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The Management Factor in Developing-Country Agriculture: Argentina

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ABSTRACT

This paper discusses the economics of non-owner management of medium and large-scale farms in Argentina. The first section of the paper shows that management by non-owners increases at a diminishing rate with farm size. For equal farm sizes as measured by output, however, large variations in the importance of non-owner management is detected. It is hypothesized that these differences are caused by the relative importance of land versus capital, and labor inputs used in production.

The second section analyzes production efficiency of farms with non-owner versus owner management. Non-owner managed farms appear to be more efficient; however, this difference is not statistically significant.

1 INTRODUCTION

The management of medium- and large-scale farms is frequently carried out by non-owner managers. Whether this increases or decreases efficiency as compared to the case of management by owners is an empirical issue to be settled by analyzing micro-level data. Professional managers face incentives that differ from those faced by equity holders (Williamson, 1964), and this may result in sub-optimal performance. However, it can also be argued that professional managers embody greater human capital (both through formal training as well as through on-the-job experience) and this can be conducive to increased efficiency. Little is known on this topic notwithstanding its importance for answering questions related to agricultural credit, economic development and privatization. For example, non-owner management is frequent in enterprises formed with equity capital supplied by outside (i.e. non-farmer) investors. Similarly, the 'structuralist' interpretations of economic development have frequently been critical of absentee ownership (and hence non-owner management) due to its alleged negative impacts on productivity. Few references, however, can be found in which this type of ownership structure is shown to be inherently inefficient. Lastly, in the case of the new market economies of the former USSR, an understanding of whether non-owner management achieves high levels of efficiency can help in designing strategies for the privatization of state-run agricultural enterprises.

Management (both by owners as well as by non-owners) faces special challenges in extensive grazing systems where understanding of complex interactions requires not only knowledge of production principles but considerable experience and judgement. A private consultant to large farms once told us: 'Many of my clients are good at crop production, but just a handful efficiently manage grazing systems' (Frank Wilken, personal communication). Attempts to increase productivity of these systems have generally emphasized output per unit of land as a relevant performance measure. This is particularly true in western Europe where land has a high opportunity cost due to favorable conditions for production as well as to policies which maintain high prices for agricultural products. A contrasting case is that of Latin America, where land is abundant but capital in the form of forage-handling machinery, fertilizers and technical knowledge is scarce.

This paper analyzes the impact of management on productivity and profits of medium and large farms. Attention is directed to the relative efficiency of owner managed versus non-owner managed units. Following this introduction, Section 2 presents hypotheses regarding the efficiency of non-owner management. It also presents empirical information about non-owner management in Argentina, the country selected for the case study. In this country, calculations done with the 1988 agricultural census show that some 20–30% of land in farms in the main production areas is under non-owner management. Therefore, the performance of this segment of the farm population is important for the performance of the agricultural sector as a whole. More generally, it is probable that non-owner management is also of importance in grazing areas of neighboring countries such as Uruguay, Brazil and Paraguay.

The issues to be addressed will be examined with simple production economics models. It should be emphasized, however, that few studies have analyzed extensive grazing systems with farm accounting data. Some exceptions include Te Kloot & Anderson (1977) and Anderson & Griffiths (1981) for sheep production in Australia. Despite the importance of livestock production for the Argentine economy, firm-level productivity studies are not abundant. The analysis of Viglizzio & Roberto (1989) corresponds to farms operating in roughly the same region as those analyzed here. Obschatko & de Janvry (1971) and Bochetto (1981) have analyzed livestock production in Argentina with farm-level data, but have not focused attention on the impacts of different managerial forms.

2 PRODUCTION RESPONSE IN EXTENSIVE GRAZING SYSTEMS

An extensive grazing system can be represented by a production function:

$$Y = f(X_1,...,X_k, M) \quad (1)$$

where Y represents output, the X_is represent factors of production (land, biological capital, different classes of expenses, labor, etc.) and M represents the quantity/quality of management. Input M is separated from the vector $<X_1...,X_k>$ to highlight that management has two effects: (a) the direct effect corresponds to the increase in output resulting from increases in M; and (b) the indirect effect corresponds to the increased productivity of inputs in $<X_1,...,X_k>$ that result when higher levels of M are present. Management therefore affects the productivity of all inputs used by the firm.

This model abstracts from the complexities of livestock systems (for a more realistic model see Dillon & Anderson, 1990). In particular, three complications may arise in real-world situations. First, the dynamic nature of these systems implies that decisions made in period $t = t_0$ affect output not only in t_1 but in the period $t_2 - t_n$ as well. In fact, 'n' in some cases may be at least 4 or 5 years. Second, livestock production systems can be considered a multi-stage process where a set of inputs is used to produce an intermediate output (forage) and an additional set is used to transform forage to final output (beef). And last, in multi-output farms the livestock enterprise frequently interacts with crop enterprises and this further complicates decision-making. This last aspect is probably responsible for the rapid growth in the demand for private management consulting services in areas of Argentina where mixed crop-livestock farms are prevalent (Gallacher, 1988).

The impact of non-owner management may be analyzed by presenting two hypotheses. *Hypothesis A*, based on the theory of agency (Jensen & Meckling, 1976) predicts that management by non-owners ('agents') is likely to result in less efficiency than management by owners ('principals'). If managers are paid as a function of time worked, they are likely to supply less-than-optimal effort levels because their own marginal returns to additional effort are zero. It is possible, however, that agents may be monitored and punished if their perfomance is less than optimal. Suppose, for example, that given some fixed wage compensation to agents (w_M), increased effort can be elicited by increasing monitoring. For example, with no monitoring the agent will supply a minimum effort level M^L, while with continuous monitoring effort approaches M^H asymptotically. A function may be postulated which maps inputs expended in monitoring to effort expended by the agent:

$$M = M(z) \qquad \partial M/\partial z > 0,\ \partial^2 M/\partial z^2 < 0 \tag{2}$$

where M is the effort expended by the agent, and z is some measure of the amount of input used in information gathering by the principal (e.g. time, auditing, etc). Under this scenario, the principal would engage in information gathering (monitoring) so as to equate:

$$\partial Y/\partial z = (\partial Y/\partial M)\ (\partial M/\partial z) = w_z \tag{3}$$

where w_z represents the ratio between the price of z and that of Y. Hence, the amount of monitoring will depend on the marginal product of the manager's effort, on the monitoring technology and on the cost of the input used for monitoring. Monitoring may involve the use of formal auditing, of inter-firm productivity comparisons, of constraints on the use of the manager's time for outside work, etc. Moreover, as has been discussed in the labor economics literature (e.g. Shapiro & Stiglitz, 1984) the need for monitoring will also depend on the difference between the agent's wage (w_M), and his reservation wage (w_R), that is, the minimum wage for which he is willing to enter into a contract with the principal. This occurs because as $w_M - w_R$ increases, termination of the contract between principal and agent causes increased cost to the latter.

In agriculture, measures of performance such as those mentioned above depend not only on the agent's effort but on random factors as well. Hence, the effort level expended by agents is measured with error. Under these conditions, efficient arrangements may involve a combination of direct monitoring of effort with some 'payment by results' scheme. In summary, in agriculture the design of efficient incentive schemes is not straightforward and hence opportunities for inefficiencies may arise.

The previous paragraphs present arguments supporting the hypothesis that firms managed by non-owners are likely to be less efficient than those managed by owners. However, management of medium and large-scale farms may require specialized knowledge that is best supplied by professionals. *Hypothesis B* predicts that non-owner management may actually increase efficiency because of the higher human capital embodied in individuals who 'earn their bread' providing managerial services.

While the impacts of education on efficiency have been analyzed by many researchers (see Jamison & Lau, 1982), it is not clear that occupational specialization and college-level training (which are frequent among professional managers) contribute to increased output. Rahm & Huffman (1984) for example, found that college-level training had no impact on the efficiency of adoption of reduced-tillage practices. Relatedly, Schmitt (1991) argues that owner-management has advantages over non-owner management due to the fact that the high cost of the latter is not compensated with higher efficiency.

For the case of *Hypothesis B*, let M^0 and M^1 represent owner and non-owner management. In this situation, the production surface shifts up from $f(X; M^0)$ to $f(X; M^1)$ as management is contracted out. Moreover, and assuming that improved management increases the marginal productivity of variable inputs ($\partial^2 Y/\partial X \partial M > 0$), optimum input use increases. Under $f(X; M^0)$, optimum input use corresponds to X^A. Under $f(X; M^1)$, and assuming no change in the input level used, output increases from $f(X^A; M^0)$ to $f(X^A; M^1)$. However, given that by assumption $\partial^2 Y/\partial X \partial M > 0$, optimum input use increases from X^A to X^B, and output is then $f(X^B; M^1)$. The firm achieves greater profits through both a 'direct' as well as an 'indirect' effect of improved management. This situation is similar to the one that results when analyzing changes in fertilizer use (X) when improved crop varieties (M) are available.

Three profit levels can be defined:

$$\pi^* = f(X^A; M^0) - w_x X^A \tag{4}$$

$$\pi^{**} = f(X^A; M^1) - w_x X^A - w_m M^1 \tag{5}$$

$$\pi^{***} = f(X^B; M^1) - w_x X^B - w_m M^1 \tag{6}$$

where w_x and w_m represent the prices of X and M (both normalized by output price). For farms that hire managers, presumably $\pi^{***} \geq \pi^{**} \geq \pi^*$. The previous model suggests that:

(a) The incentives to hire managers depend on the 'value added' that these provide; that is on the magnitude of the shift between production functions described above. Value added is another term for marginal productivity of management, which in turn depends on inherent characteristics of the production process.

(b) For a given production technology, value added by managers increases as the amount of fixed resources over which inputs X and M are deployed increases. Hence, larger farms are more likely to employ professional managers, not because they have more financial resources but because the impact of improved management is greater.

(c) The magnitude of value added ($\pi^{***} - \pi^{**}$) depends not only on the physical characteristics of production, as represented by $f(X; M)$, but on the price of the variable input (w_x) as well. In particular, a decrease in the price of variable inputs increases value added by managers because it allows these to make full use of high productivity processes such as $f(X; M^1)$.

In relation to (c), it is hypothesized that professional management is complementary (in particular) with non-land inputs in the sense that the marginal product of management will increase as the amount of these used in production increases. More generally, the marginal productivity of management depends on factors such as whether the firm is single or multi-output, on the number of inputs used, on the relative importance of land *vis-a-vis* labor and capital, on the degree of imperfections in input and output markets and on the degree to which productivity is dependent on exact timing of input injections. Indeed, the relative importance of quantity as opposed to moment in which inputs are used may vary between activities and/or regions.

Some of these issues can be further analyzed by drawing on empirical evidence from the area under study. Figure 1 shows — for farms of different sizes — the extent to which non-owner management is prevalent in several provinces of the Argentine 'Pampa' region. The measure of farm size represented in the horizontal axis corresponds to total hectares. A more accurate inter-regional comparison would require a measure of output and not of land size; however, data on this variable are not available at the regional level.

Areas CBA and SF show relatively similar patterns: the proportion of farms with non-owner management in both cases increases rapidly, reaching 45–50% of total farms at sizes of some 5000 hectares. Two areas of lower productivity (ER and LP) present sharp contrasts with respect to their demand of management services: regions ER and LP, in fact, constitute the upper and lower bounds of the graphs presented in Fig. 1. In region LP even in very large farm classes (some 15 000 hectares), only 30% of non-owner management is reported; in contrast in ER farms one-third of this size are managed primarily by non-owners. Part of the differences in demands for managerial services probably lies in the different intensity with which labor and capital are used in the four areas analyzed previously. The labor/land ratio in areas ER, CBA and SF are some 5 to 6 times higher than those in LP. The ratio between biological capital ('animal equivalents') and land; as well as that between machinery capital and land are, respectively 2–3 and 4–6 times higher in the three former regions than in region LP. Another reason for differences in managerial requirements is that farms in regions CBA, SF, BA (and to a lesser degree) ER are multiple-output, while farms in LP are mostly specialized beef production units.

In summary, the marginal product of management (and hence the demand for this input) increases as diversification increases and as production is less dependent on land and more dependent on labor and capital. These data therefore provide support for the proposition that incentives to hire managers depend not only on 'size', as measured by land area. Agricultural production systems differ greatly in the extent to which they depend on decision-making and organizational skills as opposed to 'physical' inputs, and range from situations in which land is of secondary importance (a greenhouse or a feedlot) to situations where land is by far the most important input (for an insightful discussion on the role of management *vis-a-vis* other factors of production see Roumasset & Uy, 1987).

3 THE CASE STUDY: DATA SET AND ECONOMETRIC MODEL

3.1 Method

The data set to be analyzed corresponds to a group of medium- and large-scale farms located in the north, western and south-western part of region BA discussed previously. This region also borders areas SF, CBA and LP (Fig. 1). Table 1 summarizes basic characteristics of the production units. A total of 231 observations was available corresponding to 7 years of data (an annual sample of some 25-35 farms). The sample presents considerable variability: it includes both large units as well as (for

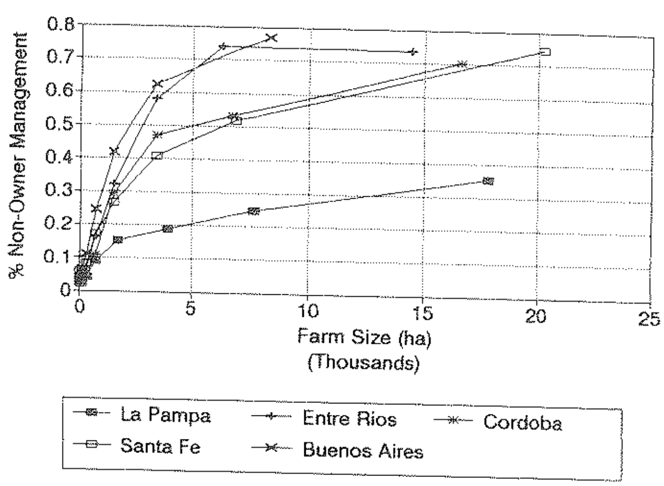

Fig. 1. Non-owner management and size.

TABLE 1
Sample of Farms—Production Characteristics

	Size		
	Average	*Maximum*	*Minimum*
Farm size (ha)	2410	7344	357
Livestock enterprise (ha)	1553	5875	200
Number of cattle	1487	6478	87
Labor (man-equivalents)	2·7	10·0	0·3
Land productivity (kg/ha)[a]	196	474	43

Number of observations: Owner-managed farms, 162; non-owner-managed farms, 69.
[a]Ratio between output (kg liveweight) and land input allocated to livestock enterprise (ha).

the analyzed region) farms of relatively modest size. For the purposes of this study, heterogeneity in farm size is a definite advantage as it provides a data grid over which the production surface may be estimated. The farms utilize above-average production technology (most hire private-sector consultants). Data analysis was based on financial and production records maintained by a business-management consulting firm. The low ratio between labor and land is readily apparent, and indicates that the farms under consideration are 'extensive' units.

Given that the objective of the study was to estimate input productivities and not to focus attention on substitution among inputs, a simple Cobb-Douglas production function was chosen:

$$\ln Y = \alpha_0 + \Sigma_i \alpha_i \ln X_i + \Sigma_j \beta_j Z_j + \gamma M + \epsilon \tag{7}$$

where Y is output measured in physical units (kg), X_i are inputs measured either in financial or physical units, Z_j are dummy variables representing production areas and climatic conditions, M represents management and ϵ represents an error term. Dummy variables attempt to capture differences in production caused by geographical location (see Table 2). Also, a dummy variable was included to capture better-than-average production conditions prevalent in one year of the series.

The impact of management on efficiency can be tested in several forms. One alternative — as done above — is to include dummy variables for management type. Management is an input and it can be argued that the firm's production function if correctly specified should include all inputs (see, in particular, Stigler, 1976). Another approach is

TABLE 2
Estimation Results. Dependent Variable: Beef Output (kg/farm)

Variable	*Units*	*Parameter*	*Estimate*
Intercept		α_0	4·044 (11·05)
Land	ha	α_1	0·336 (7·81)
Supplemental feeds	$	α_2	0·009 (2·91)
Veterinary expenses	$	α_3	0·105 (3·21)
Annual pasture expenses	$	α_4	0·012 (4·45)
Perennial pasture expenses	$	α_5	0·004 (1·08)
Labor (man-years)	$	α_6	0·08 (2·82)
Biological capital	$	α_7	0·233 (5·32)
Overhead expenses	$	α_8	0·079 (2·13)
Dummy Area 2		D_2	0·015 (0·29)
Dummy Area 3		D_3	–0·152 (–3·79)
Dummy climate		D_4	0·093 (2·05)
Dummy management		E_2	0·056 (1·50)

Adjusted R-square: 0·9003.
t-values in parenthesis.
Production areas north, west and south-west of Province of Buenos Aires for i = 1,2,3.
Climate $D_4 = 1$ if 1987.
Management $E_2 = 1$ if non-owner management.
Time t = 1985–1991/1992.
$ denotes constant Argentine pesos (September, 1992).

to fit eqn (7) without the management variable, using econometric frontier methods, and then to regress a measure of 'efficiency' such as the ratio between actual output and frontier output on the management variable (for frontier methodologies see Brattesse, 1991; Bravo-Ureta & Pinheiro, 1993; Fried *et al.*, 1993).

3.2 Results and economic implications

Results of estimation are shown in Table 2. With the exception of perennial pasture inputs all t-values of inputs $X_1 - X_8$ are significant at $\alpha = 0{\cdot}05$. These results are encouraging, in particular given the measurement and collinearity problems of firm-level data. The null hypothesis that non-owner management does not shift the production function cannot be rejected using a two-tailed test at $\alpha = 0{\cdot}10$. However, under the one-sided alternative hypothesis that non-owner management increases efficiency, and using the same significance level as before, the null hypothesis is rejected. Although the results are not robust (the original null hypothesis was two-sided), for discussion purposes we 'accept' *Hypothesis B*, which claimed that professional management results in an upward shift in the production function. These results allow inferences on the magnitude of the returns to alternative management systems. As suggested in eqns (4)–(6), input prices first have to be estimated and, indeed, returns to professional management are contingent on these estimates. In the production model used here, the most problematic inputs to price are land (X_1), livestock capital (X_7) and overhead expenses (X_8). A discussion of the economics of professional management, moreover, also requires an estimate of the (opportunity) cost of owner-management.

The price of land for grazing is the opportunity cost of using this land in the farm as compared to renting it out to other graziers. Different arrangements exist for renting grazing lands, but in the area under study the most common include the landowner receiving a share (some 50–60%) of liveweight gain as a return both for the use of land as well as for sharing part of veterinary expenses (in the same proportion as output is shared). The net rental price of land can therefore be estimated as:

$$w_{x1} = Y^{A}\, p\, s - w_{v}\, s \tag{8}$$

where w_{x1} is the estimated rental price of land, and Y^{A}, p, s and w_v represent, respectively, expected output per hectare of land, expected net price of output, share to the landowner and veterinary expenses per hectare. Output level Y^{A} used here was obtained by slightly adjusting downward (–10%) 'engineering' productivity levels reported in a trade journal (Agromercado, June 1993). This downward adjustment is made because trade journals such as the one cited (in our opinion) tend to report 'best' production practices.

The price of livestock capital can be expressed by transforming investment in livestock into a rental flow by multiplying this investment by an opportunity cost of funds (an 8% cost of funds invested in livestock was used here). This procedure is at best a crude approximation to the returns required by investors in livestock; in particular portfolio-investment motives may determine that the simple imputation described above may not be adequate. Finally, overhead expenses (X_8) may be difficult to price because they frequently have spillover effects which are not accounted for in the simple one-output production process analyzed here. One solution would be to charge only a fraction of the increased input cost to the enterprise under analysis. This would 'favor' the use of X_8. For example, hiring better workers for the livestock enterprise will frequently result in indirect benefits for the whole farm. These spillover effects are characteristic of inputs that are used for more than one output such as firm-level overhead expenses; however, in this paper expenses incurred in input X_8 will be allocated entirely to the livestock enterprise.

Table 3 shows the size of the livestock enterprise, total profits, and marginal rate of return obtained by shifting from system M_0 to system M_1. Comparisons are made between profit levels (eqns (4) and (6)). In order to derive these figures, assumptions have to be made on the cost of hiring professional management, and the value of the time of M_0 that is replaced by M_1. One possible assumption is that the value of the owner's time is equal to that of the professional manager, and thus that these two cancel out when calculating marginal benefits and marginal costs of delegating management. In this case, the reported profit differences are net of either compensation to professional managers or of time released by owners.

The Cobb-Douglas function (by construction) results in management systems M_0 and M_1 having the same ratios between land and non-land inputs (other than M itself). Input ratios are a function only of input relative prices and input elasticities of production. Hence, adjustments take place through changing land area and not through changing ratios

TABLE 3
Profits under Different Management Arrangements: Production Region I

	Owner management	*Non-owner management*
Enterprise size:		
Land Area (ha)	1020	1719
Total costs (US$)	57 904	84 375
Performance measures:		
Total profits (US$)	18 400	31 130
Marginal rr (%)[a]	48%	

[a]Marginal rr = 100* (Δprofits/Δcosts)

between inputs. Notwithstanding the above, M_1 results in a 50% increase in profits. The fact that these extra profits are obtained by a substantial increase in enterprise size suggests that attention should be directed not only to the profit levels of each system, but to the marginal rate of return obtained on the increased use of inputs that are required by M_1. This return exceeds 40%, which again confirms that for the farms in the sample, management by non-owners is an attractive proposition.

It should be emphasized, once again, that these results are sensitive to input pricing assumptions. In particular, the difference in profit obtained (some US$ 13 000) may only marginally cover management fees if the opportunity cost of the owner's time is low and/or transaction costs (travel, auditing/control) for input M_1 are considered. Further, the excess productivity obtained by professional management is to some extent non-observable, and thus will be discounted by some risk-adjustment factor when a decision has to be taken on whether to delegate management. In agriculture, and in contrast to what happens in the non-agricultural sector the linkages between managerial effort and physical production are difficult to detect due to the pervasive influence of climate. The marginal return of 40% calculated here, while high, is probably not much higher than the rates of returns required by farmers before risking capital on inputs such as fertilizer.

4 FINAL COMMENTS

This paper compared owner with non-owner management. Some evidence exists that the latter allows greater efficiency than the former. Whether this increased efficiency is sufficient to neutralize increased transaction costs that are likely to be generated by a professional management structure is a moot point. It may be useful, however, to take into account the fact that advantages to professional management accrue only in larger farms and therefore that a change in management system may require additional resources for training managers:

> 'As farm size increases, management becomes a critical cost item. Management skills must be learned and producing a superior manager is expensive. To discuss the efficiency of farms of alternative sizes without allowing for the differential cost of producing a manager, plus the cost of management error, feedback and growth in skills, is to ignore one of the most important aspects of transition in size of farm' (Raup, cited by Stanton, 1978).

The non-random nature of the data set constitutes one criticism of the results presented here. Our suspicion is that these farms are better managed than most similar-sized farms. One can argue both ways as to whether productivity differences between owner and non-owner management of randomly selected farms will increase or decrease as compared to the results found here. Also, future analysis should utilize functional forms which relax the assumption that management only acts through a scale effect, and not through input combinations. The approach taken by Ulveling & Fletcher (1970) in which the input elasticities are not constant but a function of a vector of variables might be worth considering.

The analysis of the relative advantages of different management systems has important implications. In Argentina, economic policy has generally resulted in explicit or implicit discrimination against the agricultural sector in the sense that price ratios have been more unfavorable and/or taxation levels have been higher than in other sectors of the economy (see, e.g. Sturzenneger, 1991). Until recently, the tax system was based on export levies. During the 1980s, however, land-based and VAT taxes have increased in importance, replacing *ad valorem* export taxes completely by the early 1990s. If tax collection costs are a function of the number of farms (the current, as opposed to the past situation) and if the agricultural sector is viewed primarily as a source of taxable income (both not unrealistic assumptions for Argentina) policy makers will prefer land consolidation into larger units. Whether this consolidation changes efficiency depends, in particular, on the nature of returns to scale. More pertinent to this paper, it also depends on the relative efficiency with which non-owners are able to manage agricultural enterprises, as a farm sector with larger farms will demand more of this type of management.

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