Victoria University of Wellington

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AGRICULTURE AND NEW ZEALAND ECONOMIC GROWTH

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by

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AGRICULTURE AND NEW ZEALAND ECONOMIC GROWTH

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1. Introduction

When your President invited me to give this paper he suggested a number of questions which he thought justified discussion. These included such questions as:

What is the place of agriculture in the macroeconomy?
What is the relation between agricultural and national productivity?
What effect has agricultural restructuring had?
What contribution can agriculture make to growth and employment?
Is agriculture a growth leader?

I decided that many of these questions could be subsumed under the last one and hence the very general title of the paper "Agriculture and Economic Growth".

I would be doing both myself and you a disservice if right at the outset I left the impression that one has the answers to these questions. But at the least it is possible to throw up a wide number of considerations which need to be taken into account in trying to answer them.

Indeed given the modern addiction to free markets and non interventionist policy you may wonder whether it is even worth asking - is agriculture a growth leader? So what, if we decide that it is? However I personally have much less sympathy than most other economists, with modern doctrines of economic predestination, and I think it is worthwhile to try to quantify agriculture's role in growth and to ask under what conditions, and in what way, should it be encouraged or indeed, if necessary, discouraged.

I shall deal with the topic of agriculture and economic growth under three main headings or sections.

- First, I look at some recent history of productivity growth in agriculture and the rest of the economy.

- Secondly, I use a computable general equilibrium model to examine the question in the context of some comparative static analysis of 1997.[1]

- Finally I adduce some dynamic considerations which especially bear on macro economic policy with respect to agriculture.

I.   PAST PRODUCTIVITY GROWTH

2.   Agricultural and National Productivity 1950 - 93

A large amount of data on productivity growth in the main sectors of the New Zealand economy over the last 40 years was presented in an earlier paper of mine (Philpott, 1990) and some of it is repeated in Table 1 below.

Table 1 shows quinquennial rates of growth of real GDP and total factor productivity, for each of a various groups of industries viz agriculture, other exportables, total exportables, importables, total tradables, non tradables and the whole economy.[2]

One should also observe, though the figures are not directly presented in the table, that agricultural real GDP as a proportion of total real GDP has been declining almost continuously from about 20 per cent in the 1950s to around 6 per cent in the 1970s and 80s and is now around 8 per cent. Nothing too specific should be inferred, about the role of agriculture in growth, from this trend decline which one would take to be representative of a normal growing economy[3] but in any case it has to be remembered that over the period many on-farm activities have been transferred to off-farm providers of non factor inputs with obvious effects on agricultural GDP per se.

However returning to the growth rate data in the tables, it is difficult to observe any clear patterns of association between the performance of agriculture and that of the aggregate economy, either in comparisons of agricultural and aggregate GDP growth or in total factor productivity growth. There is, it is true, the appearance of such a positive association for all tradable goods industries, but this itself is very strongly a reflection of the growth rates in importables - a matter to which we will allude to later.

3.   Productivity by Type of Farming 1971 - 93

To supplement this set of long period economy-wide data, I want now to present the results of some recent research (Philpott 1994) on agricultural productivity trends in the two decades since 1973, and specifically related to various types of farming.

This particular piece of research work was prompted by the observation, as shown in Table 1, that since 1984 agricultural real GDP had grown by no less than 6.4 per cent per annum and total factor productivity by 7.7 per cent per annum. Where did these astounding rates of growth spring from, one was disposed to ask. The official data available for this research did not allow us to go back much earlier than 1971 and so I have expressed the results in terms of growth rates over two decades 1973 - 83 and 1983 - 93. As it happens, this is not an inappropriate split up since post 1983 has seen major restructuring of New Zealand agriculture compared with the previous ten years of subsidies and explicit encouragement of the sector.

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[2]   Exportables other than Agriculture include Fishing, Forestry, Mining, Food, Wood, Paper and Basic Metal Industries. Importables include Textiles, Chemicals, Non Metallic Minerals, Fabricated Metal Manufactures and Other Manufacturing. Non Tradables include the remainder the 25 SNA industry groups.

There are of course considerable dangers in arbitrarily choosing quinquennia which ignore cyclical peaks and troughs, but until careful regression analysis is conducted on the data such an approach is the simplest available.

[3]   A similar falling trend (over and above the influence of relative profitability) is observed by Scobie (1990) in his econometric analysis of agricultural performance as related to real exchange rates.

TABLE 1

GROWTH RATES OF GDP & TFP BY SECTORS 1950 - 93

	REAL GDP								TOTAL FACTOR PRODUCTIVITY						
	Agriculture	Other Exportables	Total Exportables	Importables	Total Tradables	Total Non Tradables	Total Economy		Agriculture	Other Exportables	Total Exportables	Importables	Total Tradables	Total Non Tradables	Total Economy
								Percentage Per Annum Growth Rates							
1955 - 59	10.2	5.6	8.1	9.4	8.6	2.3	3.7		9.2	1.7	6.2	7.1	6.7	-0.9	1.0
1960 - 64	4.0	6.3	5.8	8.4	6.9	4.7	5.3		3.4	3.3	4.5	3.3	4.7	1.6	2.6
1965 - 69	4.5	4.2	4.3	4.7	4.5	1.1	2.1		4.0	0.5	2.8	1.9	2.8	-2.0	-0.4
1970 - 74	-2.9	7.7	3.0	5.9	4.4	4.5	4.5		-3.5	3.5	1.1	3.6	2.4	1.0	1.5
1975 - 79	-1.5	6.3	3.5	-5.9	-0.5	0.1	-0.1		-2.5	2.9	1.8	-6.2	1.8	-1.8	-1.6
1980 - 84	3.5	3.4	3.4	2.1	3.0	2.1	2.4		3.6	2.8	3.5	-1.2	3.1	1.1	1.8
1984 - 89	6.0	3.1	4.7	-2.0	2.6	1.4	1.8		7.6	3.2	5.9	-0.6	4.1	0.2	1.5
1989 - 93	1.3						0.3		2.2						0.0

TABLE 2

PRODUCTIVITY GROWTH BY TYPE OF FARMING

	Sheep, Beef & Cropping		Dairy Farming		Horticulture		Sheep & Dairy & Horticulture		Total Agriculture including Others	
	Average Per Annum Percentage Growth Rates									
Average of 3 years (a) Ending Years Shown	(a) 1973 - 83	1983 - 93	1973 - 83	1983 - 93	1973 - 83	1983 - 93	1973 - 83	1983 - 93	1973 - 83	1983 - 93
Real Growth Output	1.4	-0.8	0.7	1.8	5.4	9.5	1.6	2.1	1.5	2.1
Real Non Factor Inputs	0.3	-2.2	2.2	1.9	9.0	3.9	1.4	0.0	2.8	0.6
Real Net Output	3.3	1.0	0.3	1.8	2.9	13.2	1.8	4.0	0.2	3.8
Real Non Factor Inputs ÷ Real Gross Output	-1.1	-1.4	0.6	0.0	3.4	-5.1	-0.2	-2.1	1.3	-1.7
Real Capital Stock	0.3	-0.9	0.8	0.4	1.0	1.2	0.5	-0.3	0.5	-0.3
Employment	2.6	-0.9	-0.8	1.0	9.5	5.3	2.0	0.6	0.4	-0.7
Land in Use	0.8	-0.9	-1.4	1.7	2.1	8.2	0.6	-0.6	0.6	-0.6
Total Factor Use	1.6	0.9	-0.5	1.0	7.6	5.0	1.4	0.2	0.4	-0.6
Real Net Output/Capital	2.9	1.9	-0.5	1.4	1.9	11.9	1.3	4.3	-0.4	4.1
Real Net Output/Labour	0.7	1.9	1.0	0.8	-6.1	7.5	-0.2	3.3	-0.2	4.5
Real Net Output/Land	2.5	2.0	1.6	0.1	0.8	4.6	1.2	4.6	-0.4	4.4
Total Factor Productivity	1.7	1.9	0.8	0.8	-4.4	7.9	0.4	3.8	-0.2	4.4

(a) Thus 1973 is measured as average of three years 1971, 72 & 73 and similarly for 1983 and 1993.

Table 2 gives, in percentage growth rate form, the salient variables - real gross and net output, land, labour and capital use, and productivity levels - for the three most important sections of the agricultural industry viz sheep, beef and cropping, dairy farming, and horticulture. The figures are also given for total agriculture which in addition to the above includes a very volatile group comprising deer and goat farming, various small animal and specialised products as well as agricultural services. Finally, to avoid cyclic peak and trough problems, the beginning and end of each period are measured as three year averages - thus 1970/71 - 72/73, 1980/81 - 82/83 and 1990/91 - 92/93.

It is clear from these results that the dramatic turn around, in agriculture as a whole, between the first and second of our decades, in growth of real net output and in total factor productivity, has less to do with changes in traditional sheep and dairy industries than it has with horticulture.

Total factor productivity in sheep and dairying has hardly changed at all over the whole 20 years. In the case of sheep farming, the small rise to 1.9% per annum is partly the result of lower factor use - but also of a fall in the ratio of real non factor inputs to real gross output - possibly reflecting wasteful over-expenditure in the subsidised years of the first decade.

But it is in horticulture where the really dramatic turn around has occurred and one which underpins the 4.4% pa productivity growth rate in total agriculture in the ten years to 1993. Here again, in horticulture, there has been, between the two decades, a big turn around in the use of non factor inputs. This is possibly due to the heavy rate of new plantings of fruit trees and vines up to the mid 80s the expenditure on which, though really of a quasi capital nature, is officially counted as current expenditure.

A check on the annual statistics of number of new horticultural holdings and of orchard areas planted show that there was indeed a massive expansion in plantings in the first of our two decades, the benefits of which, in terms of growth in real gross and net output, being reaped in the second decade.

These results carry three important implications. Firstly it is clear that the acceleration to 4.4% pa of productivity in total agriculture since 1983 has little to do with restructuring but much to do with the lagged effect of horticultural investment in the pre 1983 period.

Secondly it has implications for aggregate productivity growth. This, as Table 1 suggests, averaged about 0.4% pa from 1985 - 93. This, in all conscience, is a low enough result. But if (on grounds of its idiosyncratic nature just discussed) we exclude agriculture, the national figure would fall to zero an even less attractive result compared with the much vaunted productivity gains which it is claimed our restructuring has produced.

Finally when, as in a moment we do, we turn to future analysis and projections it would be unwise to assume a continuation of the 4.4% pa growth is agricultural productivity, critically dependent as this has been on horticulture which is unlikely to sustain its fast rate.[4] Instead we have opted for the average of sheep and dairy rates viz about 1.6% pa.

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[4] As indicated in Philpott (1994), the rate of productivity growth in horticulture has already in the second quinquennia of the 1983 - 93 decade, slowed down to half the rate recorded in the first quinquennia.

The upshot of this discussion of productivity has been to throw only minimal light on the questions posed at the beginning on agriculture and the growth. Indeed we are probably unjustified in expecting much more than this given the multitude of variables at work requiring, if their effects are to be disentangled, a properly specified econometric model encapsulating real exchange rates, terms of trade, wage rates and a host of other macroeconomic entities.

To some extent this is what we attempt to do in the next section where, while not engaging in thorough going econometrics, we use a computable general equilibrium (CGE) model to examine the role of agriculture in New Zealand economic growth to 1997.

II. FUTURE COMPARATIVE STATICS

4. The General Equilibrium Model

The Julianne general equilibrium model which we put to work in this section is described in detail in Philpott & Nana (1993). Essentially the model establishes an economy-wide or general equilibrium for the New Zealand economy in 1996/97 and especially the allocation, between 26 sectors, of a given endowment of capital, land and labour in that year. Additional given, or exogenous, variables include the level of Government consumption and social investment; the rate of advance in total factor productivity; the slope, and expected shifts over the next ten years in overseas demand curves for New Zealand exports; and the requirement of an overseas balance of trade surplus of $2.2 bn to finance factor payments abroad and contribute to overseas debt repayment.

Compared with earlier versions, the model has been extended in sectoral coverage by disaggregating the agricultural sector into three components viz dairy farming, sheep & beef farming, and other agriculture. A similar threefold disaggregation has also been introduced for the agricultural processing industry. Finally the factor of production, land, has been added to the earlier two factor labour and capital approach.[5]

The numeraire of the model is "world prices" represented in the model by New Zealand import prices which are set in the model at the base year (1989/90) level of 1.0 i.e. the model is agnostic about world or New Zealand inflation. World real prices, or essentially world agricultural terms of trade for New Zealand export type products, can be set exogenously and in the present runs are so set at a level of 0.94. The terms of trade facing New Zealand, however are determined by the volume level of each type of export in conjunction with the price elasticity of demand of the relevant export demand curve.

The model is designed not so much for forecasting as for comparative static analysis in which context we shall be using it here. The time period covered is seven years from a base year solution for 1990 to a horizon year 1997. But no

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[5] These amendments and extensions to the JULIANNE model were carried out by RPEP as part of a project undertaken by a group of researchers assembled by the NZ Institute of Economic Research to investigate the implications for New Zealand agriculture of a successful GATT round with the support of a grant from the Foundation for Research Science and Technology.

great importance should be attached to these two years in real time so much as to an analysis of growth rates in an economy like New Zealand over a seven year slice of time which could just as easily be from 1993 to 2000.

Our procedure is to first set up a standard, or control, projection for 1997 which in fact is a replica of the similar projection produced in the National Sectoral Programme formerly conducted by the NZ Planning Council and now by BERL (1993).

We then explore, comparative static wise, the implications of alternative rates of growth of agricultural exports and of other export types. This we do by changing the degree of shift of each of the relevant export demand curves by pre-set amounts.

5. The 1997 Control Projection

The results[6] of the 1997 control run are given in Table 3. They show an economy with real GDP growing over the seven year period at 2.7% pa with total agricultural output and export growth of 3.6% pa. In a real time context, given that actual GDP growth in New Zealand between 1990 and 1993 has been around zero this implies a projected growth rate from 1993 to 1997 of 3.3% pa. The macro and sectoral variables given in Table 3 are thus those with which we wish to compare the results of various comparative static exercises in what follows.

6. 1997 Comparative Statics - Specifications

Our purpose now is to conduct comparative static analysis by varying the level of agricultural and other outputs and exports and observing the results in terms of changes, compared with the control projection, in the 1997 level of real GDP and in other variables.

To avoid capricious arbitrary changes and preserve some degree of realism (and in any case because it is useful) we have adopted, as the framework for the changes to be examined, the extended export ta gets recently proposed by the NZ Trade and Development Board (TRADENZ), in their recent paper "Stretching for Growth" (Tradenz 1993). In that paper Tradenz suggested as quite feasible a stretching - in fact a virtual doubling - of export growth rates compared with traditional rates as, for example, those incorporated in our control projection.

These stretched targets are set down in Table 4 - firstly stretched agriculture, with other exports at control level. And secondly stretched "other" exports, with agriculture at control level.

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6 Further aspects of the specification of the model and more detailed results of this control run and of the further runs of the model are given in the appendix.

TABLE 3

CONTROL PROJECTION

$mn 1990 Prices Except Where Indicated P.A. Growth Rates in Parentheses	Macro Variables 1990		1997
Private Consumption	44,022	(1.8)	49,973
Gross Capital Formation	14,679	(3.6)	18,819
Exports of Goods & Services	18,608	(5.4)	26,839
Imports of Goods & Services	19,250	(2.6)	23,108
Real Balance of Trade	-642		3,731
Gross Domestic Product	71,502	(2.7)	86,233
Effective Gross Domestic Product	71,502	(2.5)	84,733
Capital Stock	284,526	(1.8)	321,793
Employment ('000)	1,290	(1.0)	1,385
Land	19,357	(0.0)	19,357
GDP Deflator (1990 = 1.0)	1.0		0.941
Export Prices & Terms of Trade (1990 = 1.0)	1.0		0.919
Real Exchange Rate (1990 = 1.0)	1.0		0.955

Sectoral Variables	1990		1997
OUTPUT			
Agriculture	9,081	(3.6)	11,656
Processing	12,856	(4.7)	17,707
Other	127,865	(2.7)	153,611
Total	149,802	(2.9)	182,974
CAPITAL			
Agriculture	32,628	(2.1)	37,838
Processing	10,918	(0.9)	11,624
Other	240,980	(1.8)	272,231
Total	284,526	(1.8)	321,793
EMPLOYMENT ('000)			
Agriculture	124	(2.3)	145
Processing	58	(0.0)	58
Other	1,108	(0.9)	1,182
Total	1,290	(1.0)	1,385
EXPORTS			
Agriculture & Processing	8,382	(3.6)	10,716
Other	10,226	(6.7)	16,125
Total	18,608	(5.4)	26,839

TABLE 4

ALTERNATIVE EXPORT TARGETS

$mn 1990 Prices Except Where Indicated P.A. Growth Rates in Parentheses	1990 Actual	1997 Control Run		1997 Stretched Agriculture		1997 Stretched "Other" Exports	
AGRICULTURE							
Dairy Products	1,826	3,048	(7.6)	3,652	(10.4)	3,048	
Meat	3,664	4,705	(3.6)	5,657	(6.4)	4,705	
Wool	1,586	1,067	(-5.6)	2,308	(5.5)	1,067	
Horticulture	954	1,104	(2.1)	2,217	(12.8)	1,104	
Other Food	352	555	(6.7)	699	(10.3)	555	
TOTAL AGRICULTURE	8,382	10,479	(3.2)	15,222	(8.9)	10,479	(3.2)
OTHER GOODS & SERVICES	10,226	12,948	(3.4)	12,948	(3.4)	17,691	(8.1)
TOTAL	18,608	23,427	(3.3)	28,170	(6.1)	28,170	(6.1)

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In the 1997 model runs which follow, these, and some other important changes, are incorporated to give a three broad scenarios as follows:

(i)   **With Exogenous Available Capital and Labour as in the Control Projection**

    Model Run No 1   Stretched agricultural export target growth rate
                               Other exports targets as in control run

    Model Run No 2   Stretched agricultural export target growth rate but 70%
                               of increase to come from more processing
                               Other exports targets as in control run

(ii) **With Endogenous and Increased Capital and Labour** (Exogenous Wage and Profit Rates at Control Level)

    Model Run No 3   Stretched agricultural target exports   )   as in Run 1
                               Other exports as in control run   )

    Model Run No 4   Stretched agriculture targets with processing - as in Run 2

(iii) **With Endogenous and Increased Capital and Labour as in (ii)**

    Model Run No 5   Stretched agricultural export growth rates
                               Other export targets as in control run
                               (forced agricultural policy)

    Model Run No 6   Stretched "other" export growth rates
                               Agriculture export targets as in control run
                               (forced industrial policy)

    Model Run No 7   Stretched "other" export growth rates
                                 plus 10% rise in tariff levels
                               Agricultural export targets as in control run
                               (forced industrial policy plus tariff)

In Model Runs 1 to 4, the stretching of agricultural export targets is effected by shifting outwards, by the required percentage, the model's individual product export demand curves along which, in reaching a solution, the model has complete freedom to move thus leading to possible changes in exports prices and thus terms of trade facing New Zealand.

In Model Runs 5 to 7 by contrast we are concerned with the effects of a forced agricultural or a forced industrial policy and the stretched agricultural or other exports are set, not as demand curve shifts, but as levels to be achieved.

Model Run 7 is included to examine the implications of a policy of import substitution.

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TABLE 5

MODEL RESULTS FOR 1997

Run No	1	2		3	4		5	6	7
				% Changes on Control Projection Unless Otherwise Indicated					
	Aggregate Capital and Labour at Control Level			Aggregate Capital and Labour at Increased Level					
	Stretched Agriculture	Stretched Agriculture plus Processing		Stretched Agriculture	Stretched Agriculture plus Processing		Forced Agriculture Policy	Forced Industrial Policy	Forced Industrial Policy plus Tariff
MACRO VARIABLES									
Real Gross Domestic Product	-1.2	1.1		16.3	18.8		15.8	17.1	16.0
Effective Real GDP	0.4	1.3		16.6	17.8		16.1	15.9	19.0
Imports	8.3	11.1		16.6	19.5		16.0	8.2	11.7
Terms of Trade) Index	0.993	0.955		0.952	0.919		0.952	0.908	1.028
Real Exchange Rate) 1990 = 1.0	1.005	0.958		0.954	0.941		0.954	0.905	1.058
OUTPUT									
Agriculture	17.9	2.3		28.4	12.4		27.7	8.4	1.9
Processing	3.9	15.8		16.7	29.6		16.2	11.6	4.7
Other	-3.4	-1.4		15.4	17.4		14.9	18.7	20.0
EXPORTS									
Agriculture & Processing	29.3	38.1		37.0	45.8		35.6	6.0	-10.5
Other	-15.6	-10.6		-0.8	4.6		-2.7	9.7	9.7
TOTAL	2.3	8.8		14.3	21.0		13.7	8.2	1.7
CAPITAL									
Agriculture	21.8	1.6		34.4	13.2		34.4	9.6	3.5
Processing	4.0	15.3		16.7	29.5		16.2	11.6	5.1
Other	-3.2	-0.8		19.2	21.8		18.3	22.2	23.4
TOTAL	0.0	0.0		20.9	21.0		20.3	20.3	20.3
EMPLOYMENT									
Agriculture	20.0	2.1		30.1	13.1		31.7	9.7	2.1
Processing	5.2	1.6		17.2	27.6		17.2	12.1	5.2
Other	-2.7	-0.9		13.8	15.5		13.4	16.3	17.7
TOTAL	0.0	0.0		15.9	15.8		15.4	15.4	15.5

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7. 1997 Comparative Statics - Results

Detailed results from our seven model runs are given in the Appendix. Here we give, in Table 5, a summarised view with variables expressed as percentage changes on the control projection. Our main interest is in real GDP but also on the sectoral allocation of capital, labour, and land and sectoral exports. In some instances reference will be made to effective real GDP i.e. real GDP corrected for changes in the terms of trade.

Model Run No 1

With stretched agricultural export targets, agricultural exports rise markedly, other exports fall, and total exports show a small rise. But the overall result is for real GDP to fall by 1.2%. The reason (and it is important) is to be found in the fixed agricultural land base in our model and so diminishing returns to capital and labour in agriculture. Agricultural output rises 17.9% but capital and labour employed rise 21.8% and 20% respectively, and so less of the fixed aggregate supply of labour and capital is available for other sectors whose output and exports thus fall.

Model Run No 2

This is as in Run No (1), but now with additional processing providing almost three quarters of the increased agricultural exports. The agricultural output increase is now much lower and processing much greater. There is consequently mitigation of the diminishing returns problem and so other exports and output do not fall as much, aggregate exports rise 8.8% and with them real GDP by 1.1%. Whatever other benefits are conveyed by the policy of adding value (and there are many), the offsetting of agricultural diminishing returns is a further one to add to the list.

Model Run No 3

We now repeat Runs (1) & (2) but with increased supplies of capital and labour - but not land. In fact we set exogenously the profit rate and wage rate which result from the control run and, thus let the model choose endogenously the quantities of capital and labour it wishes to employ, with of course a sympathetic and consistent rise in the level gross capital formation.

In Run (3), with no additional processing, Real GDP now rises by 16.3%. There is still diminishing returns in agriculture, with output rising less than capital and labour employed, and so still a small squeeze on other exports.

Model Run No 4

As for Run (3) but with more processing, the diminishing returns impact is again muted, all variables expand and real GDP hits 18.8% above control again confirming the value of additional value-added by more processing.[7]

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[7] It is useful at this stage to record an estimate of the employment multiplier from Run 3. As shown in the Appendix as between the control run and Run 3, the increase in agricultural employment amounts to 48,000 persons, and in total employment 220,000 persons implying a multiplier of 4.6. This is almost identical to that calculated in the very thorough work of Narayan and Sri Ramarathan (1992) and also in earlier research by RPEP in Philpott (1984a) and (1984b).

We now turn to the third set of model runs in which, again with increased endogenous supply of capital and labour, we contrast the effects of a forced agricultural with a forced industrial policy.

Model Run No 5

We have dubbed this in Table 5, a Forced Agricultural Policy. Here we force in the stretched agricultural export targets while leaving other exports to be determined by the model, given the targets or demand curve shifts at control level. The results are, not surprisingly, much the same as those of Run 3 with which it is broadly similar.

Model Run No 6

We have dubbed this a Forced Industrial Policy, and it explores, by contrast, an industrial policy with "other" (mainly manufacturing) stretched exports forced in, while leaving agricultural exports to be determined by the model given the targets or demand curve shifts set at control run level. While this performs, in terms of real GDP, marginally better than Run 5 or Run 3 (all of them without added processing) it is marginally inferior to Run 4 with processing. Furthermore it throws up a very important outcome, in that the increase in imports is only 8% on control compared with about double this for other comparable runs.[8] This fall is occasioned by the considerable reduction in the real exchange rate which renders so much more competitive, import competing industries and so reduces import volumes.

Model Run No 7

Finally we repeat Run 6 with an industrial policy but, as well, submit to the ultimate heresy, and introduce a 10 per cent rise in import tariffs as a surrogate for an explicit and determined import substitution policy. In this case agricultural exports are cut back 10% below control; other exports rise nearly 10% but total exports are only marginally greater than control. And yet real GDP still shows a very respectable 16% increase comparable with that achieved in other runs.

This startling result is achieved again because of a much lower rise in imports but, more importantly, because of a fall of about $2 bn in the real balance of trade required to provide the targeted current account surplus of $2.2 bn. And that itself results from the 8% rise in the terms trade due to much lower agricultural exports facing low elasticity demand curves.

The upshot is that the 16% rise in real GDP is converted into no less than a 19% rise in effective GDP - the highest of all the model runs we have considered.

8. Comparative Statics - Conclusions

Our conclusions from these model runs can be summarised as follows:

(i)   In terms of real GDP the top performer is undoubtedly Run No 4 i.e. stretched agriculture with increased processing giving GDP 18.8% higher than control: a per annum GDP growth rate of 5.3% (nearly double the control rate); and a growth rate in employment of 3.2% pa sufficient to produce near full employment by 1997.

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[8]   In fact (as shown in the Appendix tables) the import to GDP ratio falls a full 3 percentage points to 0.238 from 0.268 in the control run - this being the lowest import ratio of all the runs considered.

(ii) Ever present is the problem of diminishing returns in agricultural production and the limitation this places on resources available for expansion in other sectors. The problem is partly ameliorated by the rates of agricultural productivity we have assumed and by increased supplies of capital and labour, but the major benefit in this regard is conferred by a substantial increase in value added through more agricultural processing.

(iii) Consonant with the diminishing returns problem we have a diminishing marginal revenue problem reflecting the low export demand price elasticities[9] facing New Zealand for our traditional agricultural products. This shows itself in reverse in Run No 7 where, with an industrial policy plus tariff, agricultural exports actually fall below control and the terms of trade rise.

(iv) As a consequence we have in Run No 7 a rise in effective GDP such that, in terms of that variable, Run 7's industrial policy plus tariff scores highest of the lot, as well as producing a very desirable reduction in the import/GDP ratio.

Thus while the evidence, as in Run 4, favours agriculture with more processing as the preferred progenitor of economic growth the argument is at best tendentious. The margin of difference in terms of real GDP is no more than 2 to 3 per cent compared with its diametric opposite Run 7. Such small marginal differences from substantial changes in resource allocation, are (as Lucas 1988 shows) characteristic results from comparative static analyses which, by definition ignore the dynamics of the changes and so to such dynamic questions we must now turn.

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[9] As noted in the Appendix the price elasticity for traditional agricultural products assumes the value of - 1. This, it should be noted, is the price elasticity facing New Zealand given estimates of world price elasticities and New Zealand's share of world trade (in some cases e.g. dairy products , lamb and crossbred wool, this being quite high. The aggregate price elasticity of - 1 assumes no reaction from other suppliers which is probably justified in the present investigations in which we can conceive of agriculture stretching being based on a lot of overseas market development and promotion as part of the process of shifting our demand curves further to the right. In a parallel examination of the influence of the GATT round in which world prices rise because of reduced supplies of dumped product the above assumption of unchanged reactions from other suppliers would be most unwise and the demand price elasticity would need to be reduced, if not completely to the world level, certainly closer to it than the -1 value assumed above.

III. FUTURE DYNAMICS

9. Dynamic Considerations

In this final section our concern is with questions of dynamics - the dynamics of growth compared with what have so far been questions relating to allocation. It would of course have been appropriate to discuss this with an empirical dynamic model but in the absence[10] of such a model our treatment must be confined to theoretical speculation and to adducing the set of considerations which should be taken into account when dealing with dynamics.

The first question which arises is whether, in aiming to secure optimal resource allocation, in which, as we have observed, the percentage gains are small, we impede the rate of growth of the economy from which the gains are very large.[11]

In considering dynamics we need now to return to the questions relating to the growth of aggregate GDP and aggregate total factor productivity with which we were concerned in Part 1. We need to enquire as to the conditions required to ensure continuation, in future, of productivity growth in agriculture at the rates we have assumed and equally for other sectors especially manufacturing. For it is on the outcome for these rates of productivity growth that finally rests the decision as to whether we prefer the outcome of Run 4 (Agricultural accent) or Run 7 (Industrial accent).

Productivity growth rates in both agriculture and industry depend on capital accumulation, research development and innovation, and on adequate levels of profitability. But there are some critical differences in the economic environments in which these occur.

Agriculture being a price taker in world markets requires low costs or more particularly minimal rates of inflation, low interest rates and accommodating exchange rates. So too do industrial enterprises but in addition they require a high and steady rate of growth in demand.

During periods of steady and growing demand and gross output, industrial firms are more likely to adopt new technologies both through necessity and as embodied in new capital goods, reflected in relatively high levels of gross investment. Under such conditions, firms are also more likely to enjoy economies of scale; to find it more desirable and easier to reallocate resources within and between firms and sectors; and to engage in the sort of microeconomic and managerial reforms which contribute to high productivity.

This output-productivity relationship may also be an empirical reflection of the new types of growth theory now emerging in the literature. There the stress is laid on increasing returns and external economies from "learning by doing", from increases in human capital, and from nationally funded education research and development expenditure (Lucas (1988), Romer (1986) (1987)).

Such considerations find some empirical support in the earlier results on economic growth which we discussed in Part 1. Though not reported here, there appeares to be a close relationship between growth rates in real gross output (as a surrogate for

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[10] Through research work on dynamic computable general equilibrium model has now been initiated at Victoria University.

[11] Something like this may have been happening in New Zealand over the last decade of restructuring in which the preeminent goal has been improved resource allocation and the rate of growth has been minimal.

demand) and total factor productivity growth in non agricultural tradables but especially so for importables (Philpott 1988).

Further, as we earlier observed, growth rates in GDP and productivity in importables was itself closely related to aggregate GDP growth in the same way that we find in the projection of Run 7 (Industrial accent). In both history and projection, the import/GDP ratio falls and in this connection it is well to remind ourselves of the basic Thirlwall relationship between economic growth on the one hand and export growth divided by the propensity to import on the other.[12]

Returning now to the difference in economic environments for agricultural and industrial growth, the critical requirement for price taking agriculture of low costs and minimal inflation, requires for an agriculturally oriented growth policy constant vigilance by the monetary authorities with inevitable phases of higher interest rates, exchange rates and a general dampening of demand and overall growth.[13] - just the reverse required for a successful industrial policy. As a consequence, the danger is we finish up with lowered industrial productivity and GDP growth acting as a severe offset to whatever benefits are conferred on agriculture.

Macroeconomic policy needs to be reoriented towards growth and in a way which explicitly recognises that it is changes in the rate of growth of demand and total output which raise productivity, and not the other way round and that increased productivity is not something which can be injected into the system from outside.

In the absence of such a reorientation of policy[14], a commitment solely to an agricultural growth policy will condemn us to an overall growth rate which will not exploit our full potential, as it is outlined in our Run No 7 (industrial policy). But with such a policy change, we can secure the best of both worlds.

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[12] Already in New Zealand's "recovery" phase, fears are being expressed about the problem of the rapidly rising trend of imports.

[13] Ironically even using land values as a result of accelerated agricultural growth can contribute to inflation as it is conventionally measured and thus to the onset of contractionary policies.

[14] The necessary policy reorientation has outlined in my "Vistas of 1995 from the Summit of 1990" (Philpott 1990a) together with a projection under current policies of the economy in 1994/95 a projection which is turning out to be largely validated.

10. Conclusion

A possible answer to our basic question on agriculture as a growth leader, is that agricultural growth is a necessary but not sufficient condition for aggregate growth. Thus, for example, in addition to stressing, almost ad nauseam, the virtues of earning foreign exchange by exporting and particularly agricultural exporting, such bodies as TRADENZ should devote equal attention to the task of saving foreign exchange by import substitution and should be prepared to divert some of the large amount of money spent on the export side of the deal, to the encouragement of efficient and potentially competitive import replacement industries.[15][16]

In this way perhaps we can get the best of both of the worlds explored before by our model runs.

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[15] I have specifically cited Tradenz policy since it is this - along with a number of other examples one could cite - which represents the sort of import replacement policies which I favour rather than the return to higher tariffs and certainly not import controls - even though, for convenience in modelling, a tariff as a surrogate was used in run 7 to explore the benefits of an industrial policy and with import substitution as part of it.

[16] An argument not dissimilar to that developed above is much more thoroughly developed by Hazeldine (1993) in an excellent paper on the "The Exporter as Hero?"

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APPENDICES

I. SPECIFICATION OF THE JULIANNE MODEL

The Julianne model covers 26 SNA industry groups viz the 25 SNA sectors reduced to 22 by combination of central and local government; by combination of three private services sectors into one; and by disaggregation of agriculture into 3 sub-groups with the same disaggregation for food, beverages and tobacco. In addition, compared with earlier versions, a third factor of production - land is added to the production functions for the agricultural industries.

The data sources and construction of the model are described in Philpott (1993) and Philpott & Nana (1993a). In addition mention should be made of the demand price elasticities assumed to face New Zealand for broad classes of export commodities.

These are:
- Agricultural Products — - 1.0
- Horticulture Products — - 2.0
- All Other Goods & Services — - 5.0

Import tariff levels averaging about 6.7% in 1990 are assumed (except in model runs where they are varied) to be halved to 3.5% by 1997 as part of ongoing tariff reviews.

The values of most exogenous variables relating to 1997, come from National Sectoral Programme (NSP) discussions and consultations with industry groups or from the results of running a three sector macro model (TRI). The following are some of the critical exogenous variable assumptions, with 1990 as the base for those expressed as growth rates to 1997.

- Real Capital Stock — 1.77% pa
- Employment — 1.02% pa
- Real Gross Investment — 3.57% pa
- Real Government Consumption & Investment — - 0.50% pa
- Real Housing Investment — 2.20% pa

- Real Balance of Trade in 1997 = + $2,224 mn in 89/90 prices. Note this is a balance of trade and not payments and against this surplus must be reckoned overseas factor payments and debt repayment - neither of which are included in the routines of the Julianne model.

- Overseas Prices for 1997 are assumed to be at same level as 1990 ie overseas (as well as New Zealand inflation is ignored) except for agricultural exports which, in line with World Bank forecasts, are assumed to fall 6% in real terms by 1997. This fall in world agricultural terms of trade is separate from the endogenous changes in terms of trade emerging from model runs, the latter being induced by movement of New Zealand export volumes up or down NZ export demand curves.

- Total Factor Productivity Growth Rates
  These are derived, by sector, from NSP consultations with industry groups or where necessary by extrapolation of historical rates of change. The rates are set down in Appendix Table 1 following.

- Export Demand Curve Shifts to 1997
  These, as given in Tables following, are derived from NSP consultations with industry groups or by using the forecasts given in NZIER (1993). It should be noted that they represent an attempt to simulate the shift in demand curves at constant prices (i.e. in some sense of the word they are targets) but the model is free to operate at any point on these curves given the price elasticities assumed and

in the light of the model's optimising flavour. In addition to the export targets used by the NSP, and thus in the control run of the model, an alternative set encapsulating the stretched levels from TRADENZ are included.

- <u>Allowance for Extra Agricultural Processing</u>
The TRADENZ stretch scenarios assume that only 30% of the extra agricultural exports would be from greater production at the farm gate. The balance of 70% coming from extra value added in processing. To allow for this the interindustry coefficients in all three of the model's processing sectors were amended as follows:

	1990 Coefficients As At Present	1997 Amended Coefficients
	Per $ of Processing Output	
Input from Farm Sectors	0.50	0.32
Other Intermediate Inputs	0.30	0.41
Value Added	<u>0.20</u>	<u>0.27</u>
	<u>1.00</u>	<u>1.00</u>

RATES OF TORAL FACTOR PRODUCTIVITY ADVANCE
AND NSP EXPORT TARGETS FOR 1997

Industry Group	Total Factor Productivity	Export Group	1990 Levels $mn	1997 Levels $mn 1990 Prices	% Growt
		% Rates of Change pa 1990 - 1997			
Dairy Farming	1.6	Dairy Products	1,826	3,048	7
Sheep & Beef Farming	1.6	Meat	3,664	4,705	3
Other Farming	1.6	Wool	1,586	1,067	-5
Fishing	1.5	Horticultural	954	1,104	2
Logging	2.0	Other Food	352	555	6
Mining	3.0	TOTAL AGRICULTURE	8,382	10,479	3
Meat Processing	4.0				
Dairy Processing	4.0	Mining	40	63	6
Other Food, Beverages & Tobacco	4.0	Fish	805	1,674	11
Textiles	2.5	Textiles	269	424	6
Wood & Products	3.0	Wood & Products	591	832	5
Paper & Products	2.1	Paper & Products	783	1,102	5
Chemicals	0.7	Chemicals	766	1,207	6
Non Metallic Minerals	1.0	Non Metallic Minerals	43	68	6
Basic Metals	1.9	Basic Metals	1,297	1,287	-0
Fabricated Metal Products	1.5	Fabricated Metal Products	679	1,070	6
Other Manufacturing	2.0	Other Manufacturing	435	685	6
Electricity, Gas & Water	1.8	Energy	470	554	2
Building & Construction	1.4	TOTAL GOODS	14,580	19,445	4
Trade, Restaurants & Hotels	0.6	Tourism	2,193	1,999	-1
Transport	1.4	Transport	1,142	1,240	1
Communication	4.5	Other Services	713	743	0
Finance, Insurance etc	1.5	TOTAL SERVICES	4,048	3,981	-0
Ownership of Dwellings	0.0	TOTAL GOODS & SERVICES	18,608	23,427	3.
Private Services	0.5				
Public Services	0.7				
TOTAL	1.5				

STRETCHED EXPORT TARGETS

	Stretched Agriculture			Stretched "Other" Exports	
	1990	1997	% Change pa	1997	% Change pa
Dairy Products	1,826	3,652	10.4	3,048	7.6
Meat	3,664	5,657	6.4	4,705	3.6
Wool	1,586	2,308	5.5	1,067	-5.5
Horticulture	954	2,217	12.8	1,104	2.1
Other Food	352	699	10.3	555	6.7
Total Agriculture	8,382	15,222	8.9	10,479	3.2
Other Goods & Services	10,226	12,948	3.4	17,691	8.1
TOTAL	18,608	28,170	6.1	28,170	6.1

II. SPECIFICATION OF THE MODEL RUNS

In Appendix Tables 2 to 5 following, are given the detailed results of the model runs in level form. They fall into three groups as per the following schedule.

(i) <u>With Exogenous Available Capital and Labour as in the Control Projection</u>

    Model Run No 1   Stretched agricultural export target growth rate
                             Other export targets as in control run

    Model Run No 2   Stretched agricultural export target growth rate (but 70% of
                             increase to come from more processing)
                             Other export targets as in control run

(ii) <u>With Endogenous and Increased Capital and Labour</u> (Exogenous Wage and Profit Rates at Control Level)

    Model Run No 3   Stretched agricultural target exports   )   as in Run 1
                             Other exports as in control run   )

    Model Run No 4   Stretched agriculture targets with processing - as in Run 2

(iii) <u>With Endogenous and Increased Capital and Labour as in (ii)</u>

    Model Run No 5   Stretched agricultural export growth <u>rates</u>
                             Other export targets as in control run
                             (forced agricultural policy)

    Model Run No 6   Stretched "other" export growth <u>rates</u>
                             Agriculture export targets as in control run
                             (forced industrial policy)

    Model Run No 7   Stretched "other" export growth <u>rates</u>
                             plus 10% rise in tariff levels
                             Agricultural export targets as in control run
                             (forced industrial policy plus tariff)

In Model Runs 1 to 4, the stretching of agricultural export targets is effected by shifting outwards, by the required percentage, the model's individual product export demand curves along which, in reaching a solution, the model has complete freedom to move thus leading to possible changes in exports prices and thus terms of trade facing New Zealand.

In Model Runs 5 to 7 by contrast we are concerned with the effects of a forced agricultural or a forced industrial policy and the stretched agricultural or other exports are set, not as demand curve shifts, but as levels to be achieved.

Model Run 7 is included to examine the implications of a policy of import substitution.

APPENDIX TABLE 2

CONTROL PROJECTION

$mn 1990 Prices Except Where Indicated pa Growth Rates in Parentheses	Macro Variables				Sectoral Variables			
	1990		1997			1990		1997
Private Consumption	44,022	(1.8)	49,973	OUTPUT	Agriculture	9,081	(3.6)	11,656
Gross Capital Formation	14,679	(3.6)	18,819		Processing	12,856	(4.7)	17,707
Exports of Goods & Services	18,608	(5.4)	26,839		Other	127,865	(2.7)	153,611
Imports of Goods & Services	19,250	(2.6)	23,108		TOTAL	149,802	(2.9)	182,974
Real Balance of Trade	-642		3,731					
Gross Domestic Product	71,502	(2.7)	86,233	CAPITAL	Agriculture	32,628	(2.1)	37,838
Effective Gross Domestic Product	71,502	(2.5)	84,733		Processing	10,918	(0.9)	11,624
Capital Stock	284,526	(1.8)	321,793		Other	240,980	(1.8)	272,231
Employment ('000)	1,290	(1.0)	1,385		TOTAL	284,526	(1.8)	321,793
Land	19,357	(0.0)	19,357					
GDP Deflator (1990 = 1)	1.0		0.941	EMPLOYMENT	Agriculture	124	(2.3)	145
Export Prices & Terms of Trade (1990 = 1)	1.0		0.955	('000)	Processing	58	(0.0)	58
Real Exchange Rate (1990 = 1)	1.0		0.919		Other	1,108	(0.9)	1,182
					TOTAL	1,290	(1.0)	1,385
				EXPORTS	Agriculture & Processing	8,382	(3.6)	10,716
					Other	10,226	(6.7)	16,125
					TOTAL	18,608	(5.4)	26,839

APPENDIX TABLE 3

MODEL RUNS - MACROECONOMIC RESULTS FOR 1997

$mn 1989/90 Prices Unless Otherwise Indicated	1990 BASE YEAR	1997 CONTROL RUN	Aggregate Capital & Labour at Control Level		Increased Aggregate Capital Labour				
			Stretched Agriculture	Stretched Agriculture plus Processing	Stretched Agriculture	Stretched Agriculture plus Processing	Forced Agriculture Policy	Forced Industrial Policy	Forced Industrial Policy plus Tariff
					1997 RUNS				
			1	2	3	4	5	6	7
Private Consumption	44,022	49,973	50,204	50,833	60,399	61,173	60,071	59,945	61,910
Gross Capital Formation	14,679	18,819	18,889	19,072	22,028	22,255	21,927	21,888	22,487
Exports - Goods & Services	18,608	26,839	27,487	29,209	30,670	32,480	30,524	29,056	27,287
Imports - Goods & Services	19,250	23,108	25,036	25,673	26,951	27,611	26,815	24,059	25,809
Real Balance of Trade	-642	3,731	2,451	3,536	3,719	4,869	3,709	4,997	1,478
Real GDP	71,502	86,233	85,243	87,149	100,292	102,435	99,838	100,955	100,062
Effective GDP	71,502	84,733	85,043	85,846	98,804	99,798	98,361	98,188	100,815
Export Price Level & Terms of Trade 1989/90 = 1	1.000	0.944	0.993	0.955	0.952	0.919	0.952	0.905	1.028
Capital Stock	284,526	321,793	321,790	321,784	388,965	389,446	387,262	387,264	387,256
Employment ('000)	1,290	1,385	1,385	1,385	1,605	1,605	1,599	1,599	1,599
Real Exchange Rate 1989/90 = 1.0	1.000	0.955	1.009	0.991	0.957	0.944	0.957	0.908	1.062
Import/GDP Ratio	0.269	0.268	0.294	0.295	0.269	0.270	0.270	0.238	0.258

APPENDIX TABLE 4

MODEL RUNS - SECTORAL RESULTS FOR 1997

$mn 1989/90 Prices Unless Otherwise Indicated	1990 BASE YEAR	1997 CONTROL RUN	Aggregate Capital & Labour at Control Level		Increased Aggregate Capital Labour				
			Stretched Agriculture	Stretched Agriculture plus Processing	Stretched Agriculture	Stretched Agriculture plus Processing	Forced Agriculture Policy	Forced Industrial Policy	Forced Industrial Policy plus Tariff
			1	2	3	4	5	6	7
OUTPUT									
Agriculture	9,081	11,656	13,739	11,926	14,972	13,097	14,888	12,629	11,876
Processing	12,856	17,707	18,405	20,495	20,662	22,945	20,578	19,757	18,533
Other	127,865	153,611	148,429	151,403	177,207	180,411	176,474	182,333	184,336
TOTAL	149,802	182,974	180,573	183,824	212,841	216,453	211,940	214,719	214,745
CAPITAL									
Agriculture	32,625	37,838	46,082	38,428	50,841	42,837	50,881	41,473	39,174
Processing	10,918	11,624	12,089	13,403	13,566	15,053	13,508	12,971	12,213
Other	240,980	272,231	263,219	269,953	324,558	331,556	322,873	332,820	335,877
TOTAL	284,526	321,793	321,790	321,792	388,965	389,446	387,262	387,264	387,256
EMPLOYMENT									
Agriculture	124	145	174	148	193	164	191	159	148
Processing	58	58	61	67	68	74	68	65	61
Other	1,108	1,182	1,150	1,171	1,345	1,365	1,340	1,375	1,391
TOTAL	1,290	1,385	1,385	1,385	1,605	1,604	1,599	1,599	1,599
EXPORTS									
Agriculture & Processing	8,382	10,716	13,858	14,800	14,677	15,620	14,533	11,365	9,596
Other	10,226	16,125	13,609	14,409	15,993	16,860	15,691	17,691	17,691
TOTAL	18,608	26,839	27,467	29,209	30,670	32,480	30,524	29,056	27,287

1997 RUNS

MODEL RUNS - AGRICULTURAL SECTOR RESULTS FOR 1997

$mn 1989/90 Prices Unless Otherwise Indicated	1990 BASE YEAR	1997 CONTROL RUN	Aggregate Capital & Labour at Control Level		Increased Aggregate Capital Labour				
			Stretched Agriculture	Stretched Agriculture plus Processing	Stretched Agriculture	Stretched Agriculture plus Processing	Forced Agriculture Policy	Forced Industrial Policy	Forced Industrial Policy plus Tariff
			1	2	3	4	5	6	7
SHEEP, BEEF & CROPS									
Output	4,116	4,587	5,622	4,899	6,105	5,330	6,155	5,010	4,859
Land Used	12,357	11,152	11,630	11,715	11,635	11,684	11,722	11,282	11,474
Capital Employed	20,553	21,455	27,286	22,937	30,119	25,501	30,369	23,798	22,871
Employment ('000)	49	49	62	53	69	58	69	54	52
Exports	5,250	5,807	7,557	8,005	7,869	8,317	7,965	6,051	5,329
DAIRY FARMING									
Output	2,206	3,410	3,537	2,755	3,863	3,013	3,880	3,558	3,313
Land Used	4,000	4,995	4,368	3,965	4,371	3,955	4,388	4,804	4,719
Capital Employed	6,982	10,085	10,754	8,147	11,875	9,058	11,930	10,636	9,870
Employment ('000)	35	48	51	39	57	43	57	51	47
Exports	1,826	3,059	3,467	3,899	3,613	4,054	3,652	3,190	2,811
OTHER FARMING									
Output	2,759	3,659	4,580	4,272	5,004	4,754	4,853	4,061	3,714
Land Used	3,000	3,209	3,360	3,677	3,351	3,718	3,247	3,271	3,164
Capital Employed	5,090	6,298	8,041	7,355	8,847	8,277	8,582	7,039	6,433
Employment ('000)	40	48	61	56	67	62	65	53	49
Exports	1,306	1,850	2,834	2,896	3,196	3,249	2,916	2,124	1,456

1997 RUNS