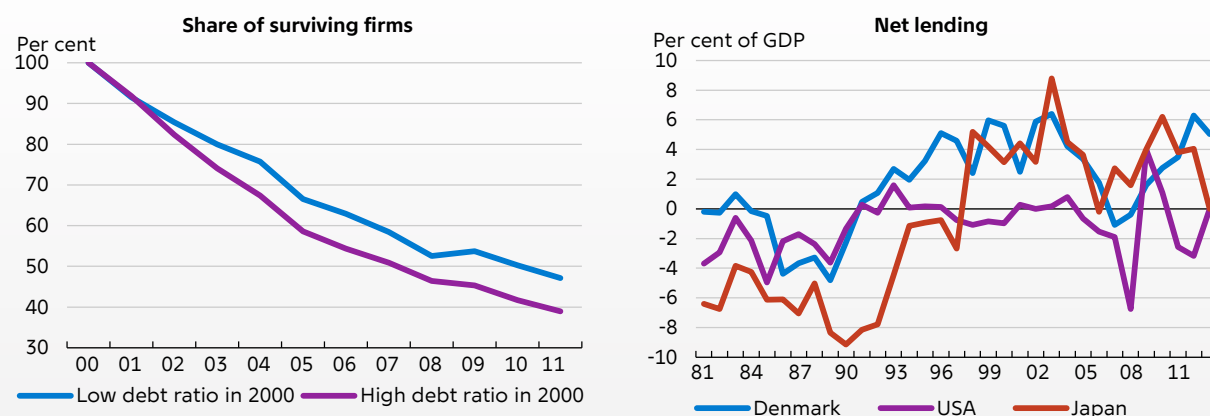
Moreover, a high solvency ratio makes a firm more robust to macroeconomic shocks, which in turn supports financial stability. It is very clear from Danmarks Nationalbank's failure rate model that the lower a firm's debt ratio is, the smaller the default risk is, cf. Lykke et al. (2004) and Abildgren and Damgaard (2012). This also applies if adjustment is made for firm size, return on assets, form of ownership, age, geography, industry and the cyclical position in general. This also appears from the survival curves in Chart 14 (left).

It has been evident in a number of countries that the business sector was in need of comprehensive consolidation for many years as a result of weak capitalisation in the wake of a financial crisis with plummeting asset prices. Japan in the 1990s is a case in point, cf. Koo (2011) and ECB (2012). A business sector with weak capitalisation can thus generate macroeconomic stability problems. In Denmark, strong consolidation in the business sector was also observed in the second half of the 1980s and the early 1990s; a period characterised by banking and foreign exchange crises and an unusually long period of low growth, cf. Chart 14 (right).

The analysis in the article indicates that there are no costs in the form of lower profitability (before tax) or a lower level of or weaker development in productivity associated with a capital structure with a large capital buffer compared with a highly leveraged capital structure. However, profitability after tax may be affected due to the bias in favour of debt financing over equity financing in the Danish tax system.

Survival curves and non-financial corporations' net lending

Chart 14



Note: Low debt covers firms with debt accounting for less than 60 per cent of total assets in 2000, while high debt covers firms with a debt ratio of more than 80 per cent in 2000. Surviving firms denote firms with an unchanged CVR number (business registration number) relative to 2000. Non-surviving firms denote discontinued firms as well as firms that have been acquired or changed their CVR numbers for other reasons.

Source: Survival curves: own calculations based on firm-level data for private business sectors excluding agriculture from Statistics Denmark, cf. the description of the sample in Abildgren et al. (2014). Net lending: own calculations based on data from Statistics Denmark and the OECD.

LITERATURE

Abildgren, Kim and Jannick Damgaard (2012), Models for banks' loan impairment charges in stress tests of the financial system, Danmarks Nationalbank, *Monetary Review*, 1st Quarter, Part 2.

Abildgren, Kim, Peter Askjær Drejer and Andreas Kuchler (2013), Banks' loan rejection rates and the creditworthiness of the banks' corporate customers, *Nationaløkonomisk Tidsskrift*, Vol. 151, No. 2.

Abildgren, Kim, Mark Niels Strøger Hansen, Carina Moselund Jensen, Mark Strøm Kristoffersen and Oxana Skakoun (2014), Corporate capital structure and profitability, productivity and access to finance, Danmarks Nationalbank, *Working Paper*, No. 91.

Albareto, Giorgio and Paolo Finaldi (2012), Financial fragility and growth prospects: credit rationing during the crisis, *Bank of Italy Working Paper*, No. 127.

Barton, Sidney L. and Paul J. Gordon (1988), Corporate strategy and capital structure, *Strategic Management Journal*, Vol. 9, No. 6.

Brogaard, Martin and Søren Staal (2011), Developments in total factor productivity within the Danish manufacturing sector – reallocation, technical efficiency and capital structure, Master's thesis, Aarhus School of Business, Aarhus University.

Buchholst, Birgitte Vølund, Peter Askjær Drejer and Erik Haller Pedersen (2014), Danish agriculture, Danmarks Nationalbank, *Monetary Review*, 2nd Quarter.

Chittenden, Francis, Graham Hall and Patrick Hutchinson (1996), Small firm growth, access to capital markets and financial structure: Review of issues and an empirical investigation, *Small Business Economics*, Vol. 8, No. 1.

Coricelli, Fabrizio, Nigel Driffield, Sarmistha Pal and Isabelle Roland (2011), Optimal leverage and firm performance: an endogenous threshold analysis, *Brunel University CEDI Working Paper*, No. 5.

Danish Bankers Association (2014), Rapport om risikovillig kapital (Venture capital report – in Danish only).

Danish Productivity Commission (2014), Skat og produktivitet. Baggrundsrapport (Tax and productivity. Background report – in Danish only).

Danmarks Nationalbank and Ministry of Economic Affairs and Business (2006), *Aktiemarkedet og globaliseringen* (The stock market and globalisation – in Danish only), Schultz.

De Mooij, Ruud A. and Sief Ederveen (2008), Corporate tax elasticities: a reader's guide to empirical findings, *Oxford Review of Economic Policy*, Vol. 24, No. 4.

ECB (2012), Comparing the recent financial crisis in the United States and the euro area with the experience of Japan in the 1990s, ECB, *Monthly Bulletin*.

ECB (2013), Corporate finance and economic activity in the euro area. Structural issues report 2013, *ECB Occasional Paper Series*, No. 151.

Holmström, Bengt (1979), Moral hazard and observability, *Bell Journal of Economics*, Vol. 10, No. 1.

Jensen, Michael C. (1986), Agency costs of free cash flow, corporate finance, and takeovers, *American Economic Review*, Vol. 76, No. 2.

Knowledge Centre for Agriculture (2012), Landbrugets egenfinansiering – udvikling, ønsker og muligheder (Internal funding in agriculture – development, requirements and possibilities – in Danish only).

Koo, Richard C. (2011), The world in balance sheet recession: causes, cure, and politics, *Real-World Economics Review*, Vol. 58.

Levinsohn, James and Amil Petrin (2003), Estimating production functions using inputs to control for unobservables, *Review of Economic Studies*, Vol. 70, No. 2.

Lykke, Morten, Kenneth Juhl Pedersen and Heidi Mølgaard Vinther (2004), A failure-rate model for the Danish corporate sector, Danmarks Nationalbank, *Working Paper*, No. 16.

Ministry of Business and Growth (2013), *The financial crisis in Denmark – causes, consequences and lessons*, Schultz.

Myers, Stewart C. (1977), Determinants of corporate borrowing, *Journal of Financial Economics*, Vol. 5, No. 2.

Myers, Stewart C. (1984), The capital structure puzzle, *Journal of Finance*, Vol. 39, No. 3.

Modigliani, Franco and Merton H. Miller (1958), The cost of capital, corporation finance and the theory of investment, *American Economic Review*, Vol. 48, No. 3.

Modigliani, Franco and Merton H. Miller (1963), Corporate income taxes and the cost of capital: a correction, *American Economic Review*, Vol. 53, No. 3.

Nickell, Stephen and Daphne Nicolitsas (1999), How does financial pressure affect firms?, *European Economic Review*, Vol. 43, No. 8.

Nucci, Francesco, Alberto Franco and Fabiano Schivardi (2005), Is firm's productivity related to its financial structure? Evidence from microeconomic data, *Rivista di Politica Economica*, Vol. 95, No. 1.

Pushner, George M. (1995), Equity ownership structure, leverage and productivity: Empirical evidence from Japan, *Pacific-Basin Finance Journal*, Vol. 3, Nos. 2-3.

Statistics Denmark (2010), Små og mellemstore virksomheders adgang til finansiering (Small and medium-sized enterprises' access to finance – in Danish only), *TemaPubl*, No. 1.

The Economic Councils (2008), *The Danish economy* (in Danish with an English summary), autumn.

Tsuji, Chikashi (2013), Corporate profitability and capital structure: the case of the machinery industry firms of the Tokyo Stock Exchange, *International Journal of Business Administration*, Vol. 4, No. 3.