THE COMPARATIVE PROFITABILITY AND EFFICIENCY OF AGRICULTURE IN DIFFERENT REGIONS OF AUSTRALIA

B. R. DAVIDSON*

1. INTRODUCTION

The quantity and types of resources used by farmers and the kinds and quantities of products produced by them are chiefly determined by the farmers' aim of maximizing profits. The profitability of farming will vary with the scale of the farmer's operations, the physical environment and the prices the farmer receives. Thus the return to farmers' capital should vary in different parts of Australia because the physical environment, scale of farming, and commodities produced differ from region to region. On the other hand, since land represents a large proportion of the farmers' capital the price of land in different regions should adjust to a level where the return to capital invested in farming is approximately equal in all regions. A comparison of the profitability of farming in different regions in Australia should measure the degree to which different land values tend to equalize the return to farmers' capital in various farming regions.

The very fact that land values are part of a farmer's capital invalidates the use of return to farmers' capital as a measure of the efficiency with which resources are used in agriculture, because unimproved land values are created without the use of the nation's resources. Further imperfections are introduced by subsidies paid by the state to farmers producing certain commodities. In addition the state provides farmers with some capital items, such as irrigation works, free of charge. The efficiency with which resources are used in any region can only be measured by finding the unsubsidized return to all of the resources used, including those provided by the state, after deducting the unimproved value of land from the capital invested in agriculture.

Australian farming is more highly specialized than that of most other countries. The small size of the population in the 19th century ensured that large quantities of a commodity could only be produced if it were exported. Large export markets could only be found for a limited range of products which would not deteriorate during transport to European markets. The lack of cheap labour further restricted the range of commodities to those which could be produced using little labour. Even today eighty per cent of Australia's agricultural output consists of wool, wheat, beef, sheep-meats, sugar, butter and milk. These seven commodities are produced on highly specialized farms which seldom produce more than three or four commodities.

* University of Sydney.

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The actual commodities produced in any particular part of the continent are chiefly determined by the availability of moisture and the period of the year when precipitation occurs. North of the Tropic of Capricorn the whole of the continent is used for cattle and sheep grazing, except for isolated areas with a growing season of more than nine months on the Queensland coast which are used for dairying, or for producing sugar or tropical fruits. In the south east and south west of the continent the wet coastal areas are used for dairying. Further inland the region with a growing season of from five to seven months, called the High Rainfall Sheep Zone, is used for sheep and cattle grazing. Wheat can only be produced where the growing season is from five to seven months long, as varieties capable of giving high yields in areas of high rainfall have not been developed and the topography of much of the high rainfall regions makes cultivation difficult. The usable portion of the south of the continent with a growing season of less than five months is used for sparse cattle and sheep grazing and is referred to as the Pastoral Zone.

In addition to the agricultural zones where the type of production is determined by the natural environment, 2·9 million acres of land in Australia are irrigated by water conserved in large reservoirs constructed by the various State Governments. More than three quarters of the irrigated land in Australia is irrigated with water from the Murray and Murrumbidgee River systems in southern New South Wales and northern Victoria. As the availability of moisture is the principal factor determining land use in Australia, a number of commodities can be produced under irrigation because the moisture status of the soil can be controlled. All of the nation's rice and the majority of its vegetable, citrus, dried, and stone fruits are produced under irrigation. Because profitable markets for these products are limited, 68 per cent of Australia's irrigated land is sown to pasture and used for dairying and fat lamb production.

Although these agricultural zones are quite distinct, no comparison of the profitability or efficiency of farming in the different regions has been published and few attempts have been made to establish what factors determine the profitability or efficiency of farming within a region. Such a study can be made using the economic surveys carried out by the B.A.E.

As these surveys were carried out over different periods of time and with differing objectives a number of adjustments are needed before they can be used as a basis for comparing farm profits and the efficiency of resource use between regions. These adjustments and the surveys used as a basis for this analysis are described in an Appendix.

2. THE COMPARATIVE PROFITABILITY OF FARMING

From the individual farmer's point of view, profitability can be measured by calculating the net return to capital which the farmer has invested, after deducting all annual costs including depreciation of fixed assets and machinery and an allowance for the labour of the farmer and his family, but excluding any interest charges for the farmer's capital.

(1) Inter-zonal comparisons

In most farming zones the system of farming is relatively uniform and it is possible to make comparisons of the profitability of farming between zones, as well as between regions within the zones. The exception is irrigated farming where a wide variety of types of farming is possible and profits vary widely with the type of farming selected. Similarly the isolated areas of dryland used for fruit production cannot be compared with the four broad farming zones, as they occupy selected areas with suitable climate or soil within two of the four major zones. In some cases they are also favourably situated in relation to local markets (see Figure 1, page 204).

The return for each of the four major farming zones on an indexed and unindexed basis is shown in Table 1, together with the physical and financial characteristics of farming in each zone which appear to affect profitability.

Scale of operation measured either in terms of farm capital, size of holding or revenue per holding appears to be the dominant factor in determining the difference in the average profitability of farming between zones. Returns to capital are highest in the dry Pastoral Zone where output per acre is lowest and lowest in the Dairying Zone where rainfall and output per acre is highest. The Wheat and Sheep Zone and the High Rainfall Sheep Zone occupy an intermediate position between these two extremes. This order persists in spite of the fact that the dairy industry receives a direct price subsidy and a home support price for butter fat.

In the Dairying Zone is it possible to divide farms into those which sell some of their produce as milk for human consumption and those who sell all their produce for manufacturing purposes chiefly for butter production. When this division is made it is seen that higher returns are obtained per unit of capital on farms selling milk for human consumption than on High Rainfall Sheep Zone farms. The greater profitability of the whole milk producing farms is caused by the local protection created by State milk boards which only permit whole milk to be produced on specified farms or in specified areas. In all states except South Australia and Queensland the boards fix the whole milk price at twice that obtained for manufacturing milk. Even in South Australia and Queensland whole milk sells at a higher price.

In comparing the relative profits obtained from farming in each zone the effect of drought must not be ignored. The period covered by the Sheep Industry and Dairy Industry surveys only contains the minor drought of 1957–58. A period including a major drought like that of 1940–47, or even the short but severe drought of 1964–65 could show an entirely different level of profits in the major farming zones. However it should not be forgotten that major droughts decrease farm profits in all zones. Sheep numbers decrease in all zones and although the decrease is normally largest in the Pastoral Zone and least in the High Rainfall Sheep Zone the profit margin is far lower in the latter zones. Thus smaller losses could have a more marked effect on profits in the High Rainfall than in the Pastoral Zone. In the Wheat and Sheep Zone both wheat yields and sheep numbers decrease during a drought. In the

TABLE 1

Average Return to Capital in Australian Farming Zones

Zone	Net return as percentage of farm capital		Net return as percentage of capital less U.C.V. (V.G.)*		Average area of farm	Total farm capital	Ratio of revenue to resources (Revenue per $100 of—)			Revenue per acre	Net return per farm indexed	Net return as percentage of farm capital including increase in land value	
	Indexed	Unindexed	Indexed	Unindexed			Labour	Capital	Total costs less labour			Indexed	Unindexed
	per cent	per cent	per cent	per cent	acres	$'000	$	$	$	$	$	per cent	per cent
PASTORAL	5·3	6·3	6·7	8·3	41,376†	170	317	20	242	0·81	9,071	6·6	7·8
WHEAT SHEEP	4·2	4·7	7·9	10·0	2,774	85	339	17	215	5·31	3,542	5·6	6·3
HIGH RAINFALL SHEEP.	3·0	2·9	4·5	4·7	1,363	75	288	15	222	7·15	2,265	4·5	4·5
DAIRYING—													
Whole Milk	4·2	4·1	n.a.	n.a.	323	39	307	26	191	31·27	1,618	5·0	4·9
Manufacturing	1·8	2·0	n.a.	n.a.	380	32	261	21	187	17·91	598	2·6	2·8
All Industry	2·9	2·9	5·2	5·5	357	35	280	23	192	22·08	989	3·7	3·8

* Based on the Valuer General's estimate of unimproved land value.

† Excluding W.A. (for average areas in individual Pastoral regions see Table 2).

Notes:

In all calculations capital revenue and costs are indexed by individual items and years to the common year 1964–65 unless otherwise indicated.

The Sheep Industry Survey covers the period 1957–58 to 1962–63 and the Dairy Industry Survey from 1961–62 to 1963–64.

Dairying Zone large increases in feeding costs occur on whole milk producing farms and output declines on farms producing milk for manufacturing. The exact effect of drought on profits in the different farming zones could only be examined by comparing profits over a large number of years which included periods of drought.

It is probable that higher profits are demanded in the lower rainfall areas where losses due to droughts are greater than in the areas with a more assured rainfall. A comparison of returns to capital minus the unimproved value of land in each farming zone supports this hypothesis. If the unimproved value of land is removed, the Wheat and Sheep Zone shows the highest return to capital and the Dairying Zone has a return to capital similar to that obtained in the Pastoral Zone (see Table 1). Land values might also be forced up in the Dairying and High Rainfall Sheep Zones because the total capital required to purchase a farm is lower and there is more competition for farms. If all farmers invest to obtain the highest possible average return on capital then land appears to be undervalued in the Pastoral and Wheat and Sheep Zones and over valued in the High Rainfall Sheep and Dairying Zones.

As the zones with the highest amounts of capital invested per farm are also those with the highest return to capital, average net income per farm is also highest in zones with the highest return to capital. The only exception is when distinction is made in the Dairying Zone between farms selling milk for human consumption and those relying entirely on sales of milk for manufacturing purposes. Whole milk farms have a higher return to capital than High Rainfall Sheep farms but because the total capital invested on whole milk farms is less than on High Rainfall Sheep farms the average net income per farm is higher on the sheep farms.

One disadvantage of using the ratio between net return and farmer's capital as a measure of profitability is that this measure neglects increases in capital value. This disadvantage can be reduced by calculating the average increase per annum in the improved value of farms over the period of the survey using the B.A.E. index for rents which is based on land values. This amount can then be added to net return and expressed as a percentage of capital. This adjustment has no effect on the ranking of the different farming zones in order of profitability but it does increase the return to capital more in the High Rainfall Sheep Zone than in any other zone (see Table 1). Such an adjustment can only be regarded as approximate as it depends on an index of land values which is dependent on the Valuer General's estimate of land values in each state.

(2) Differences in profitability within zones

THE PASTORAL ZONE

Scale and land values appear to be the factors dominating profits (see Table 2). In spite of the low output per sheep and per acre, large properties in Western Australia are more profitable than those in any other State. This advantage is cancelled if the unimproved value of land is removed from capital. The return to capital excluding unimproved land values is higher in New South Wales than in any other State because of the higher output per sheep. The effect of scale is still apparent, however, as the smaller flocks of South Australia show the lowest return to capital less the unimproved value of land even though the output per sheep is higher than in other regions of the Pastoral Zone.

TABLE 2

*Profitability of Different Regions Within the Pastoral Zone**

Region	Net return to farm capital	Average area of farm	Number of sheep per farm	Revenue from sheep per sheep	Revenue per—			Return to capital less U.C.V. of land†	Total capital per farm	Net return per farm	Net return (including increase in land value) as percentage of farm capital
					$100 labour	$100 capital	$100 costs—labour				
Queensland ..	per cent 3·7	'000 acres 35	6,636	$ 4·5	$ 293	$ 20	$ 213	Per cent 5·6	$'000 170	$ 6,350	per cent 5·5
New South Wales	6·1	29	5,123	6·1	365	19	247	8·0	179	10,858	6·6
South Australia ..	4·7	60	3,206	6·8	298	17	259	5·3	133	6,248	8·8
Western Australia	6·8	433	9,096	4·1	265	29	259	6·9	152	10,333	7·5

* Based on surveys from 1957–58 to 1962–63 with individual items of capital revenue and costs indexed by individual years to 1964–65.

† Based on Valuer General's estimate.

TABLE 3

*Profitability of Different Regions within the Wheat and Sheep Zone**

Region	Net return to farm capital	Average area of farm	Area of wheat per per farm	Number of sheep per farm	Revenue from sheep per sheep	Revenue per—				Return to capital less U.C.V. of land†	Net return per farm	Net return (including increase in land value) as percentage of farm capital
						Acre of wheat	$100 labour	$100 capital	$100 costs—labour			
	per cent	acres	acres		$	$	$	$	$	per cent	$	per cent
Queensland ..	3·4	4,018	189	1,666	5·1	16·1	326	16	211	7·0	3,408	4·5
New South Wales	4·0	2,130	252	1,710	6·1	18·2	342	17	211	7·6	3,974	4·5
Victoria	2·85	1,997	284	808	7·5	13·3	274	16	217	6·3	1,808	3·7
South Australia ..	2·5	2,111	211	803	6·0	15·9	316	14	198	3·6	1,929	8·1
Western Australia	7·0	3,616	485	1,487	5·9	15·5	428	22	221	9·6	5,502	7·6

* Based on surveys from 1957–58 to 1962–63 with individual items of capital revenue and costs indexed by individual years to 1964–65.

† Valuer General's rate (except in the case of Q'ld and Vic. where the Valuer General's rate exceeded improved value of land; here the improved land value has been deducted).

The Wheat and Sheep Zone

Scale of operations appears to be the factor dominating profitability in the Wheat and Sheep Zone, particularly the area of wheat per farm (see Table 3). South Australia and Victoria with small sheep flocks and small wheat acreages have the lowest return to capital. In Queensland and New South Wales this is partially compensated for by the large sheep flocks and by the higher yield of wheat in New South Wales. Return to capital is highest in Western Australia where the acreage of wheat sown is almost double the average in other states and sheep flocks are almost as large as in any other state. The value of land in this zone appears to have little effect on the order of profitability between regions.

The High Rainfall Sheep Zone

The causes of regional differences in profits are far less clear in the High Rainfall Sheep Zone than in other sheep producing zones (see Table 4). Stocking rates are highest in Victoria and South Australia but this is not sufficient to compensate for the larger flocks carried in New South Wales and Western Australia where profits are higher even though the output per sheep is lower. Profit appears to be related to the number of sheep per farm and to the efficiency of labour usage. The low returns obtained in Tasmania appear to be due to the low output per man and the low stocking rate. A high output per sheep is obtained by producing a high proportion of fat lambs but this is insufficient to compensate for the low stocking rate and inefficiency in labour usage. The unimproved value of land has little effect on profit in this zone and the low return to capital suggests that land is overvalued.

The Dairying Zone

Size of herd, the suitability of the physical environment for dairying which is reflected in the gallons of milk produced per cow, and the proportion of products sold as whole milk, appear to be the three dominant factors in determining the differences in profitability between dairying regions (see Table 5). These three factors do not occur together in any one region but when at least two of them are present the return to capital in the region is relatively high. The Hunter and Manning, and the South Coast and Cumberland regions in N.S.W. sell a high proportion of their produce as whole milk and have relatively large herds. The Central and Lower North region in South Australia, with a high output per cow and a high proportion of produce sold as whole milk, also has high profits although the average herd size is the smallest in Australia. Gippsland farmers sell a very small proportion of their produce as milk for human consumption but herds are large and output per cow is relatively high. In all of these regions net return to capital is greater than 3·5 per cent.

The North Coast of New South Wales and all of the Queensland regions except Rockhampton and Maryborough have low or even negative returns to capital. The environment is unfavourable and the amount of milk produced per cow and the proportion of milk sold for human consumption is low. In the latter respect, the Cairns, Townsville, Mackay region in North Queensland is the only exception; here the proportion of milk sold for human consumption is the highest in Australia

TABLE 4

*Profitability of Different Regions in the High Rainfall Sheep Zone**

Region	Net return to farm capital	Average area of farm	Number of sheep per farm	Number of cattle per farm	Revenue from sheep per sheep	Revenue from beef cattle per beast	Revenue per—			Pasture improved as percentage of total area	Return to capital less U.C.V. of land†	Merinos as percentage of total sheep	Net income per farm	Net return (including increase in land value) as percentage of farm capital
							$100 labour	$100 capital	$100 cost—labour					
New South Wales.	per cent 3·1	acres 1,708	1,682	83	$ 5·8	$ 24·8	$ 299	$ 14·5	$ 219	per cent 38	per cent 4·5	per cent 65	$ 2,637	per cent 3·5
Victoria ..	2·7	798	1,218	59	6·8	29·0	277	13·9	225	70	4·8	36	2,000	3·5
Tasmania ..	2·5	1,888	1,167	53	7·5	23·7	244	17·3	224	20	3·9	4	1,655	4·1
South Australia	2·5	959	1,175	52	6·6	25·5	307	12·7	211	69	3·5	44	2,064	8·2
Western Australia.	5·3	1,462	1,323	41	6·0	15·4	340	20·3	225	64	7·1	58	2,894	5·9

* Based on surveys from 1957–58 to 1962–63 with individual items of capital revenue and cost indexed by individual years to 1964–65.

† Valuer General's estimate.

TABLE 5

*Profitability of Different Regions within the Dairying Zone**

Region	Net return to capital	Average area of farm	Average size of herd	Acres per cow	Milk per cow	Improved pastures as percentage of farm area	Percent produce sold as whole milk	Revenue from dairying per cow	Revenue per—			Net return to capital less U.C.V. of land†	Net return per farm	Net return (including increase in land value) as percentage of farm capital
									$100 labour	$100 capital	$100 costs—labour			
	per cent	acres	No. of cows	acres	gals	per cent	per cent	$	$	$	$	per cent	$	per cent
NEW SOUTH WALES—														
North Coast	−3·3	279	53	5·3	323	8	..	93	164	21	182	−4·4	−773	−2·8
Hunter and Manning	3·5	347	60	5·8	440	16	49	143	271	27	198	4·7	1,099	4·0
Cumberland, South Coast, and Southern Tableland.	3·6	307	59	5·2	560	41	53	188	298	27	187	4·7	1,486	4·2
VICTORIA—														
Western and Wimmera	1·9	207	46	4·5	611	63	6	142	257	23	188	2·5	540	2·9
Central and North Central	2·4	202	53	3·8	549	64	22	144	290	20	185	3·4	900	3·5
North Eastern	2·8	504	56	9·0	561	38	5	178	278	21	197	3·5	1,354	3·8
Gippsland	4·2	205	61	3·4	641	68	13	150	316	23	198	5·4	1,663	5·2
QUEENSLAND—														
Cairns, Townsville, and Mackay	0·9	320	47	6·8	330	29	55	124	308	24	156	0·9	213	2·2
Rockhampton and Maryborough	3·5	652	59	11·1	365	9	10	147	295	26	191	4·1	1,203	4·9
Moreton	−1·2	497	54	9·2	331	7	21	106	193	21	185	−1·4	−319	0·07
Downs and Roma	1·9	507	52	9·7	386	14	4	152	254	21	194	2·3	733	3·3
SOUTH AUSTRALIA—														
Central and Lower North	4·3	279	34	8·2	569	55	97	293	269	20	241	4·5	2,154	12·1
South East and Murray Malle.	1·0	360	40	9·0	524	69	..	188	286	15	168	1·0	484	8·2
WESTERN AUSTRALIA	2·0	483	49	9·9	455	54	22	142	342	18	165	2·4	781	2·2
TASMANIA	3·3	398	44	9·0	528	37	24	204	306	21	193	3·5	1,401	3·9

* Based on the Dairy survey from 1960–61 to 1963–64 with individual items of capital revenue and cost indexed by individual years to 1964–65.

† As the Valuer General's estimation of unimproved land in many dairy regions exceeded the total improved value of farm land, the value based on shire rating is used in this Table.

Notes:

Samples of New South Wales dairy farms on the Northern and Central Tablelands and on the South Western Slopes and in the Riverina are excluded as these areas only contain a small proportion of Australia's dairy cattle.

As 94 per cent of the area of the Mallee and Northern sample of dairy farms in Victoria is irrigated this region is included under irrigated farming in Table 6.

but the environment is extremely unfavourable and returns to capital are low. The Western and Wimmera, Central and North Central, and the North Eastern districts in Victoria together with the South Eastern region in South Australia, occupy an intermediate position.

Tasmania and Western Australia dairying areas also show returns to capital of between 2·0 and 3·5 per cent. In these states the results are misleading as farms producing milk entirely for manufacturing are not separated from those selling milk for human consumption. The former farms have lower returns and the latter higher returns to capital than indicated by the average figure.

Dairying is only profitable if herds are relatively large, and output per cow is high or at least twenty per cent of the milk produced is sold for human consumption. The high returns to capital obtained in Gippsland where only a small proportion of milk is sold for human consumption compared with the lower returns in whole milk producing regions in New South Wales and Queensland indicates the basic unsuitability of the latter regions for dairying.

Deduction of the unimproved value of land has little effect on the order of profitability and is apparently a direct reflection of the profit earning capacity of the farms. The low returns to capital in many regions suggest that farms are overvalued in terms of income-earning capacity. This is possibly due to a lack of alternative employment opportunities for farmers and the small amount of capital required to purchase a farm in some dairying regions. Net farm incomes are low, or even negative in some regions, indicating that farmers earn an income, including the interest on the capital they have invested, which is less than the award wage-rate if off-farm income and perquisites including free housing and the use of a motor vehicle charged as part of farm costs are ignored.

Irrigated Areas

Nearly all of the studies of irrigated farming undertaken by the B.A.E. are of schemes supplied by water from the Murray and Murrumbidgee Rivers in New South Wales, Victoria, and South Australia. As three-quarters of Australia's irrigated land is found on these two rivers the surveys can be taken as being typical of the majority of existing irrigated farming in Australia.[1] The only other survey available is of irrigated banana production at Carnarvon in Western Australia.

The irrigation areas differ from the other zones because the control of available moisture makes a wide range of farming types possible within the zone. Under these circumstances it is a question of comparing the profitability of types of irrigated farming rather than comparing the profitability of different geographical regions where the same type of farming is practised. In doing so it is not implied that any one type of irrigated farming could be practised on any part of an irrigation scheme. Certain crops such as fruit and vegetables will only produce high yields on particular soils. However, permanent pastures could be established over most of the irrigated area and this type of use of irrigated land could be expanded if it was considered desirable.

[1] Bureau of Census and Statistics, *Yearbook of the Commonwealth of Australia, No.* 52, (Canberra, 1966), pp. 170–87.

An examination of the returns to capital and of the physical and financial characteristics of irrigated farms reveals that the type of farming is the dominant feature in determining the profitability of irrigated farming (see Table 6). Large scale 1,000-acre farms, producing rice and sheep are the most profitable but these are closely followed by 70- to 150-acre farms producing citrus fruits. Within any one type of farming scale plays an important part in determining profitability. Large citrus farms on the Murrumbidgee Irrigation Area and on the Murray Upper Irrigation Area have high returns to capital. Small citrus holdings on the Murray have low or even negative returns to capital.

Although it is impossible to compare the profitability of irrigated farming as a whole with the profitability of other farming zones because of the wide range of farming types found in irrigated areas, it is possible to compare the profits obtained from individual irrigated farming types in Table 5 with those of the main farming zones shown in Table 1. Irrigated rice and sheep farming and large scale irrigated citrus production have a higher return to capital than any type of farming carried out under dry land conditions. Similarly, irrigated dairy farms have a higher return to capital than farms in any other dry land farming zone with the exception of sheep grazing in the Pastoral Zone. The return to capital on irrigated dairy farms is also higher than that obtained in any other dairying region (see Tables 5 and 6).

Dairy products, dried vine fruit, and rice produced on irrigated farms all receive subsidies either in the form of a home support price, a direct government price support, or both. All irrigation projects are subsidized by the state supplying farmers with water at the cost of delivering the water and maintaining the irrigation schemes without charging interest on capital invested in state irrigation works. The extremely high profits received by large scale irrigation farmers suggest that the level of subsidy on irrigation water supplied to these farmers could be reduced without reducing the return to farmers' capital below that obtained by dry land farmers. The additional profit cannot be justified by high risks as in the case of the Pastoral and Wheat and Sheep Zones. Irrigation farmers are less exposed to variations in weather and many of their products (rice, dried vine fruit, and dairy produce) are partially protected from variations in prices by government price support schemes.

The unimproved value of large scale irrigation sheep and rice farms and sheep farms is extremely high. The percentage return to capital obtained on these farms rises dramatically if net return is expressed as a percentage of capital less unimproved land value. On the other hand the unimproved value of citrus and vine producing holdings is low and making allowance for this has little effect on return to capital. As the returns to capital on large scale citrus properties are almost as high as on rice producing farms and higher than on large scale fat lamb farms it would seem that the large citrus orchards are undervalued and rice and sheep farms overvalued.

TABLE 6
*The Profitability of Irrigated Farming**

Farming type	Net return to capital	Average area of farm	Area of main crop	Area irrigated	Revenue per—					Percentage of revenue formed by main crop	Net return to capital less U.C.V. of land	Net return per farm	Net return (including increase in land value) as percentage of farm capital
					Acre of farm	Acre main crop	$100 labour	$100 capital	$100 costs—labour				
	per cent	acres	acres	acres	$	$	$	$	$	per cent	per cent	$	per cent
RICE AND SHEEP 1957–58 and 1958–59.	7·9	1,005	68	519	20	143	549	22	226	..	16·5‡	7,482	8·3
SHEEP— 1957–58 and 1958–59.	4·9	1,794	..	400	8	..	515	14	220	..	7·3‡	5,186	5·4
CITRUS— 1960–61 to 1962–63													
M.I.A.	6·9	69	17†	50	167	306	258	39	234	48	8·3§	2,086	7·5
Mid-Murray ..	—3·4	72	11†	58	97	247	192	28	167	51	—4·4§	—848	—1·9
Upper Murray ..	6·2	156	26†	128	129	671	308	39	195	87	7·0§	3,266	6·7
Riverland ..	—0·37	43	10†	38	175	319	209	23	186	48	—0·4§	—121	3·7
DRIED VINE FRUITS— 1960–61 to 1962–63	2·7	31	19†	24	315	305	215	34	220	77	3·0§	602	5·5
BANANAS— Gascoyne, W.A., 1959–60 to 1961–62.	1·1	46	3†	9	178	1,094	197	42	215	40	1·26‡	217	1·5
DAIRYING— Victoria, 1961–62 to 1963–64.	5·2	185	..	104	53	..	340	23	206	..	7·7‡	2,196	6·2

* Based on surveys for the years shown with individual items of capital cost and revenue indexed by individual years to 1964–65.

† Bearing Acreage only.

‡ Valuer General's Estimate.

§ Shire Values used as Valuer General Estimate was not available.

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TABLE 7

*The Profitability of Dry Land Horticultural Farms**

Farming type	Net return to farm capital	Average area of farm	Area of main crop†	Revenue per—					Net return to capital less U.C.V. of land	Net income per farm	Net return (including increase in land value) as percentage of farm capital
				Acre of farm	Acre of of main crop	$100 labour	$100 capital	$100 costs—labour			
CITRUS—	per cent	acres	acres	$	$	$	$	$	per cent	$	per cent
1960–61 to 1962–63											
N.S.W. Coastal ..	0·03	62	12·3	116	306	266	32	162	0·04‡	8	0·6
BANANAS—											
1959–60 to 1961–62											
Q'ld—Far north	−2·4	101	8·4	42	385	190	57	194	−3·9 §	−178	−1·03
East Coast—											
N.S.W. and Q'ld ..	−3·8	105	8·25	44	392	165	53	215	−4·54¶	−329	−2·7

* Based on surveys for the years shown with individual items of capital revenue and cost indexed by individual years to 1964–65.

† Bearing Acreage only.

‡ Valuer General's estimate.

§ Total Improved Value.

¶ Value Based on Shire Ratings.

DRY LAND HORTICULTURAL FARMS

Three groups of fruit producing farms have been studied by the B.A.E., viz. the citrus orchards at Gosford, N.S.W., the banana farms in southern Queensland and northern New South Wales, and the banana farms in the far north of Queensland. The physical and financial characteristics of these farms are shown in Table 7. Only the citrus farms in New South Wales show a positive return to capital; all the banana producing regions show a negative return to capital during the period of survey. Like small-scale irrigation farms, small dry land fruit farms are unprofitable under Australian conditions. In spite of the high output per acre obtained, the high cost of labour makes this type of farming unprofitable. Such farms do not benefit from government subsidies in the form of cheap irrigation water which assists similar types of farming in irrigated areas.

3. THE REGIONAL EFFICIENCY OF FARMING

From a national point of view farming can be defined as the process in which resources are combined to produce crop and livestock products. The efficiency with which this process is carried out can be measured by expressing the difference between the value of the output obtained and the costs of the variable resources used as a percentage of the capital used in the productive process, when resources and capital are valued at their opportunity cost and output is valued at the price it will fetch in a free market. In other words efficiency is the rate at which the productive process is capable of creating new capital. The higher this rate in a society where capital is a scarce resource, the greater the efficiency of the farming.

The level of efficiency in farming defined in this way will differ from the level of farm profit indicated by the net return to farm capital for three reasons.

(i) The farmer's profits will contain any element of support paid to the farmer by the state. This may take the form of direct price or cost subsidies, or protection from external competition.

(ii) Part of a farmer's capital is the value of the land. This value is not necessarily a measure of the resources used in bringing the land into production. Most land has a value in its unimproved state because it is capable of producing a profit after it has been developed. Although the individual farmer must count this unimproved value as part of his capital the nation need not, as it has no opportunity cost from the nation's point of view.

(iii) Any capital which is supplied by the state to farmers must be included as capital at its opportunity cost. In the strictest sense such capital includes irrigation works, drainage schemes, means of communication, research, advisory and educational services supplied by the state. As some of these, such as means of communication and research and advisory services, are common to all farming zones their cost may be neglected in comparing the efficiency of farming between regions. Such an omission is not strictly valid as the cost of providing the services to one region may be greater than in another. For instance, densely settled regions are normally better supplied with communications,

research, and educational facilities than sparsely settled areas, but the cost per farm of providing services in the more densely settled areas may be lower as they are charged against a larger number of farms.

On the other hand capital works in the form of irrigation and drainage schemes are peculiar to a particular region and the capital contained in them must be added to the capital supplied by farmers in the region if they are supplied free of charge to the farmer by the state.

Efficiency of farming in any particular region is thus equal to:

$$(1)\quad \frac{\text{Total Revenue} - \text{Price and Protection Subsidies} - \text{Annual Costs} + \text{Production Subsidies}}{\text{Farmer's Capital} + \text{State Capital} - (\text{The Unimproved Value of Land})} \times \frac{100}{1}$$

Total Revenue and Annual Costs and Farmer's Capital can be taken from the B.A.E. surveys indexed to a particular year or simply averaged over the period of the survey.

Agriculture in Australia is subsidized in a variety of ways. Butterfat and dried fruit producers are paid a direct price subsidy. Rice, sugar, butterfat, and dried vine fruits are protected from external competition by tariffs. In addition the portion of these products consumed in Australia is sold at a fixed price which is higher than both the import or export parity price. In some years wheat is protected in the same manner, in others it is sold at a fixed price which is lower than the export price and so has a negative subsidy. Wool and meat are not protected. The total subsidy for products consumed in Australia can be defined as the difference between the revenue received by the farmer at the protected price and the revenue he would receive if the same product were sold at import parity price. For exported products the total subsidy is equal to the difference between the revenue received by the farmer at the protected price and the revenue which would be received if the product were sold at export parity prices.

Such a definition assumes that the withdrawal of Australian exports from the world markets would have little effect on world prices. The only Australian products which form a large proportion of total world trade are wool, wheat, oats, and beef. Of these only wool exceeds 25 per cent of total world trade. The withdrawal of any product other than wool from the world market would probably only have a short term price effect. The withdrawal of Cuban sugar in 1963 which constituted 25 per cent of world trade in this commodity only increased the price of sugar for a relatively short period of time. Similarly the purchase of agricultural products by Australia would probably be too small to have any long term effect on world prices.

The level of protection given to Australian products during the years covered by the B.A.E. surveys has been calculated by Harris.[2] The subsidies received by farmers in each year was calculated using these indices (see Table 8).

[2] S. F. Harris, "Some Measures of Levels of Protection in Australia's Rural Industries", *Australian Journal of Agricultural Economics*, Vol. 8, No. 2, (December 1964), pp. 124–44. (Supplemented by data supplied by the author).

TABLE 8

Estimates of Protection Levels:

(Free Market Price as a Percentage of Price Received by the Farmer)

Commodity	Averages for years:						
	1957–58	1958–59	1959–60	1960–61	1961–62	1962–63	1963–64
WHEAT	87.4	96.4	98.4	102.3	100.6	103.4	..
BUTTER	..	..	..	..	138.5	128.6	125.6
RICE	104.6	108.9	..	..	..	..	..
DRIED VINE FRUIT	..	108.3	107.7	..	113*	..	..

* Average of 3 years ended 1961–62.

Production subsidies are uncommon in Australia. The bounty on superphosphate of $6 per ton, which was commenced in August, 1963, was the only major one during the years in which the B.A.E. surveys were carried out. Superphosphate costs were increased by this amount in the calculation for the last year of the dairy survey, the only year in which the bounty applied. A bounty on one Australian-made tractor is paid by the Commonwealth Government, but this only reduces it to the price which would be paid for similar types of imported tractor. The tractor bounty is thus a subsidy to the tractor manufacturer and not to the farmer and is ignored in these calculations.

The unimproved value of land can be defined as the sale value of land in its natural state. This price will naturally rise as the services in the proximity of the land increase or if the profitability of farming in the surrounding district increases. Thus the provision of roads, railways, or irrigation facilities by the state will increase the unimproved value of land. Improvements in technology, increases in product prices, or decreases in resource costs will have the same effect. Unimproved value should be estimated from sales of unimproved land which are taking place in the same area. In many well-settled districts little unimproved land remains and the estimation of unimproved value is extremely difficult.

Land valuations are carried out by the following Departments in each State:

New South Wales: The Valuer General's Department.

Queensland: The Department of the Valuer General.

Victoria: The Department of Local Government.

South Australia: The Land Tax Department.

Western Australia: The Commonwealth Taxation Department.

Tasmania: The Lands and Survey Department.

The senior district valuer in each of these departments was asked to provide an estimate of the unimproved value per acre of a typical farm of each type, in each shire, in each farming region.[3] The values received were then weighted by the acreage of farm land in the B.A.E. surveys in the various shires and the average unimproved value per farm was calculated for each farm type in the B.A.E. surveys. In some dairying regions in New South Wales and Queensland this value exceeded the improved value of farms estimated by the B.A.E. It appears that in some regions district values had supplied the valuer of better class dairy land rather than the value of all land on dairy farms.

A further attempt was made to establish unimproved land values by calculating the unimproved value of the land used for local government taxes. Unfortunately this figure was not collected in the B.A.E. surveys. However, the total rates and taxes made up of shire rates, State land taxes, and other government levies were recorded in all surveys. The Departments of Local Government in each State were asked for the rate charged per dollar of unimproved land value in each shire.[4] This rate was then weighted by the acreage of farm land in the B.A.E. survey in that shire to obtain a composite rating for each farm type region. The total rates and taxes paid in each sample were reduced by the amount paid as land tax and in special levies and the unimproved value of land was calculated by dividing the amount paid as shire rates by the weighted shire rate per dollar for each farming type region. The unimproved land value obtained from shire rates was always lower than that obtained directly from the Valuer General. Since the estimate of the Valuer General was a recent estimate and not necessarily used for taxation purposes, it was considered to be the more accurate of the two. However, since it exceeded the total improved value of farms in some areas, it was decided to calculate the efficiencies of farming using both methods. In farm type regions where the estimate of the Valuer General exceeded the improved value of land as stated in B.A.E. surveys, the latter figure was substituted for it.

As the water rates paid by farmers using irrigation water from state irrigation works is barely sufficient to cover the cost of maintaining these schemes and of delivering water, the total capital invested in state schemes must be added to the capital invested by farmers in irrigation areas before calculating the efficiency of farming. The total capital invested in irrigation works can be calculated by indexing the actual capital expenditure in any particular year to its present value.[5] Surveys of irrigated farming have been carried out by the B.A.E. on both the Murrumbidgee River and on the Murray River and its tributaries. The major storages (Burrinjuck and the Hume Weir) on both rivers affect the quantity of water available for irrigation throughout the length of each river. The only method of apportioning the capital cost of irrigation between farms

[3] Private communications from the Departments listed. 1966.

[4] Private communications from State Departments of Local Government, 1966.

[5] Using the cost of construction index of the Water Conservation and Irrigation Commission of N.S.W. This is based on changes in the basic wage and in the cost of construction materials.

TABLE 9

Capital Cost of Irrigation Water (Including Stock and Domestic Supplies)

	Murrumbidgee	Murray Only	Murray and Tributaries
Total initial capital ($m)	27.4	102.9	228.1
Capital at present day value ($m)	111.1	313.9	519.9
Average water delivered (million acre feet) ..	0.481*	2.197†	3.293†
Average capital cost per acre foot of water delivered ($)	213.0	143	158

* 1956–57 to 1960–61.

† 1957–58 to 1964–65.

Note: Both of these periods are before water from the Snowy Mountains Scheme was diverted into the Murray and Murrumbidgee Rivers.

is to calculate the capital invested per acre foot of water delivered by the scheme and then add an amount of capital to farm capital equivalent to the amount of irrigation water used during the period of survey. As the amount of water delivered by a scheme varies from year to year the capital cost per acre foot was obtained by dividing the total capital invested by the average amount of water delivered over a number of years. Table 9 shows the total capital invested in Murray and Murrumbidgee works, the amount of water delivered, and the average capital cost per acre foot.[6] The capital cost of water per acre foot on the Murrumbidgee is 60 per cent higher than the capital cost per acre foot of Murray water because far more expensive works were required to impound a smaller quantity of water on the Murrumbidgee.

A second method of assessing the efficiency of farming in the various regions is by means of the benefit-cost ratio. This is the ratio between the total revenue received and the total value of resources used. If this method is adopted interest must be charged on both the farmer's capital and any state capital. The ratio used is:

$$(2) \quad \frac{\text{Annual Total Revenue} - \text{Annual Subsidies}}{\text{Total Annual Costs} + 7 \text{ per cent of (All Capital} - \text{Unimproved Value of Land)}} \times \frac{100}{1}$$

The interest rate adopted should be the opportunity cost of the capital invested. This should not be less than the current borrowing rate of approximately 7 per cent as borrowed capital when invested should earn more than the borrowing rate.

The net return to capital defined in equation (1), and the benefit-cost ratio defined in equation (2), calculated using both estimates of unimproved land values, are shown in Table 10. The farmer's net return to his capital is repeated in Table 10 as a means of assessing how accurate a guide this is to the efficiency of resource use in the various regions.

[6] Private communications from the Water Conservation and Irrigation Commission of N.S.W., 1966.

TABLE 10

The Efficiency of Australian Farming Regions

Region	Unsubsidized Net Return to Total Capital — Unimproved Land Value based on:		Ratio of Unsubsidized Revenue to Total Cost x 100 — Unimproved Land Value based on:		Subsidized Net Return to Total Farm Capital
	V.G.	S.R.	V.G.	S.R.	
	1	2	3	4	5
	%	%			%
PASTORAL ZONE					
Queensland	5.6	4.3	95	90	3.7
New South Wales	8.0	7.9	104	104	6.1
South Australia	5.3	4.8	92	89	4.7
Western Australia	6.9	7.8	99	103	6.8
All Pastoral	6.7	6.1	99	96	5.3
WHEAT AND SHEEP ZONE					
Queensland	6.9*	4.2	100	87	3.4
New South Wales	7.7	5.3	102	93	4.0
Victoria	6.5*	4.1	99*	89	2.9
South Australia	3.7	2.7	86	77	2.5
Western Australia	9.8	8.1	110	104	7.0
All wheat and sheep	8.0	5.3	103	93	4.2
HIGH RAINFALL SHEEP ZONE					
New South Wales	4.5	3.6	89	83	3.1
Victoria	4.8	3.5	92	84	2.7
Tasmania	3.9	2.6	90	81	2.5
South Australia	3.5	2.6	83	75	2.5
Western Australia	7.1	6.0	100	96	5.3
All beef and sheep	4.5	3.4	90	82	3.0
DAIRYING ZONE					
Queensland—					
Cairns, Townsville and Mackay	−0.4	−0.3	78	77	0.9
Rockhampton and Maryborough	1.7	1.4	86	83	3.5
Moreton	−5.5*	−3.8	73*	68	−1.2
Roma and Downs	−1.1	−0.9	76	73	1.9
New South Wales—					
North Coast	−10.1*	−8.2	64*	62	−3.3
Hunter and Manning	3.3*	2.3	93*	88	3.5
Cumberland, South Coast and Southern Tableland.	4.4*	2.7	95*	89	3.6
Victoria—					
Western and Wimmera	−3.1	−2.4	77	73	1.9
Central and North Central	0.0*	0.0	84*	78	2.4
North Eastern	0.8*	0.5	85*	78	2.8
Gippsland	1.7	1.0	89	81	4.2
South Australia—					
Central and Lower North	6.1	4.4	97	89	4.3
South East and Murray Mallee	1.3	−0.9	69	63	1.0
Tasmania	2.5	1.8	86	74	3.3
Western Australia	0.2	0.2	73	80	2.0
All Dairying	0.7	0.5	86	79	2.9
HORTICULTURAL					
Citrus—New South Wales Coastal	0.04	0.04	86	85	0.03
Bananas—Queensland Far North	−3.9*	−2.7	90*	87	−2.4
Bananas—Queensland and N.S.W.	−5.9*	−4.5	80*	85	−3.8

TABLE 10—*continued*

The Efficiency of Australian Farming Regions—continued

Region	Unsubsidized Net Return to Total Capital, Unimproved Land Value based on: V.G.	Unsubsidized Net Return to Total Capital, Unimproved Land Value based on: S.R.	Ratio of Unsubsidized Revenue to Total Cost x 100, Unimproved Land Value based on: V.G.	Ratio of Unsubsidized Revenue to Total Cost x 100, Unimproved Land Value based on: S.R.	Subsidized Net Return to Total Farm Capital
	1	2	3	4	5
	%	%			%
IRRIGATION					
Rice and sheep—(MIA)	2.6	n.a.†	64	n.a.†	7.9
Sheep—(MIA)	2.3	n.a.†	59	n.a.†	4.9
Dairying—Murray	1.04	1.1	70	71	5.2
Dried fruit—MIA	−0.8	−0.7	76	75	2.7
Citrus—M.I.A.	4.7	4.1	92	89	6.9
Upper Murray	4.3	3.8	91	88	6.2
Mid Murray	−2.4	−2.3	68	67	−3.4
Riverland	−0.3	−0.3	75	72	−0.37
Bananas—Western Australia	1.7*	1.26	92*	89	1.1

* Improved land value used, since Valuer General's estimate of unimproved value exceeded improved value.

† Land values not available.

Notes:

Column 1 = Equation (1) using U.C.V. calculated from Valuer General's estimates.

Column 2 = Equation (1) using U.C.V. calculated from cents in dollars of shire rating.

Column 3 = Equation (2) using U.C.V. calculated from Valuer General's estimates.

Column 4 = Equation (2) using U.C.V. calculated from cents in dollars of shire rating.

Column 5 = Subsidized Net Return to Farm Capital.

The first point to emerge is that the adoption of either the Valuer Generals' estimates of unimproved land value or the unimproved land values calculated from shire rates has little effect on the ranking of the regions in order of efficiency. They appear to be more efficient using the Valuer Generals' estimates as these are higher and result in a greater reduction in the total capital used.

Within any one farming zone the adoption of net return to total capital or a benefit-cost ratio has little effect on the efficiency ranking. When comparisons are made between the farming zones the regions with a low capital investment per farm have a higher ranking on a benefit-cost basis than on a return-to-capital basis. This is particularly true of the banana and small-scale citrus farms. Thus the Coastal Citrus region in New South Wales has an indexed return to capital of 0·8 per cent and a benefit-cost ratio of 0·85 while the High Rainfall Sheep Zone with a return to capital of 3 per cent has a benefit-cost ratio of 0·81. A charge of 7 per cent on a small amount of capital adds little to the total annual costs and the benefit-cost ratio is high. The converse is true of farming zones with a high capital value per property.

In spite of this discrepancy the broad picture of efficiency using both methods of efficiency measurement is the same. The order of efficiency between zones in descending order is Wheat and Sheep, Pastoral, High Rainfall Sheep, and Dairying. Higher returns to farm capital were obtained in the Pastoral Zone, than in the Wheat and Sheep Zone, but the subtraction of unimproved land value, which is high in the Wheat and Sheep Zone, is sufficient to alter this order in New South Wales and Western Australia and for the zones as a whole.

The removal of the dairy subsidy increases the number of dairying regions showing a negative return to capital. Only regions selling a high proportion of milk for human consumption have a return to capital of more than three per cent.

The removal of subsidies on rice and dried vine fruit and the addition of capital included in state capital works has the effect of reducing the return to total capital on all irrigation farms below the return to farm capital. The net return to farmers' capital for large scale irrigation rice and sheep farms is 7·9 per cent, i.e., higher than in any other region, but when the capital invested in state-owned irrigation works is included the return to capital is only 2·6 per cent. On a benefit cost basis irrigated rice and sheep farms are the least efficient users of resources. The only type of irrigation farming which shows a return to total capital of more than 3 per cent are the large scale citrus farms where the state capital involved in supplying water is a small proportion of total capital. On irrigation farms and on dairy farms the subtraction of subsidies from revenue and the addition of state capital in irrigation works is not balanced by the subtraction of unimproved land values from total capital. Thus, from the nation's point of view, efficiency of resource use on irrigated farms and dairy farms is lower than the subsidized net returns to farm capital indicates. The converse is true of farms in the Pastoral, Wheat and Sheep, and High Rainfall Sheep Zones. As the products of these latter zones are unsubsidized and are not supported with state capital, the subtraction of the unimproved value of land has the effect of making the net return to national capital higher than to farm capital.

These results clearly indicate that Australia's dry Pastoral Zone and Wheat and Sheep Zone are the regions where the nation's resources are used most efficiently.

Within the various farming zones the order of efficiency of the different farming regions is the same as that indicated by the net return to farm capital, with two notable exceptions. In South Australia the unimproved value of land, calculated using either the Valuer General's figures or shire ratings as a basis, are extremely low for all regions except the dairying regions. This results in low values for both equations (1) and (2) because the amount of capital subtracted for the unimproved value of land is small. It is probable that the results shown in Table 10 underestimate the efficiency of farming in South Australia's Pastoral, Wheat and Sheep, and High Rainfall Zones.

The other notable change in ranking is amongst the irrigation regions. The charge for state capital in irrigation works greatly increases the capital invested on the irrigated rice and sheep, dairy farm, and sheep farms, making this type of farming much less efficient than the large scale citrus holdings where the quantity of water consumed is lower and the addition of state capital to farmers' capital smaller. From a national point of view irrigation appears to be efficient if water is used to produce high-priced products such as citrus fruits if this crop is grown on relatively large scale farms as it is on the M.I.A. and the Murray Upper Irrigation region. Small scale citrus farms on the Mid and Lower Murray are not efficient. It is interesting to note that they are less efficient than low-profit dry land citrus farms in the Gosford area which are not supplied with subsidized irrigation water.

It is possible that the ranking of the various farming regions in order of efficiency on a benefit-cost basis is affected by indexing them to a common financial year. However, an examination of rankings on an unindexed basis shows that of the total forty-one farm type regions, eleven occupy the same ranking as on an indexed basis and thirty of them do not change their ranking by more than three places. The largest changes are in the irrigated citrus regions. On an indexed basis the Murray Upper Irrigated citrus farms are the ninth most profitable group and Mid Murray citrus farms are the twenty-ninth most profitable. On an unindexed basis they are the sixteenth and thirty-eighth respectively. This change appears to be due to an increase in the price of citrus fruits between the period of survey and 1964–65. The relative efficiency of 75 per cent of the farm type groups is scarcely affected by indexing all groups to a common year.

Efficiency in farming in Australia is closely related to the scale of operations. Large sheep and sheep and wheat farms using large areas of land and large amounts of capital use labour and capital efficiently. Farms relying on the sale of butterfat for a high proportion of their income are inefficient in all states except Victoria. In the irrigated areas, only large scale citrus farms appear to use labour and capital efficiently.

There appears to be little reason for creating new irrigation schemes unless these are used to produce high priced products on a large scale and if the market for these products is large. The results of this investigation suggest that any resources which are used for opening up new land in southern Australia are better used in unsettled portions of the wheat belt. It has been estimated that approximately twelve million acres of land of this type exist in the south of Western Australia.[7]

However, conclusions drawn concerning the efficiency and profitability of farming in different regions of Australia are only valid for the period of the survey. Different climatic conditions or product prices could give very different results. The years covered by the surveys were relatively free of drought and the irrigation areas would appear in a more favourable light if a period of severe drought were included. Caution should also be exercised in using these results as a basis for expanding those sections of the agricultural industry which appear to be efficient. Such a decision implies that expansion is possible without a decline in product prices. The decision to expand a particular type of farming should only be made after an investigation of the price elasticity of supply for the products concerned. Similarly the inefficiency of most types of irrigated farming on the Murray and Murrumbidgee rivers, does not necessarily mean that all types of irrigated farming are inefficient. As this investigation suggests, the efficiency of resource use in irrigated farming depends largely on the scale of operations, on the amount of capital needed to store and distribute water and on the particular product produced.

[7] See A. W. Hogstrom and J. S. Nalson, "Farm Population and Land Development in Western Australia", *Farm Policy*, Vol. 4, No. 4, (March 1965), pp. 126–35; and B. R. Davidson and J. S. Nalson, "Investment Opportunities in Western Australia", *ibid.*, Vol. 3, No. 4, (March 1964), pp. 106–18.

4. SUMMARY AND CONCLUSIONS

A comparison of farm profits and the efficiency of resource use in different agricultural regions of Australia indicates that unimproved land values and the payment of state subsidies destroys the validity of using return to farmers' capital as a measure of the efficiency of resource use in agriculture. The degree of distortion is greatest in regions where the state supplies large amounts of capital in the form of irrigation works for which the farmer is not charged.

Both profits and the efficiency of resource use between regions appear to be determined more by the scale of farming operations than by any other factor. Resources are used more efficiently and net return to farmers' capital is higher in Australia's Pastoral and Wheat and Sheep Zones than in the wetter High Rainfall Sheep and Dairying Zones. Efficiency of resource use is lower and returns to farmers' capital are higher in the irrigation areas along the Murray and Murrumbidgee Rivers than in any other farming region. This discrepancy is caused by the fact that the state provides irrigation water to the farmer at a price which excludes any charge for interest on state capital invested in irrigation works.

APPENDIX

During the years 1957 to 1965 the following national economic surveys of Australian agriculture were carried out by the Bureau of Agricultural Economics:

The Australian Sheep Industry Survey, 1957–58 to 1959–60.[8]

The Australian Sheep Industry Survey, 1960–61 to 1962–63.[9] (Including sheep and wheat farms.)

The Australian Dairy Industry Survey, 1961–62 to 1963–4.[10]

The Australian Wheatgrowing Industry, 1959–60 to 1961–2.[11]

The Dried Vine Fruit Industry, 1960–61 to 1962–63.[12]

The Citrus Industry, 1960–61 to 1962–63.[13]

The Australian Banana Industry, 1959–60 to 1961–62.[14]

The Canning Fruit Growing Industry.[15]

The Continuous Farm Survey of the Riverina, 1957–58 and 1958–59.[16]

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[8] Bureau of Agricultural Economics, *The Australian Sheep Industry Survey* 1957–58 *to* 1959–60, (Canberra, 1962 and 1963).

[9] Bureau of Agricultural Economics, *The Australian Sheep Industry Survey* 1960–61 *to* 1962–63, (Canberra, 1965).

[10] Bureau of Agricultural Economics, *The Australian Dairy Industry* 1961–62 *to* 1963–64, (Canberra, 1966).

[11] Bureau of Agricultural Economics, *The Australian Wheatgrowing Industry* 1959–60 *to* 1961–62, (Canberra, 1964).

[12] Bureau of Agricultural Economics, *The Australian Dried Vine Fruit Industry* 1961–62 *to* 1962–63, (Canberra, 1966).

[13] Bureau of Agricultural Economics, *The Citrus Industry* 1960–61 *to* 1961–62, (Canberra, 1965).

[14] Bureau of Agricultural Economics, *The Australian Banana Industry* 1959–60 *to* 1961–62, (Canberra, 1964).

[15] Bureau of Agricultural Economics, *The Canning Fruit Growing Industry*, (Canberra, 1961).

[16] Bureau of Agricultural Economics, *The Continuous Farm Survey of the Riverina* 1957–58, (Canberra, *n.d.*), and Bureau of Agricultural Economics, *The Continuous Farm Study of the Riverina* 1959–60, (Canberra, *n.d.*).

As these surveys were conducted on a national basis they embrace all of the major agricultural zones with the exception of the tropical beef zone, and the sugar producing zone on the coasts of Queensland and northern New South Wales.

Australian wheat and sheep farms were studied in both the Australian Sheep Industry Survey, 1957–58 to 1959–60 and 1960–61 to 1962–63 and in surveys of the Australian Wheatgrowing Industry, 1959–60 to 1961–62. In one respect the survey of The Australian Wheatgrowing Industry is a more accurate report of wheat and sheep farms than that provided by the Wheat and Sheep Zone included in the Australian Sheep Industry Survey. The farms in the Wheatgrowing Industry Survey were selected on a basis of both sheep numbers grazed and area of wheat per farm. In the Sheep Industry Survey, however, farms were only selected on a basis of number of sheep per farm. On the other hand the Sheep Industry Survey covers a longer continuous period than the Wheatgrowing Industry Survey. In addition the Wheat and Sheep Zone described in the Sheep Industry Survey is contiguous with the neighbouring Pastoral and High Rainfall Sheep Zones. For these reasons the Wheat and Sheep Zone described in the Sheep Industry Survey was selected to estimate the profitability and efficiency of wheat and sheep farming. This decision selects farms with a smaller acreage of wheat and a larger number of sheep than the Wheatgrowing Industry Survey. The divergence is particularly large in Queensland where the area covered by the Wheatgrowing Industry Survey is much smaller than that covered by the Wheat and Sheep Zone of the Sheep Industry Survey. Generally average farms are smaller and profits lower in the Sheep Industry Survey than in the Wheatgrowing Industry Survey.

As any estimation of the profitability or efficiency of farming is partly dependent on the amount of capital invested, the Canning Fruit Industry Survey had to be excluded as capital invested by farmers was not recorded.

Two other surveys, of the Berry Fruit Growing Industry [17] and the Western Australian Tobacco Industry[18] were also excluded. The Tobacco survey only deals with a small section of the Australian Tobacco Industry and Berry Fruits are a negligible part of the Australian agricultural economy.

Using the survey data it is possible to divide temperate Australia into four major agricultural zones. These zones can be further subdivided into twenty-nine large agricultural regions. In addition three small regions producing fruit under dry land conditions and six of the main types of farming practiced under irrigation can be examined. For the location of these regions see Figure 1.

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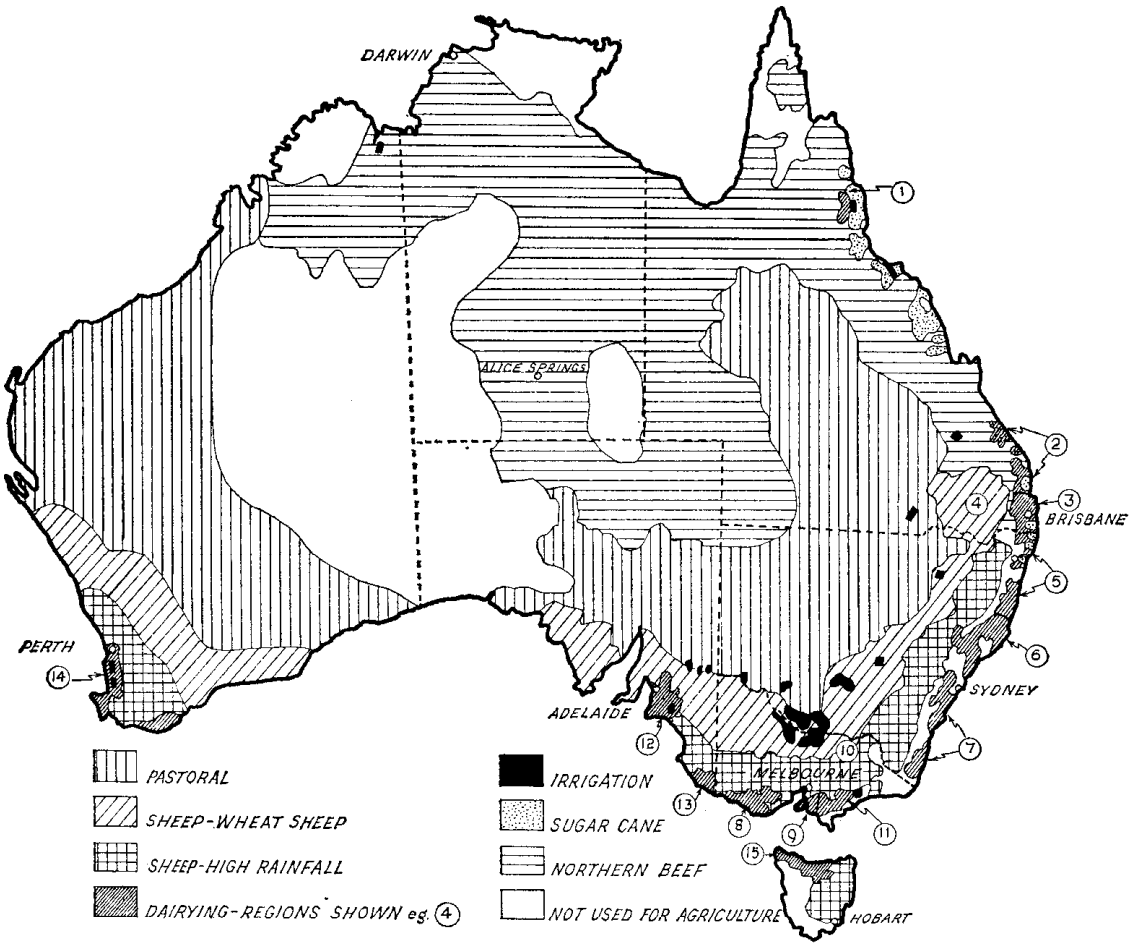
[17] Bureau of Agricultural Economics, *The Berry Fruit Growing Industry*, (Canberra, 1962).

[18] Bureau of Agricultural Economics, *The Western Australian Tobacco Industry*, (Canberra, 1962).

FIGURE 1—AUSTRALIAN FARMING AND GRAZING ZONES



KEY TO DAIRYING REGIONS

(1) Cairns, Townsville and Mackay.
(2) Rockhampton and Maryborough.
(3) Moreton.
(4) Downs and Roma.
(5) North Coast.
(6) Hunter and Manning.
(7) Cumberland, South Coast and Southern Tableland.
(8) Western and Wimmera.
(9) Central and North Central.
(10) North Eastern.
(11) Gippsland.
(12) Central and Lower North.
(13) South Eastern and Murray Mallee.
(14) Western Australia.
(15) Tasmania.

To examine irrigated farming it is necessary in the case of citrus, bananas, and dairying to extract samples of irrigated farming from the wider Citrus Industry, the Australian Dairying Industry, and the Australian Banana Industry surveys, which deal with the production of bananas, citrus fruits, and dairy products under both dry land and irrigated conditions. Although these surveys were designed to cover the whole industry and not merely the irrigated portion of it, the samples selected in the irrigated areas were stratified in such a way that they are typical of the region.

Although the B.A.E. Surveys were made on an industry basis the information they contain can be converted to a regional basis because of the specialized nature of Australian farming in any particular location and because the results of many of the surveys are published on a regional basis. The only overlap of type of farming which occurs in Australia is the presence of dairying, beef and sheep, and fruit production in the high rainfall areas and the existence of several highly specialized types of farming under irrigation.

A possible disadvantage of using the B.A.E. surveys as a basis of regional comparison is that in many surveys, type of farming zones have been subdivided on a political (State) rather than on an environmental basis. Even this disadvantage is not as great as it might have been. Two states, Western Australia and Tasmania, are separate geographical entities. The land policies pursued by the different States during and since settlement have had a definite effect on the profitability and efficiency of agriculture because these policies radically affected farm size. If Australian farm type zones are subdivided for the purpose of economic investigation, a State basis is probably as useful as any other.

Most of the surveys have the advantage of being based on stratified samples of farms dependent on livestock numbers, area of the main cash crop or farm size, and have been specifically designed to represent a particular type of farming in a particular region. Thus the conclusions drawn from these samples can reasonably be expected to be typical of the region from which the sample was drawn (see footnotes 8 to 14). In other cases they are typical of the main type of farming within a region (see footnote 16). In most of the B.A.E. surveys, capital costs and returns have been defined on the same basis, or in such a way that it is possible to convert them to the same basis. The major disadvantages of making comparisons between the surveys lie in their extending over different periods of time. Differences caused by variations in weather will obviously be minimized if the total period of the survey is used in the comparison, but this involves comparing years in which prices and costs might have altered radically. This disadvantage can be reduced by indexing the individual items of cost, revenue, and capital in each particular year of the survey to a common year, 1964–65, using the B.A.E. Index of Prices Received and Paid by farmers in each State.[19] Such a procedure makes the assumption that farmers would not have altered their system of farming or the level of farm inputs in the face of changes in costs and prices. This assumption may have some validity in regions where only one product is produced and no alternative exists, as in the Pastoral Zone, the Dairying Zone, or on irrigation farms producing fruit, but it could give misleading results in the Wheat and Sheep Zone or in the High Rainfall Sheep Zone. In these two zones the ratio of the two alternative products, sheep and wheat, and beef and sheep could be and probably is altered with changes in the product price ratio. In all regions the quantity of resources used could be varied with changes in resource costs or product prices. Because of these disadvantages any comparison between zones or regions should be made using both indexed and unindexed data.

[19] Bureau of Agricultural Economics, *Indices of Prices Received and Paid in Different States*, (Canberra, 1965).

If comparisons are to be made between the various B.A.E. surveys it is essential that all returns and costs should be recorded on the same basis. The revenue recorded in all surveys is total farm revenue including any government bounties or subsidies paid to farmers. Off-farm income is recorded separately and was excluded in comparing the different farming zones and regions. Most costs are annual cash costs and are directly comparable. In all surveys unpaid family labour other than that of the operator has been allowed for at the appropriate award rates. The method of estimating an allowance for the farm operator varies between the surveys. In the Dairy Industry survey no allowance was made for the owner operator. Before a comparison was made an award wage (including an allowance for overtime) for dairy farms was assessed by the B.A.E. and included as a cost before calculating net value of output.[20] Depreciation of buildings and machinery has been estimated using the straight line method of depreciation in all surveys.

The valuation of farm land for all surveys was carried out by officers of the Reserve Bank of Australia and are on a comparable basis. Livestock valuations are on a basis of sale value, excepting in the Sheep Industry survey for 1957–58 to 1959–60 when natural increase was valued at 1952–53 prices.

In some surveys farm rents and interest on farmer's capital are recorded. As the amount of these items will vary between regions they are excluded from the list of costs and net farm incomes in the various regions and zones are compared assuming farms are debt free and completely owned by the farmer.

With these adjustments to the original B.A.E. surveys it is possible to compare the profitability of farming between and within the Australian farming zones, both directly and on a basis of indexing individual items of returns, costs, and capital for each year of each survey to the common financial year of 1964–65.

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[20] Bureau of Agricultural Economics, *The Australian Dairy Industry* 1961–62 *to* 1963–64, (Canberra, 1966), p. 104.