Capital Structure in Agricultural Sole Proprietorships

- Relation to Economies of Scale, Economies of Size, Investment, and Risk

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"In choices related to growth, consequences of financial alternatives are likely to be at least as important as those of production alternatives. Moreover, and more important still, production and financial alternatives are interrelated" (Baker, 1968).

Introduction

The level of farm debt has been a recurrent theme in agricultural economics. However, the implications of debt-choice models in agriculture finance, does not seem to be reflected in related areas of agricultural economic research, despite the early insight of Baker indicated by the quote above.

Furthermore, agricultural debt-choice models of sole proprietorships, does not take economies of scale and size into account (Collins 1985), although this has been a central question in general economics of agricultural production.

	Debt-choice models *	Production economic models **	Objective of this research
Economies of scale matters for the farmer	-	+	+
Leverage matters for the farmer	+	-	+
Leverage matters for the lender	-	-	+
Business risk can be balanced by financial risk	+	-	+
Business risk can be balanced by interest rate risk	-	-	+

*Based on Collins (1985) & Moss et al. (2012)
** Based on Chavas 2008.

Objective

The overall objective of the research is to contribute to a reconciliation of agricultural production economics and agricultural finance.

The central research question of the presentation is whether or not capital structure affects the optimal size of a farm. That is, does economies of scale (or scope) in production outweigh the cost of increased financial leverage that is implied by an increase in the size of a farm organized as a sole proprietorship?

A secondary objective is to address (some) of the empirical problems in connection with estimation or measurement of the cost of debt and the (opportunity) cost of equity for the farmer, using accounting data.

Method

The Collins (1985) model assumes that the cost of debt (K) is independent of the debt-to-asset ratio. In a footnote it is recognized that this conflicts with financial theory. But justified by the claim that it is in line with agricultural banking practice. This may not be universally true, and there is reason to believe that the cost of debt (K) may have become more dependent on the debt-to-asset ratio after the financial crisis.

A model is developed were the cost of debt and the cost of equity is dependent on the debt-to-asset ratio. With a given equity at any point in time, the size of the farm, the debt-to-asset ratio and the cost of capital is interdependent in the model.

This means that…
…the wealth of the farmer codetermines optimal farm size…

Consider a "U" shaped Weighted Average Cost of Capital (WACC) in the debt-to-asset ratio (Figure 1).

- Cost of debt should be increasing in debt-to-assets (pre-tax)
- Cost of equity should be above the cost of debt at any level
- The value of the tax shield reduce the cost of debt (after tax)

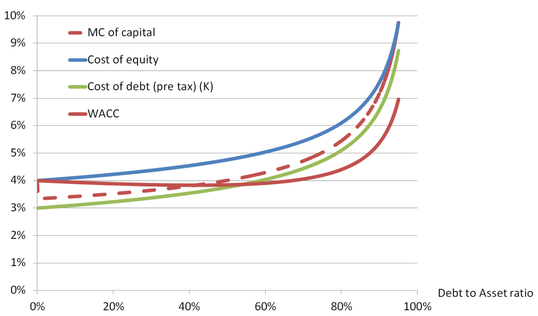

Figure 1: Elements of the Weighted Average Cost of Capital (WACC), as a function of the Debt to Asset ratio

Now consider a sole proprietor farm with a given equity position. If the farmer considers growth in farm size by purchase of land debt-to-asset ratio and the cost of capital will be increasing in the farm size (acreage) (Figure 2).

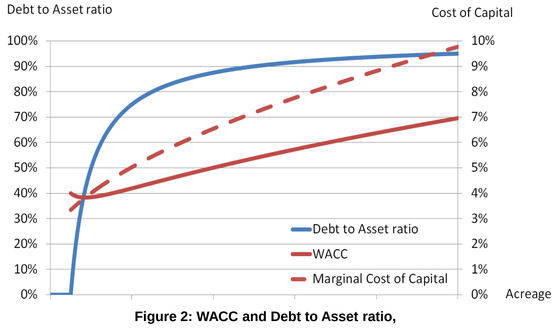

Figure 2: WACC and Debt to Asset ratio, as a function of Acreage (farm size) for a given equity position

Agricultural production economics

In agricultural production economics the "L" shaped average cost function is a common empirical finding (Chavas 2008) (Figure 3).

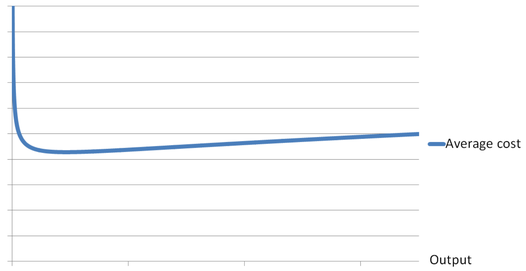

Figure 3: Classic "L" shaped Average Cost Curve as a function of output

Given appropriate assumptions the average cost curve can be transformed into a Ricardian rent curve (Figure 4).

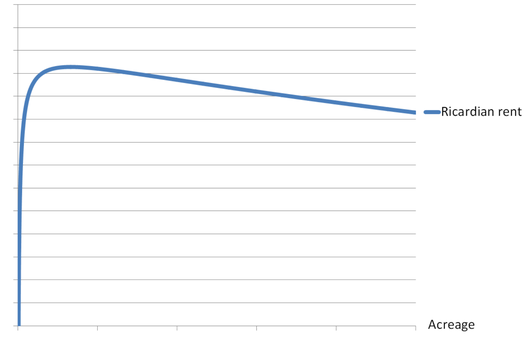

Figure 4: Transformation of the "L" shaped Average Cost Curve to an "r" shaped Ricardian rent curve, as a function of Acreage (farm size)

By combining Figure 2 and 4 it is possible to equate the marginal cost of capital with the marginal land rent (Ricardian rent) which seem a better indicator of optimal farm size than the standard minimum of the average cost curve (pre cost of capital or assuming cost of capital that is independent of the debt-to-asset).

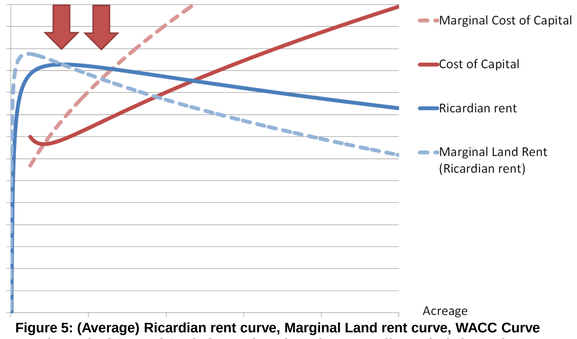

Figure 5: (Average) Ricardian rent curve, Marginal Land rent curve, WACC Curve and Marginal Cost of Capital, as a function of Acreage (farm size), for a given equity position

Empirical challenges

Putting the model to the empirical test is challenging as the relation between the individual risk premium (R) and the debt-to-asset ratio is difficult to estimate empirically as it is usually only the aggregate cost of debt (K) that is observed. The market rates of interest (I) is affected by the farmers choice of financial products (fixed and adjustable rate loans) which constitutes the farmer's choice of interest rate risk (K = R + I). Data that is expected to be available in the autumn this year will provide information on both the mix of market interest rates farmers are exposed to and the risk premium paid for mortgage loans of Danish farmers.

Results & Discussion

Our work so fare indicates that treating capital cost or the WACC as independent of the debt-to-asset ratio is problematic, but our research is not (yet) able to quantify the problem.

Conclusion

For many years the work on agricultural finance (finance of sole proprietorship) has indicated an important interrelation between financial position, financial decisions and production decisions related to risk. The farmers financial position is however, ignored in the bulk of the production economic research in agricultural economics. We claim that this poses a serious problem for applied purposes of this research.

One of the insights provided here is that ***the wealth of the farmer matters for production economics***. Interesting question follow: What happens in case of a shock to the farmers equity position? What happens if the farm growth is based on rented land (tenant farming) instead of owned land? etc.

Further research

Future research may shed light on the magnitude of the problem by getting access to more detailed information on the composition of cost of debt (K) or by improving the models of the market interest rate (I) and the individual risk premiums (R). As the market interest rate (I), the individual risk premium (R) and the opportunity cost of equity capital cannot be assumed to be constant over time or place, the implications of changes with regard to optimal farm size and investment behavior are interesting topics for further research.

References:

Baker, C. B. (1968), "Financial Organization and Production Choices," American Journal of Agricultural Economics, Vol. 50, No. 5, pp. 1566-1577.

Chavas, J-P. (2008), "On the economics of agricultural production," The Australian Journal of Agricultural and Resource Economics, Vol. 52, pp. 365-380.

Collins, R. A. (1985), "Expected Utility, Debt-Equity Structure, and Risk Balancing," American Journal of Agricultural Economics, Vol. 79, No. 2, pp. 488-499.

Moss, C. B., A. K. Mishra and H. Uematsu (2012), "Capital Structure in Modern American Agriculture: Evidence from a National Survey," Agricultural and Applied Economics Association 2012 Annual Meeting, August 12-14, 2012, Seattle, Washington.