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REFEREED ARTICLE

INDICATORS AND DETERMINANTS OF FARM FINANCIAL SUCCESS

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A study using data from some 200 farms provided by one of the major banks and covering farms across England and Wales for the period 1996-2001 sought to derive an indicator of financial success and its determinants. Previous findings are first reviewed and a theoretical framework is developed. The descriptive results suggest that farms in the England and Wales are in a difficult position, particularly with regard to liquidity and the drain on profits and net worth caused by debt and private drawings. The farm models indicate that variables in the profitability and external factors categories are statistically significant as determinants of financial 'success' as measured by percentage change in net worth. Liquidity and solvency also have some influence, but financial efficiency and repayment capacity and dummy variables denoting farm type and region are not significant.

Keywords: financial performance, net worth, solvency, profitability, liquidity

Introduction

Judging and predicting the financial success of farm businesses are problems that continue to exercise banks and farm economists. However, although a considerable number of studies analysing financial determinants of business performance have been carried out in the United States, apart from growth and survival studies more focused on physical and social determinants (Rizov and Mathijs, 2001; Weiss, 1998; Diwisch *et al*., 2005) and Crabtree's (1984) and Franks' (1996; 1998) work in the eighties and nineties respectively, there has been little formal analysis in a European farming context. Furthermore, much of the work using financial determinants has been based on performance categories, classified according to credit-worthiness or default risk, rather than continuous variables measuring 'success' from the owner's viewpoint.

This paper seeks to provide some guidelines for addressing these problems by drawing from and extending a study using sets of 2-3 years' accounts data from 212 farms provided by one of the major banks and covering farms across England and Wales for the period 1996-2001.

Prior to presenting and discussing the results of the study, a review of previous research is undertaken followed by the development of a conceptual framework.

Previous studies

Over the past thirty to forty years numerous studies have been carried out, most in the United States, aimed at developing models for the prediction of farm business performance based on financial indicators. Farming has not been the only sector of interest to researchers and groundbreaking work has been carried out at the industry level, with predictive indices, such as Altman's Z-ratio dating back nearly forty years (Altman, 1968). A range of methods has been used, particularly linear probability models (LPM), discriminant analysis (DA), logistic regression (Logit) and probit regression (Probit) popular

amongst them, to group farms and to test models which have varied in terms of the indicator to be predicted (the dependent variable) and the factors used as its determinants (independent variables).

Turvey (1999) reviewed the four key statistical models used in credit scoring research: LPM, DA, Logit and Probit, and recommended that, on balance, Logit should be preferred due to its predictive accuracy and ease of use. However, despite the advantages of Logit, by using a categorical dependent variable it does curtail the use of some of the detail of the data. Consequently, if continuous data are available more conventional multiple regression methods can be used (Ibendahl and Fleming, 2003; Crabtree, 1984).

As regards dependent variables, the main focus of university researchers working with banks has been to develop means of improved credit scoring or categorizing farms according to the likelihood of loan default (see Johnson and Hayes, 1973; Hardy and Weed, 1980; Novak and LaDue, 1999; and Barry and Ellinger, 1989, for example). Other studies have looked at bankruptcy (Beaver, 1968; Altman, 1968), with a few being concerned with 'financial stress' (Melichar, 1986), 'success' (Kaase *et al*., 2003), 'non-viability' (Argiles, 2001), 'health' (Griffis, 1988) and financial instability (Franks, 1996; 1998). Most studies have attempted to categorise or group farms using a single indicator or groupings expressed as indices. These indicators have been derived objectively using statistical procedures or, perhaps more commonly, from subjective judgements (such as the 'experience models' of Splett *et al*, 1994). Of the direct, single measures default/non-default and bankruptcy/solvency at a particular date have been the most popular. More normative counterparts of these have been credit classifications in terms of expected loan performance, 'problem borrowers' and 'non-acceptable/high risk/low risk'. Similarly, Melichar (1986) grouped farms into financial stress categories and Griffis (1988) in the UK did likewise with business health categories. Linked to the idea of loan default prediction, Novak and LaDue (1999) used the coverage ratio (profit:expected debt repayments) as an indicator of creditworthiness while Santarossa (2003) derived an index based on movement in long-term debt. And in some ways linked to bankruptcy, as the point towards which falling net worth tends, Zech and Pederson (2003), Escalante and Turvey (2005) and Crabtree (1984; 1985) employed a measure of percentage change in net worth and Ibendahl and Fleming (2003) used a similar, but more complex indicator.

With regard to the determinants or independent variables, what factors are hypothesised depend on what is being predicted. Nevertheless, there is a considerable degree of consensus, if not on the specific measures, then at least on the general categories. Many authors put forward five major groupings of factors: liquidity, solvency or leverage, profitability, financial efficiency and repayment capacity (or capability) (Splett *et al*., 1994). Although Barry and Ellinger (1989) and Kohl (1992) do add 'collateral' to the first three, it appears that the measures they use could come under the umbrella of leverage or repayment capacity. Nevertheless, despite hypotheses concerning the importance of variables in the five categories, not all are found to be significant. Measures of solvency and repayment capacity appear to be the most important determinants. Liquidity is also significant in some, but not all,

studies and measures of financial efficiency and profitability play a more limited part. Some studies have found a measure of personal drawings to be significant (Zech and Pederson, 2003), and when other, non-financial measures have been introduced region, farm size, management activity, business understanding and attitude and farmer age have been shown to influence business performance (Ibendahl and Fleming, 2003; Santarossa, 2003; McBride and Johnson, 2004).

Conceptual framework

Despite the large numbers of papers on this subject the conceptual framework supporting the models does not appear to have been satisfactorily explained. This section, therefore, is concerned with building such a framework.

Before a framework can be constructed, it is first necessary to define what is meant by farm business performance. In Britain, farm management professionals have tended to employ the threefold profit-cash-capital expression when discussing farm financial performance. More accurately, this should be termed profitability, liquidity and solvency/stability (Barnard and Nix, 1979): profitability is concerned with the generation of a satisfactory return to the owners of the business; liquidity concerns the availability of cash, immediately or at short notice, to meet the demands upon it without detriment to the future performance of the business; and solvency/stability relates to whether the business, both overall and in terms of the owner's share, is of a sufficient size or value and likely to remain so. Furthermore, there are two further aspects of performance mentioned in many of the U.S. studies, namely financial efficiency and repayment capacity. Financial efficiency measures are generally ratios of cost and revenue elements which, in aggregate, represent profitability. Therefore, financial efficiency could be argued as being a subsidiary of profitability and so belongs under that heading, but since financial efficiency ratios can be used to provide a more detailed view of the factors contributing to profitability many analysts prefer a separate category. It might also be argued that repayment capacity, or borrowing risk, is covered under the other headings, since profitability might be used to indicate surplus to cover debt repayment and solvency measures can be used as proxies for debt repayment liability. However, there are a number of alternative measures which aim to specifically indicate the vulnerability of the business due to its level of indebtedness relative to its capacity to meet repayments within the required time.

Given these three, or five, key aspects of financial performance, it might be suggested that some index could be constructed to measure all of them together, as Kaase *et al.* (2003) did attempt to do. However, it may not be pertinent, since each of these aspects reveals a different facet of the business, and the focus might be on different ones depending upon what feature of a business – profitability, risk, ability to repay, long term stability, etc. one is investigating. In this paper the concern is with measuring the success of the business over the medium to long term, but to measure success it must first be defined and for this one needs to ascertain the objective of the business. Thus, the question might be posed, "what is the ultimate aim of the business?" Many

of the answers to this question, such as, "to ensure that the business is 'strong'" or "not vulnerable" or "likely to survive if things go wrong" or "profitable" or "likely to remain in existence come what may" or "generates a satisfactory return into the long term", could be said to be subsidiary to or be covered by one key, medium/long-term objective, namely that the owner's share in the business, i.e. their wealth, should grow or at least remain stable into the future.

To measure this, what might be termed, ultimate objective of the business the size of the owner's share needs to be gauged, and if its stability or growth is to be measured, then the change in that, particularly the proportionate change, should be calculated (Barry *et al*., 2000). Thus, the suggested measure of the key objective would be the percentage change in net worth (or equity) over the period under consideration – a measure that has been used in some earlier studies.

With percentage change in net worth as the dependent variable for the model, its likely determinants need now to be derived. Change in net worth arises from profit, made up of operating profit less net interest charges, over that period. However, only retained profit will add to net worth, so any taxation and distribution to shareholders (private drawings and benefits in kind in the case of the sole trader or partnership) must be subtracted. Finally, as the capital account reveals, net worth will also rise if there are other additions in the form of off-farm earnings or holding gains on land, machinery or buildings due to inflation (Bright, 2001). Thus, the functional identity is:

$$\Delta NW = O - I - (D + T) + N + A \qquad (1)$$

where Δ denotes 'change in', NW is net worth or equity (total assets less total liabilities), O is operating profit, I is net interest, D is personal drawings, T is income tax, N is off-farm income/capital introduced and A is capital appreciation or holding gain.

Since percentage change in net worth implies dividing the left hand side by NW, then all of the terms on the right hand side would also be divided by the same, thus:

$$\frac{\Delta NW}{NW} = \left(\frac{O}{NW} - \frac{I}{NW} - \frac{(D+T)}{NW} + \frac{N}{NW} + \frac{A}{NW} \right) \times 100 \qquad (2)$$

Consequently, percentage change in net worth[1] is directly determined by:

a) Operating profit. This measure is not normally divided by net worth, but instead by total; or net assets to give return on capital employed (ROCE). To transform the latter into the required form would necessitate

1. Note that these values are expressed in nominal, rather than real, terms, so any given percentage change in net worth would have to exceed the rate of retail price inflation if it were to signify an improvement in real terms.

dividing by percent equity (net worth divided by total assets);

b) Interest. The interest term extends to:

$$\frac{I}{NW} = \frac{(L \times i)}{NW} = \frac{L}{NW} \times i \qquad (3)$$

where L signifies outstanding loans, including overdraft; and i is the prevailing weighted average interest rate on such debt.

The first term on the far right hand side of equation 3 is known as the gearing ratio.[2] The higher this ratio, *ceteris paribus*, then, as equation 2 suggests, the lower will be the dependent variable. Since the gearing ratio is a measure of solvency, and other solvency measures such as percent equity do, under common conditions, correlate very closely with it, it can be said that solvency, along with the interest rate, has a negative effect on percentage change in net worth.

As regards the interest rate, this will vary between years and between farms. However, except in periods of high inflation, it will not vary a great deal between years, nor even between farm businesses. Nevertheless, variation that does occur between businesses is likely to be dependent upon a number of factors, major amongst which is perceived risk of default. Judgment of this may be based on both security, which can be measured by solvency, and credit-worthiness, which may be indicated by measures of repayment capacity. Consequently, solvency and repayment capacity may be indirect determinants of net worth change.

c) Drawings and tax. A number of ratios including drawings are advocated in the literature to represent 'external' factors, one being the term in equation 2 above, namely, the ratio of drawings to net worth (Florey, 2005). Given that, for the unincorporated business (sole trader or partnership), income tax, rather than corporation or company tax, is payable, then this can reasonably be combined with drawings in the ratio. Alternatively, the variables could be subtracted from profit to generate a retained earnings measure, such as those employed by Altman (1968) and Escalante and Turvey (2003).

d) Off-farm income/capital introduced. There is no ratio normally included in analyses for this variable, although it has been included in some analyses in some form (see McBride and Johnson, 2004, for instance) and can have a significant influence on the business (Hill, 2000). In company accounts 'other income' might be included in the profit and loss account under 'non-operating income and expenditure', and would therefore be included in net profit, but it is often missing from the accounts of an unincorporated business. Without further details of the business, it is also unclear as to whether an inflow of funds is derived from off-farm income or is simply a transfer from a non-farm bank

2. This is gearing according to the accountancy definition of the term; gearing is sometimes measured instead by L/(+NW) or total liabilities/total assets, the latter particularly by the banks.

account;

e) Holding gain. Accounts with valuations carried out on an historic basis would not include any holding gain, whereas those employing more modern methods such as current cost or fair value accounting (Elad, 2004) could include the effect of capital appreciation, albeit not substantial, under the current low inflation rates. Nevertheless, this variable has not tended to be employed in analyses, although Crabtree (1984) did give a good deal of consideration to its effects.

Thus, direct determinants of percentage change in net worth would fall under the categories of profitability, solvency (via the interest term) and, indirectly, repayment capacity (also via the interest term). Financial efficiency and liquidity could also be expected to have an indirect effect on change in net worth. Financial efficiency measures generally relate costs to gross output or total assets to gross output, giving an indication of the building blocks for profit. Thus, greater financial efficiency leads to greater profitability. Liquidity affects profitability, since having sufficient liquid assets allows trading activities to take place within an optimal timing framework, whereas a shortage may force the farmer to buy or sell at times and at prices which are unfavourable and to take on expensive debt. Furthermore, this will have knock-on effects on solvency.

However, the last three terms in equation 2 do not fit into the five categories, so a sixth, 'capital account' or 'external factors' category would include drawings, off-farm income/capital introduced and holding gain.

Although it can be seen that variables in the 6 financial categories directly and indirectly determine net worth change in the current period, what is more important is to determine which factors influence future change. Current measures might have effects on future net worth change in two ways: either, their own future levels might be closely correlated with their current levels and/or their current levels might themselves affect future net worth change in some way. We will take each of the 6 categories in turn to consider the extent to which they might be expected to influence net worth change in future periods.

Because of the natural environment within which agricultural production takes place, one might expect farm profitability to be somewhat volatile, as government and EU figures indicate (DEFRA, 2005; Eurostat, 2006), although one might also expect farm profitability rankings to be fairly consistent over time, at least within farm types (although the work of Phimister *et al*. work (2004) might suggest otherwise). However, there is another reason to expect that current profits will affect future net worth change and that is because the greater the profits in one period the greater the repayment of debt and increased investment facilitated. Greater investment gives the potential for increased operating profits, while reduced debt lowers the future interest burden and may also improve liquidity, which, as we have seen above, can indirectly affect profitability.

The level of solvency tends to be slow moving, except when a farm is doing particularly well or badly. Consequently, there is likely to be fairly close correlation over a number of years, so current solvency is likely to influence

future net worth change via future solvency and thence via the interest charge, as we saw earlier. However, solvency is also likely to affect net worth change via its impact on profitability. As Bright (2001) has shown, for a highly geared, low percent-equity business, profitability, measured by return on equity, will tend to be higher than that for the low geared business when the return on all capital exceeds the interest rate, and this will tend to generate a greater improvement in net worth. However, since the reverse also holds it is not clear, *a priori,* whether the relationship will be positive or negative, weak or strong.

Although future liquidity may be expected to affect future net worth change, because of the likely fluctuations in liquidity over time as revenues vary with yields and prices, present liquidity might show poor correlation between periods. Nevertheless, because present liquidity may affect present decisions about current purchases, sales and investments which may have knock-on effects on future profitability, there may be some limited influence on future net worth changes.

Due to its close links with profitability, present financial feasibility indicators can be expected to have a similar impact on future changes in net worth.

The fifth category, repayment capacity, indicates the relation between debt (and the interest which ensues) and the means of meeting that debt, expressed either as profit, value of output or cash flow surplus and because of fluctuations in the latter, there may not be close correlation over time. However, in the same way that future repayment capacity may affect lenders' decisions regarding interest rates and the timely release of funds, perceived current repayment capacity may have some effect on future interest rates and perhaps profitability, and consequently, movement in net worth.

Finally, the 'capital account' or 'external factors'. Drawings, as the data illustrates later in the paper, do not tend to show great year-on-year variation, and similarly with off-farm income, although other capital injections might be less predictable. The third external element, capital appreciation, may be difficult to forecast because variations in land prices can show a good deal of variation from one year to the next and if land is revalued regularly this can cause sizeable fluctuations (DEFRA, 2005).

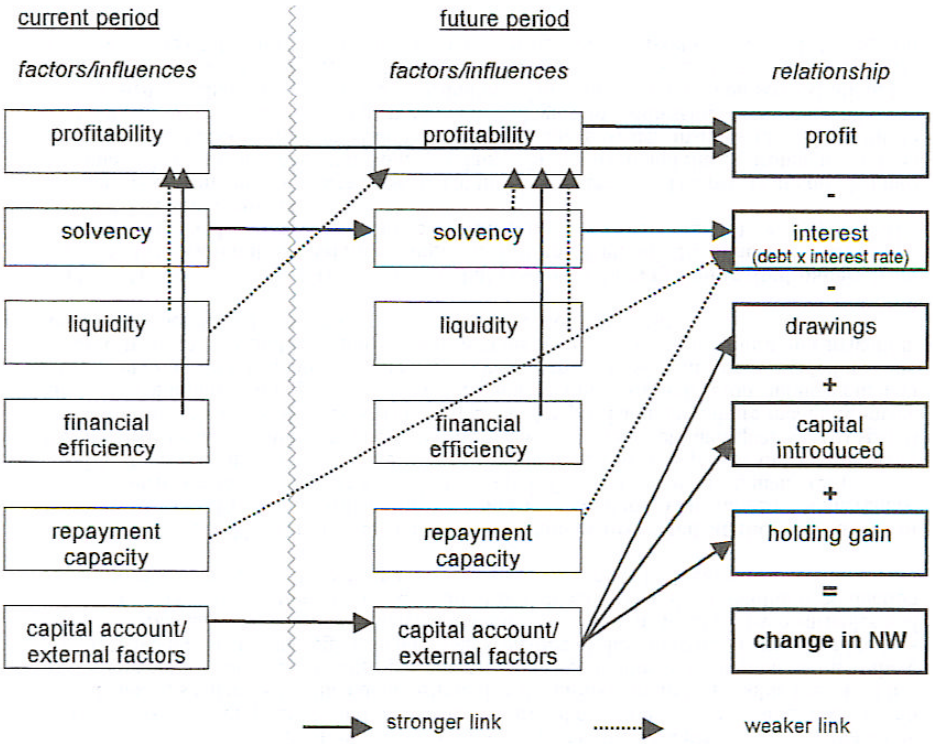
Thus, apart from holding gains, the size of current 'external factors' might be used to estimate their future values which themselves directly influence net worth change.

From the above discussion it can be hypothesized that present levels of all six categories of financial indicator could be used to estimate future financial success, with profitability, financial efficiency and external factors expected to have the strongest influence, as Figure 1 illustrates.

The study

Profit and balance sheet data, as well as some physical information, were provided by one of the major UK banks for 212 farms across different farms types for England and Wales for the period 1996-2001 (Florey, 2005). As far as possible a set of three years' balance sheets was provided for each farm, although in some cases only two years' details were given.

Figure 1. Conceptual framework - current determinants of future net worth change.



Using bank data, as opposed to that from official sources, has both its drawbacks and advantages. Bank data could be argued as being from a biased sample, i.e. those holding bank accounts, and not having been collected using a uniform approach, arising as it does from a large number of different accountants and bank branches across the country. However, on the first point, since the overwhelming majority of commercial farmers are likely to hold bank accounts, one bank's farm customers are not likely to have significantly different profiles from any others, and since bank managers were asked to select a representative sample of accounts, albeit from within the specified farm types, there may be no more reason to suspect bias than with officially collected farm data which is more likely to have problems of self-selection. On the second point, official collection organisations also face problems of incomplete data and adjustment methods applied may also be criticised. On the positive side, bank-sourced data can be claimed to be more realistic, since they contain information on which the farmers, their advisers and banks base judgments. Such data does also allow the assessment of its shortcomings and where erroneous decisions might be based.

Before any analysis could take place, data had to be checked and classified. Some data items (personal drawings, for instance) were missing from some farm accounts and obvious errors had to be eliminated. Furthermore, a large number of farm accounts used valuations based on

historic information. Due to the seriously inaccurate picture this can give, it was necessary to attempt to adjust for this, particularly in the case of owned land. Using official land price data on a regional basis, adjustments were therefore made to historically-based farm valuations by imputing the current value of the farm.

Although taxation accounts may differ from management accounts in terms of their approach to valuations, in the absence of more detailed information it was not considered feasible to make any further adjustments.

Descriptive statistics were generated for a large number of ratios cited in the literature and variation, particularly by region and farm type, was noted. Models were then tested using ordinary least squares regression for continuous variables and logistic regression (Logit) for the dichotomous dependent variable. The latter was derived by assigning a value of 0 if the net worth declined over the period and 1 if it rose or was stable.

Descriptive results

Florey (2005) presented over 80 ratios of relevance to, and used within, agriculture. Most of these ratios fit readily into the six categories outlined above and many ratios within those categories can be expected to be extremely closely correlated. Therefore, it is unnecessary to display results for all of the ratios; rather, an appreciation can be gained by taking one of the key measures for each of the six categories, and these are presented in Table 1.

The average percentage change in net worth, being taken as the measure of 'success', is -4.3%, which compares with a mean of -13% if unadjusted accounts (including those with valuations on a 'historic' basis) are used. The values for individual farms ranged rather widely, although almost two-thirds had values between +10% and -10% where imputed land values had been incorporated. The range between years was not statistically significant but did vary between a mean of +14% at the beginning of the period and -10% at the end, which matched the fortunes of agriculture in Britain at that time. By type and region the range of means was not great either, although cropping farms showed an average fall of about 1% whereas livestock farms performed worse with reductions of between 5 and 7%.

Profitability, expressed by return on capital employed (ROCE), was 7% when unadjusted figures were used, and lower still at 4% if imputed values were used to derive the denominator. Again the range was wide, but 70% of observations lay within the range 0-10%. As might be expected, returns were highest in 1996 and low at the turn of the millennium: the mean ROCE for 1996 was significantly different from the 1999 value. The means varied little by region or farm type, but dairying stood a little above the others, and significantly so. The North and North West were also higher, but not significantly greater than the other regions.

3. Note that some farms had to be excluded because of a negative net worth, or capital deficit – an unexpected result which, nevertheless, persisted in some cases even when historical accounts were adjusted.

Table 1. Financial performance indicators - mean values by year

category	'success'	liquidity	profitability	sol-	financial	repayment	External
indicator	ΔNW %	current ratio	return on capital em-	percent equity	asset turn-over ratio	interest cov-erage ratio	drawings ratio %
mean	-4.3	1.74	4.0	67.6	0.322	1.30	6.8
	(19.2)	(31.44)	(6.3)	(21.3)	(0.315)	(3.36)	
Year							
1996	-	2.99	9.1	61.8	0.299	3.38	7.2
		(4.32)	(5.9)	(19.8)	(0.218)	(3.25)	(7.1)
1997	-	1.52	5.1	66.1	0.396	1.79	6.3
		(1.59)	(4.9)	(21.6)	(0.459)	(2.31)	(6.9)
1998	13.5	2.01	3.8	69.3	0.318	1.16	6.1
	(13.2)	(3.87)	(5.4)	(21.3)	(0.302)	(3.77)	(5.4)
1999	-3.2	1.70	3.6	67.6	0.302	1.11	7.2
	(22.5)	(3.14)	(7.0)	(22.1)	(0.275)	(3.15)	(11.0)
2000	-6.0	1.48	3.7	67.1	0.319	1.32	7.1
	(17.7)	(2.44)	(6.7)	(20.1)	(0.307)	(3.50)	(9.6)
2001	-9.7	0.60	6.0	63.6	0.361	1.33	8.8
	(6.0)	(0.32)	(5.7)	(18.2)	(0.287)	(1.15)	(12.4)
Farm type							
cereals	-0.9	1.52	4.3	69.8	0.294	1.42	6.5
	(11.8)	(3.01)	(5.4)	(21.0)	(0.339)	(2.02)	(9.0)
dairy	-7.4	2.95	7.0	60.0	0.396	1.55	10.1
	(23.7)	(5.69)	(8.2)	(21.7)	(0.387)	(1.51)	(14.4)
gen.	-0.8	1.55	3.7	76.4	0.243	1.43	4.9
cropping	(9.3)	(1.86)	(4.3)	(13.0)	(0.141)	(2.88)	(5.5)
livestock	-5.2	1.31	4.1	62.9	0.435	0.76	6.9
	(21.7)	(1.16)	(7.1)	(23.0)	(0.410)	(2.56)	(6.8)
mixed	-6.5	1.66	2.3	68.3	0.270	1.36	5.9
	(22.2)	(2.51)	(5.4)	(21.7)	(0.180)	(5.29)	(6.1)
Region							
east	-0.9	1.58	3.7	68.5	0.368	2.08	6.0
	(8.6)	(2.79)	(5.7)	(21.8)	(0.386)	(6.05)	(6.9)
north	-6.1	2.26	4.8	58.3	0.364	1.14	5.5
	(21.2)	(4.67)	(5.2)	(20.1)	(0.358)	(1.39)	(4.3)
north-	-10.0	1.57	5.4	65.8	0.332	1.17	10.0
west	(25.4)	(1.92)	(9.2)	(20.4)	(0.281)	(2.59)	(14.2)
south-	-5.7	1.88	3.0	73.7	0.263	0.84	7.4
east	(21.6)	(3.56)	(5.9)	(22.1)	(0.238)	(2.65)	(8.7)
south-	1.6	1.62	4.3	73.4	0.326	1.45	5.4
west	(13.3)	(2.98)	(5.5)	(17.8)	(0.332)	(1.60)	(8.5)
Wales &	-4.8	1.50	2.9	63.2	0.246	0.78	7.1
w. mid.	(18.4)	(1.87)	(4.2)	(21.0)	(0.174)	(1.64)	(6.3)

Standard deviations in parentheses

Solvency/leverage was measured in a number of ways; the indicator used here, percent equity, rose from 44% to 68% when imputed values were substituted for historic ones. The range was wide, with, as mentioned above, some farms showing negative equity and a fifth below 50% (compared to more than half before adjustment), and more than half above 70%. This measure did not vary significantly over the period of the study, but ranged from 60% for dairy farms to 76% for general cropping farms and from 58% in the North East to around 74% in the South East and South West and differences between the regions and farm types with the highest and lowest values were significant. This can be compared with an average figure consistently over 90% for the aggregate balance sheet for UK agriculture (DEFRA, 2006).

Liquidity, measured by current ratio, was, on average, below the level of 2 generally considered as 'safe' (Florey, 2005), but showed a huge range with three-quarters below 1.5, suggesting that lack of liquidity could be a widespread problem. Differences between years and regions were not significant. Only dairy farms (the mean of which was significantly different from all other farm types) and the North and South East regions exhibited mean values close to or above the 'safe' level.

One aspect of financial efficiency is measured by the asset turnover ratio which relates gross output to total assets, and here the average (using imputed values) was 0.32, which would be considered just short of a reasonable level (Boehlje *et al*., 1999). Four-fifths of the observations fell below 0.4, so most farms could be considered as not efficient in this regard. The annual figures do not vary widely nor significantly, whereas livestock farms have means of around 0.4, with other farms ranging between 0.2 and 0.3; livestock and dairy farm values are significantly different from those of general cropping and mixed farms. By region the means are generally above 0.3 whereas the South East and Wales and the West Midlands are around 0.25, although no differences are significant.

The interest coverage ratio measures the ratio of profit before interest and tax to interest (Vause, 1997). This indicator of repayment capacity averages 1.3 in the study, showing that profits only just cover interest charges. There is an extremely wide range, although the bulk of values are between -0.5 (indicating a loss before interest) and 2.0. The mean exceeded 3.0 for only one year, 1996, the other years all showing mean values between 1.1 and 1.8. Such a wide variation is not unexpected (Barry *et al*., 2000). The only region above 2.0 was the East, while Wales and West Midlands and the South East means were below 1.0.

As far as external factors are concerned, information on personal drawings and capital introduced was available only for a subset of farms. The ratio of drawings to net worth (imputed) averaged 6.8%, with a range from 0 to 72%. With income tax included in this ratio, the figure was nearly 9%. Nevertheless, the bulk of farms withdrew less than 10% of net worth, and many under 5%. Annual differences were insignificant, but dairy farms' values were significantly different from general cropping and mixed farms as were those for the north-west compared to the north and south-west. Capital introduced also averaged 7% of net worth, this having the opposite effect to drawings in

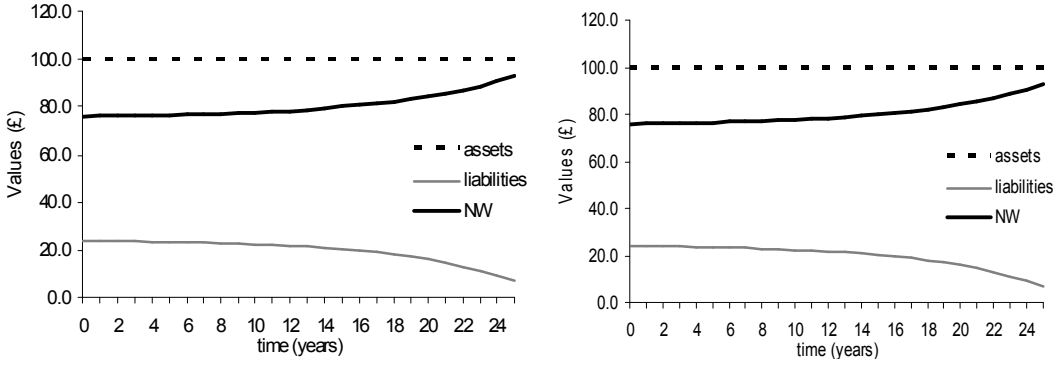
increasing rather than reducing net worth. Again, there was a wide range, with the highest injection being 172% of net worth. However, all of the farms reporting the introduction of capital also reported drawings.

Finally, the holding gain on the imputed value of the land, as a ratio to net worth, averaged close to zero, yet this disguises a wide range from -98% to +36%, and this is likely to have had a considerable effect on the change in the net worth.

It can be concluded from the descriptive statistics that the farms represented by the data would seem to be moderate to poor in terms of liquidity, and have reasonable, but lower than expected, solvency. Profitability and financial efficiency are barely acceptable, and this is exacerbated by a sizeable debt burden and unsustainable levels of drawings although the latter is counterbalanced, on average, by capital introduced from outside the farm business. These factors contribute to the key measure of performance chosen here, namely percentage change in net worth, which indicates a generally poor trend. If its average 4% decline continued it would lead to a halving of net worth in 17 years, a further halving in 34 years and the wealth of the owners of the business being decimated within a generation. In fact, businesses would probably be liquidated much sooner if the trend continued since the debt burden would become increasingly heavy and the demise of the business accelerated.

A basic model can be developed to project these results into the future. Assuming the mean ROCE and level of actual drawings are constant and using the starting percent equity and interest coverage ratio, Figure 2a projects the results over a 22 year period. These results show that, with a starting percent equity of 67.6, and unless steps were taken to improve returns or reduce net outgoings, the wealth of the business' owners would be wiped out in little over twenty years and the business possibly foreclosed before then. In fact, if it were not for the capital introduced the business would cease to exist within a decade. Interestingly, however, if the opening net worth exceeds 75% then a virtuous, rather than a vicious, circle prevails, with percent equity reaching 100 within 28 years (Figure 2b). Similarly, if the interest charges were halved, net worth would rise, rather than fall, more than doubling within twenty years.

Figure 2. Farm business growth model a) using study results b) with opening percent equity of 76.



And, furthermore, if capital (particularly land values) were to appreciate [4], the net worth would be boosted, although this wealth could only be realized if some of the assets were liquidated, thus reducing the potential profits of the business.

Analysis results

A number of regression analyses were carried out, the key ones of which are reported in Table 2 for both the ordinary least squares (OLS) regression and the logistic regression.

The dependent variable in equation I was the percentage change in net worth between the end of year one (NW_2) and the end of year two (NW_3) using the 'actual' or unadjusted value of net worth (as reported in the original accounts). One independent variable was chosen from each of the 6 categories discussed above, on the basis of the highest correlation coefficient or as best representing that category. For financial efficiency, however, the two variables operating profit margin and asset turnover ratio were used as these are seen as secondary measures which can be combined together in the 'Du Pont pyramid of ratios' (Vause, 1997) to produce the return on capital. The values were derived from year one or the end of year one balance sheet and used unadjusted values. The R^2 value was just over 0.7, but only 2 of the 7 variables were significant at the 95% level - the profitability and external factors concerning drawings net of capital introduced. The coefficients for the liquidity, solvency, repayment capability and financial efficiency variables were not significant.

Because of the problems with using 'actual' values, relating to the presence of some historic valuations of land, the dependent and independent variables in Equation II used imputed values (with land values updated where necessary). The resulting R^2 value was much lower, at less than 0.5, although here again the same indicators of profitability and external factors were significant, along with the liquidity measure. Also significant was a variable measuring the holding gain on land, since the imputed net worth would be likely to be affected to a major extent by any rise (or reduction) in land values. Nevertheless, this variable was only significant at the 90% level.

Since the annual holding gain based on inflation of land values appeared to have varied considerably from year to year, equation III used, as the dependent variable, the percentage change in net worth with the holding gain excluded. The effect was to raise the R^2 value considerably to over 0.8. The same variables were significant – profitability and net drawings, with all other measures being insignificant.

To test whether farm type and region had any impact on the adjusted change in net worth, dummy variables for these were added to the exogenous variables from equation III in equation IV. Little improvement was seen in the explanatory power of the equation and none of the dummy variables was significant at the 95% level. Despite this, the coefficients suggest that mixed and cereals farms and those in the Wales and West Midlands and the South East tend to give marginally better results, while livestock, dairy and general cropping farms and those in the North West give slightly inferior results (i.e. a lower percentage change in net worth).

Finally, equation V presents the results of a Logit (logistic regression)

4. Although this might only bring about a nominal, rather than real terms, improvement.

Table 2. Multiple regression results.

	Equation	I	II	III	IV	V
	Dependent variable	% $\Delta NW_{a\ 2-3}$	% $\Delta NW_{i\ 2-3}$	Adjusted% $\Delta NW_{i\ 2-3}$	Adjusted % $\Delta NW_{i\ 2-3}$	Logit Adj.% $DNW_{i\ 2-3}$
	constant	3.300 (12.553)	-9.091 (7.433)	-2.118 (1.277)	-0.834 (2.423)	1.932 (2.960)
Liquidity	Current ratio	-0.013 (0.038)	0.033** (0.011)	0.001 (0.005)	-0.001 (0.006)	-0.004 (0.008)
Solvency	$Debt:equity_i$		0.007 (0.013)	0.007 (0.006)	0.007 (0.006)	0.015 (0.014)
	$Debt:equity_a$	0.024 (0.031)				
Profitability	$ROFE_i$		0.490** (0.136)	0.604** (0.057)	0.601** (0.064)	1.716** (0.748)
	$ROFE_a$	1.232** (0.200)				
Financial efficiency	Operating profit margin	-0.052 (0.534)	0.294* (0.156)	0.059 (0.066)	0.058 (0.077)	0.083 (0.081)
	Asset turnover $ratio_i$		-0.039 (0.067)	0.012 (0.028)	0.025 (0.033)	-2.000* (0.104)
	Asset turnover $ratio_a$	0.114 (0.183)				
Repayment capacity	PRFCFS-servic'g margin	-0.379 (0.483)	-0.212 (0.121)	0.017 (0.051)	0.024 (0.062)	-0.044 (0.075)
External factors	Net drawings: $net\ worth_i$		-0.525** (0.172)	-0.871** (0.072)	-0.874** (0.078)	-1.847** (0.696)
	Net drawings: $net\ worth_a$	-0.592** (0.134)				
Dummy variables	South East				-0.267 (2.489)	
	East				-1.006 (2.303)	
	South West				-0.837 (2.316)	
	North West				-2.001 (2.217)	
	North				-1.058 (2.480)	
	Cereals				-0.293 (1.655)	
	Livestock				-0.882 (1.995)	
	Dairy				-0.998 (1.874)	
	Gen. cropping				-0.735 (2.001)	
	N	68	72	72	72	72
	F	17.567**	9.390**	51.19**	19.98**	
	R^2	0.672	0.507	0.848	0.853	0.636^+ 0.856
	% correct step 0					58.3%
	step 1					91.7%

analysis with the dependent variable taking the value of 0 if net worth (excluding holding gain) declined and 1 otherwise, with coefficients (when adjusted) reflecting the probability of a rise or fall in net worth. The R^2 value, albeit not directly comparable, was similar to those for the multiple regression equations and the equation gave a 33% improvement in the percentage correctly predicted, although the number of observations was, as with the other equations, a good deal smaller than the sample of 136 farms due to a large number of missing values. Again, current profitability and net drawings are highly significant predictors of the probability of future change in net worth. The only other variable of significance (but only at the 90% level) was asset:turnover ratio, although this had a counterintuitive negative sign, indicating that the higher this ratio, the lower the probability of net worth increasing in the following year.

Conclusions

A number of conclusions can be drawn, not only from the findings of the descriptive and statistical analysis, but also from the data themselves.

A conceptual framework is presented here which, although not complex, can provide a model for a clearer understanding of the underlying determinants of financial performance. *A priori*, all six categories of financial indicators can be expected to influence future percentage change in net worth, with profitability, financial efficiency and external factors prominent.

As regards the descriptive results, although there is a wide range of performance, to the extent that our sample is representative then many farms in England and Wales appear to be in a difficult position, particularly with regard to liquidity and the drain on profits caused by debt and private drawings, although capital introduced ameliorates the situation. If these conditions, with the consequent decline in net worth were to continue, those farms with less than two thirds percent equity[5] would be likely to go out of business in the medium term. However, farms with percent equity exceeding three quarters appear to be safe.

Linked to this is a concern: the results, particularly in terms of solvency, do seem to give a rather worse picture than those provided by official figures. Although this data was not constructed in such a way as to enable claim to be laid that it gave a true representation of the aggregate farming picture, it should give a reasonable impression of the range of performance, so there does appear to be some cause for disquiet.

This leads us on to a further conclusion: in order to produce a valuable data set a great deal of work had to be done to 'clean' the data and adjust for inaccuracies. If this data set were representative of that being used by the banks, then, it might not only lead to problems for academics, but may also lead to erroneous judgements and advice for individual farmers, if not adjusted.

The farm models give moderate explanatory power, albeit over a short period, and do give some interesting results which deserve further exploration. As might have been expected from the conceptual framework, current profitability and external factors (drawings, capital introduced and holding

5. Based on adjusted asset valuations.

gains) were the major determinants of future performance. Unlike many of the previous studies[6], however, solvency or leverage does not appear to be an important factor in explaining performance trends, nor does repayment capacity have the significance of earlier studies. Nevertheless, this is in line with *a priori* reasoning, since solvency, repayment capacity and liquidity were only expected to have an indirect influence. The only surprising result was the insignificance of the financial efficiency measures, although much of their influence is likely to be taken up by the profitability measure.

Further research analysing the relationships over a longer time span would be helpful, as would a detailed study of the levels and determinants of drawings and capital injections, and a closer look at those farms which appear to have unsustainable liability levels.

Despite the changing nature of farming, financial success continues to be of key significance and this paper not only paves the way for further research into its levels and determinants but also highlights the need for a full and comprehensive understanding of farm business performance indicators and for their greater use so that businesses can avail themselves of criteria that will enhance the planning, monitoring and control processes on farms

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6. Bearing in mind that most of these studies were not attempting to predict net worth change.

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