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Drought, Regions and the Australian Economy between 2001-02 and 2004-05

by

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The Centre of Policy Studies (COPS) is a research centre at Monash University devoted to quantitative analysis of issues relevant to Australian economic policy.

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ABSTRACT

During the latter part of 2002 large areas of Australia have been affected by severe drought. In this paper, we examine the prospects for the Australian economy between 2001-02 and 2004-05, with particular emphasis on the implications of the drought for regions. Forecasts that take into account the drought and an assumed recovery are undertaken with the MONASH model. Year-on-year forecasts are provided for macro and micro variables at the national level. The paper then reports on simulations of the regional effects of the drought, undertaken with a new multiregional model, TERM. Detailed effects of the drought for the model's 45 regions are reported. The drought is estimated to lower 2002-03 GDP by 1.6 per cent and employment by 0.8 per cent. All mainland states are negatively affected. Eleven of the model's 45 regions are projected to have their GRPs lowered by more than 10 per cent by the drought, with a further seven regions being projected to have their GRPs lowered by between 5 and 10 per cent.

Main Points

- During 2002 Australia has experienced a severe drought that has been one of the most widespread on record.
- The drought is expected to have a severe impact in 2002-03 on agricultural output which on average is expected to be almost 30 per cent lower than the base case.
- The fall in agricultural output can be expected of itself to remove 1.0 percentage points from Australia's gross domestic product growth rate.
- Flow-on effects to the rest of the economy are expected to lower real GDP growth by a further 0.6 percentage points, leading to a total negative impact of the drought on GDP of 1.6 per cent.
- All mainland states of the economy are projected to experience a significant reduction in their gross state product and employment as a result of the drought. Queensland, New South Wales and South Australia are all projected to have their GSP growth rates reduced by around 2 percentage points.
- The estimated percentage change in employment in each state due to the drought is expected to be about a third to a half of that for gross state product. The reason for this is a rigidity in agricultural sector employment which loses productivity because of the drought.
- The drought is estimated to have an effect on capital city employment which is projected to be lower than the base case by between 0.4 per cent (Melbourne and Perth) and 0.8 per cent (Brisbane).
- Many rural regions are projected to experience severe output contractions as a result of the drought. Eleven of the 45 regions covering Australia in our model are projected to have their gross regional product reduced by more than 10 per cent by the drought, and the GRPs of a further seven regions are projected to fall by between 5 and 10 per cent. The worst affected regions are South West Queensland (with a -21 per cent change in GRP), North West NSW (-18%), the WA Wheatbelt(-17%), the Victorian Mallee (-16%)and Northern NSW (-15%).
- The fate of regions in respect of the drought is a combination of their dependence on agriculture and the severity of the rainfall deficit in their region. Given the widespread nature of the

drought, all of Australia's most agricultural intensive regions are projected to be severely affected. The 17 worst-affected regions included all 14 of Australia's regions that had 20 per cent or more of their output in the agricultural sector.

- The difference between the reduction in employment and output is even more marked at the regional level, since most of the output contraction in these regions is in agriculture which sheds very little employment as a result of the drought. The worst affected region, South West Queensland, is projected to have its employment lowered by 5.5 per cent (compared with a reduction in GRP of 21 per cent). Altogether 15 regions are projected to have their employment reduced by 2 per cent or more as a result of the drought.
- It is quite likely that the drought will begin to break in the last half of 2002-03. In this event very little of the negative effects of the drought can be expected to persist into 2003-04, except for the livestock industries in some inland regions, which will take time to recover from destocking during 2002.

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Introduction

During the latter part of 2002 large areas of Australia have been affected by severe drought. This is having a detrimental impact on many agricultural industries and on regions that are agriculturally dependent. In this paper, we examine the prospects for the Australian economy between 2001-02 and 2004-05, with particular emphasis on the implications of the drought for regions. Our analysis is undertaken with two economic models: MONASH, an annual dynamic computable general equilibrium model of the Australian economy; and TERM, a very detailed economic model of Australia's regions. MONASH is used to generate year-to-year forecasts for macro and micro variables at the Australia-wide level. Embedded in these forecasts are the effects of the drought and the assumed recovery. TERM is used to model the 2002-03 impacts of the drought only.

In the next two sections we report the MONASH-generated forecasts. These forecasts cover the period 2001-02 to 2004-05, and update the forecasts reported in Adams, Dixon and Rimmer (2001). The fourth and fifth sections focus on the impacts of the drought on Australian regions. These impacts, generated using the TERM model, are expressed as deviations away from a hypothetical no-drought projection. The final section contains concluding remarks.

National Forecasts for 2001-02 to 2004-05

As described in previous articles (e.g., Adams, Dixon and Rimmer, 2001), we impose on MONASH forecasts from specialist groups, and use the model to derive the implications of the extraneously given information for structural variables. For the forecasts reported in this paper, we use:

- macro forecasts from "Five Year Business Outlook" (September quarter 2002), published by Access Economics[1];
- price and quantity forecasts for exports of agricultural and mineral products from "Australian Commodities" (September 2002), published by the Australian Bureau of Agricultural and Resource Economics (ABARE)[2]; and

- forecasts of changes in technology and consumer preferences produced by the Centre of Policy Studies (CoPS).

Table 1 summarises the MONASH-generated forecasts for macro variables. Table 2, which is discussed later, shows MONASH-generated forecasts for employment by 21 industrial sectors.

Table 1: Macro Forecasts

	History	Percentage growth rates			
		Forecast			
	2001-02	2002-03	2003-04	2004-05	Average
Real private consumption	3.8	3.4	2.9	3.4	3.2
Real public consumption	2.8	3.0	3.0	3.3	3.1
Real investment	9.6	5.0	2.0	-1.5	1.8
Exports, volume	-1.9	0.1	12.3	7.8	6.6
Imports, volume	2.5	3.7	7.5	1.6	4.2
Real GDP	3.9	2.7	3.1	3.7	3.2
Employment	-0.1	1.0	2.0	1.5	1.5
Real wage rate	2.7	1.1	1.8	1.5	1.5
Terms of trade	2.6	-0.8	4.7	-5.5	-0.6

The MONASH GDP forecasts reflect, in the main, those made by Access. Table 1 shows average growth in real GDP over the next three years of 3.2 per cent. This is a little below the average of the previous three years, reflecting, in part, the adverse impacts of the drought. We assume that the drought has its most direct impact on real GDP in 2002-03. In that year, GDP growth is forecast to be 2.7 per cent, compared with an observed rate of 3.9 per cent in 2001-02. We assume a return to normal seasonal conditions after 2002-03, leading to a gradual recovery in agricultural production.

Aside from the drought, the other key factor affecting forecast GDP growth is the state of world demand. Access expects a moderate recovery in economic growth in the US and Europe, but is pessimistic about the growth prospects of Japan. On balance, Access thinks that the global recovery, which began in the middle of this year, will proceed at a moderate rate through the next three years.

Improving growth in the world economy underlies Access's forecast for strong growth in Australia's exports following the drought-affected year. The prospects for growth in real private consumption are also good, even in 2002-03 when Access thinks that the factors driving strong consumer spending – low interest rates, strong growth in housing construction, and rising employment – will peak. The outlook for investment, however, is less buoyant. Solid growth in business and housing investment is expected for 2002-03, but thereafter the expectation is for a levelling off.

Employment growth over the new three years is expected to average 1.5 per cent, 1.7 percentage points less than average growth in real GDP. The implied productivity improvement is in line with recent history.

Forecasts of Employment by Sector

Table 2 shows MONASH forecasts for employment by industry aggregated to 21 industrial sectors. It also shows forecast average annual growth rates in production for each of the 21 sectors.

Table 2: Employment Forecasts for Industrial Sectors

Sector	Percentage growth in employment					Percentage growth in output
	History	Forecast				Forecast
	2001-02	2002-03	2003-04	2004-05	Average	Average
Agriculture, forestry and fishing	1.2	-2.8	4.0	2.1	1.0	-0.5
Mining	0.7	2.5	-0.9	-3.3	-0.6	4.3
Food, beverages and tobacco	1.0	-0.8	3.2	2.1	1.5	3.7
Textiles, clothing and footwear	-13.0	-6.6	-3.9	1.1	-3.2	2.8
Wood, wood products and furniture	2.2	2.4	-0.2	3.1	1.7	2.3
Paper, paper products, printing and publishing	-9.9	0.3	1.1	4.6	2.0	4.1
Chemicals, petroleum and coal products	1.7	1.0	2.5	7.8	3.7	5.8
Non-metallic construction materials	-1.1	0.7	-4.0	-3.0	-2.1	2.5
Basic metal products	-11.7	-1.0	0.1	1.5	0.2	5.2
Cars and other transport equipment	-3.5	-3.7	0.2	4.5	0.3	4.0
Electronic, and other specialist equipment	4.5	0.1	3.7	8.5	4.0	7.6
Leather, rubber, plastic and other products	-8.6	-2.4	-0.7	4.8	0.5	5.2
Utilities	4.1	-9.0	-4.7	-4.9	-6.2	3.1
Construction	2.0	7.0	1.0	-4.8	0.9	2.0
Wholesale and retail trade	2.2	-0.6	1.9	0.9	0.7	3.4
Transport and storage	-3.2	-0.9	3.4	1.6	1.3	4.3
Communications	-8.9	-0.7	0.6	1.5	0.5	6.5
Finance, property and business services	-2.6	3.1	3.9	5.8	4.3	4.7
Public administration and defence	2.1	-1.0	0.0	-0.9	-0.6	2.8
Health, education and welfare	2.7	1.1	1.8	1.2	1.4	3.6
Hospitality, leisure and personal services	-1.3	0.9	3.2	2.6	2.2	3.2

In terms of average growth through the forecast years, the sectors with the highest employment growth are Finance, property and business services (4.3 per cent average annual growth), Electronic, and other specialist equipment (4.0 per cent), Chemicals, petroleum and coal products (3.7 per cent), and Hospitality, leisure and personal services (2.2 per cent). All these sectors are expected to experience above-average rates of growth in output, with relatively weak improvements in productivity (labour used per unit of output). Output in the Finance, property and business services sector is forecast to increase at an average annual rate of 4.7 per cent. This is higher than forecast average growth in real GDP reflecting the assumption in our forecasts that the financial-intensity of industry inputs and household consumption will grow strongly, in line with trends through the 1990s. Growth in the hospitality industries is assisted by Access' forecast of a recovery in growth in the number of foreign visitors. Favourable trends in technology explain our forecast of rapid growth in the output of electronic, and other specialist equipment, and in chemical products.

Despite a generally positive outlook for output, employment is forecast to decline over the forecast period in five sectors. The Utilities sector is forecast to have the largest percentage fall in employment (-6.2 per cent average annual growth). This reflects very strong

productivity improvement arising from exogenously imposed technological change, which reduces the amount of primary factors used per unit of output in line with historical trends. Another sector forecast to experience a large fall in employment is Textiles, clothing and footwear (-3.2 per cent average annual growth). On average over the forecast period, productivity in this sector increases by 6.0 per cent. This improvement is due to strong capital growth, rather than exogenously imposed technological change. At the beginning of the forecast period, profitability in this industry was high. Thus we are forecasting relatively strong investment growth through the forecast period, which increases the ratio of capital to output and suppresses the ratio of employment to output.

For agriculture, we are forecasting average annual growth in output of –0.5 per cent and in employment of 1.0 per cent. Output declines significantly in the drought year, before recovering to fairly typical levels. The average growth rate is weak because agricultural production in 2001-02 was atypically high. In our modelling, we assume that the drought has relatively mild affects on agricultural employment, with farmers reluctant to put aside both their own labour and the labour of their skilled employees in the expectation of a return to better seasonal conditions. Agricultural investment, however, is seriously eroded by the drought and the subsequent decline in capital through the forecast period results in a decline on average in labour productivity.

Modelling the Regional Impacts of the 2002-03 Drought

Even in a drought as widespread as that of 2002, the impact on farmers has varied widely across regions. For example, some grain growers around Adelaide, the south east of South Australia and south-western Victoria have realised near average harvests. Yet on eastern Eyre Peninsula, in the Murray districts and northerly grain growing areas of South Australia, in north-western Victoria and western New South Wales, many farmers suffered substantial or total crop failure.

Rainfall deficits generally have been worse in inland grain-growing regions than in coastal regions. This has meant a bleaker outlook for grains than some other crops, but it also has meant that the same agricultural product is likely to be affected differently in different regions. The regional extension of the MONASH model is not well equipped to model such interregional differences. In order to be able to model properly the regional impact of the drought we required a model that explicitly treats the behaviour of economic agents at the regional level. A model which has just such capabilities in modelling regions at the statistical division level has recently been constructed at CoPS.

The new model, known as TERM, is a multiregional computable general equilibrium (CGE) model which, for this project, models 38 industries in 45 Australian regions (see Horridge, 2002). Regions are either statistical divisions or combinations of statistical divisions. Each region has its own CGE model with a similar theoretical structure to ORANI (Dixon, et al., 1982). The 45 regional CGE models are linked by additional equations controlling interregional trade in each commodity. The model's database was formed using a variety of sources with gravity modelling being used to estimate the pattern of interregional trade flows. Of particular relevance for the current project was the formation of the agricultural component of the database which was estimated using ABS agricultural output data at the statistical division level. The simulations reported here employ a 1996-97 database. Nineteen of the 38 industries are in the agricultural sector. The level of industry and regional detail in the TERM model provides a unique tool for estimating both the regional and macroeconomic effects of the current drought.

Estimating the direct impact of drought at the regional level

From April to November 2002 Australia has experienced one of its worst widespread 8-month period droughts on record[3]. In October ABARE (2002a) issued a special drought issue of its crop report further revising downwards its expectations for winter crop output and warning of an inauspicious outlook for summer crops. The grim 2002-03 outlook for Australian crops was confirmed in ABARE's (2002b) December crop report, with winter and summer crop output down on average on 2001-02 output by 56 per cent and 59 per cent respectively.

For the forecasting estimates reported above our concern was with such year-on-year estimates. In this section, however, we wish to compare the impact of the drought with what otherwise would have been the case. We assume the latter to be encapsulated in ABARE's earlier 2002-03 forecasts published in the first part of 2002, before it became apparent that Australia was facing a severe drought.

To undertake properly our modelling of the drought at the regional (statistical division) level it was important to make estimates of the direct effect of the drought on output for agricultural industries within individual statistical divisions. We did this by developing estimation formulae that computed productivity losses due to the drought for each agricultural industry in each region. The formulae related the productivity losses to rainfall deficits in individual regions which, in turn, were estimated from district rainfall deficit figures (for specific periods up to 31/10/02) available from the Bureau of Meteorology. Separate formulae were developed for different types of crops and for livestock. For example, for winter grains grown in southern Australia, we assumed that the productivity loss for the crop in a particular region was a progressively increasing function of the 3-month rainfall deficit, and was also affected to a lesser extent by the 6-month deficit. Thus as the severity of the 3-month rainfall deficit increased, productivity losses were estimated to become increasingly greater at the margin. Other crops were either linearly or progressively related to combinations of 3-month, 6-month and 18-month rainfall deficits. In each case, regional industry productivity losses were adjusted so that the simulation result for the effect of the drought on the Australia-wide output of the industry coincided with the difference between the latest ABARE 2002-03 output forecast and the Bureau's earlier forecast for the industry.

For cattle and sheep grazing, we used 18-month rainfall deficits to estimate the productivity impact of the drought. However, using ABARE's estimates for the Australia-wide output effects on the various livestock industry presented a particular difficulty. ABARE (2002c) forecasts a modest overall increase above the 2001-02 figure in the number of livestock slaughtered and also a small increase in meat produced. The latter increase is by only a slightly smaller percentage than the former, which would appear to indicate only limited deterioration in the quality of the livestock slaughtered. However, for the most severely affected regions, where the 18-month rainfall deficits have been extreme, it would appear that de-stocking may have been the dominant response to the drought. We decided to adjust the ABARE estimates to account for some of the livestock sales in the worst affected regions being in the form of disinvestment, rather than increased production. Thus for regions such as Central West and South West Queensland we ascribed a near zero level of investment to livestock sectors. Our 2002-03 results may still not fully capture the negative effects of the drought on some livestock regions as it is not possible to gauge properly the degree to which maintaining livestock sales has been via de-stocking. Reduced herd numbers can also be expected to have an effect on certain regions well beyond 2002-03.

We also recognised in our modelling that in less severely affected livestock regions, especially with the expectation of the drought breaking relatively early in 2003, increased

feed grain would be used to keep livestock alive. Feed-grain-using productivity losses in livestock industries were computed on the basis of rainfall deficits, in order to capture this effect.

Impact of the Drought on the National and Regional Economies

Table 3 shows the results for the macroeconomic effects of the drought generated by the TERM simulation. It can be seen from the first row of the final column that we expect the drought to lower Australian GDP by 1.6 per cent. One percentage point of this relates to reductions in value added in the agriculture sector (row 2), while the remaining 0.6 percentage point (row 3) is contributed by other industries suffering negative multiplier effects.

Table 3: Macroeconomic Impacts of Drought, 2002-03

Percentage change relative to base case

	NSW	VIC	QLD	SA	WA	TAS	NT	ACT	AUST.
Real GDP (total)	-1.9	-1.2	-2.0	-1.9	-1.5	0.3	-0.1	-0.1	-1.6
-- Agriculture contribution	-1.2	-0.7	-1.2	-1.4	-1.2	0.3	-0.1	0.0	-1.0
-- Other industries contribution	-0.7	-0.5	-0.8	-0.5	-0.3	0.0	0.0	-0.1	-0.6
Real consumption	-0.9	-0.5	-0.9	-0.8	-0.6	0.1	0.0	-0.1	-0.7
Real investment	-1.6	-0.7	-1.2	-1.6	0.3	1.6	-0.5	2.1	-0.9
Export volume	-2.7	-4.3	-3.8	-12.1	-8.8	-3.0	0.5	-1.1	-5.0
Import volume	-0.4	0.1	-0.4	-0.4	0.1	1.3	0.3	0.5	-0.2
Export prices	0.7	1.2	1.0	2.8	1.8	0.8	-0.1	0.3	1.2
Employment	-0.9	-0.6	-1.1	-0.7	-0.5	0.1	-0.1	-0.2	-0.8
Average wage rate	-1.2	-0.7	-1.3	-0.8	-0.6	0.2	-0.1	-0.2	-0.9

The bottom two rows of Table 3 show that the drought is projected to have considerable adverse effects on the Australian labour market in 2002-03. It will be noticed that the drought is projected to cause a reduction both in employment and in the national real wage rate of a little under 1 per cent. This reflects our assumption that the temporary drought-induced reduction in the demand for labour will be shared between a decline in employment and a decline in real wages.

Our assumption regarding adjustment in the labour market limits the degree of multiplier effects of the drought. The fall in economy-wide employment accounts for only 0.4 percentage points of the projected negative effect of the drought on GDP, while reductions in the indirect tax base accounts for a further 0.2 per cent reduction in GDP.

Both real investment and real household consumption are projected to suffer a smaller percentage reduction than GDP. Again this reflects our assumptions about the macroeconomic environment. In the case of household consumption we expect reductions in expenditure to be

ameliorated by increased borrowing (particularly given the current low interest rates), increased government benefits (e.g. unemployment benefits and government relief schemes) and, for severely-affected farmers, deferrals in investments in machinery. Using these considerations we set a particular ratio for the percentage change in real household expenditure to the percentage change in gross regional product (GRP) for each of the 45 regions. It can be seen from Table 3 that the drought-induced percentage decline in real consumption is slightly under half the percentage decline in GDP.

The reduction in real investment of 0.9 per cent is made up entirely of falls in investment in the agricultural sector, particularly the postulated marked reductions in investment in livestock in the sheep and cattle industries. We assume that, given widespread expectations that the drought will not continue very much longer, there will be no overall change in the non-agricultural level of real investment from what would otherwise have been the case.

The widespread nature of the drought can be seen through the substantial projected fall in gross state product (GSP) in all the mainland states. Queensland, New South Wales and South Australia are all projected to experience reductions in Gross State Product of approximately 2 per cent. New South Wales's agricultural sector is the hardest hit in percentage change terms with an overall agricultural production loss of around 45 per cent. However, NSW was the state least intensive in agriculture in 2001-02 and thus the decline in agriculture had only the same impact on GSP as it did in Queensland where the agriculture sector is projected to be reduced by a quarter as a result of the drought, but where agriculture's 2001-02 share of GSP is 4.7 per cent (2.2 percentage points higher than for NSW)[4]. The estimated reduction in agricultural output in both South Australia and Victoria is a little under 20 per cent, but their 2001-02 shares in total state output are 7.2 per cent and 3.6 per cent respectively, leading to the drought having a significantly worse effect on the former state's economy. Western Australia with a projected reduction in overall agricultural output of around 30 per cent and a base-year agricultural share slightly above the Australian average of 3.6 per cent is projected to experience the same fall in GSP directly through agriculture's contraction as NSW and Queensland. However, the negative flow-on effects to the Western Australian economy are projected to be substantially smaller than the other two states. A major reason for this is that Mining, which makes up a very large proportion of WA output relative to other states[5], is projected to increase its output slightly as a result of the drought-induced decline in the real wage rate.

Tasmania is the only state that is not negatively affected by the drought. While the state is quite agriculture intensive (with an agricultural share in output of over 4 per cent), it experienced a reasonable level of rainfall in 2002, with serious or severe rainfall deficits only being experienced on the east coast of the island. Tasmania is thus projected to gain from the beneficial effects of agricultural price rises without having to suffer output contractions in agricultural industries. The ACT has virtually no agricultural industry and thus suffers little from the drought. While agriculture, consisting largely of Beef cattle, comprises 2.7 per cent of the Northern Territory economy, the rainfall deficit in the Territory was considered not to have had any major effect on that region's agricultural output.

In Table 4 we see that the effects of the drought are estimated to vary considerably across Australian regions. As would be expected, the serious effects of the drought are projected to be experienced outside the capital cities. However, our projections do not show the capital cities to be absolutely unaffected by the drought, which is estimated to lower GRP for Sydney/Illawarra, Melbourne/Barwon, Brisbane and Adelaide/Outer-Adelaide by around half a per cent in each case.

Table 4: Impact of Drought on Major Regional Aggregates [(a)]

	Real Household consumption	Real Investment	Real GRP	Aggregate Employment	Real Wage Rate
New South Wales					
Sydney/Illawarra	-0.2	1.1	-0.5	-0.7	-0.8
Hunter	-0.3	0.9	-0.6	-0.6	-0.8
North NSW Coast	-0.7	-0.2	-1.3	-0.8	-1.0
Northern NSW	-8.0	-12.7	-15.4	-2.9	-3.7
North West NSW	-9.6	-19.3	-18.4	-5.1	-6.3
Central West NSW	-3.5	-8.1	-6.9	-2.4	-3.0
South East NSW	-1.2	-3.3	-2.3	-1.0	-1.2
Murrumbidgee	-5.8	-10.8	-11.4	-2.7	-3.4
Murray NSW	-6.7	-13.0	-13.0	-3.3	-4.2
Far West NSW	-2.8	-4.8	-5.5	-2.0	-2.5
Victoria					
Melbourne/Barwon	-0.2	1.4	-0.4	-0.4	-0.6
Western District	-1.8	-11.3	-3.5	-1.3	-1.7
Central Highlands	-0.7	-1.1	-1.4	-0.7	-0.9
Wimmera	-5.7	-9.6	-11.1	-2.2	-2.7
Mallee	-8.1	-13.1	-15.5	-3.3	-4.1
Loddon	-0.9	-1.2	-1.8	-0.8	-0.9
Goulburn	-2.6	-6.9	-5.1	-1.4	-1.8
Ovens Murray	-0.8	-1.6	-1.7	-0.7	-0.9
Gippsland/East Gippsland	-0.5	-1.4	-1.0	-0.2	-0.3
Queensland					
Brisbane	-0.3	0.8	-0.6	-0.8	-1.0
Moreton	-0.5	0.8	-1.0	-0.8	-1.0
Wide Bay-Burnett	-1.1	0.0	-2.1	-1.0	-1.2
Darling Downs	-4.4	-7.3	-8.6	-2.3	-2.9
South West Qld	-11.1	-24.1	-21.0	-5.5	-6.9
Fitzroy	-1.3	-0.6	-2.7	-1.3	-1.6
Central West Qld	-7.3	-19.0	-14.0	-4.6	-5.7
Mackay Qld	-1.8	0.8	-3.5	-1.6	-2.0
Northern Qld	-1.6	0.7	-3.3	-1.3	-1.6
Far North Qld	-1.0	1.0	-1.9	-0.9	-1.1
North West Qld	-1.1	-3.0	-2.3	-1.0	-1.3

Table 4 continued

	Real Household consumption	Real Investment	Real GRP	Aggregate Employment	Real Wage Rate
South Australia					
Adelaide (&Outer Adelaide)	-0.3	1.1	-0.5	-0.5	-0.6
Yorke and Lower North	-5.4	-7.9	-10.5	-2.3	-2.9
Murray Lands SA	-5.0	-5.8	-9.7	-1.3	-1.6
South East SA	-1.3	-2.2	-2.6	-0.6	-0.8
Eyre SA	-6.8	-11.3	-13.2	-3.5	-4.3
Northern SA	-1.6	-1.7	-3.1	-1.3	-1.6
Western Australia					
Perth & Sth West WA	-0.2	1.4	-0.3	-0.4	-0.5
Great Southern WA	-3.7	-9.0	-7.3	-2.3	-2.8
Wheatbelt	-8.7	-11.7	-16.6	-2.6	-3.2
Goldfields Esperance	-1.0	0.5	-2.1	-0.5	-0.6
Mid West WA	-2.8	-1.8	-5.4	-0.9	-1.1
Northern WA[(b)]	0.0	2.8	-0.1	0.3	0.4

(a) Table excludes Tasmania, the Northern Territory and the Australian Capital Territory which are already covered in Table 3. (b) Covers the areas of the Gascoyne, Pilbara and Kimberley.

While a small number of non-capital-city regions are projected to suffer smaller declines in their real GRP than the national GDP decline, rural Australia overall is projected to suffer severe output contractions in 2002-03. Eighteen out of the 45 regions in the model are projected to suffer GRP declines of over 5 per cent. A GRP reduction of greater than 10 per cent is projected for eleven of these. Given the widespread nature of the drought, all of Australia's most agricultural intensive regions are projected to be severely affected. The 17 worst-affected regions included all 14 of Australia's regions that had 20 per cent or more of their output in the agricultural sector.

The projected severity of the drought on a region can largely be explained as a combination of the region's reliance on agriculture and the severity of the drought in the region[6]. The worst affected regions are South West Queensland (with a -21 per cent change in GRP), North West NSW (-18%), the WA Wheatbelt(-17%), the Victorian Mallee (-16%)and Northern NSW (-15%). The Wheatbelt has an agricultural share of output of 46 per cent, compared to the mid to high 20s for the other four regions. However, the other four regions have suffered an even more severe drought than the Wheatbelt.

The next most affected region is Central West Queensland which has a projected GRP reduction of 14 per cent relative to the base case in 2002-03. It is likely that this region, among a number of other regions, will be slow to recover from the drought as its agricultural output consists of Sheep and Beef cattle, and it may therefore have been subject to significant destocking.

Table 5: Effect of Drought on Selected Industries for Regions - listed in order of negative GRP effects (per cent change in output)

	Sheep	Barley	Wheat	Oth Broadacre	Beef Cattle	Dairy Cattle	Rice	Cotton	Fruit & Nuts	Grapes	Multi-Grape	Sugar Cane	PastureIrrig	Vegetables	Other Crops	Agric. Services	Meat Products	Dairy Products	Flour, Cereals	Wine	Fibre Woven	Construction	Trade	Transport	OtherSrvcs
South West Qld	-38	-63	-66	-42	-37	1	0	-71	-36	0	-37	0	4	7	-58	-19	-5	0	0	0	-5	-13	-7	-12	-6
North West NSW	-30	-64	-67	-43	-29	-41	0	-67	-34	-32	-36	0	-36	-34	-52	-16	-3	-10	2	-5	-2	-12	-7	-11	-5
Wheatbelt	-11	-36	-41	-24	-11	0	0	0	-19	-9	-21	0	-22	-20	-20	-13	4	-5	0	0	0	-8	-6	-6	-4
Mallee	-12	-64	-67	-43	-12	-19	-50	0	-30	-16	-32	0	-30	-30	-31	-15	4	-9	0	-5	0	-8	-8	-10	-4
Northern NSW	-8	-42	-47	-28	-7	-14	0	-66	-22	11	0	0	-24	-22	-51	-15	4	-5	1	0	1	-9	-5	-6	-4
Central West Qld	-38	0	0	0	-38	0	0	0	0	0	0	0	0	0	0	-18	-7	0	0	0	0	-6	-5	-9	-3
Eyre SA	-5	-41	-45	-27	3	0	0	0	0	0	0	0	-17	0	-16	-14	5	0	-2	0	0	-8	-5	-7	-3
Murray NSW	-14	-65	-68	-44	-14	-23	-50	0	-33	-20	-35	0	-33	-33	-34	-14	1	-10	-1	-5	0	-7	-5	-9	-3
Murrumbidgee	-14	-62	-66	-42	-13	-22	-50	0	-29	-15	0	0	-30	-29	-30	-14	2	-6	-1	-5	-1	-5	-6	-7	-3
Wimmera	-9	-38	-43	-26	-7	0	0	0	-19	-17	0	0	-20	6	-20	-14	3	-7	0	-6	0	-5	-5	-9	-3
Yorke, Lwr North	-4	-33	-39	-23	-4	-5	0	0	-12	-9	0	0	-13	0	-13	-14	3	0	-2	-6	-1	-4	-4	-7	-2
Murray Lands SA	-9	-55	-59	-37	-8	-15	0	0	-24	-1	-6	0	-25	-24	-25	-15	1	-9	-2	-5	0	-4	-5	-7	-2
Darling Downs	-11	-42	-47	-28	-10	-18	0	-58	-20	-18	-23	0	-23	-21	-39	-14	-1	-9	-1	0	-3	-4	-4	-5	-2
Great Southern	-6	-34	-39	-23	-5	-10	0	0	-14	-11	0	0	-17	-15	-15	-13	4	-7	0	-6	0	-3	-5	-5	-2
Cent'l West NSW	-12	-64	-67	-43	-12	-20	0	0	-30	-27	0	0	-31	-31	-32	-15	0	-9	-2	-7	-2	-3	-4	-5	-2
Far West NSW	-30	-66	-69	0	-29	0	0	-72	-36	10	-38	0	0	0	5	-17	-7	0	0	-6	0	-3	-3	-5	-2
Mid West WA	-9	-17	-24	-14	-8	0	0	0	0	0	0	0	4	0	-15	-14	2	0	0	0	0	0	-4	-7	-1
Goulburn Vic	-12	-40	-45	-27	-11	-19	-50	0	-22	-17	-25	0	-24	-23	-24	-15	0	-11	-2	-7	-3	-2	-3	-3	-1

In Table 5 we show the percentage changes in the output of 25 selected industries for each of the 18 regions worst affected by the drought (in GRP terms) in 2002-03. It can be seen that the output for a number of agricultural industries are expected to be devastated. Negative flow-on effects, although not as large, can also be seen in those industries which process agricultural products. There are negative effects on Trade and Transport which supply both margin services on the sales of agricultural products and form part of farmers' consumption expenditure. The Construction industry contracts in these regions as investors, at least temporarily, transfer their investment activities to non-agricultural regions.

For the agricultural industries the large negative effects on output are not matched by similar reductions in employment. Indeed, employment in the agricultural industries is projected to change little due to the drought. The principal reason for this is that the drought gives rise to much lower labour productivity in agriculture, which means that farmers must continue to hire labour and supply their own labour at around pre-drought levels in order to produce the reduced output levels. However, the processing and service-sector industries shown to lose output in Table 5 reduce their employment by a slightly greater percentage than their output. Thus, there are only seven regions for which more than a fifth of the total number of jobs lost in the region are in the agricultural sector.

The limited contraction in agricultural employment explains why the rural regions suffer a much smaller percentage reduction in total employment than in GRP, while there is a slightly greater percentage contraction in aggregate employment than in GRP in the capital city regions.

Concluding Remarks

During 2002 Australia has experienced one of its most widespread droughts with serious to severe rainfall deficiencies covering a good deal of Australian agricultural land, particularly for the last three-quarters of the year. The effect of the drought has been to reduce severely agricultural output in most regions. On average Australian agricultural output is estimated to be reduced by the drought by slightly under 30 per cent. Given agriculture's share of 3.6 per cent of Australian GDP, this projected contraction in agricultural output is estimated to reduce Australian GDP growth by 1 percentage point. A further 0.6 percentage points is expected to be cut from GDP growth due to negative multiplier effects.

It is estimated that Australian employment will be almost 0.8 per cent lower on average in 2002-03 than would have been the case in the absence of the drought. While the greatest employment contractions are projected for rural regions, the bulk of the jobs lost in those regions are projected for the non-agricultural sector. Employment within the agricultural sector is not expected to change much, relative to the large output contractions, due partly to the nature of agricultural employment (i.e. a large proportion of owner-operators) and partly to the drought-induced reduction in the productivity of labour.

It should be borne in mind that the effects of the drought are in the main of a quite temporary nature. There would appear to be an imminent prospect that the El Nino weather pattern is about to end. While the Bureau of Meteorology (2002b) is unable to forecast exactly when the drought will end, January to March is the most common period for the El Nino effect on Australian weather to ease. Our economic forecasts are based on the expectation that the agricultural sector will not still be suffering from general drought conditions in 2003-04. We project an improved GDP growth rate for 2003-04 and forecast employment growth of 2.0 per

cent for that year compared with a 1.0 per cent forecast for employment growth in 2002-03. Following a forecast fall in Agriculture, forestry and fishing employment in 2002-03 of 2.8 per cent, we expect employment to recover in that sector to a 4.0 per cent increase on the present financial year in 2003-04. The rate of recovery is not expected to be uniform across the sector, however, as lower herd numbers are likely to hold back growth in the livestock industry in 2003-04 and perhaps longer.

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[1] These are adjusted to reflect the impacts of the drought as simulated by the TERM model and reported in the latter part of this article.

[2] We adjust the ABARE forecasts reported in September 2002 to reflect the latest data on the impacts of the drought on cropping industries. The latest data are consistent with the input used in the TERM modelling.

[3] The Bureau of Meteorology (2002a) Drought statement shows serious to severe rainfall deficiencies across much of the eastern states (excluding Tasmania) and significant parts of South Australia and Western Australia. In the Bureau's terminology serious deficiency involves rainfall

that is below the 10th percentile in historical records for such a period. However, if it is in the lowest 5 per cent on record it is defined as being a severe rainfall deficiency.

[4] Agricultural shares are CoPS estimates. They exclude forestry and fishing activities.

[5] Mining makes up about 20 per cent of Western Australian GSP, compared with around 5 per cent for the nation as a whole.

[6] Also of importance is the composition of agricultural output in the region, as different agricultural products are affected differently by rainfall deficits over different periods (as explained in an earlier section).