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THE DEBT RATIO AND RISK

Soren Svendsen

Senior Research Associate, Danish Research Institute of Food Economics, Denmark

svendsen@foi.dk

Abstract

The agricultural development has caused still bigger and more expensive farms in Denmark. The debt ratio therefore has increased and has become a severe problem for the farmer. The magnitude of the debt ratio is the highest in Europe. The objective of this study is to analyse the possibility to optimise the debt ratio. In order to analyse the debt ratio 1200 financial statements have been investigated. The study confirms that it is impossible to optimise the debt ratio in line with Modigliani & Miller. On the other hand the study points out an inoptimal range, which is in accordance with the 'Trade-off Theory of Capital Structure'. That is on the high end of the scale. Finally the study demonstrates a significant correlation between the debt ratio and the financial risk.

Introduction

Does a high debt ratio constitute a problem for the farmer? If the return on assets, ROA, is higher than the interest rate paid it does not, but if earnings are not adequate it certainly does. A derived question is if it is possible to optimise the debt ratio. In the financial theory there are basically two schools. One of them, the Modigliani and Miller, M&M School, states it is not possible to optimise the debt ratio. The other school, the trade-off theory of capital structure, claims it is possible because of financial distress when the debt ratio grows too much! This study analyses empirically the possibility of optimising the debt ratio. The concept of risk from the portfolio theory is introduced and the coherence between debt ratio and financial risk is demonstrated.

Different debt ratios in the EU

The accounting statistics of farmers from countries in the EU have been assembled in RICA (Resau d'Information Comptable Agricole). From its database it is possible to derive some key figures in order to benchmark the conditions. The key figures in table 1 are averages from 1998, and the absolute numbers are valued in 1,000 Euro:

Table 1. Key figures of farms in EU countries

	DK	Sweden	Germany	GB	France	Holland	Finland	Average
Total Assets	480	310	563	767	250	736	157	
Debt Ratio	58,1%	30,8%	14,8%	12,5%	34,9%	34,6%	29,9%	30,8 %
Net interests	27	11	10	15	11	21	4	14
Net Profit	17	5	23	27	29	42	19	23

Four Danish empirical investigations have found that the high debt ratio in Danish agriculture is a severe problem. Coward (1993) points out, that the debt ratio in British agriculture is no problem because the strong balance sheet provides a firm cushion for the farmers. A new Dutch investigation (Van Veen 2002) confirms that high debt ratios are problematic for farmers. Particularly it emphasises that the extremely high debt ratios in Denmark are a severe problem for Danish farmers. Franks (1999) shows the importance of farmer's equity, because the return of agricultural assets is generally lower than the interest rate charged on bank loans as he claims. It might not always be the case, but interests must always be paid in spite of earnings fall. Table 1 shows that the interest expense is by far the biggest in Denmark and therefore the net profit is not satisfactory. In most countries the net profit is much higher than net interests. But in Denmark it is the reverse due to the high debt ratio, which is almost twice the average.

Theory, Models and hypotheses

In order to analyse the issue of an optimal debt ratio two different financial sets of theories are dealt with. The first one is the M&M theory, which claims that in a perfect market the capital structure does not affect the value of a firm. The financial leverage theory demonstrates that the problem is dichotomous because earnings as well as risk increase with increasing debt ratio. While earnings are something positive risk is regarded as a negative consequence. Or we want to maximise profit and minimise risk. M & M's propositions depend on perfect capital markets, but borrowing is costly and inconvenient for many individuals. The most serious capital market imperfections are often those created by the government like taxes. Brealey (2000) say: 'US tax system clearly favors debt over equity financing.' But if the debt ratio grows too high the financial distress costs also increase. Therefore another theory, the trade off theory of capital structure, states that after a certain point the costs of capital increase more than can be earned by the borrowing. That is why an optimal debt ratio can be demonstrated in principle. But the theory is not capable of calculating the magnitude of the optimal debt ratio, because financial distress covers several intangible items. Moreover the trade off theory recognises that target debt ratios may vary from firm to firm. The pecking order theory, which is widely used, and the most sited theory today is based on asymmetric information. The theory claims that because of asymmetric information issuing equity capital will undermine the existing value of the company. The theory cannot be used directly on farms because it deals with stock companies. But one important issue from the theory can be used however. The pecking order theory states that well performing companies do not need borrowing the same amount of money as less successful companies. That is the reason that well performing companies usually have a lower debt ratio. So the pecking order theory does not agree with the M & M thesis that the debt ratio has no influence on the value of a company. The pecking order theory is in the same category as the trade off theory, as it means that companies must avoid too much debt. Hence the theory states that too much debt is inoptimal. The two partly contradictory sets of theories are scheduled in table 2.

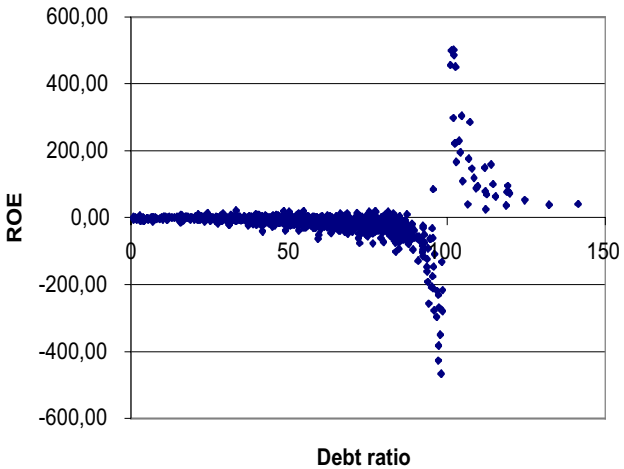
Table 2. Theories of capital structure

Theory	Proposition	Hypothesis
Modigliani & Miller	Proposition 1: The market value of any firm is independent of its capital structure	The debt ratio cannot be optimised
Financial Leverage	EPS as well as risk increases with increasing debt	The debt ratio cannot be optimised
Trade Off Theory of Capital Structure	The theoretical optimum is reached when the present value of the tax savings due to additional borrowing is just off set by increases in the present value of costs of distress	An inoptimal debt ratio can be demonstrated not as a specific point but as a range
The pecking order theory	Firms prefer internal finance Firms try to avoid sudden changes in dividends If internally generated cash flow is more than capital expenditure, the firm pays off the debt If external finance is required the starts with debt and issuing equity as a last resort	Inefficient farmers face the highest debt ratios

The hypothesis from M &M and from the statements of financial leverage is that an optimal debt ratio cannot be demonstrated. From the trade-off theory it is difficult to pinpoint an exact optimum, but after a certain level the optimum has been reached. That means that from the trade off theory a hypothesis should be deduced that it should be possible to show an inoptimal range on the high end of the debt ratio spectrum. Young farmers are normally effective and efficient farmers while they also have a high debt ratio because of high installation costs. These young farmers therefore, do not fit in with the pecking order theory. But older farmers who have been in business for long do. Report 1137 (1988), which is based on an empirical investigation, states p. 13: 'for a big number of farms the failure of earnings is due to a combination of a high debt and an efficiency below average. This is an essential statement, which is in accordance with the pecking order theory. Therefore the hypothesis from the pecking order theory is that farmers facing an extremely high debt ratio are inefficient farmers.

Danish Research Institute of Food Economics has analysed the financial leverage in 1999 in Danish agriculture. The sample consists of more than 1200 financial statements, which is an adequate sample size to be more than 99% confident that the results cover the entire sector. In the financial leverage theory the pivotal point is the debt ratio. The theory states that earnings per share, EPS, increases as debt increases. Farms normally do not contain shares. Thus the relative earnings are expressed as return on equity, ROE. ROE is equivalent to EPS as both key figures represent earnings related to equity. Thus the task is to find a maximum ROE. ROE is examined in relation to the debt Ratio for 1200 financial statements. Therefore this exercise has been carried out in Statistical Application System, SAS. If a maximum ROE can be demonstrated the corresponding debt ratio will turn out to be the optimal debt ratio. In the study 1,200 observations of the debt ratio and ROE are plotted in a scatter diagram illustrated in figure 1.

Figure 1



A debt ratio about 100%, which means an equity about zero, causes a significant variation, because equity enters into the denominator in the equation for ROE. Therefore ROE $\rightarrow \pm \infty$, when debt ratio $\rightarrow$ 100%. Notice that the scatter diagram looks like a hyperbola with the center (X, Y) = (100, 0).

The farms at the left curve all have a debt ratio less than 100%, which is of course the normal case. There is a top frontier and a bottom frontier. The best performing farmers are on the top frontier and the poorest on the bottom. It is harder to tell anything from the top frontier than from the lower frontier. The figure illustrates that it is impossible to demonstrate a maximum ROE and hence an optimal debt ratio. Thus the result confirms the M & M thesis and rejects the trade off theory looking at the upper frontier.
It is obvious to realize that ROE is falling exponentially at the lower frontier however. Especially it falls heavily after the 50% level. And it becomes extremely negative as debt ratio approaches 100%. The average debt ratio in Denmark is 58%. Thus it is easier to demonstrate an inoptimal level, which is on the wrong side of the average level for a normal managed farm. That is due to the burden of interest expenses. This result is interesting because it is in accordance with the trade off theory, as the theory deducts that small debt ratios do not constitute a problem. The problem arises for big debt ratios because of increasing financial distress. And even if it is difficult to pinpoint an exact optimum it is obvious that the optimal point has been reached before the average debt ratio regarding the lower frontier. The trade off theory cannot pinpoint an exact optimum, which is in

accordance with the results from figure 1. The result is also in accordance with the pecking order theory that profitable firms generally borrow less because they do not need outside money.

The farms on the right curve have a debt ratio over 100%, which means they are insolvent. Negative earnings divided with a negative equity cause a positive number. Consequently these farms all show negative earnings. A negative earnings on top of a negative equity is an extremely unfavourable combination. This result indicates a connection between bad management and a bad financial position.

The two sets of points in figure 1 are in accordance with Kester (1986), who found that within an industry the most profitable companies generally borrow the least because they don't need to borrow. Again this is in accordance with the pecking order theory and with the report quoted which stated that for a big number of farms the failure of earnings is due to a combination of a high debt and an efficiency below average.

Risk

In the portfolio theory risk is defined as the standard deviation of return in a certain period of time. The theory prescribes that both return and risk increase when the debt ratio increases. The risk analysis has not been based on 1200 financial statements because it has been carried out as a case study. Five pork farms have been analysed during a six years period from 1995 to 2000. Table 3 shows the debt ratio, total risk, business risk and financial risk of the five farms. The debt ratio is well known but: What are financial risk, business risk and total risk? And what should the level rather be? The latter is difficult to reply to because the three measures have only been dealt with as concepts in the agriculture. They have not yet been calculated as numbers and therefore no references exist.

$$financialrisk = \frac{1 + totalrisk}{1 + bus.risk} - 1$$

Total risk is the standard deviation on ROE, over a certain period of time. The time period in question is six years. Business risk is the standard deviation on Return on Assets, ROA, because business risk must be independent of the way, the firm is financed. Finally financial risk is calculated as:

So financial risk is the added risk by using debt, and financial risk would be zero if the debt ratio were zero. Financial risk increases as debt increases as is seen in table 3:

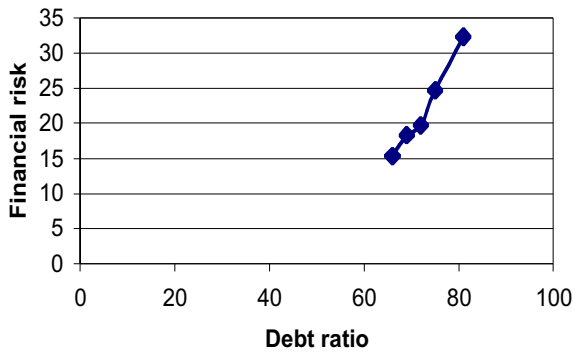
Table 3. Connection between debt ratio and risk

Case	Debt ratio. Ultimo	Financial risk	Business risk	Total risk
1	66%	15,40%	6,17%	22,50%
3	69%	18,37%	3,79%	22,87%
2	72%	19,73%	14,82%	37,48%
5	75%	24,69%	5,66%	31,75%

4	81%	32,34%	6,63%	41,12%

The risk measures in the table must not be interpreted as a bankruptcy risk or risk of any particular incident. They should be interpreted as pure dispersion measures. The risk levels are sensible compared to the industry. The standard deviation on Standard & Poor's market portfolio from 1990 to 1997 was 14%, which is comparable to the total risk in the table. That makes sense because this portfolio contains a huge number of companies. The computer maker, Compaq's standard deviation was 42% and the much more stable oil company, Exxon had a standard deviation on 14%. Consequently the numbers in the table should be trustworthy. The numbers from the table demonstrate an unambiguous connection between debt ratio and financial risk, which could be depicted in a diagram in figure 2:

Figure 2



The farmers are almost lying on a straight line, and the correlationen is as much as 98.84%. The linearity could be a coincidence. But it could be valid on the other hand, because the farms are much alike on the balance sheet and on the statement of income. They are facing the same variances in prices all of them, and all of them are chosen as efficient farmers. Of course five single farms are not enough to make sure there is a liniarity, but an unambiguous connection between debt ratio and financial risk is demonstrated.

Conclusion

An initial question is if a high debt ratio constitutes a problem for the farmer. A comparison among countries plus other investigations seem to concur that the high debt ratio in Denmark has a negative influence on the economy and the financial position. By extension the overall question is if it is possible to optimise the debt ratio. The findings are interesting because fragments of the theories, which are partly contradictory, are proven. The M & M proposition 1 states that in perfect markets the value of any firm is independent of its capital structure. This statement is shown as no optimum can be demonstrated. The trade-off theory of capital structure states that if the debt grows too much, the distress cost will grow still more. Thus an optimal debt ratio has been reached before a dramatic increase in distress costs takes place. Consequently some optimal debt ratio exists even if it is impossible to demonstrate an exact optimum. This is precisely what happens on the lower frontier in figure 1.

After reaching the average debt ratio, 58%, the ROE gets still more negative. So an inoptimal level of debt ratio, which is more than 58%, has been demonstrated but not as a precise point. Finally the pecking order theory states that profitable firms generally borrow less because they don't need outside money. Less profitable firms issue debt because they do not have internal funds sufficient for their capital investment programs. These statements are demonstrated too as the farms, which are highly debt-financed all have a negative ROE. At the end an unambiguous connection between the debt ratio and financial risk is demonstrated. Consequently the overall conclusion of this study is that a high debt ratio is generally undesirable as it decreases earnings and increases risk.

Biographical note

Soren Svendsen is Ph.D. in auditing and accounting and senior research associate in Danish Research Institute of Food Economics, where he is dealing with financial problems and farm transfers.

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