The current issue and full text archive of this journal is available at
www.emeraldinsight.com/0002-1466.htm

Farm business decisions and the sustainable growth challenge paradigm

Cesar L. Escalante
Department of Agricultural and Applied Economics, University of Georgia, Athens, Georgia, USA
Calum G. Turvey
Department of Applied Economics and Management, Cornell University, Ithaca, New York, USA, and
Peter J. Barry
Department of Agricultural and Consumer Economics, University of Illinois, Urbana, Illinois, USA

Abstract

Purpose – The purpose of this paper is to introduce the application of sustainable growth challenge (SGC) model in agricultural finance as a conceptual paradigm and then uses the model to measure sustainable growth rates for Illinois grain and livestock farmers. The SGC concept is used to understand the economic conditions and business decisions made by farmers in certain episodes of the time period analyzed.

Design/methodology/approach – A seemingly unrelated regression approach is used to analyze the interrelationships of the four levers of growth using a panel data of Illinois farm-level financial and operating information. The second analysis flows from the first and examines aggregate US farm data to provide an historical perspective of changes in the SGC over time.

Findings – Econometric results indicate the relevance of the SGC model in explaining farm financial and operating decisions. The farms' tendencies to attain balanced growth seem to be more influenced by asset productivity and leverage decisions, which are given different emphasis by grain and livestock farms due to differing operational structures and constraints. This study's estimation and analysis of the USA farm sector's actual and sustainable growth rates from 1981 to 2001 data generally show that the industry has adapted to positive or negative SGCs in a manner consistent with the model.

Originality/value – This paper explores the relevance of the SGC model as a business, policy and teaching tool for understanding issues surrounding farmers' financial and operating decisions.

Keywords Capital structure, United States of America, Farms, Sustainable development

Paper type Research paper

The relationship between farm growth and working capital has received very little attention in the agricultural finance literature despite the constant recognition that farm numbers are dwindling while farm size is growing. A growth strategy is one in which additional output arising from either an increase in productive assets such as land or livestock, or more intense production from existing assets, is in balance with the working capital requirements of the farm. Growth, despite ambition, is not always compatible with the financial policies of the firm and far too often growth strategies fail as deficiencies in working capital force the relinquishing of productive assets.

Agricultural Finance Review
Vol. 69 No. 2, 2009
pp. 228-247
© Emerald Group Publishing Limited
0002-1466
DOI 10.1108/00021460910978706

JEL/EconLit citations – Q110, Q140, D200

المنارة للاستشارات
www.mana

This paper identifies linkages between farm production (and sales) and financial decisions made by farmers that balance growth. To accomplish this, we rely on the sustainable growth paradigm (Higgins, 2003), which emphasizes the relevance of internal business operating parameters, as supplementary to the effects of exogenous factors, in formulating farm production decisions. In the context of the more general field of business finance, sustainable growth represents the maximum rate at which a firm can expand its sales or revenues without depleting its financial resources (Higgins, 2003). The model is closely related to DuPont analysis which has recently been presented as an extension tool for agriculture by Melvin *et al.* (2004) and is also presented in Barry *et al.* (2003) but differs in one significant factor by switching owners' equity for beginning owner's equity. This switching, as will be shown presently, allows the measure to be identified as sales growth rather than profits or conventional returns to equity. Nonetheless, the sustainable growth model has not been used to investigate financial strategies within the agricultural sector.

In agriculture, planned growth is a long-run expectation. Intra-year variability in commodity prices and/or yields can significantly influence actual growth, and farmers' cautious response to uncertainty is well known. Regardless, if planned growth exceeds sustainable growth, then the farm must source capital from other sources, such as increased borrowing or the sale of assets. When planned growth in sales falls short of the sustainable growth rate, assets are being underutilized and cash will generally be accumulated in unproductive ways. This is not the same as risk. From time to time, risk will result in revenues larger than expectations which will increase cash flow and working capital. At other times, revenues below expectations will result in reduced cash flows and will require draws on working capital. Risk, however, plays a central role in planned growth, especially if planned growth involves irreversible investment decisions. The greater the risk the slower will be the rate of planned growth (Dixit and Pyndick, 1994)[1].

This paper first introduces the sustainable growth rate model as a conceptual paradigm and then uses the model to measure sustainable growth rates for Illinois grain and livestock farmers. Time-series cross-sectional regression techniques are applied to a panel farm-level dataset to validate the relevance of the sustainable growth paradigm at the farm business setting. In the latter part of this paper, aggregate farm financial data are used to measure national and regional rates of actual and sustainable growth. The sustainable growth challenge (SGC) concept is used to understand the economic conditions and business decisions made by farmers in certain episodes of the time period analyzed.

As a positivist approach to understanding financial leverage in agriculture, the use of sustainable growth in explaining debt is more than pragmatic. There are three benefits to using the sustainable growth model. First, from a business perspective, the model provides a useful yet simple approach to explaining financial leverage and working capital strategies to farmers; second, from a policy perspective, the inevitability principle provides some guidance as to how public policy can impact leverage decisions at the farm level; and third, from an academic perspective, this paper introduces as new, a tool that has been used by financial practitioners in the non-farm sector since the 1970s (e.g. Higgins, 1977).

The sustainable growth paradigm

Financial leverage in agriculture has been of considerable interest to a wide range of stakeholders for over 20 years. The financial crises of the late 1980s and market

المنارة للاستشارات
www.mana

instability in the late 1990s has exemplified the need to continually investigate models that aid in understanding farm debt decisions. For many, the expected utility-mean-variance approach to modeling farm financial structure decisions has provided considerable insights into the financial leveraging process (Barry and Robison, 1987; Collins, 1985; Barry *et al.*, 1981). Studies that have investigated the relationship between reductions in business risk and increased financial leverage include Collins (1985) and Escalante and Barry (2001) who examine risk balancing in general; Turvey and Baker (1989) who examine relationships between leverage and hedging; Featherstone *et al.* (1988) who examine various issues in agricultural finance and price support policies; Moss *et al.* (1989) who examine capital gains deductions; and Ahrendsen *et al.* (1994) who examine depreciation and investment tax credits.

Sustainable or balanced growth examines the same issue, except from an operating and accounting point of view. It decomposes the returns to equity into four components; profit margin, retention (owner withdrawals), asset turnover and leverage (assets-beginning equity ratio). A decrease in any one of these ratios will lower the sustainable growth rate, and increase the likelihood that financial leverage will be required to sustain the farm. In contrast to the risk-balancing strategy derived in mean-variance models, the sustainable growth rate is proscriptive, as well as explanatory, and can provide insights into farm operating and financial decisions based on readily available accounting information. Furthermore, analyses of financial risk, as per the root model of Barry *et al.* (1981) and Collins (1985) take the variability of the return on assets or equity as given and do not ordinarily examine the operating factors that give rise to such volatility in the first place. The advantage of exploring a sustainable growth rate paradigm is that it possesses such insights. We are unaware of any previous studies that have explored the sustainable growth rate model in the context of agricultural finance, and we believe that this paradigm is a complement to previous studies.

We start off with the principle that anticipated sales (S) are generated from the asset base (A) in a fixed proportion $x = S/A$ and that $\Delta x = (\Delta S/A) - (S/A^2)\Delta A$. Assuming that $\Delta x = 0$, then $\Delta S/\Delta A = S/A$. Next, from the accounting identity that assets equals debt plus equity, $A = D + E$, we obtain $\Delta A/A = (\Delta D/D) + (\Delta E/E) = \Delta S/S$. Now assume that the ratio of debt to equity is held in proportion, then $z = D/E$ and $\Delta D = \Delta E(D/E)$. Assume further that the firm has no desire to dilute ownership by issuing equity, has no capital to invest as equity or does not have access to equity markets. In such circumstance changes to equity are solely the result of accumulated retained earnings. That is, $\Delta E = NI(1 - w)$ with net income NI and owner withdrawals w. We can then write $\Delta D = NI(1 - w)D/E$ and by substitution into $\Delta S/S$, $\Delta S/S = (NI(1 - w)/A)(1 + (D/E))$. To place the right-hand side in the context of sales, multiply it by $S/S = 1$to get

$$\frac{\Delta S}{S} = \frac{NI}{S}(1 - w)\frac{S}{A}\left(1 + \frac{D}{E}\right) \tag{1}$$

Equation (1) is equivalent to Higgins (1981) formula for sustainable growth and can be summarized as follows:

$$g_s = \prod_{i=1}^{4} \gamma_i \tag{2}$$

www.mana

where

$$\gamma_1 = \frac{Income}{Sales}$$
$$\gamma_2 = \frac{Income - Withdrawls}{Income}$$
$$\gamma_3 = \frac{Sales}{Assets}$$
$$\gamma_4 = \frac{Assets}{Equity} = \left[1 + \frac{Debt}{Equity}\right]$$

In Higgins (2000) Higgins uses $\gamma_4^* = Assets/Equity_{beginning} = [1 + (Debt/Equity_{beginning})]$ where $Equity_{beginning}$ is the beginning of period equity. The right hand side values of (1) represent profit margin (γ_1), retention ratio (γ_2), asset turnover (γ_3) and financial leverage (γ_4). At the farm level, the revenue variable is a function of size, productivity and prices. For purposes of this paper, the term "targeted sales growth" refers to intentional increases in the asset base (e.g. acres or head of livestock), prices (e.g. niche or contracted) or productivity (e.g. yield/acre).

Comparing with the DuPont model

Equation (1) is similar in structure to the well-known DuPont formula (see Van Hoorhis, 1981; Eisemann, 1997, Blumenthal, 1998, Firer, 1999 for general discussions; Mishra *et al.*, 2009; Melvin *et al.*, 2004 for agricultural applications), but differs in the use of the variable $Equity_{beginning}$ rather than $Equity_{end}$. While subtle, this is not a trivial difference. For one, the DuPont formula is an identity and as such provides little economic information outside of explaining how the four levers of performance combined to determine the return on equity (ROE). The strategist can examine the levers and decide which one(s) can be adjusted and by how much to obtain (on expectation) a higher or lower ROE. In contrast, the Higgins model defines growth as the percentage change in equity from one period to another and considers what actions must be taken to accomplish this. Nonetheless, the relationship between the DuPont model and the Higgins model is

$$g_s = ROE\left[\frac{Equity_{end}}{Equity_{beginning}}\right], \tag{3}$$

which is obtained by the manipulation

$$\gamma_4^* = \frac{Assets}{Equity_{beginning}}\frac{Equity_{end}}{Equity_{end}} = \frac{Assets}{Equity_{end}}\frac{Equity_{end}}{Equity_{beginning}}. \tag{4}$$

To see that the Higgins model gives the percentage change (or growth) in equity, (1) can be compressed to

$$g_s = \frac{Income - withdrawals}{Equity_{beginning}} = \frac{Equity_{end} - Equity_{beginning}}{Equity_{beginning}}, \tag{5}$$

which uses the accounting identity

المنارة للاستشارات

www.mana

$$Equity_{end} = Equity_{beginning} + Income - withdrawals. \tag{6}$$

Furthermore, by examining (3), it can be seen that growth in equity is not necessarily the same as the ROE except when ending and beginning equity are equal, or when income equals withdrawals.

Higgins' model of balanced growth requires that any planned changes in sales vis-à-vis the scale of the operation rather than positive price movements must be balanced by changes to Equation (1):

$$\mathrm{d}g_s = \frac{\partial g_s}{\partial S}\mathrm{d}S + \frac{\partial g_s}{\partial C}\mathrm{d}C + \frac{\partial g_s}{\partial W}\mathrm{d}W + \cdots + \frac{\partial g_s}{\partial D}\mathrm{d}D \tag{7}$$

and

$$\frac{\mathrm{d}g_s}{\mathrm{d}S} = \frac{\partial g_s}{\partial S} + \frac{\partial g_s}{\partial C}\frac{\mathrm{d}C}{\mathrm{d}S} + \frac{\partial g_s}{\partial W}\frac{\mathrm{d}W}{\mathrm{d}S} + \cdots + \frac{\partial g_s}{\partial D}\frac{\mathrm{d}D}{\mathrm{d}S} \tag{8}$$

where S, C, W and D denote sales, costs, withdrawals and debt, respectively. However it is also important to recognize that while targeted sales growth is an obvious metric in strategic planning, Equation (7) applies to all of the choice variables. For example, if a decision is made to increase owner withdrawals, then (8) takes the form of

$$\frac{\mathrm{d}g_s}{\mathrm{d}W} = \frac{\partial g_s}{\partial W} + \frac{\partial g_s}{\partial S}\frac{\mathrm{d}S}{\mathrm{d}W} + \frac{\partial g_s}{\partial C}\frac{\mathrm{d}C}{\mathrm{d}W} + \cdots + \frac{\partial g_s}{\partial D}\frac{\mathrm{d}D}{\mathrm{d}W} \tag{9}$$

In this study, we focus on the sales (revenue).

An example

Before asking the fundamental question to this study of whether or not farmers' financial decisions are consistent with Higgin's (1977) notion of sustainable growth, it is worth pursuing an example that places the concept in context. The dairy industry in New York is facing constant competition from large dairies in California and the Midwestern states. There is a significant gap between the average herd size of 80 cows, and to many farmers it is believed that any herd size less than this cannot grow quick enough to remain competitive. The 2005 New York Dairy Farm Business Summary for farms with 80 farms or fewer (Knoblauch *et al.*, 2006) provides the following data obtained from a survey of 47 small herd farms.

$$E_{2004} = 413{,}955$$
$$E_{2005} = 438{,}201$$
$$A_{2005} = 565{,}361$$
$$D_{2005} = 127{,}160$$
$$NI_{2005} = 40{,}248$$

$$Withdrawals_{2005} = 35{,}830$$
$$w_{2005} = 0.10976$$
$$S_{2005} = 188{,}406$$

المنارة للاستشارات
www.mana

Using the related formulas,

$$\gamma_1 = \frac{Income}{Sales} = \frac{40{,}248}{188{,}406} = 0.2136$$

$$\gamma_2 = \frac{Income - Withdrawals}{Income} = 1 - \frac{35{,}830}{40{,}248} = 0.10976$$

$$\gamma_3 = \frac{Sales}{Assets} = \frac{188{,}406 + 9{,}490}{565{,}361} = 0.35$$

$$\gamma_4^* = \frac{Assets}{Equity} = \left[1 + \frac{Debt}{Equity}\right] = 1 + \frac{565{,}361}{413{,}955} = 1.366$$

sustainable growth is given by

$$g_s = 0.2136 \times 0.10976 \times 0.35 \times 1.366 = 0.0112 = 1.12\%.$$

A sustainable growth rate of 1.12 percent suggests that it would be very difficult for a typical small herd farmer in New York to increase sales by simply increasing the herd size. In order to keep the current financial structure in balance, growth is constrained to very modest rates indeed. One possibility is to take on off-farm employment to reduce the amount of owner withdrawals. Suppose withdrawals are eliminated (and thus takes a value of 0 in the g_s equation), then the most the farm can grow is 10.21 percent. Alternatively, the farm can free up working capital by reducing expenses through increased efficiencies. Suppose this can be done costlessly so that the profit margin increases to 0.30. Without withdrawals, sustainable growth will be 14.3 percent. However, if withdrawals are still in place, growth rises only modestly to 1.57 percent. In the absence of off-farm employment, many farmers are indeed stuck. The only real possibility is to increase debt or decrease equity. Suppose a new debt to equity target is established at 100 percent so that the asset to equity ratio increases from 1.36 to 2.0, then farm's sustainable growth rate is 1.64 percent, which again is only a modest increase.

One can see the dilemma faced by many small scale farmers and the rising need for off-farm employment to free up working capital. The growth paradox might suggest that small farms might find it easier to grow because the fixed costs of expansion would be much smaller for a 53 cow herd to double to 106 than a 530 cow herd doubling to 1,060. But herein lies the paradox. Growth is relative and independent of scale. It depends on the financial balance amongst the various levers of performance that give rise to sustainability. The larger farm might have a higher sustained rate of growth because it is more cost efficient, has the greater flexibility or capability to increase the profit margin, is less reliant on a large proportion of retained earnings for withdrawals, has more efficient utilization of assets achieving greater economies of size, and is better able to absorb higher debt. These aspects of the farm business provide greater amounts of working capital to the business, both individually and collectively. Consider the possibility of a larger farm able to obtain 20 percent greater profit margin, withdrawals of only 10 percent, sales/assets 20 percent higher and the ability to carry 20 percent more debt relative to assets. The sustainable growth rate under these assumptions is 13.9 percent.

المنارة للاستشارات

www.mana

Sustainable growth strategies

If one views the sustainable growth rate as an economic target, its connection with aggregate supply becomes immediate. In periods of high commodity prices or positive technological change, increased farm revenues will lead to increased growth if there are sufficient economies of scale to ensure that profit margins increase. If these economies exist then there will be increased efficiency in the use of assets, increasing the asset turnover. If the effects on land (or other assets) values are neutral then growth will occur and will be sustainable even without having to borrow to fund the growth. But this does not always happen in agriculture. One of the unique attributes in agriculture is the endogeneity of positive cash flows on land values. Simply put, during sustained growth, land values rise, thus increasing the asset base and decreasing asset turnover. As land values increase, the only opportunity to maintain the targeted growth rate is to increase financial leverage (assets-beginning equity ratio) or decrease owner withdrawals (or both). Later we argue that this is precisely what happened leading up to the land price bust of the late 1980s. In fact much of Higgins (1977, 1981) dealt with the impact of inflation in much the same manor, and at least in the context of the Fisher effect real sustainable growth nets out inflation from nominal growth.

When the agricultural economy cycles into a lower price regime, perhaps best characterized by Ezekiel's (1938) cobweb model or Cochrane's treadmill (see Levins, 2000), an opposite effect takes place. Lower profit margins reduce the sustainable growth target. As the target falls, so will investment, and there will be less demand for term or operating credit. A lower, stable growth path is more conservative, and with less demands on cash flow, debt can be paid down or at least not increased. As operating cash flows fall, so ultimately will asset values, improving the efficiency of those assets until new growth equilibrium occurs. Later we provide evidence that this is precisely what happened in the early to mid-1990s.

It has long been argued that increases in farm size have been justified based on economies of scale that reduce costs on a per unit basis. If output increases at a lower per unit cost, the anticipated profit margin would increase. Holding all other factors constant, economies of scale can be used to justify a balanced growth strategy with increased sales. That is, if farm expansion coincides with increased sales (active growth) without achieving economies of scale (actual growth exceeds sustainable growth) then the balance can only be maintained by decreasing household consumption, increasing financial leverage or increasing asset turnover. This latter consideration has also been the focus of considerable interest in the agricultural finance literature. If sales can increase without having to increase the asset base, even if profit margins remain constant, then increased sales growth can be balanced with sustainable growth. Perhaps this is best illustrated by comparing the sustainable growth rate model for a beginning farmer paying the market rate for farm assets. In comparison to an existing farmer of identical scale and consumption habits, but with a lower book value of assets, the beginning farmer will have a lower asset turnover. In order to achieve the same sustainable growth rate target as the existing farmer, the beginning farmer will have to increase financial leverage. But, if the land base is subjected to speculative prices, then the sustainable growth rate target of the beginning farmer may simply not be achieved, especially if the beginning farmer is credit constrained. In other words, if increased profit margins are not sufficient to offset lower asset turnover, then sustainable growth rates would fall. Even if land is priced to fundamentals but farmers are credit constrained, the sustainable growth rate at best stipulates the maximum growth rate that can be achieved and at worst cannot be

المنارة للاستشارات
www.mana

obtained (Platt *et al.*, 1995). Ultimately, cash shortages will arise and, either household consumption will have to decrease or financial leverage will have to increase. If neither of these can be achieved, then growth can only be brought into balance if the asset (e.g. land) base is reduced, i.e. sold.

The sustainable growth relationships show how increases in sales via increased productivity or sophisticated marketing must be managed. Balanced growth occurs when the percentage change in sales from one period to the next is equal to the sustainable growth rate. If this happens, then no adjustments need to be made to the profit margin, owner withdrawals, asset turnover or leverage.

The sustainable growth challenge

The difference between the growth in sales and the sustainable growth rate is referred to as the SGC (Higgins, 2003), i.e.

$$SGC = \ln\left(\frac{Revenue_t}{Revenue_{t-1}}\right) - g_s \qquad (10)$$

Ex ante, if targeted sales, or in this case revenues, increase faster than the sustainable growth rate, the SGC is positive and operating and financial adjustments need to be made in order to restore an accounting and operating balance such that SGC $\rightarrow 0$. This is accomplished by increasing the sustainable growth rate g_s. For example, suppose a dairy farmer wanted to increase the number of milking cows, a beef farmer the number of calves in the feedlot or a grain farmer the number of acres planted to a cash crop, any or all of the following must support the targeted increase in sales: an increase in profitability (decrease in costs), a decrease in owner withdrawals, an increase in asset turnover or an increase in financial leverage. In contrast, if the SGC is negative such as might occur with scale inefficiencies in the utilization of existing resources, targeted sales growth will be lower than the sustainable growth rate. Consequently, unproductive cash surpluses will increase and to drive SGC $\rightarrow 0$ adjustments must be made to decrease the sustainable growth rate g_s: either sales must decrease (such as might occur when herd size or acres planted are reduced without changing the scale of the operation), owner withdrawals increase, asset turnover decreases or financial leverage is reduced.

In terms of aggregate supply, the operating and financial decisions as discussed above illustrate how year-to-year changes in supply are far more complex, at least in the short run, than suggested by a price-taking economy. In order to respond to market signals, farmers must weigh many internal operating and financial requirements before a response can be made. The farm sector's inability to respond instantaneously is not a trivial factor in the inelasticity of supply.

The empirical framework

It would appear from the above discussion that farmers must constantly adjust the levers of performance in response to not only market conditions but also growth strategies. The need for short term working capital to operate growth on the one hand while responding to markets on the other is a truism from an accounting point of view but is it also a truism obeyed by farm businesses? And if farms do respond to growth challenges as described above, which levers of performance become more prevalent?

The empirical content is comprised of two separate analyses. First, we examine in detail the levers of performance at the farm level using data from Illinois. Because of

المنارة للاستشارات

www.mana

the interrelationships between the four levers of growth, we use a seemingly unrelated regression (SUR) model to determine which of the four levers of performance are most commonly used to adjust for growth challenges. We are also able to determine if there are significant differences in adjustment between cash crop and livestock farmers. For the farm-level analyses, we utilize a rich farm-level panel dataset comprised of 251 grain and livestock farms participating under the Illinois Farm Business Farm Management (FBFM) record-keeping program. The FBFM system has an annual membership of about 7,000 farmers. However, rigorous certification procedures implemented by FBFM field staff usually results in much fewer farms with certified financial and family living records. Moreover, an additional criterion restricts the panel dataset only to farms that received continuous record certification from the FBFM from 1995 to 2001.

The second analysis flows from the first and examines aggregate US farm data to provide an historical perspective of changes in the SGC over time. Our micro-level results provide strong support for the balanced-growth model at the farm level, but leaves open the question of whether balanced growth is an economically significant driver at the aggregate or macro level. Using national data, we examine the proposition that $SGC \rightarrow 0$. That is, no matter what, we would expect economic forces at the aggregate and farm level to pressure $SGC \rightarrow 0$ regardless of whether at any moment in time $SGC > 0$ or $SGC < 0$. Our estimates of sustainable and actual business growth rates for the USA farm sector were obtained from the farm balance sheet and income statement information compiled by the United States Department of Agriculture (USDA) at the state level from 1980 to 2001. Sustainable growth rates were derived from measures of farm equity returns, calculated using net worth value at the beginning of each year, and the farm business' earnings retention rate for the year. The latter measure is merely estimated since the USDA's reporting format uses only aggregate financial measures and leaves out details concerning the inflows and outflows to the farm equity account such as non-farm incomes, family living withdrawals and both unrealized and realized capital gains from property appreciation and sales, respectively. We therefore used an approximation of the earnings retention rate using net farm income levels realized for the year and the beginning and ending levels of farm net worth. The approximated rates of sustainable growth are then compared to the actual farm revenue growth rates to calculate the SGC rates.

Farm-level descriptive summary

Table I presents a summary of the mean values of the financial performance and growth measures for 197 grain and 54 livestock farms that consistently received FBFM record certification during the period 1995-2001. The results indicate that, on average, livestock farms, relative to crop farms, have lower financial efficiency ratios, higher proportions of assets to equity, and higher earnings retention rates. Livestock farms registered a higher average revenue growth rate of 9.06 percent per year, but lower sustainable growth rate of -1.57 percent, than crop farms during the period. Figure 1 plots the revenue and sustainable growth rates along with the resulting SGC rates for all farms. The trends in Figure 1 indicate less fluctuation in average sustainable growth rates that mostly settle along the x-axis. The highly volatile commodity prices experienced by farmers in 1998-2001 resulted in wide swings in average revenues which consequently influenced the SGC values.

المنارة للاستشارات

www.mana

Developing the econometric model

One of the issues not explained by Higgins is the issue of signaling and causality. What is clear is that any discrepancy between sustainable and actual growth must be remedied. This is not simply an economic argument but an accounting argument as well. The economic question is whether the adjustment to the levers of performance occurs *ex ante* to put a strategy in place, or as a response *ex post* to the outcomes of strategies, or indeed a combination of the two. It seems reasonable, given uncertainties in production, costs and market prices that farmers make cropping and stocking decisions in advance based on reasonable expectations rooted in production economics. These decisions will also take into account owner withdrawals for family living expenses. Hence it is reasonable to assume, *ex ante*, that those expected values of financial efficiency and retention are determined. Decisions might also be made with respect to asset turnover, leaving the leverage ratio to pick up the slack. The amount of debt requested will be no less than that required to maintain balanced growth. Farm plans submitted to lenders to acquire sufficient loans or credit lines is evidence of the order in which the levers of performance are determined *ex ante*.

At harvest, with uncertainties resolved, the true parameters of growth are known and growth is rebalanced. For example, if financial efficiency is high (e.g. higher sales

Table I. Mean values of farm-level financial performance and growth measures, Illinois grain and livestock farms, 1997-2001

Measures	All farms	Grain farms	Livestock farms
Number of farms	251	197	54
Financial efficiency ratio	0.15	0.16	0.13
Asset turnover ratio	0.26	0.26	0.26
Leverage ratio	1.89	1.77	2.33
Earnings retention rate (%)	43.96	40.66	56.01
Annual revenue growth (%)	4.64	3.42	9.06
Sustainable growth rate (%)	−0.39	−0.07	−1.57
SGC (%)	5.03	3.49	10.63

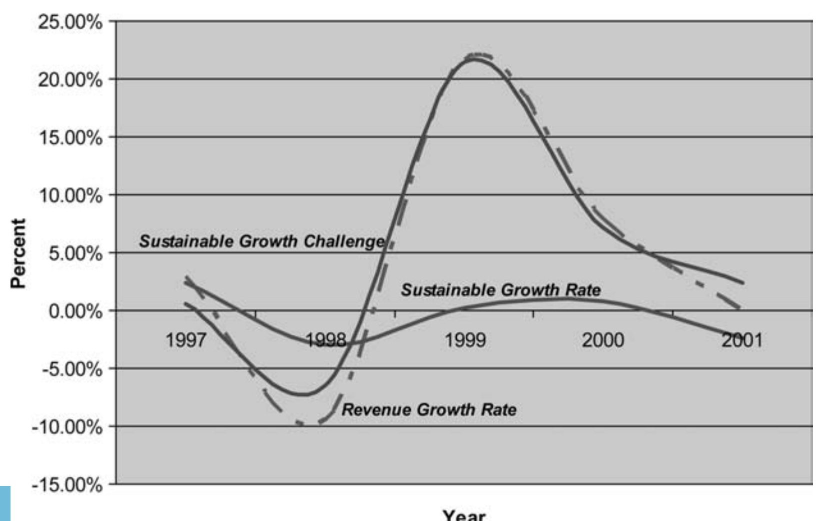

Figure 1. Rates of revenue growth, sustainable growth and SGC, Illinois Grain and Livestock Farms, 1997-2001

المنارة للاستشارات
www.mana

and/or lower costs) and sustainable growth exceeds actual growth then decisions could involve reducing debt, acquiring capital or increasing withdrawals. This framework requires a continuous balancing of sustainable and actual (or expected growth) and suggests that the balancing is simultaneously determined. *Ex ante* decisions determine the sustainable growth rate based on expectations of actual growth, and *ex post* the sustainable growth rate is brought into balance based on observable outcomes of actual growth. Since sustainable growth rates determine production decisions and production decisions ultimately determine sustainable growth, it is necessary to measure the influences jointly using SURs.

The SUR model

The basic SUR system assumes that for each individual observation i there are M cross-sectional units, each with its own linear regression model (Greene, 2003):

$$y_{ij} = X_{ij}\beta_{j+}\varepsilon_{ij}, \quad i = 1, \ldots, N, j = 1, \ldots, M. \tag{11}$$

The distinct property of the SUR model is that it allows non-zero covariance between error terms ε_{ij} and ε_{ik} for a given individual i across equations j and k:

$$Cov(\varepsilon_{ij}, \varepsilon_{ik}) = \sigma_{;ij} \tag{12}$$

$$Cov(\varepsilon_{ij}, \varepsilon'_{ik}) = 0 \; if \; i \neq i'. \tag{13}$$

In this study, we employ the *sureg* procedure available in Stata which uses the asymptotically efficient, feasible generalized least-squares algorithm developed in Greene (2003). The resulting GLS estimator, which was designed to address heteroscedastic and autocorrelated disturbances, is given by the following:

$$\beta = [X'\Omega^{-1}X]^{-1}X'\Omega^{-1}y = [X'(\Sigma^{-1} \otimes I)X]^{-1}X'(\Sigma^{-1} \otimes I)y. \tag{14}$$

Our model includes the following five equations, one for each of the four levers of performance as the dependent variable and lagged dependent and SGC as independent variables, plus a fifth equation with SGC as the dependent variable with the year-to-year changes in the levers of performance as independent variables:

$$\begin{aligned} FINRAT_t &= \beta_{01} + \beta_{11}FINRAT_{t-1} + \beta_{21}SGC_t + \beta_{31}LVSTK + \varepsilon_1 \\ ATO_t &= \beta_{02} + \beta_{12}ATO_{t-1} + \beta_{22}SGC_t + \beta_{32}LVSTK + \varepsilon_2 \\ LEV_t &= \beta_{03} + \beta_{13}LEV_{t-1} + \beta_{23}SGC_t + \beta_{33}LVSTK + \varepsilon_3 \\ ERR_t &= \beta_{04} + \beta_{14}ERR_{t-1} + \beta_{24}SGC_t + \beta_{34}LVSTK + \varepsilon_4 \\ SGC_t &= \beta_{05} + \beta_{15}CHGFINRAT_{t-1tot} + \beta_{25}CHGATO_{t-1tot} \\ &\quad + \beta_{35}CHGLEV_{t-1tot} + \beta_{45}CHGERR_{t-1tot} + \beta_{55}LVSTK + \varepsilon_5 \end{aligned} \tag{15}$$

where *FINRAT* is the financial efficiency ratio, *SGC* is the rate of sustainable growth challenge, *LVSTK* is the farm enterprise dummy variable (taking on a value of 1 for livestock farms and 0 for grain farms), *ATO* is the asset turnover ratio. *LEV* is the asset-beginning equity ratio, *ERR* is the earnings retention rate and *CHG* prefixes denote rate of annual change in the values of the financial performance variables.

المنارة للاستشارات
www.mana

This system of equations is estimated for a general model based on all farm observations in the sample as well as two enterprise models, grain and livestock, that are estimated without the farm enterprise dummy variable. The SUR approach to this empirical issue is justified by the results of the Breusch and Pagan test of independence conducted on the different models. The tests indicate the presence of contemporaneous correlation between residuals of the equations in each system/model.

Econometric results

The results of the SUR models reported in Table II provide interesting and intuitive implications. The lagged financial efficiency variable is positively related to observed

Variables	All farms	Grain farms	Livestock farms
A. Dependent Variable: Financial efficiency ratio			
Intercept	0.07580* (0.00715)	0.07529* (0.00732)	0.03927* (0.01528)
Lagged financial efficiency ratio	0.42875* (0.02607)	0.43284* (0.02940)	0.49667* (0.05190)
Sustainable growth challenge	0.12445* (0.01295)	0.11841* (0.01590)	0.12397* (0.02410)
Livestock dummy variable	−0.02656* (0.01135)		
χ^2	290.44*	220.38*	94.66*
R^2	0.1414	0.1655	0.0627
B. Dependent Variable: Asset turnover ratio			
Intercept	0.03180* (0.00461)	0.02450* (0.00456)	0.06434* (0.01205)
Lagged asset turnover ratio	0.81551* (0.01314)	0.83363* (0.01327)	0.71876* (0.03989)
Sustainable growth challenge	0.08963* (0.00613)	0.15264* (0.00758)	−0.00547 (0.01007)
Livestock dummy variable	−0.00356 (0.00593)		
χ^2	4,003.68*	4,184.23*	325.25*
R^2	0.6785	0.7418	0.3765
C. Dependent Variable: Leverage ratio (Assets/Beginning Equity)			
Intercept	1.33523* (0.09326)	1.36766* (0.06659)	1.42652* (0.24059)
Lagged leverage ratio	0.19434* (0.02150)	0.21328* (0.02231)	0.14367* (0.04286)
Sustainable growth challenge	2.10445* (0.17006)	0.16769 (0.15713)	5.18184* (0.38333)
Livestock dummy variable	0.29475** (0.16199)		
χ^2	240.23*	92.36*	189.78*
R^2	0.1520	0.0366	0.4001
D. Dependent Variable: Earnings retention rate			
Intercept	0.37690 (0.44436)	0.39525 (0.49483)	0.38088 (0.32482)
Lagged earnings retention rate	−0.00212 (0.03103)	−0.00125 (0.03504)	−0.02435 (0.06436)
Sustainable growth challenge	0.89890 (1.01032)	0.35361 (1.49623)	1.82391* (0.57214)
Livestock dummy variable	0.08889 (0.95616)		
χ^2	0.83	0.06	10.30*
R^2	0.0003	−0.0002	0.0505
E. Dependent Variable: Sustainable Growth Challenge			
Intercept	0.03888* (0.01049)	0.03778* (0.00813)	0.07360* (0.03017)
Change in financial efficiency ratio	0.00092 (0.00073)	0.00087 (0.00055)	−0.00128 (0.00831)
Change in asset turnover ratio	0.46054* (0.01939)	0.53436* (0.01787)	0.17847* (0.05424)
Change in leverage ratio	0.01764* (0.00151)	0.05558* (0.01141)	0.01964* (0.00233)
Change in earnings retention rate	0.00003 (0.00003)	−0.00002 (0.00011)	0.00004 (0.00005)
Livestock dummy variable	0.03108 (0.02274)		
χ^2	677.92*	902.50*	78.13*
R^2	0.2671	0.3824	0.2201

Notes: *, ** denote significance at the 1 and 10 percent confidence levels, respectively

Table II. Results of farm-level econometric analyses using seemingly unrelated regressions (SUR), 1995-2001 (standard errors in parentheses)

المنارة للاستشارات

www.mana

financial efficiency but not on a one-to-one basis. The current year's financial efficiency is about 43 and 50 percent of the lagged value for grain and livestock farms, respectively. The rate of SGC is an additional significant positive indicator of variations of financial efficiency ratios for both types of farms.

On the other hand, the effects of lagged asset turnover rates on observed asset turnover rates are much higher at 83 and 72 percent for grain and livestock farms, respectively. This is expected given asset fixities and the comparative results among farm types suggest that livestock producers have greater flexibility in production throughout the year. Moreover, grain farmers appear to use the asset turnover ratio to balance growth given the significant positive coefficient of the SGC variable. This is consistent with the results obtained by Escalante and Barry (2002) confirming the grain farmers' use of asset productivity-enhancing strategies to attain higher business growth rates.

The evidence here also suggests that livestock farms do not use the asset productivity-related strategies for balancing growth. Rather, livestock farms rely more on leverage-related strategies. In the leverage equations, the SGC variable is significantly positive for livestock farms, but insignificant for grain farms. Among livestock farms, there is little, albeit significant, relationship (at 14 percent) between debts in two consecutive periods, perhaps suggesting a flow from revolving lines of credit. These farmers, however, are more likely to balance growth using financial leverage than operating efficiencies. Grain farmers, on the other hand, rely more heavily on production efficiency-related strategies (affecting financial efficiency and asset turnover rates) to balance growth. This may be because grain farmers have greater opportunities to employ enterprise or production diversification plans than livestock farmers.

Earnings retention is a significant growth balancing strategy only among livestock farmers. Notably, the earnings retention equation for grain farms does not have any overall significant explanatory power. This suggests that grain farmers do not relate retentions or withdrawals in one period to the next. Decisions on earnings retention seem to be not consciously made to balance growth.

Among the estimating equations for the four levers of performance, only the leverage equation for livestock farms and the asset turnover equations for all farms and both farm types produced R^2 values that exceed 30 percent. The rest of the estimating equations produced marginal R^2 values ranging from 3.6 to 16.5 percent. Consistent with these results, the significant regressors in the fifth estimating equation for SGC are asset turnover and leverage ratios.

National and regional rates of SGC

The preceding analysis provided strong evidence that farmers in Illinois employ a number of strategies to balance growth. The results show that there are differences between cash crop and livestock producers largely due to differences in the fixity of assets and flexibility in operating strategies. Earlier we argued that in addition to macroeconomic influences on the agricultural economy there were also micro influences as well and these, we argue, are due to balancing the various levers of performance to manage growth. While this appears to be the case for Illinois farmers, is there a general truth to the proposition at the national level? In this section we apply the sustainable growth model to aggregate data, again using the SGC as the primary unit of measurement.

Figure 2 presents a plot of actual growth, sustainable growth and the resulting SGC rates for USA farms during the period 1981-2001. The trends indicate a tendency for

المنارة للاستشارات
www.mana

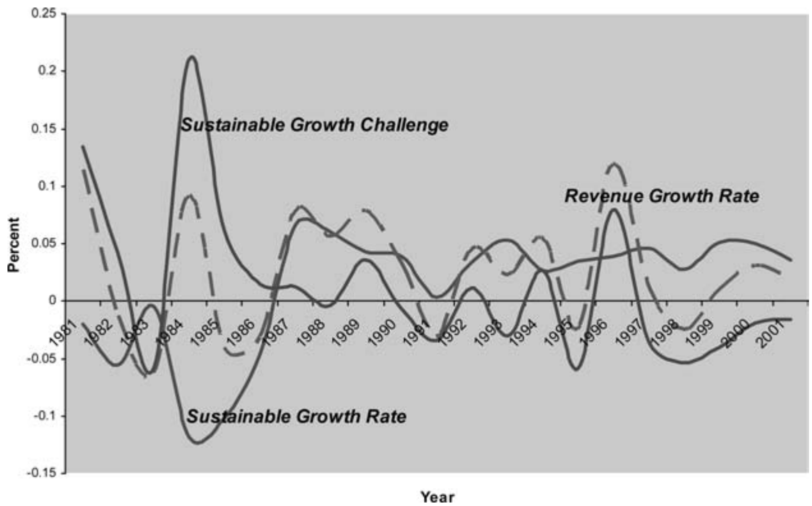

Figure 2.
Rates of actual growth, sustainable growth and SGC, US farms, 1981-2001 (Financial Data from the USDA-ERS)

farms to experience positive SGCs in the 1980s. Interestingly, the farm sector was plagued with declining commodity prices during this period, although farmers continued to receive substantial counter-cyclical subsidies from the government. However, it appears that positive SGCs can be largely attributed to lower rates of sustainable growth for the farm sector during these years, instead of the industry's capacity to generate higher actual revenues. This is a direct result of the rapid depletion of farm equity, indicative of the severe financial crises experienced by most farm businesses at that time. As far back as the mid to late 1970s, the farm sector's loan to value ratios had increased significantly, thus, enabling farmers to increase asset holdings even with less equity commitment. During this time, farmers were able to monetize their unrealized capital gains as the appreciation of land values allowed farmers to borrow beyond the farm's actual repayment capacity. The dramatic decline of land values in the 1980s, however, ushered in a period of severe financial stress as the real concern for debt repayment capacity surfaced for farm borrowers that incurred debts beyond the affordable limit.

In the 1990s, reforms and conservative credit policies implemented by lenders pressured farmers to make more cautious borrowing decisions. As business expansion plans were more synchronized with actual farm production and financial capabilities, the SGC values in the early to mid-1990s in Figure 2 border along the horizontal axis, suggesting only slight differences between realized and sustainable growth rates. Notably, the SGC values have been negative from 1998 to 2001, consistent with the steady plunge of farm commodity prices during this period. Moreover, radical changes in federal policy towards agriculture involve a shift from market-based to fixed, decoupled production and price support payments. Although the federal government later disbursed large *ad hoc* farm income subsidy appropriations, most farms actually realized lower business growth rates due to perceptions of increased income volatility and uncertainty.

Tables III-V report actual farm revenue growth rates, estimates of the rate of sustainable growth and the resulting SGC rates, respectively, for the ten production regions in the country. The USDA has actually introduced a newer scheme for classifying counties in each state into major farm resource regions, however, since our

المنـــارة للاستشارات
www.mana

Year	APL[a]	CB[b]	DS[c]	LS[d]	MTNS[e]	NE[f]	NPLNS[g]	PCFC[h]	SE[i]	SPLNS[j]	All states
1981	14.46	10.98	16.20	7.98	−0.15	12.63	16.90	2.06	16.53	13.16	11.42
1982	−1.37	−3.90	−2.56	0.14	−1.81	4.49	4.38	4.38	−1.27	0.92	−1.31
1983	−8.47	−15.53	−4.30	−6.82	1.72	1.67	−3.94	8.86	−4.66	−4.60	−6.27
1984	12.34	21.29	8.33	7.67	−0.58	1.62	9.84	−1.01	9.05	−0.24	9.18
1985	−9.28	−2.10	−9.34	−5.18	−6.16	−1.20	−1.48	−3.10	−6.98	−2.41	−4.02
1986	−4.84	−6.76	−9.29	−3.49	2.27	0.39	−4.09	6.95	−5.01	−0.87	−3.15
1987	7.70	4.01	17.61	5.49	10.90	5.01	5.48	6.69	13.26	9.96	7.86
1988	8.48	1.72	16.63	−1.56	9.50	5.71	1.82	6.17	12.14	11.44	5.64
1989	7.89	12.82	1.30	17.34	7.14	4.71	3.95	4.75	12.99	1.89	7.85
1990	3.86	0.08	−0.11	−1.08	4.58	2.89	11.30	2.95	−8.36	7.60	3.22
1991	−0.68	−7.83	2.51	−5.05	−0.26	−3.46	−5.66	−2.04	7.25	−1.24	−3.09
1992	7.03	11.99	5.67	0.03	−2.65	5.53	7.76	1.35	−1.10	−0.40	4.50
1993	2.79	−3.61	2.05	−1.06	13.95	−1.17	−2.45	9.90	2.36	6.96	2.22
1994	5.70	8.88	9.17	10.72	−3.93	4.35	7.01	4.54	8.89	1.84	5.36
1995	−1.77	−7.43	−3.00	−1.56	2.38	−2.60	−7.84	0.59	−0.99	−5.70	−2.45
1996	7.19	20.99	16.65	9.55	4.76	7.02	22.65	7.89	9.58	−0.58	11.86
1997	1.66	0.74	−5.06	−1.22	6.92	−3.32	−6.82	3.04	2.15	13.49	1.00
1998	0.20	−6.75	−4.73	1.89	−0.03	2.10	3.55	−3.15	−0.44	−7.10	−2.53
1999	−3.62	−4.97	5.47	1.17	3.75	−0.63	−0.35	1.40	2.18	12.47	1.02
2000	12.48	9.35	−6.90	−1.86	2.94	3.42	6.36	4.37	−0.90	−2.55	3.09
2001	−2.76	1.97	7.58	2.64	4.34	0.66	0.16	−0.50	6.52	1.97	1.99

Notes: [a]The Appalachian states include Kentucky, North Carolina, Tennessee, Virginia and West Virginia; [b]The Corn Belt states include Illinois, Indiana, Iowa, Missouri and Ohio; [c]The Delta States are Arkansas, Louisiana and Mississippi; [d]The Lake States are Michigan, Minnesota and Wisconsin; [e]The Mountain States are Arizona, Colorado, Idaho, Montana, Nevada, New Mexico and Wyoming; [f]The Northeast Region includes Connecticut, Delaware, Maine, Maryland, New Hampshire, New Jersey, Pennsylvania, Rhode Island and Vermont; [g]The Northern Plains includes Kansas, Nebraska, North Dakota and South Dakota; [h]The Pacific Region includes Alaska, California, Hawaii, Oregon and Washington; [i]The Southeast Region includes Alabama, Florida, Georgia and South Carolina; and [j]The Southern Plains includes Oklahoma and Texas

Table III.
Average rates of actual revenue growth of US farms (percent), by region, 1981-2001

dataset are aggregated at the state level we had to resort to the older farm production regional classification system which recognized state boundaries in defining the regions. Hence, the regions considered include the Northeast, Lake States, Corn Belt, Northern Plains, Appalachian, Southeast, Delta States, Southern Plains, Mountains and the Pacific. These groupings defined regions as neighboring states with similar production practices and resource characteristics.

Table VI presents statistical measures for each region to analyze differences in SGC patterns at certain time periods. The summary indicates overall positive mean SGC rates across all regions in the 1980s, with mean SGC rates ranging from 1.52 percent for the Northeastern states to 8.70 percent for the Delta States. The results indicate that the rapid growth in productivity and expansion throughout the 1980s was far in excess of what could have been sustained at that time. This trend, as discussed above, is well known. Farmers across the USA financed the growth of their farm businesses with increased borrowing to an extent that was not sustainable. The relative variability indicators (coefficient of variation) are considerably small, with a high of 3.28 percent for the Northeastern states and a low of 0.67 percent for the Mountain states.

In the1980s, positive SGC rates were the result of fluctuating actual revenue growth rates (Table III) and (almost consistently) negative sustainable growth rates (Table IV),

المنارة للاستشارات
www.mana

Table IV. Average rates of sustainable growth of US farms (percent), by region, 1981-2001

Year	APL[a]	CB[b]	DS[c]	LS[d]	MTNS[e]	NE[f]	NPLNS[g]	PCFC[h]	SE[i]	SPLNS[j]	All states
1981	−2.06	−9.98	−4.44	−3.36	0.52	1.28	−0.89	3.27	−6.58	2.45	−2.03
1982	−2.04	−10.33	−9.64	−5.73	−5.12	−2.47	−5.79	0.57	−3.69	−2.11	−5.51
1983	−0.66	−3.34	0.53	−3.65	0.54	1.49	−3.70	0.02	−3.38	1.17	−0.46
1984	−7.75	−22.54	−8.96	−15.99	−9.43	0.56	−19.38	−7.48	−5.76	−8.46	−11.84
1985	−2.64	−10.30	−13.15	−13.24	−11.48	2.59	−11.51	−5.24	−2.81	−14.48	−10.27
1986	−1.05	−5.47	−12.77	−8.81	−2.53	4.57	−6.08	−8.85	0.98	−6.26	−4.59
1987	−0.44	5.43	3.51	8.21	0.84	5.53	7.66	−0.22	5.73	3.12	6.59
1988	2.84	3.74	1.81	3.96	1.46	5.92	5.35	4.33	6.01	0.95	6.04
1989	3.06	2.91	−0.59	6.12	0.48	1.91	3.95	5.31	6.36	0.13	4.27
1990	−0.27	3.89	2.59	6.26	4.10	−1.77	2.77	5.23	1.41	0.39	3.86
1991	2.51	0.70	−2.74	0.55	0.19	−0.71	−2.09	−0.87	0.15	0.46	0.33
1992	4.71	3.47	2.81	3.22	−4.24	6.47	2.10	1.67	3.94	4.52	3.37
1993	2.33	2.88	2.81	−0.05	6.78	−0.79	3.93	2.69	3.97	2.98	5.28
1994	5.13	3.57	3.43	2.18	2.74	0.05	1.87	0.54	5.07	1.13	2.70
1995	3.13	2.36	2.66	3.28	2.59	−0.12	1.14	1.73	1.89	−2.13	3.43
1996	2.97	5.33	0.21	3.26	2.42	0.13	4.94	2.19	1.72	2.45	3.92
1997	2.88	4.93	4.19	1.71	3.13	−1.76	3.79	0.81	3.71	4.82	4.61
1998	0.62	2.66	4.16	3.57	0.06	2.24	−0.29	2.41	2.90	0.21	2.78
1999	2.96	1.96	4.18	4.55	3.49	−2.49	5.12	0.73	2.50	3.12	5.07
2000	5.53	2.65	1.29	2.63	2.43	3.78	3.33	1.55	5.91	4.88	4.98
2001	2.15	2.22	1.78	1.89	1.16	2.82	1.34	1.20	5.39	4.34	3.59

Notes: [a]Appalachian; [b]Corn Belt; [c]Delta States; [d]Lake States; [e]Mountain States; [f]Northeast; [g]Northern Plains; [h]Pacific; [i]Southeast; and [j]Southern Plains

Table V. Average rates of sustainable growth challenge of US farms (percent), by region, 1981-2001

Year	APL[a]	CB[b]	DS[c]	LS[d]	MTNS[e]	NE[f]	NPLNS[g]	PCFC[h]	SE[i]	SPLNS[j]	All states
1981	16.52	20.96	20.63	11.34	−0.67	11.35	17.79	−1.21	23.11	10.72	13.45
1982	0.68	6.43	7.09	5.87	3.31	6.96	10.17	3.81	2.42	3.03	4.20
1983	−7.81	−12.20	−4.83	−3.17	1.18	0.18	−0.24	8.84	−1.28	−5.78	−5.81
1984	20.09	43.84	17.29	23.66	8.85	1.06	29.22	6.47	14.80	8.23	21.02
1985	−6.64	8.20	3.82	8.05	5.33	−3.80	10.03	2.14	−4.16	12.07	6.25
1986	−3.79	−1.29	3.49	5.32	4.81	−4.18	1.99	15.80	−5.98	5.39	1.45
1987	8.14	−1.41	14.09	−2.71	10.06	−0.52	−2.17	6.91	7.54	6.84	1.27
1988	5.64	−2.03	14.82	−5.52	8.04	−0.21	−3.53	1.84	6.12	10.49	−0.41
1989	4.83	9.91	1.88	11.22	6.66	2.80	0.01	−0.56	6.64	1.76	3.58
1990	4.13	−3.81	−2.71	−7.34	0.48	4.66	8.53	−2.28	−9.78	7.21	−0.64
1991	−3.19	−8.52	5.25	−5.60	−0.45	−2.76	−3.57	−1.18	7.10	−1.70	−3.41
1992	2.32	8.53	2.86	−3.18	1.59	−0.94	5.66	−0.32	−5.04	−4.93	1.13
1993	0.45	−6.49	−0.75	−1.01	7.18	−0.38	−6.38	7.21	−1.61	3.98	−3.06
1994	0.58	5.31	5.74	8.54	−6.66	4.29	5.15	4.00	3.81	0.71	2.66
1995	−4.90	−9.79	−5.66	−4.85	−0.21	−2.48	−8.98	−1.14	−2.88	−3.57	−5.88
1996	4.23	15.65	16.44	6.29	2.33	6.88	17.71	5.69	7.87	−3.04	7.94
1997	−1.22	−4.19	−9.26	−2.93	3.78	−1.56	−10.61	2.24	−1.56	8.68	−3.61
1998	−0.42	−9.41	−8.89	−1.68	−0.08	−0.15	3.85	−5.56	−3.33	−7.32	−5.31
1999	−6.58	−6.93	1.30	−3.38	0.26	1.86	−5.46	0.67	−0.32	9.36	−4.05
2000	6.96	6.70	−8.19	−4.48	0.52	−0.36	3.03	2.82	−6.81	−7.43	−1.89
2001	−4.91	−0.24	5.80	0.75	3.18	−2.17	−1.18	−1.69	1.14	−2.37	−1.60

Notes: [a]Appalachian; [b]Corn Belt; [c]Delta States; [d]Lake States; [e]Mountain States; [f]Northeast; [g]Northern Plains; [h]Pacific; [i]Southeast; and [j]Southern Plains

المنارة للاستشارات
www.mana

Time period	APL[a]	CB[2]	DS[c]	LS[d]	MTNS[e]	NE[f]	NPLNS[g]	PCFC[h]	SE[i]	SPLNS[j]	All states
1981-2001											
Mean	1.67	2.82	3.82	1.68	2.83	0.98	3.38	2.59	1.80	2.49	1.85
Std. Dev.	7.25	12.90	8.91	7.77	3.96	3.95	9.75	4.77	7.76	6.42	6.52
C. V.	4.34	4.57	2.33	4.64	1.40	4.03	2.88	1.84	4.31	2.58	3.52
1980-1989											
Mean	4.18	8.05	8.70	6.01	5.28	1.52	7.03	4.89	5.47	5.86	6.29
Std. Dev.	9.75	16.36	8.41	9.12	3.56	4.97	10.90	5.32	9.24	5.60	6.83
C. V.	2.33	2.03	0.97	1.52	0.67	3.28	1.55	1.09	1.69	0.96	1.09
1990-1995											
Mean	−0.10	−2.46	0.79	−2.24	0.32	0.40	0.07	1.05	−1.40	0.28	−1.53
Std. Dev.	3.38	7.61	4.58	5.70	4.43	3.28	7.28	3.73	6.08	4.64	3.17
C. V.	−33.24	−3.09	5.82	−2.55	13.84	8.23	107.24	3.56	−4.35	16.38	−2.07
1996-2001											
Mean	−0.33	0.26	−0.47	−0.91	1.67	0.75	1.22	0.69	−0.50	−0.35	−1.42
Std. Dev.	5.19	9.42	10.35	3.95	1.65	3.31	9.72	3.92	4.93	7.56	4.79
C. V.	−15.91	35.68	−22.13	−4.36	0.99	4.40	7.95	5.65	−9.83	−21.49	−3.37

Notes: [a]Appalachian; [b]Corn Belt; [c]Delta States; [d]Lake States; [e]Mountain States; [f]Northeast; [g]Northern Plains; [h]Pacific; [i]Southeast; and [j]Southern Plains

Table VI.
Summary statistics for rates of sustainable growth challenge, by region, selected time periods (percent)

experienced especially in the Corn Belt, Appalachian, Lake, Northern Plains and the Southeast regions where grain producers had been most affected by the radical decline of farmland values. After farmland values had reached its peak in 1982, high interest rates and declining export demand led to a nationwide 27 percent drop in these values and compounded debt repayment problems for highly leveraged producers (Stam, 1995). Interestingly, the livestock producers in the Northeast realized positive rates of growth and sustainability for most of this period as the relatively low sensitivity of pastureland to sudden market adjustments of land values spared these producers from the financial repercussions of the boom-bust cycle of the 1970s and 1980s.

In the 1990s, the effects of increasing farm income risk due to greater market uncertainty and the changing structure of federal policy towards agriculture are reflected in mixed results obtained for the different regions. The heterogeneity of regional production profiles account for divergent trends in SGC levels.

During the period 1990-1995 when federal payments provided income stabilization benefits, the corn and soybean producers in the Corn Belt and Lake States, who largely benefited from such subsidies, were able to build up excess production capacities as a result of stronger equity positions and debt servicing capabilities. Hence, these farms realized negative average SGC rates, with lower relative variability, during this period. With sustainable growth in excess of actual growth, farmers accumulated cash flows and rather than reinvesting these cash flows into the farm they used it to reduce debt, bringing the sustainable and actual growth rates into balance.

Elsewhere in the country, the gap between actual and sustainable growth rates was lower compared to the wider disparity of growth rates realized in the 1980s. Cotton and peanut farmers in the Southeast and Delta states continued to receive federal support, although not by as much as the subsidies appropriated for the grain producers. The dairy, cattle, hog and broiler farmers in the Northeast, Northern Plains, Mountain

المنارة للاستشارات
www.mana

states and Southern Plains relied on marketing strategies and production alliances to enhance financial conditions resulting in greater access to more sources of capital.

As federal farm support veered away from a market-oriented type of subsidy and agricultural commodity prices declined steadily in the latter part of the 1990s, mean SGC rates still remained close to 1 although relative variability increased considerably in six of ten regions.

Conclusions

This paper has presented a different approach to examining certain aspects of agriculture finance using the concept of sustainable growth as presented by Higgins (1977, 2003). The sustainable growth model requires a balance between increased sales at the farm level and changes in corresponding accounting measures such as profit margin, owner withdrawals or business retention rates, asset turnover and financial leverage. We argue that this paradigm can be used to explain observed financial and operating conditions in agriculture. In particular, we note that when farm revenues increase above a measured sustainable growth rate, there is also a tendency for farm debt to increase, and when revenues fall, there is a tendency for farm debt to decrease. But the role of debt is not so simply related to increases in sales. Household consumption expenditures, represented by owner withdrawals, also play a role. As expenditures increase due to inflation, the retention ratio is reduced and sustainable growth falls relative to sales. This condition increases the pressure on cash flow and increased use of debt. Likewise, in periods of inflationary land values, as turnover falls and if sustainable growth falls relative to sales, cash shortages need to be absorbed through either restrictions in household expenditures or increased use of debt.

Results of econometric analyses using farm-level financial data indicate the relevance of the sustainable growth paradigm in explaining most financial and operating decisions made by farm businesses in each year. The farms' tendencies to attain balanced growth seem to be more influenced by asset productivity and leverage decisions, which are given different emphasis by grain and livestock farms due to differing operational structures and constraints. Specifically, grain farms, which enjoy greater flexibility to implement diversification strategies, are more inclined to balance growth through adjustments in production efficiencies. Livestock farms, on the other hand, tend to use more financial leveraging to attain the same goal.

This study has also provided estimates of actual and sustainable growth rates from 1981 to 2001 for the seven producing regions in the USA and discusses these within the context of the farm economy. In general, it has been shown that the farm sector has adapted to positive or negative SGCs in a manner consistent with the model. Most importantly, from an equilibrium point of view, countercyclical measures of the SGC indicate that there is always a tendency towards balanced growth. Our analyses show a general contribution to the sustainable growth paradigm.

Note

1. Of course, the real options approach of Dixit and Pyndick (1994) is conceptually not new to agricultural supply. In describing business cycles, or growth patterns, in agriculture, Wilcox, Cochrane and Herdt (1974) write "Let us begin this description at the bottom of the trough, in the pit of a depression. At such time, business firms (farm and non-farm) have reduced their orders for equipment, land, buildings and other producer goods to the minimum, possibly below the replacement rate. Business firms are delaying decisions to invest as long as possible because they fear the future. Businessmen do not feel certain

المنارة للاستشارات

www.mana

that the bottom has been reached, and they do not want to sink their scarce funds in heavy equipment if conditions are going to get worse (p. 262)."

References

Ahrendsen, B., Collender, R. and Dixon, B. (1994), "An empirical analysis of optimal farm capital structure decisions", *Agricultural Finance Review*, Vol. 54, pp. 108-19.

Barry, P.J. and Robison, L.J. (1987), "Portfolio theory and financial structure: an application of equilibrium analysis", *Agricultural Finance Review*, Vol. 47, pp. 142-51.

Barry, P.J., Baker, C.B. and Sanint, L.R. (1981), "Farmers' credit risks and liquidity management", *American Journal of Agricultural Economics*, Vol. 63, pp. 216-27.

Barry, P.J., Ellinger, P.N., Hopkins, J.C. and Baker, C.B. (2000), *Financial Management in Agriculture*, 6th ed., Interstate Publishers, Danville, IL.

Blumenthal, R.G. (1998), "Tis the gift to be simple (DuPont's framework for financial analysis)", *CFO, The Magazine for Senior Financial Executives*, 14, January, pp. 61-3.

Booth, L., Aivazian, V., Demirguc-Kunt, A. and Maksimovic, V. (2001), "Capital structures in developing countries", *The Journal of Finance*, Vol. 55, pp. 87-130.

Collins, R.A. (1985), "Expected utility, debt-equity structure, and risk balancing", *American Journal of Agricultural Economics*, Vol. 67, pp. 627-9.

Dixit, A.K. and Pindyck, R.S. (1994), *Investment under Uncertainty*, Princeton University Press, Princeton, NJ.

Eisemann, P.C. (1997), "Return on equity and systematic ratio analysis", *Commercial Lending Review*, Boston, MA, Summer, pp. 51-7.

Escalante, C.L. and Barry, P.J. (2001), "Risk balancing in an integrated farm risk management plan", *Journal of Agricultural and Applied Economics*, Vol. 33, pp. 413-29.

Escalante, C.L. and Barry, P.J. (2002), "Business growth strategies of Illinois grain farms", *Agricultural Finance Review*, Vol. 62 No. 1, pp. 69-79.

Ezekiel, M. (1938), "The Cobweb theorem", *Quarterly Journal of Economics*, Vol. 52, pp. 255-80.

Featherstone, A.M., Moss, C.B., Baker, T.G., and Preckel, P.V. (1988), "The theoretical effects of farm policies on optimal leverage and the probability of equity losses", *American Journal of Agricultural Economics*, Vol. 70, pp. 572-9.

Firer, C. (1999), "Driving financial performance through the DuPont identity: a strategic use of financial analysis", *Financial Practice and Education*, Vol. 9, pp. 34-46.

Greene, W.H. (2003), *Econometric Analysis*, 5th ed., Prentice Hall, New Jersey, NJ.

Higgins, R.C. (1977), "How much growth can a firm afford?", *Financial Management*, Vol. 6, No. 3, pp. 7-16.

Higgins, R.C. (1981), "Sustainable growth under inflation", *Financial Management*, Vol 10, pp. 36-40.

Higgins, R.C. (2003), *Analysis for Financial Management*, 6th ed., Irwin/McGraw-Hill, New York, NY.

Levins, R.A. (2000), *Willard Cochrane and the Family Farm*, University of Nebraska Press, Lincoln, NE.

Melvin J., Boehlje, M., Dobbins, C. and Gray A. (2004), "The DuPont profitability analysis model: an application and evaluation of an E-learning tool", *Agricultural Finance Review*, Vol. 64 No. 1, pp. 76-89.

Mishra, A.K., Moss, C.B. and Erickson, K.W. (2009), "Regional differences in agricultural profitability, government payments, and farmland values: implications of the DuPont expansion", *Agricultural Finance Review*, Vol. 69, No. 1, pp. 49-6.

المنارة للاستشارات
www.mana

Moss, C.B., Ford, S.A. and Boggess, W.G. (1989), "Capital gains, optimal leverage and the probability of equity loss: a theoretical model", *Agricultural Finance Review*, Vol. 49, pp. 127-34.

Platt, H.D., Platt, M.B. and Chen, G. (1995), "Sustainable growth rates of firms in financial distress", *Journal of Economics and Finance*, Vol. 19, pp. 147-51.

Stam, J.M. (1995). *Credit as a Factor Influencing Farmland Values*, United States Department of Agriculture, Economic Research Service, Rural Economics Division. Staff Paper # AGES 9504.

Turvey, C.G. and Baker, T.G. (1989), "Optimal hedging under alternative capital structures and risk aversion", *Canadian Journal of Agricultural Economics*, Vol. 37, pp. 135-43.

Van Voorhis, K.R. (1981), "The DuPont model revisited: a simplified application to small business", *Journal of Small Business Management* Vol. 19, pp. 45-51.

Wilcox, W.W., Cochrane, W.W. and Herdt, R.W. (1974), *Economics of American Agriculture*, Prentice-Hall, Engelwood Cliffs, NJ.

Further reading

United States of Agriculture (2003), "Economic research service", *Farm Sector Balance Sheet*, available at: www.ers.usda.gov/data/farmbalancesheet/fbsdmu.htm (accessed 4 September).

United States of Agriculture (2003), "Economic research service", *US and State Farm Income Data*, available at: www.ers.usda.gov/Data/farmincome/finfidmu.htm (accessed 8 September).

Corresponding author

Cesar L. Escalante can be contacted at: cescalan@uga.edu

To purchase reprints of this article please e-mail: **reprints@emeraldinsight.com**
Or visit our web site for further details: **www.emeraldinsight.com/reprints**

المنارة للاستشارات

www.mana

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

www.manaraa.com