THE IMPACT OF PROPERTY SIZE ON WHOLE PROPERTY PROFITABILITY IN WESTERN QUEENSLAND GRAZING AREAS

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This study focussed on economies of size on predominately wool growing properties in Western Queensland. Tests for economies of size were done by using a semi-log least squares function of per unit costs on stock carried. Results indicated that economies of size were initially dependant on increasing the utilisation of imputed (operator and family) labour across larger areas. Economies of size were limited after about 10 000 dry sheep equivalents due in part to extra hired labour requirements to augment fully utilised imputed labour.

1. INTRODUCTION

1.1 Background

The literature on economies of size in rural areas in Australia is extensive (e.g. Vlastuin et al (1981), McKay (1974), Anderson and Powell (1973)). Vlastuin et al (1981) emphasised the need for even further research to be undertaken to keep information on size economies in Australia up to date, with a view to gaining a better understanding of the forces contributing to structural adjustment and technical change.

Culpitt (1992) defined economies of size as a significant reduction in average cost per unit of output as property size increases. Examination of such reductions for western Queensland grazing properties are the focus of this paper.

Some of the data collected from an Australian Wool Corporation (AWC) economic survey into grazing properties in western Queensland were used as the basis for this paper.

Structural adjustments are occurring in grazing industries. For example, the average size of the 53 properties surveyed from the western Queensland Mitchell grass increased by about 8% over the five year period from 1985/86 to 1989/90, although this growth was accounted for by only 15% of the producers surveyed.

The Government, while helping to facilitate the acquisition of larger holdings through subsidised loans to eligible producers (efficiency goal) is also slowing the process by the providing assistence to rural producers in financial difficulty (equity goal).

The aim of this paper is to investigate the extent of any economies of size in western

Queensland grazing areas. From this, cost efficiency factors which serve to either enhance or hinder economies of size will be identified. The western Queensland results will also be compared with results previously derived from data collected in western New South Wales and discussed in Vlastuin et al (1981) and Macleod (1990).

1.2 Scope and limitations

A major advantage with this study was the relative homogeneity of the resource base within the regions surveyed. In addition, the five year time span incorporated a range of seasonal conditions thus minimising potential bias from this source.

Several limitations applied to this analysis of economies of size. They were as follows:

(a) As the study period was only five years, little could be learned about structural adjustment and technical change.

(b) Limited resources precluded collection of data from a large number of properties and hence only 16 properties were surveyed in each homogeneous grazing region defined.

(c) No data were collected from the largest properties in the region which are mainly company owned grazing properties. While not large in number, these larger properties account for a significant proportion of the western Queensland grazing area and livestock numbers.

(d) Economies of size represent only one aspect of whole property performance. There are a complex of other factors which impact on whole property profitability, some of which is accounted for by managerial ability, an attribute difficult to measure.

(e) Costs per $100 output is one measure of economic efficiency. Non-economic measures such as preservation of the grazing resource were beyond the scope of this paper.

2. METHODS

2.1 Design

Data from two of the three Mitchell grass regions were examined separately and were then combined to increase the data set from 16 to 32 observations. Data from the third region was omitted because of a higher proportion of cattle grazed relative to the other two regions. The regions included were defined as Blackall Mitchell and Longreach Mitchell grass downs respectively. The Blackall Mitchell grass downs is estimated to be about 20% more productive than the Longreach Mitchell grass downs on a dry sheep equivalent (DSE) basis.

Properties in the Blackall Mitchell grass downs averaged about 12 000 hectares in size with an average carrying capacity of about 10 000 DSE's. The Longreach Mitchell grass properties had a similar average carrying capacity but with an average size of about 14 500 hectares.

Dry sheep equivalents carried will measure input efficiency. Costs per $100 output was the output efficiency measure used.

To test for economies of size, costs were aggregated as follows:

(a) Materials

(b) Services

(c) Total labour (which included both paid and imputed labour)

(d) Total cash costs

(e) Total costs

Costs were then expressed per $100 output.

Total cash costs refer to cash payments paid for labour, materials and services. Payments for interest are excluded as these are directly related to the level of gearing and not necessarily to size. Total costs refer to total cash costs plus depreciation and imputed labour.

Output is defined as property cash receipts plus build up in trading stocks less livestock purchases.

A number of measures of size were examined including value of output, area and livestock numbers (expressed in terms of DSE's). A generalised function using linear least squares was determined:

Costs/$100 total farm output = f(dry sheep equivalents carried)

i.e. $Ci = Bo + Bi*\ln(Si)$

Where: Ci = Costs per $100 receipts
Si = DSE's carried
Bo = Constant term
Bi = Property size coefficient

This above function was chosen as DSE's most closely reflect the effective production capacity of predominately wool producing western Queensland grazing properties.

Of particular interest will be the statistical significance of the Bo and Bi components and the overall explanatory power of the model. For the combined regions, if the t-

values of the components exceed 2.04 then they are statistically significant at the 5% level and if they exceed 2.75 they are significant at the 1% level. For the individual regions the t values required for significance are 2.15 and 2.98 for 5% and 1% significance levels.

This relationship was tested for the separate items of costs noted above, with the regression for total costs shown graphically.

The most appropriate functional form was selected by firstly examining the degree of explanatory power (R^2) and then by examining a plot of reiduals against the fitted value to see if any patterns emerged. From this process a semi-log function was found to be the best fit for the data generated.

3. RESULTS

3.1 Blackall Mitchell grass downs

Results for both the Blackall and Longreach Mitchell grass regions are shown in Table 1 below:

Table 1. Economies of size equations for the Blackall and Longreach Mitchell grass downs regions (t values are shown in brackets).

Eqn No.	Dependant Variable	Constant	Property size coefficient ln(SEEQUIV)	R^2
	Blackall Mitchell grass downs			
1	total cash payments/$100	49 (4.7)	-1.0 (0.2)	0%
2	total costs/$100	104 (8.0)	-16.2 (2.9)	37%
	Longreach Mitchell grass downs			
3	total cash payments/$100	83 (8.8)	-11.8 (3.0)	34%
4	log (total costs/$100)	140 (13.1)	-27.0 (6.0)	70%

For the Blackall Mitchell grass downs region the only significant relationship occurred when non cash costs were included. Hence economies of size do not exist for cash

costs but they do for non cash costs. Graphically the regression for total costs is shown in Figure 1. From the graph economies of size appeared to be most significant up to about 10 000 DSE's.

3.2 Longreach Mitchell grass

Both relationships were statistically significant for the Longreach region and most significant when non cash costs were included. The regression for total costs is shown in Figure 2 with the inclusion of some very small holdings (< 4000 sheep) the main reason why the economies of size relationships were stronger for this region than the Blackall region. Economies of size were most significant up to about 10 000 DSE's.

3.3 Combined Mitchell grass

Data from the two regions were combined. The regressions of each of the cost catagories per $100 output and DSE's carried are shown in Table 2. Graphically the regressions for total cash costs and total costs are shown in Figure's 3 and 4.

Table 2. Economies of size equations for the combined Mitchell grass regions.

Eqn No.	Dependant Variable	Constant	Property size coefficient ln(SEEQUIV)	R^2
1	total labour/$100	59 (12.3)	-12.9 (6.3)	57%
2	services/$100	27 (7.3)	-4.6 (2.9)	22%
3	materials/$100	18.6 (4.7)	-0.8 (0.5)	1%
4	total cash payments/$100	70 (8.7)	-8.0 (2.3)	16%
5	total costs/$100	125 (13.2)	-23.1 (5.7)	52%

Total labour per $100 output and to a lesser extent services per $100 output were shown to exhibit a significant negative relationship with sheep carried. The strong negative relationship with total labour costs was due to the fuller utilisation of operator and family labour inputs across smaller and medium sized holdings.

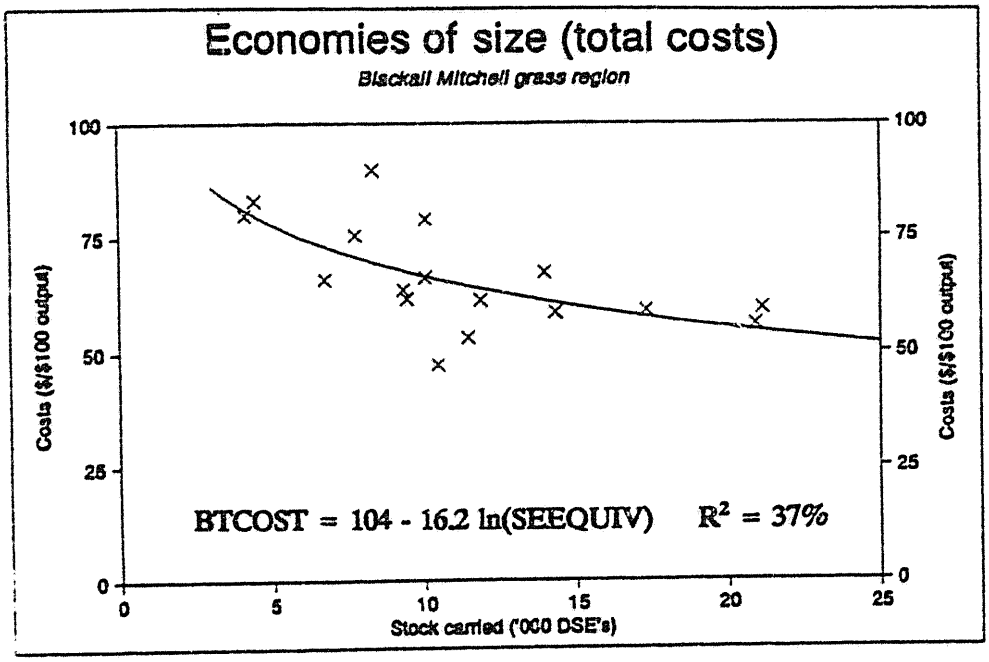

Figure 1.

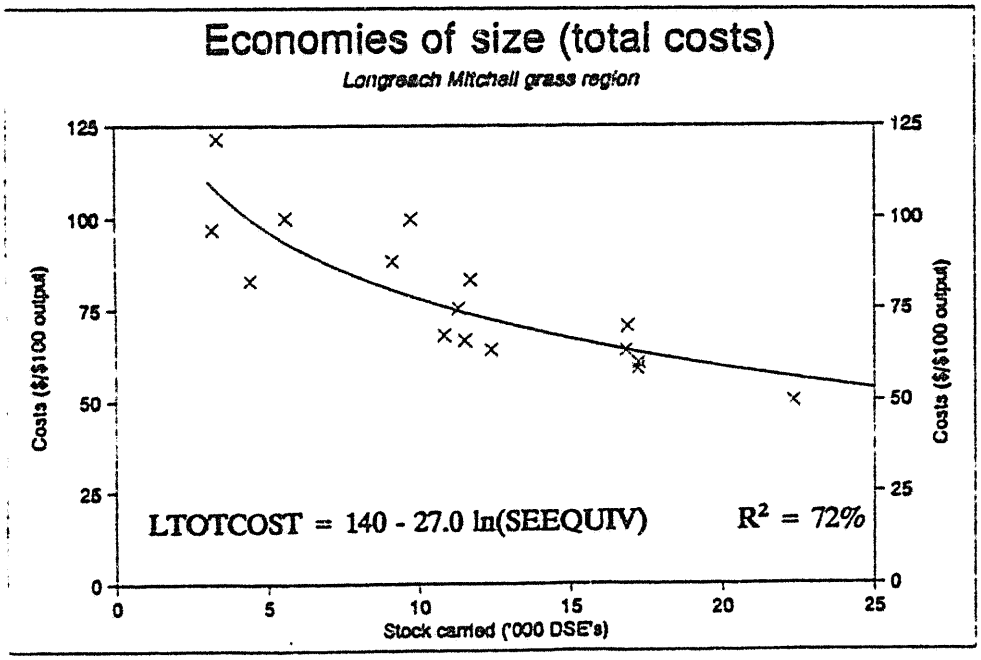

Figure 2.

One component of the labour cost:size relationship was the significant increase in hired labour costs once operator and family labour were fully utilised. From the regression's in Figures 1, 2 and 3 it was observed that the flattening of the curve after 10 000 DSE's was due in part to the increased hired labour requirements after that size. These were in response to the full utilisation of imputed labour past that point.

For the lower end of the size range (3 000 - 7 500 DSE's) there was evidence of some economies of size with cash costs with a greater slope in the curve over this range. However, across the whole curve the relationship was not strong with an R^2 of only 16%.

With the inclusion of non cash costs the negative relationship between per unit costs and property carrying capacity was strongest with an R^2 of 52% (see Figure 4). As mentioned earlier, the fuller utilisation of operator and family labour was the main reason for this relationship (see Appendix 1 for qualification) with cash costs spread over the lower size range of this curve.

From Macleod (1990) the steepest portion of the curve ocurred up to 5 000 DSE's, a size range which is becoming increasingly rare in western Queensland.

From Macleod (1990) it was extrapolated from the curve that unit costs per DSE fell about one third from 5 000 to 25 000 DSE's ($18 to $12). From the western Queensland study, unit costs fell from about $75 to $50 per $100 output (one third) over the same size range.

4. SUMMARY

4.1 Conclusions

Vlastuin et al (1981) noted that the minimum efficient farm size was dictated by the need to employ the fixed inputs of operator and family labour fully. This was also true for western Queensland wool growing properties.

Data from western Queensland grazing businesses indicated that operator and family labour for a typical family operation were utilised fully in the meduim size group (say 10 000 DSE's). It was after this point that significant inputs of hired labour were required to effectively manage the property.

Hired labour requirements for larger holdings acted as a the main constraint on economies of size in their operations. However, some economies of cash costs were evident over the smaller size range (3 000 - 7 500 DSE's) with a nearly flat cash costs per $100 output curve after about 7 500 DSE's.

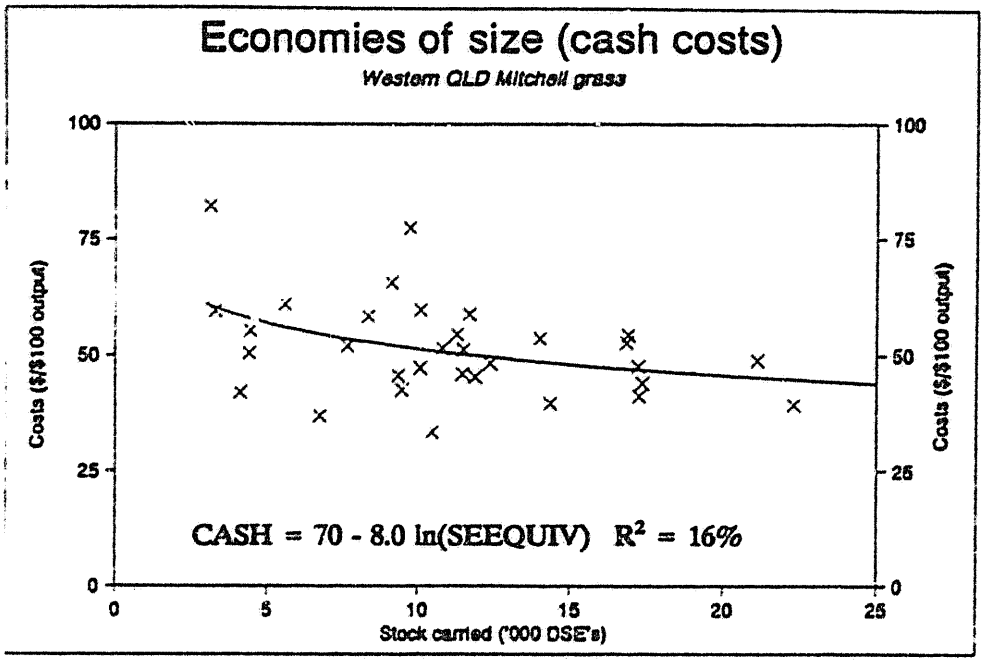

Figure 3.

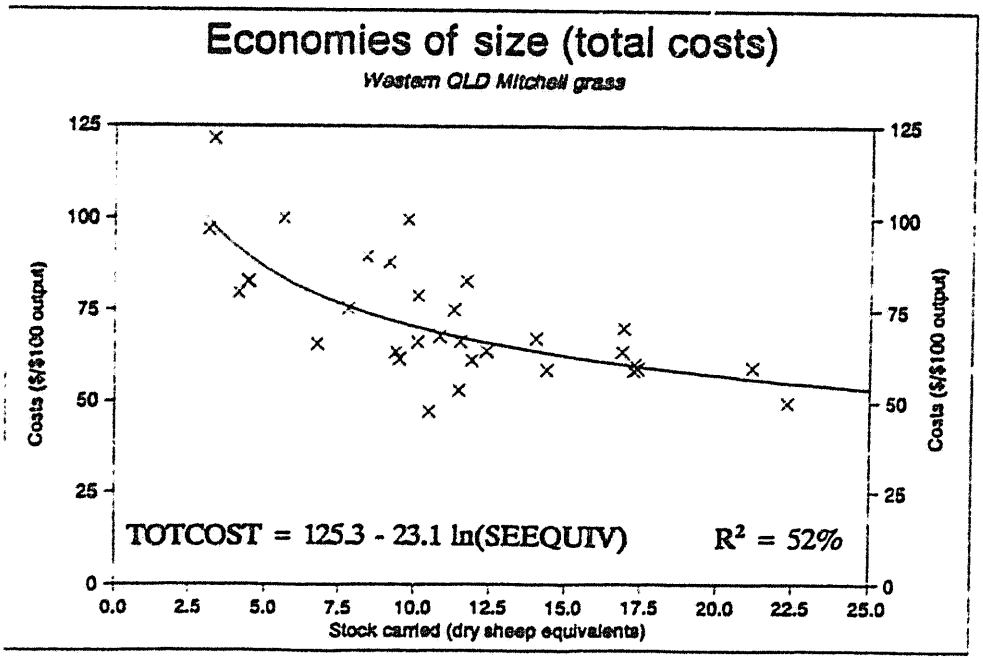

Figure 4.

4.2 Implications and recommendations

Economies of size were most evident with the fuller utilisation of operator and family labour. The results form the basis of the following recommendations that are consistent with Vlastuin et al (1981). They included:

(a) Policies aimed at facilitating rural adjustment should be encouraged in order to encourage amalgamation to employ operator and family labour more fully.

(b) Provision of off-farm employment opportunities for operators of small holdings may be an alternative means of improving this resource allocation.

On the Mitchell grass it appears that the most of the initial cash diseconomies in the 2000 to 5000 DSE range as noted by Macleod (1990) have been overcome as few properties exist in this size range.

The results of this study indicate, policies to improve the ability of rural producers to expand from a smaller holding (<6 000 DSE's) to a medium sized holding (about 10 000 DSE's) would allow the operator and family labour inputs to be fully utilised.

Off property employment opportunities in western Queensland are mainly confined to working on other properties due to the small and widely dispersed nature of the rural towns. Hence, provision of employment opportunities is difficult, especially with the demand for paid labour falling in response to increasing costs pressures on grazing properties.

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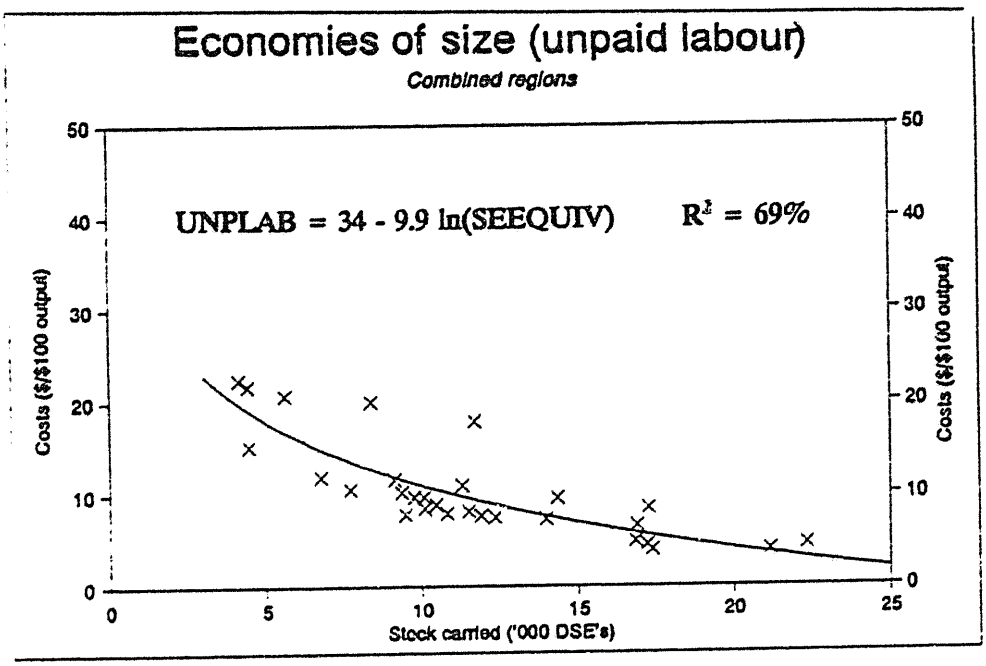
APPENDIX 1

Shown in Appendix Figure 1 below is the regression for imputed labour costs per $100 output with stock carried (DSE's). The strong negative relationship is noted but with the steepest portion of the curve up to about 10 000 DSE's.

A band of observations (about 10) just below the fitted line and in the size range from 8 000 to 12 000 DSE's indicate that imputed labour was used more efficiently than for smaller properties but not much less efficiently than for the larger holdings.



Appendix Figure 1.