Modelling the economic impacts of changing SA Water's pricing

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Executive summary

This study uses a dynamic computable general equilibrium model (VU-TERM=**V**ictoria **U**niversity-**T**he **E**normous **R**egional **M**odel) to examine the impacts of altering charges for water supply and delivery by SA Water. The context of this study is that the Essential Services Commission of SA is undertaking an inquiry into water pricing. The overall fixed costs of water supply and delivery in the state are much higher than reflected in the current charging scheme used by SA Water. At present, volumetric charges for water are high, and account for 68% of revenue associated with water supply and delivery. Fixed charges raise the remaining 32% of revenue. The Adelaide Desalination Plant has added to the fixed costs of water supply in South Australia.

The current pricing scheme is not appropriate in years in which water supply is not adversely affected by drought. Water is being priced as though it is scarce in years when it is not. Consequently, use of water by households and industries is lower than it would be with lower volumetric charges. An appropriate pricing reform would be to raise the fixed and lower the volumetric charges in years when water is not scarce. During drought, volumetric charges ought to rise again to reflect scarcity with a cut in fixed charges to meet a given revenue target.

Each baseline in the study runs from the years 2011 to 2035. The first baseline assumes that no droughts have an adverse impact on South Australia’s mains water supply in this period. In the first scenario with the pricing reform relative to this baseline, there are small welfare gains, as water use in the South Australian economy grows relative to base. The annualised national welfare gain in this scenario is $25 million. Welfare is estimated at the national rather than regional level: part of the response at the regional level in a policy scenario arises from inter-regional migration which can alter regional macroeconomic outcomes with smaller changes in per capita outcomes.

When two episodes of two-year droughts are introduced to the baseline, with pricing adjustments in drought years to reflect the altered cost conditions of water supply and delivery, the national welfare gains are slightly larger than in the first scenario, $31 million annualised.

A third scenario introduces the pricing reforms this time with a sharply reduced annual revenue requirement. This is consistent with required returns from existing water infrastructure used by SA Water falling. The reduction in costs borne by South Australian households and industries is much larger than in the first two scenarios. The impact on welfare is also larger, this time a $120 million benefit in annualised terms.

Background

Most of settled South Australia has a reasonably secure mains water supply. This reflects the extensive infrastructure that has enabled a relatively dry state to cope with limited water resources.

The Mannum-Adelaide pipeline became operational in 1955, connecting Adelaide to the water supply of the Murray-Darling Basin. In drought years, when reservoirs supplying Adelaide's water needs are depleted, the Murray-Darling Basin may supply up to 90% of Adelaide's water.

The millennium drought, which occurred over most of 2002 to 2008, resulted in water managers reducing annual allocations of water in the Murray-Darling Basin. The usual source of water to supplement Adelaide's supply was under threat. Options to supplement Adelaide's water supply were more limited than they may be now. At the time, there had been substantial advancements in desalination technology, bringing down the costs of desalination. Given the severity and duration of the millennium drought, state governments acted: each of Australia's five mainland state capitals started construction of desalination plants. At the time (around 2007 or 2008), there was insufficient confidence in alternative technologies to provide water of a potable standard.

The Adelaide Desalination Plant was constructed in response to an unprecedented water crisis in South Australia. The capital costs of the plant exceeded $1.8 billion. Since then, the rains have returned, filling dams in the Adelaide Hills and enabling water managers in the Murray-Darling Basin to restore full annual water allocations to users. The desalination plant is not required to produce potable water at present, although it is currently producing water as part of its final commissioning and proving stage. High volumetric charges remain on water, as though drought-induced scarcity still prevails.

There is an annual revenue requirement to service the capital costs of constructing the desalination plant. However, the desalination plant is only part of the water supply and delivery infrastructure and other service costs which are fixed rather than dependent on the volume of water delivered. The existing pricing formula used by SA Water, with relatively high marginal usage charges, could continue to cover part of the capital costs. Resource misallocations may arise from excessive volumetric charges for water during periods when water is not scarce.

An alternative is to adopt a pricing formula that reflects supply conditions. A change in the pricing formula that lowered volumetric charges for all users and raised the fixed charges for household users and some industries would more closely reflect supply conditions in normal years.

The CGE approach used in this study

Competing agents in the economy

We would expect a reduction in the volumetric charge for water to benefit large water users, particularly in agriculture. Therefore, costs reductions would move the supply curves for industries out, with the magnitude of the movement being influenced by the cost share of water in total production.

However, for a given revenue target, an increase in fixed charges is likely to offset these gains to industry. Households are the most likely group to bear increases in fixed costs. This is because there are many household customers, and the volume used per customer is lower than for most non-household customers. Yet, at the same time as facing raised fixed costs, households will face lower volumetric charges for water.

We require a computable general equilibrium model that includes industries plus final users including households in order to determine whether there will be gains to the economy arising from the switch towards higher fixed charges for water supply and delivery. Industries will benefit from lower water costs, but households will face increased fixed charges that are larger than the value of reduced volumetric charges imposed on them.

The regional representation in this version of dynamic VU-TERM

In this study, there are seven bottom-up regions in South Australia (Northern Adelaide, Western and Eastern Adelaide, Southern Adelaide, Barossa-Lower North-Kangaroo Island, Mt Lofty-Fleurieu, Murray-South East and Rest of South Australia. In addition, there is a single composite region covering the remaining states and territories of Australia.

Northern Adelaide includes Gawler, Playford (including most of the Virginia horticultural triangle – excluding that part north of the Gawler River), Salisbury, part of Port Adelaide and Tea Tree Gully. Western and Eastern Adelaide is predominantly suburban. Southern Adelaide extends from the southern suburbs into the Southern Vales.

The sectoral representation in this version of dynamic VU-TERM

The industries and commodities represented in this study are (with the abbreviated names in brackets):

Broadacre crops and livestock (BrdAcrShpCtl)
Grapes (Grapes)
Other Horticulture (OthHorticult)
Forestry and Fishing (ForestFish)
Mining (Mining)
Food Products (FoodPrds)
Wines & Spirits (WineSpirits)
Other Manufactures (OtherManuf)

Non-metallic mineral products (NonMetMinPrd)
Metal Products (MetalPrds)
Transport Equipment (TransportEq)
Electricity and Gas (Utilities)
Water & Sewage Services (WaterDrains)
Construction (Construction)
Retail and Wholesale Trade (Trade)
Transport (Transport)
Communication Services (Communicatn)
Business Services(BusinessSrv)
Ownership of Dwellings (OwnerDwellng)
Government Administration and Defence (GovAdminDef)
Education (Education)
Health Services (Health)
Community Services(CommuntySrv)
Other Services(OtherSrv)

The forecast baseline runs in dynamic VU-TERM

An underlying forecast baseline includes the historical construction of the desalination plant. The baseline keeps the price of water at relatively high levels, on the basis that marginal prices do not come down with availability of desalinated water. The additional capital of the desalination plant is kept dormant in normal years.

South Australia's economy is projected to grow slower than those of the other mainland states. All ABS population projections depict relatively slow growth in the state. On this basis, future water demands are not likely to grow. Per capita consumption of urban water has decreased in Australia over the past few decades through a combination of decreased garden space in urban dwellings and improvements in the water efficiency of domestic appliances.

Two baselines are used in this study:

1. No years of drought
2. Two episodes of two years drought, in 2020 and 2021 and later in 2028 and 2029.

During drought years in which water supply is markedly reduced, the desalination plant is brought into operation at an assumed capacity of 40%. That is, the plant produces 40 gigalitres of water in each of the two years of drought during both episodes of drought.

The policy scenario

The policy scenario will depict a downward movement in water usage prices and an increase in fixed prices. Additional fixed costs will be like a lump sum tax on households. However, the volumetric price of water will fall. The expected impact of this is that household consumption of goods and services other than water will fall slightly, while consumption of urban water will increase. Most industries will also bear an increase in fixed costs, treated in the model as an increase in production taxes. In most industries, the production tax hike is smaller than the fall in industry costs arising from lower volumetric charges on water.

Lower water prices will reduce the costs of production for industries, but in most cases the costs shares are quite minor and the impacts will be second order. Nevertheless, pricing reforms ought to result in efficiency gains.

We assume that households bear the brunt of the increase in fixed costs for water. An amount of $407 million is shifted from variable to fixed costs in South Australia. Of this, $342 million is paid for by households, who pay an additional $30 million on top of this for fixed sewage charges to reduce cross-subsidies. This is assigned as an inward shift in the *consumption function* in the model. The consumption function links household and government spending or consumption to labour income in each region. The dollar amount of the inward shift in the consumption function is scaled down to reflect that the statewide CPI falls by more nominal wages in the scenario (i.e., real wages rise), and that since government spending is tied to household consumption, some of the shift in nominal household spending is shared with nominal government spending. At existing levels of consumption, volumetric charges paid by households fall by $230 million.

There are over 670,000 residential properties serviced by SA Water, based on water connections, or 620,000 based on water sales customers. Annual fixed charges for water and sewage services will rise from an average of $818 to $1382per annum per residential property (based on 620,000 households). At the same time, annual volumetric charges for existing water volumes used will decrease from $2.87 to $0.65 per kilolitre, or from $501 to $128 per property per annum. That is, at existing levels of usage, each residential property will pay $191 more (=1382-818 –(501-128)) per annum for water supply and delivery and sewage services.

Most non-residential users will pay less for water. The cost impost on households will be offset by cost reductions in industries, so that it is possible in theory that the real impact on households may be positive: lower industry costs will impose downward pressure on CPI, thereby raising the spending power of given nominal level of household expenditure. Moreover, raising industry outputs should increase household consumption via the income effect. That is, nominal household consumption increases as nominal income increases.

The scenarios

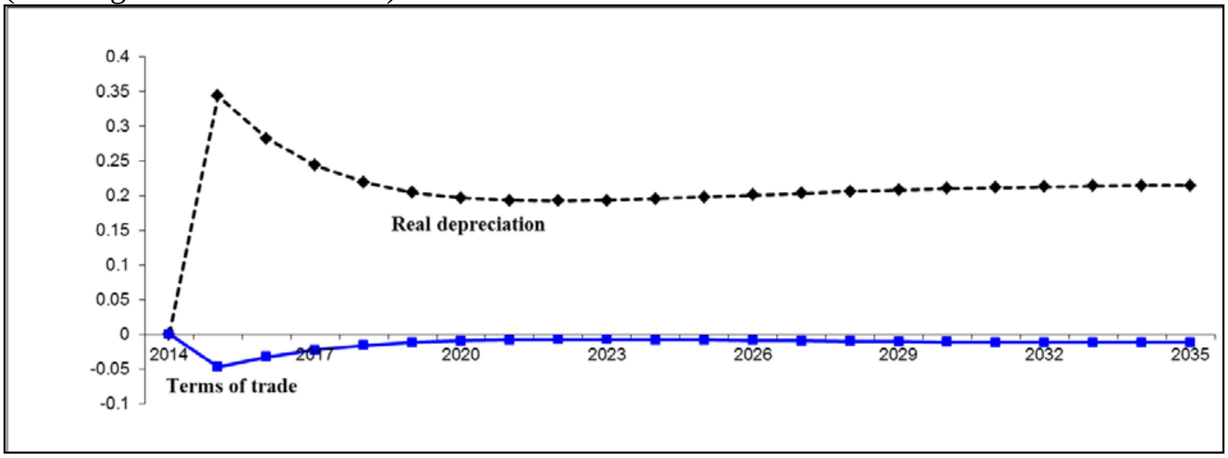
1. Water pricing reforms without drought

In the first scenario, the switch from volumetric to fixed charges is introduced in 2015.[1] In the case of households, this raises charges for the baseline volume of usage by $142 million (=342+30-230). However, industry users face lower volumetric charges which in some industries more than offset the additional fixed charges. Large non-residential users include

[1] The baseline runs from 2011 to 2035. The policy scenarios run from 2014 to 2035, so that all figure and tables reporting the scenarios include the latter time span.

the primary industries Broadacre crops and livestock, Grapes and Other horticulture. Institutions (i.e., Health and Education) are also large users.

Figure 1.1: South Australia's real depreciation and terms of trade
(% change relative to forecast)



The impact of lowering the costs of water to South Australian industries will be to improve the competitiveness of the SA economy relative to the rest of the world. The real exchange rate is a measure of competitiveness, computed as South Australia's import price index (of interstate and international imports) minus the GDP deflator (a measure of SA's price level). A positive movement in this variable represents a real depreciation, or an improvement in competitiveness as local prices move relative to prices in the rest of the world. Figure 1.1 shows that the real depreciation in South Australia reaches 0.35% in 2015 with the pricing reform, but tapers off to around 0.2% above forecast after several years. The tapering effect is a consequence of real wages rising relative to forecast in later years.

The terms of trade (that is, the price of international and interstate exports relative to the price of international and interstate imports) decline by almost 0.05% with the introduction of the pricing reform. This is because producers face down-sloping demand curves which result in a lowering of output prices as output expands. Households face lower prices, but the additional fixed charges for water reduce the ratio of nominal consumption to labour income in South Australian households.

However, the assumption that regional wages adjust sluggishly in the model means that with the strengthening of the labour market as a result of lower volumetric water charges in industry, there is a gradual upward movement in real wages (figure 1.2). This partly offsets the gain in competitiveness reflected by the real depreciation, and forces employment back towards forecast. In 2015, as a consequence of the pricing reform, state-wide jobs jump to around 0.27% or 2000 FTE jobs above forecast, but as real wages gradually rise in succeeding years, the employment gains move back to near 0.07% or around 500 FTE jobs above forecast by 2023. The movement in employment back towards forecast in turn brings output (as shown by real GDP in figure 1.3) closer to forecast and diminishes the impact on the terms of trade.

Figure 1.2: South Australia's labour market
(% change relative to forecast)

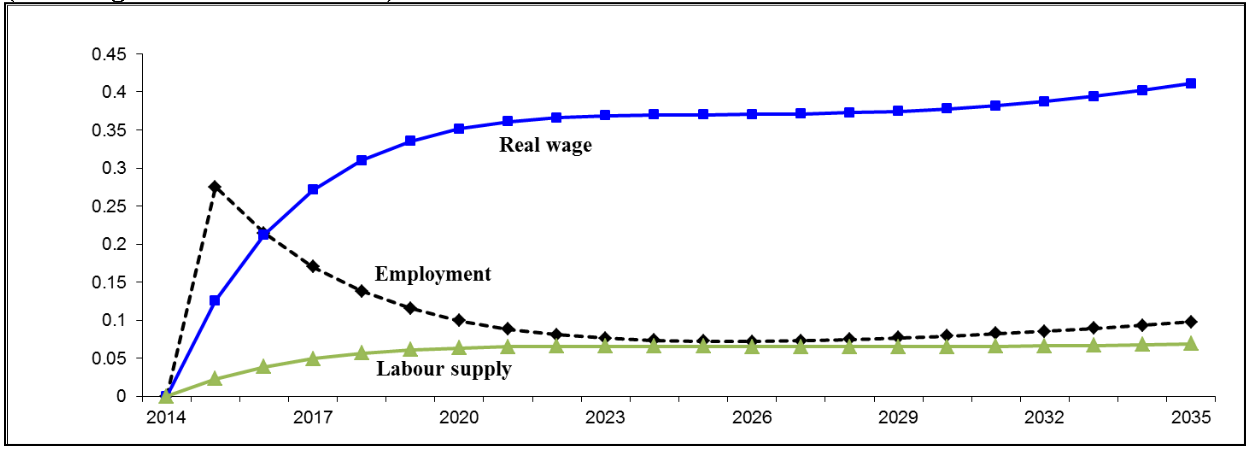
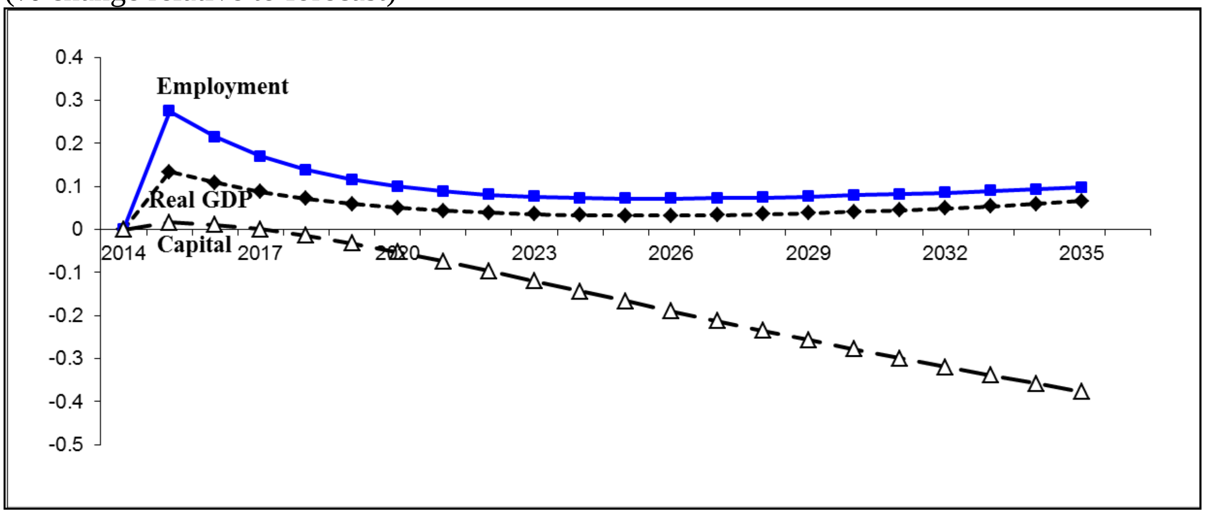
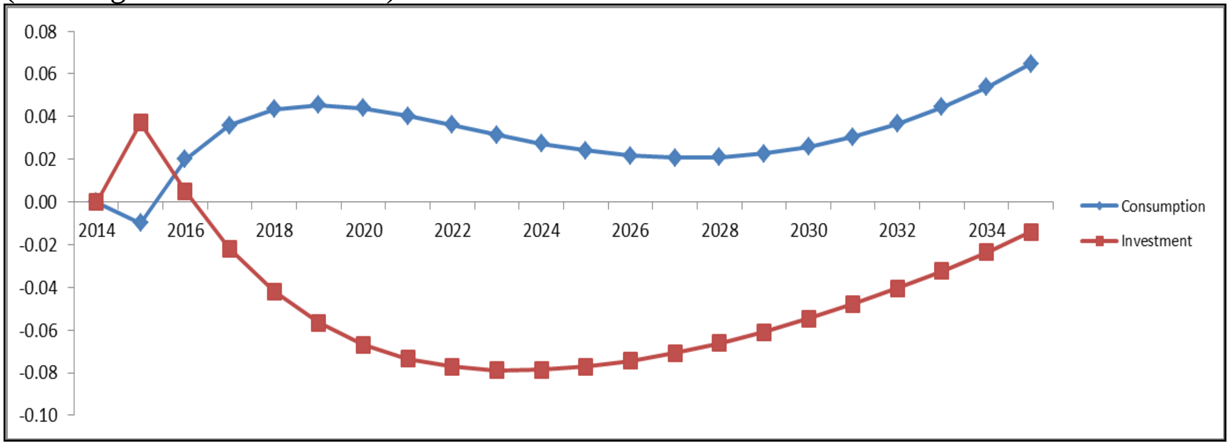


Figure 1.3 South Australia's income-side GDP
(% change relative to forecast)



The decline in capital stocks relative to forecast (figure 1.3) is dominated by the impact of the scenario on the Ownership of dwellings sector. This sector is the most income-elastic in the model, and consumption of housing falls relative to forecast in the scenario (table 1.2). Investment in housing declines relative to forecast as a consequence of the additional fixed costs required by households for water supply in the scenario. Since housing investment and capital fall relative to forecast in the state, construction activity also falls after the initial year (table 1.1). Virtually all farming, mining and manufacturing industries in all regions in South Australia experience an increase in investment relative to forecast in 2015. In subsequent years, the decline in services sector investments dominates the overall impact. Consequently, state-wide aggregate investment rises relative to forecast in 2015 but then falls as the decline in services sector investment dominates beyond 2016 (Figure 1.4). Rising real wages beyond 2015 contribute substantially to the tapering off in aggregate investment.

Figure 1.4 South Australia's real consumption and investment
(% change relative to forecast)



Aggregate consumption rises relative to forecast but by a smaller percentage than real GDP, due to the shift in the consumption function used to depict the increase in fixed costs of water supply to households. Statewide aggregate consumption per capita, as measured by the percentage change in real consumption minus the labour supply (the latter shown in Fig. 1.2) barely moves off zero. Table 1.2 shows the deviation in state-wide consumption by commodity. Water consumption rises but consumption of all other goods and services falls slightly relative to forecast.

Table 1.1: South Australia's industry outputs
($m value-added deviation relative to forecast)

	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
BrdAcrShpCtl	0.0	2.5	2.6	2.6	2.7	2.9	3.2	3.5	3.8	4.2	4.5	5.0	5.4	5.9	6.4	6.9	7.5	8.1	8.8	9.5	10.3	11.2
Grapes	0.0	0.4	0.5	0.5	0.6	0.6	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
OthHorticult	0.0	0.4	0.3	0.3	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.0	0.0	0.0	-0.1	-0.1	-0.1	-0.2	-0.2	-0.3	-0.4	-0.4
ForestFish	0.0	0.6	0.4	0.3	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2
Mining	0.0	2.0	2.1	2.1	2.1	2.0	1.9	1.8	1.6	1.5	1.4	1.3	1.3	1.2	1.1	1.1	1.0	0.9	0.9	0.8	0.8	0.7
FoodPrds	0.0	3.3	2.4	1.6	1.2	0.8	0.6	0.5	0.4	0.4	0.4	0.4	0.4	0.4	0.5	0.5	0.6	0.7	0.8	0.8	0.9	1.0
WineSpirits	0.0	1.1	1.1	1.0	0.9	0.9	0.8	0.7	0.7	0.7	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.5	0.5	0.5	0.5	0.5
OtherManuf	0.0	12.5	8.9	6.1	3.9	2.2	1.0	0.2	-0.5	-0.9	-1.1	-1.3	-1.3	-1.3	-1.3	-1.2	-1.1	-0.9	-0.8	-0.7	-0.6	-0.5
NonMetMinPrd	0.0	0.5	0.3	0.2	0.1	0.0	-0.1	-0.1	-0.1	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2
MetalPrds	0.0	2.2	1.6	1.1	0.8	0.6	0.4	0.3	0.3	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.4	0.4	0.5	0.5	0.6	0.6
TransportEq	0.0	3.4	2.3	1.4	0.6	0.0	-0.5	-0.8	-1.0	-1.2	-1.3	-1.4	-1.4	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5	-1.6
Utilities	0.0	0.4	0.2	0.1	-0.1	-0.2	-0.3	-0.4	-0.4	-0.5	-0.5	-0.6	-0.6	-0.7	-0.7	-0.7	-0.7	-0.7	-0.7	-0.7	-0.6	-0.6
WaterDrains	0.0	55.9	56.2	56.2	56.2	56.1	55.3	55.1	54.0	53.7	53.3	52.9	52.5	52.0	50.9	50.7	49.9	49.3	48.7	48.0	47.4	46.7
Construction	0.0	1.3	-0.8	-2.6	-4.1	-5.3	-6.4	-7.3	-8.0	-8.6	-9.1	-9.5	-9.8	-9.9	-10.0	-9.9	-9.7	-9.4	-9.0	-8.5	-7.9	-7.1
Trade	0.0	7.2	3.9	1.0	-1.3	-3.2	-4.8	-6.1	-7.2	-8.1	-8.9	-9.5	-10.0	-10.4	-10.7	-10.9	-11.0	-11.0	-10.9	-10.6	-10.3	-9.8
Transport	0.0	5.1	3.5	2.4	1.6	1.0	0.6	0.4	0.2	0.2	0.1	0.2	0.3	0.4	0.5	0.7	0.9	1.1	1.4	1.7	2.0	2.4
Communicatn	0.0	0.7	0.3	0.0	-0.3	-0.5	-0.7	-0.9	-1.1	-1.2	-1.3	-1.4	-1.5	-1.6	-1.6	-1.6	-1.6	-1.6	-1.6	-1.5	-1.4	-1.3
BusinessSrv	0.0	28.4	20.5	14.1	9.0	4.8	1.3	-1.7	-4.1	-6.2	-7.8	-9.1	-10.0	-10.7	-11.1	-11.2	-11.2	-10.8	-10.3	-9.6	-8.6	-7.4
OwnerDwellng	0.0	0.0	-2.2	-4.1	-5.8	-7.5	-9.2	-11.0	-12.9	-14.8	-16.9	-19.0	-21.2	-23.5	-25.8	-28.2	-30.5	-32.9	-35.2	-37.4	-39.5	-41.4
GovAdminDef	0.0	0.8	1.5	1.9	2.0	2.0	1.9	1.8	1.6	1.4	1.2	1.0	0.9	0.9	0.9	1.0	1.2	1.5	1.9	2.4	3.1	3.8
Education	0.0	12.8	9.4	6.6	4.6	3.1	2.0	1.3	0.7	0.4	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-0.2	-0.3
Health	0.0	3.7	2.2	0.9	-0.1	-1.0	-1.7	-2.3	-2.8	-3.2	-3.6	-3.8	-4.1	-4.2	-4.3	-4.4	-4.3	-4.2	-4.0	-3.8	-3.5	-3.0
CommuntySrv	0.0	0.0	0.3	0.4	0.4	0.4	0.4	0.4	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.4	0.5	0.7	0.9	1.1
OtherSrv	0.0	1.5	0.6	-0.1	-0.7	-1.2	-1.6	-2.0	-2.2	-2.5	-2.7	-2.8	-2.9	-3.0	-3.0	-3.0	-3.0	-2.9	-2.8	-2.7	-2.5	-2.3

Table 1.2: South Australia's state-wide household consumption by commodity
% deviation relative to forecast)

	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
BrdAcrShpCtl	0	-0.2	-0.2	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Grapes	0	-0.2	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
OthHorticult	0	-0.2	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
ForestFish	0	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Mining	0	-0.3	-0.2	-0.2	-0.1	-0.1	-0.1	-0.1	-0.1	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.1	-0.1	-0.1
FoodPrds	0	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WineSpirits	0	-0.1	-0.1	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
OtherManuf	0	-0.2	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
NonMetMinPrd	0	-0.3	-0.3	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2
MetalPrds	0	-0.3	-0.2	-0.2	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.1	-0.1	-0.1	-0.1
TransportEq	0	-0.2	-0.2	-0.2	-0.1	-0.1	-0.1	-0.1	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.1	-0.1
Utilities	0	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.1
WaterDrains	0	17.8	17.8	17.7	17.6	17.4	17.3	17.2	17.0	16.9	16.7	16.5	16.4	16.2	16.0	15.9	15.7	15.6	15.4	15.3	15.1	15.0
Construction	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Trade	0	-0.2	-0.2	-0.1	-0.1	-0.1	-0.1	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.1
Transport	0	-0.3	-0.3	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2
Communicatn	0	-0.2	-0.2	-0.2	-0.1	-0.1	-0.1	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.1	-0.1
BusinessSrv	0	-0.2	-0.2	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.1	-0.1
OwnerDwellng	0	0.0	0.0	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2
GovAdminDef	0	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2
Education	0	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.1	-0.1	-0.1	-0.1
Health	0	-0.2	-0.1	-0.1	-0.1	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2
CommuntySrv	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OtherSrv	0	-0.2	-0.2	-0.2	-0.1	-0.1	-0.1	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.1	-0.1

Table 1.1 shows the impact of the scenario on state-wide value-added activity by industry. Ownership of dwellings, Construction and Business services output drops relative to forecast. There are gains in farming output and some manufactures.

We can calculate formal welfare (dWELF) at the national level:

$$\text{dWELF} = \sum_{d}\sum_{t}\frac{\text{dCON}(d,t)+\text{dGOV}(d,t)}{(1-r)^{t}} - \frac{\text{dNFL}(z)}{(1-r)^{z}} \qquad (1)$$

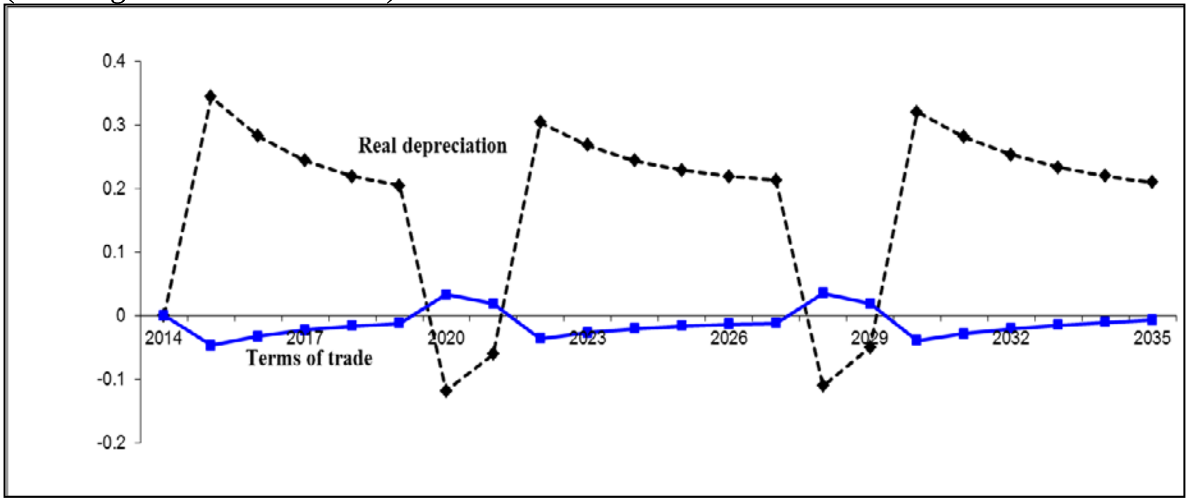
where dCON and dGOV are the deviations in real household and government spending in region *d* and year *t*; dNFL is the deviation in real net foreign liabilities in the final year (*z=2035*) of the simulation; and *r* is the discount rate. Welfare is calculated at the national level rather than state level, because state level welfare measures are confounded by interstate migration. South Australia's per capita real consumption, based on the deviation in real consumption in figure 1.4 minus the deviation in labour supply in figure 1.2, barely moves off zero: this is consistent with a relatively small national welfare impact. Using (1), the annualized discounted real welfare impact in 2014 dollars is $25 million.[2] In 2015 and for one or two years thereafter, the welfare impact is diminished somewhat by the small negative terms of trade impact arising in the scenario (see Figure 1.1).

2. Water pricing reforms with drought events in the baseline

This scenario repeats the price switching policy change against a baseline that includes two episodes of two year droughts, in 2020 and 2021, and again in 2028 and 2029. As we would expect, the main differences are in the drought years and in the years following drought. The first surprise we get is that the real depreciation, or state-wide indicator of competitiveness, falls below forecast in drought years (Figure 2.1).

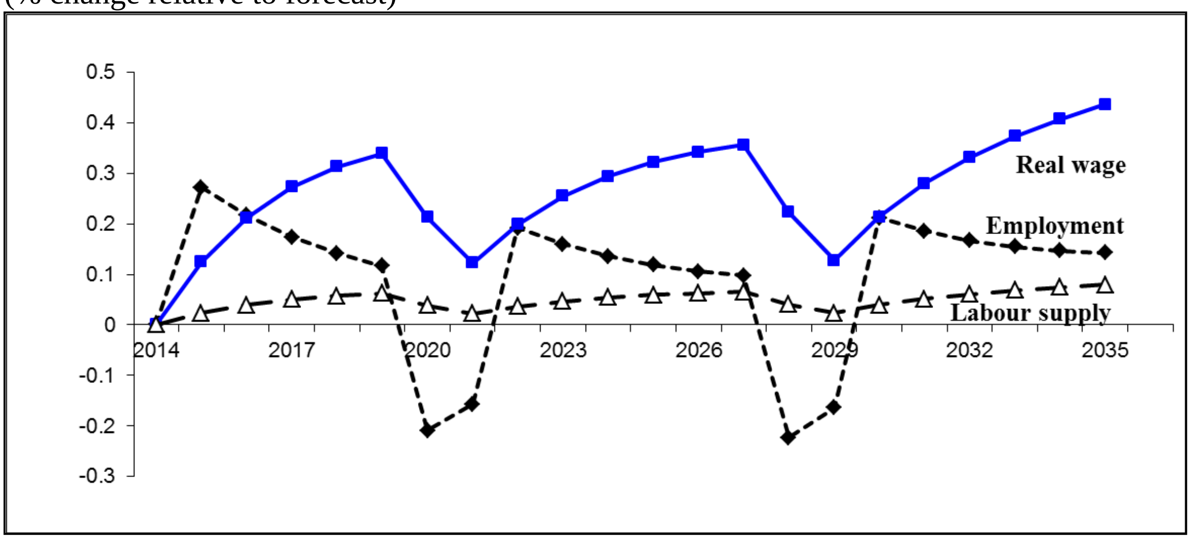
[2] The welfare calculation from (1) is represented in annualised terms by multiplying by the discount rate. An annualised term is used so because most economic data (such as GDP) are represented as annual numbers.

Figure 2.1: South Australia’s real depreciation and terms of trade
(% change relative to forecast)



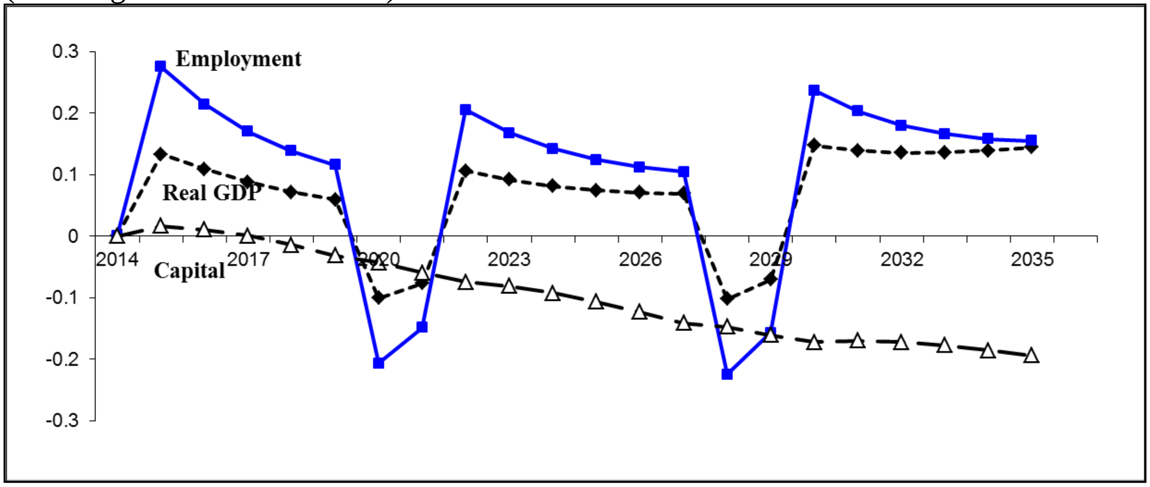
The reason for this becomes apparent when we examine the labour market impacts. The assumption of sticky wages adjustment implies that during the drought years, real wages are higher than in the baseline because they are above forecast in the years preceding drought (Figure 2.2). This also means that employment falls below forecast in drought: in 2020, for example, employment is around 0.2% or 1500 FTE jobs below forecast.

Figure 2.2: South Australia’s labour market
(% change relative to forecast)



Since employment drops below forecast during drought years as a consequence of the sticky wages assumption, real GDP also drops below the base in drought years (Figure 2.3).

Figure 2.3 South Australia's income-side GDP
(% change relative to forecast)



Real consumption and investment both dip in drought years, following the fall in real GDP relative to forecast. There is a difference in years subsequent to drought. Higher than forecast real wages during drought may force employment below forecast, but in the recovery years, real wages are lower than in scenario one. This implies that aggregate investment is likely to rise relative to forecast, and relative to scenario one, in the recovery years (Figure 2.4).

Figure 2.4 South Australia's real consumption and investment
(% change relative to forecast)

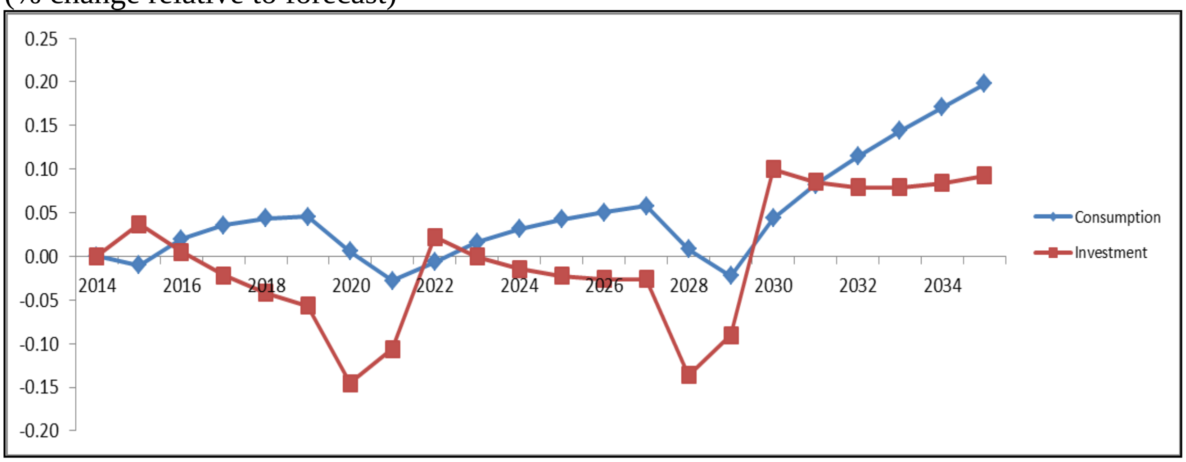


Table 2.1 shows the deviation in value-added by state industry when the pricing reforms are introduced in a baseline that includes droughts. Reflecting the macro results, industry outputs during drought years are slightly below forecast due to higher than baseline real wages.

Table 2.1: South Australia's industry outputs
($m value-added deviation relative to forecast)

	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
BrdAcrShpCtl	0.0	2.5	2.6	2.6	2.7	2.9	-0.8	-0.2	4.9	5.0	5.2	5.5	5.9	6.3	0.7	1.5	9.4	9.8	10.4	11.2	12.2	13.4
Grapes	0.0	0.4	0.5	0.5	0.6	0.6	0.2	0.2	0.6	0.7	0.7	0.7	0.8	0.8	0.4	0.3	0.7	0.8	0.8	0.8	0.8	0.8
OthHorticult	0.0	0.4	0.3	0.3	0.2	0.2	-0.2	-0.1	0.3	0.2	0.2	0.1	0.1	0.1	-0.3	-0.1	0.2	0.1	0.0	-0.1	-0.1	-0.2
ForestFish	0.0	0.6	0.4	0.3	0.2	0.1	-0.7	-0.4	0.6	0.5	0.3	0.3	0.2	0.2	-1.0	-0.6	0.9	0.7	0.5	0.3	0.2	0.2
Mining	0.0	2.0	2.1	2.1	2.1	2.0	0.0	-0.2	1.7	1.8	1.9	1.8	1.8	1.7	-0.3	-0.5	1.3	1.4	1.4	1.3	1.2	0.9
FoodPrds	0.0	3.3	2.4	1.6	1.2	0.8	-3.0	-1.9	2.8	2.2	1.7	1.4	1.2	1.1	-3.5	-2.2	4.0	3.3	2.8	2.5	2.4	2.3
WineSpirits	0.0	1.1	1.1	1.0	0.9	0.9	-0.3	-0.2	0.9	0.9	0.9	0.9	0.8	0.7	-0.5	-0.4	0.9	0.9	0.8	0.7	0.6	0.4
OtherManuf	0.0	12.5	8.9	6.1	3.9	2.2	-13.4	-9.1	10.3	7.5	5.3	3.8	2.6	1.7	-18.3	-12.2	14.5	11.0	8.3	6.3	4.7	3.5
NonMetMinPrd	0.0	0.5	0.3	0.2	0.1	0.0	-0.7	-0.5	0.4	0.2	0.1	0.0	0.0	-0.1	-1.0	-0.6	0.6	0.4	0.3	0.2	0.1	0.1
MetalPrds	0.0	2.2	1.6	1.1	0.8	0.6	-1.8	-1.2	1.7	1.3	1.1	0.9	0.7	0.7	-2.1	-1.3	2.1	1.7	1.4	1.2	1.0	0.9
TransportEq	0.0	3.4	2.3	1.4	0.6	0.0	-4.4	-3.0	2.7	1.8	1.0	0.4	0.0	-0.4	-6.2	-4.1	3.9	2.7	1.7	0.8	0.1	-0.5
Utilities	0.0	0.4	0.2	0.1	-0.1	-0.2	-0.9	-0.7	0.1	0.0	-0.1	-0.2	-0.3	-0.3	-1.2	-0.9	0.5	0.4	0.4	0.4	0.5	0.6
WaterDrains	0.0	55.9	56.2	56.2	56.2	56.1	-7.1	-6.9	49.4	49.2	49.0	48.7	48.4	48.1	-6.8	-6.5	43.8	43.5	43.3	43.0	42.7	42.4
Construction	0.0	1.3	-0.8	-2.6	-4.1	-5.3	-11.2	-9.0	-1.0	-2.7	-3.9	-4.7	-5.2	-5.5	-15.0	-11.2	5.2	4.2	3.8	4.0	4.7	5.7
Trade	0.0	7.2	3.9	1.0	-1.3	-3.2	-15.1	-11.7	3.1	0.5	-1.5	-3.0	-4.0	-4.8	-20.5	-15.3	8.4	6.4	5.2	4.8	4.9	5.5
Transport	0.0	5.1	3.5	2.4	1.6	1.0	-5.4	-3.6	4.7	3.6	2.8	2.3	2.0	1.9	-6.6	-4.1	7.9	6.8	6.1	5.8	5.7	5.9
Communicatn	0.0	0.7	0.3	0.0	-0.3	-0.5	-1.8	-1.5	0.2	-0.1	-0.3	-0.4	-0.5	-0.6	-2.6	-2.0	1.4	1.2	1.3	1.4	1.6	1.9
BusinessSrv	0.0	28.4	20.5	14.1	9.0	4.8	-31.1	-24.9	16.7	12.7	9.3	6.4	4.1	2.2	-43.3	-34.4	25.3	23.5	21.9	20.9	20.4	20.5
OwnerDwellng	0.0	0.0	-2.2	-4.1	-5.8	-7.5	-9.2	-9.2	-9.5	-11.9	-14.0	-16.0	-17.8	-19.6	-21.3	-21.1	-21.3	-23.1	-24.3	-25.0	-25.2	-25.0
GovAdminDef	0.0	0.8	1.5	1.9	2.0	2.0	-0.9	-2.0	0.6	1.3	1.9	2.3	2.6	3.0	-1.2	-2.2	3.6	5.5	7.3	9.0	10.8	12.7
Education	0.0	12.8	9.4	6.6	4.6	3.1	-15.6	-10.8	12.3	8.8	6.3	4.5	3.2	2.3	-22.8	-15.2	17.9	12.7	8.9	6.1	4.0	2.5
Health	0.0	3.7	2.2	0.9	-0.1	-1.0	-8.0	-6.5	1.9	0.7	-0.2	-0.9	-1.3	-1.6	-11.3	-8.6	5.5	4.5	4.1	4.0	4.4	5.0
CommuntySrv	0.0	0.0	0.3	0.4	0.4	0.4	-0.3	-0.6	0.0	0.3	0.4	0.6	0.7	0.8	-0.4	-0.7	1.0	1.6	2.1	2.6	3.2	3.7
OtherSrv	0.0	1.5	0.6	-0.1	-0.7	-1.2	-4.3	-3.4	0.6	-0.1	-0.6	-0.9	-1.2	-1.3	-6.2	-4.7	3.0	2.4	2.1	2.0	2.1	2.3

Table 2.2: South Australia's state-wide household consumption by commodity
(% deviation relative to forecast)

	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
BrdAcrShpCtl	0	-0.2	-0.2	-0.1	-0.1	-0.1	0.1	0.0	-0.2	-0.2	-0.1	-0.1	-0.1	-0.1	0.1	0.0	-0.1	-0.1	0.0	0.0	0.0	0.1
Grapes	0	-0.2	-0.1	-0.1	-0.1	-0.1	0.1	0.0	-0.1	-0.1	-0.1	-0.1	-0.1	0.0	0.1	0.0	-0.1	-0.1	0.0	0.0	0.1	0.1
OthHorticult	0	-0.2	-0.1	-0.1	-0.1	-0.1	0.0	0.0	-0.2	-0.1	-0.1	-0.1	-0.1	-0.1	0.0	0.0	-0.1	-0.1	-0.1	0.0	0.0	0.0
ForestFish	0	-0.1	-0.1	-0.1	-0.1	-0.1	0.0	0.0	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	0.0	0.0	-0.1	-0.1	0.0	0.0	0.0	0.0
Mining	0	-0.3	-0.2	-0.2	-0.1	-0.1	0.1	0.0	-0.2	-0.2	-0.2	-0.1	-0.1	-0.1	0.1	0.0	-0.2	-0.1	-0.1	0.0	0.0	0.0
FoodPrds	0	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WineSpirits	0	-0.1	-0.1	-0.1	0.0	0.0	0.0	0.0	-0.1	-0.1	-0.1	0.0	0.0	0.0	0.0	0.0	-0.1	0.0	0.0	0.0	0.0	0.0
OtherManuf	0	-0.2	-0.1	-0.1	-0.1	-0.1	0.0	0.0	-0.2	-0.2	-0.1	-0.1	-0.1	-0.1	0.0	0.0	-0.1	-0.1	-0.1	0.0	0.0	0.0
NonMetMinPrd	0	-0.3	-0.3	-0.2	-0.2	-0.2	0.0	0.0	-0.3	-0.2	-0.2	-0.2	-0.2	-0.2	0.0	0.0	-0.2	-0.1	-0.1	-0.1	0.0	0.0
MetalPrds	0	-0.3	-0.2	-0.2	-0.1	-0.1	0.1	0.0	-0.2	-0.2	-0.2	-0.1	-0.1	-0.1	0.1	0.0	-0.2	-0.1	-0.1	0.0	0.0	0.0
TransportEq	0	-0.2	-0.2	-0.2	-0.1	-0.1	0.0	0.0	-0.2	-0.2	-0.2	-0.1	-0.1	-0.1	0.0	0.0	-0.2	-0.1	-0.1	0.0	0.0	0.0
Utilities	0	-0.2	-0.2	-0.2	-0.2	-0.2	0.0	0.0	-0.2	-0.2	-0.2	-0.2	-0.2	-0.1	0.0	0.0	-0.2	-0.1	-0.1	0.0	0.0	0.0
WaterDrains	0	17.8	17.8	17.7	17.6	17.4	-2.4	-2.4	15.4	15.3	15.2	15.1	14.9	14.8	-3.1	-3.1	13.2	13.1	12.9	12.8	12.7	12.6
Construction	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Trade	0	-0.2	-0.2	-0.1	-0.1	-0.1	0.0	0.0	-0.2	-0.2	-0.2	-0.1	-0.1	-0.1	0.0	0.0	-0.1	-0.1	-0.1	0.0	0.0	0.0
Transport	0	-0.3	-0.3	-0.2	-0.2	-0.2	0.1	0.0	-0.3	-0.2	-0.2	-0.2	-0.2	-0.2	0.1	0.0	-0.2	-0.1	-0.1	0.0	0.0	0.0
Communicatn	0	-0.2	-0.2	-0.2	-0.1	-0.1	0.0	0.0	-0.2	-0.2	-0.2	-0.1	-0.1	-0.1	0.0	0.0	-0.1	-0.1	-0.1	0.0	0.0	0.0
BusinessSrv	0	-0.2	-0.2	-0.1	-0.1	-0.1	0.0	0.0	-0.2	-0.2	-0.2	-0.1	-0.1	-0.1	0.0	0.0	-0.2	-0.1	-0.1	0.0	0.0	0.0
OwnerDwellng	0	0.0	0.0	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
GovAdminDef	0	-0.1	-0.1	-0.1	-0.1	-0.1	0.0	-0.1	-0.2	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	0.0	0.0
Education	0	-0.1	-0.1	-0.1	-0.1	-0.1	0.0	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	0.0	0.0	0.0	0.0
Health	0	-0.2	-0.1	-0.1	-0.1	-0.2	-0.1	-0.1	-0.2	-0.2	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	0.0	0.0
CommuntySrv	0	0.0	0.0	0.0	0.0	0.0	-0.1	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-0.1	0.1	0.1	0.1	0.1	0.1	0.1
OtherSrv	0	-0.2	-0.2	-0.2	-0.1	-0.1	0.0	0.0	-0.2	-0.2	-0.2	-0.1	-0.1	-0.1	0.0	0.0	-0.1	-0.1	-0.1	0.0	0.0	0.0

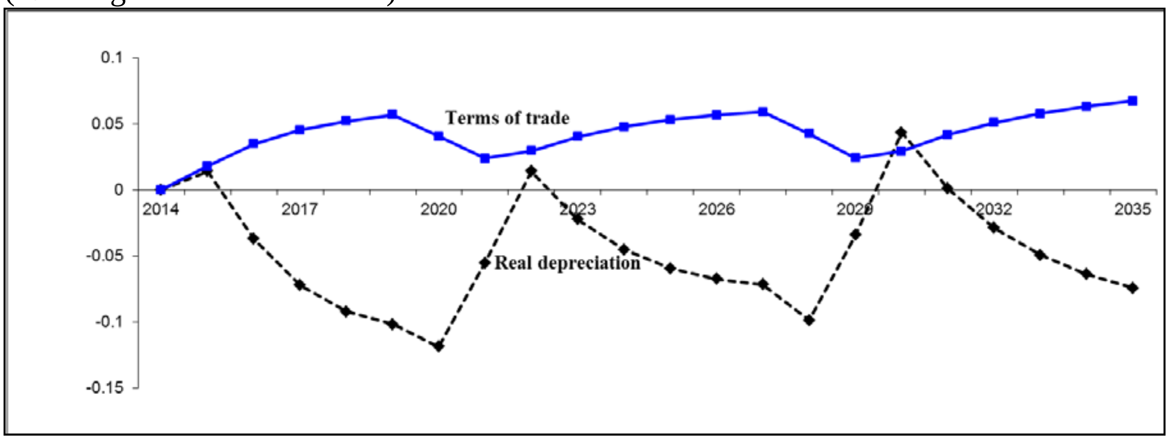
The annualised national welfare impact is $31 million in 2014 dollars. The slightly higher welfare outcome in the drought scenario relative to the first scenario arises because the terms-of-trade rise above forecast during the drought years.

3. Reduced revenue requirements against a drought baseline

A third scenario repeats the pricing switch, this time with lower revenue requirements. In this scenario, fixed charges increase by only $104 million instead of $413 million per annum.

Since the revenue requirement is smaller, demands for goods and services in South Australia are higher than otherwise. Therefore, there is a real appreciation (i.e., a negative real depreciation) instead of a real depreciation in the South Australian economy, as local prices rise more than external prices (comparing figures 2.1 and 3.1). Additional demands in South Australia reduce international and interstate export supplies, so that the terms of trade improve relative to forecast through a movement up the export demand curves. Relative terms of trade are important in explaining relative labour market outcomes between two scenarios.

Figure 3.1: South Australia's real depreciation and terms of trade
(% change relative to forecast)



South Australia's labour market strengthens more than in the second scenario. Wages therefore peak at 2700 jobs above forecast in the state in 2015, compared with 2000 jobs in the first two scenarios. By 2019, state-wide real wages have risen to 0.4% above forecast compared with 0.3% in the second scenario (Figure 3.2). In the drought years of 2020 and 2021, the employment outcome is similar to the second scenario, despite real wages being higher. In the second scenario, real wages are 0.19% above forecast in 2020 and 0.11% above forecast in 2021. In the third scenario, the corresponding deviations are 0.26% and 0.17%.

That employment outcomes are similar in the drought years despite real wages being higher in the third scenario is because the terms of trade are stronger in the third than the second scenario. The relative short-run impact of the terms of trade (p_{x3}/p_{m3}) on the labour market can be explained using the marginal product of labour (MP_L) given by

$$MP_L(K/L)=(w/p_c).(p_c/p_g) \quad (2)$$

where w is nominal wage, p_g the producer price level proxied by South Australia's GDP deflator and p_c the consumer price. In (2), the marginal product of labour as given by w/p_g is divided into two components, w/p_c, the sticky real wage as faced by consumers, and p_c/p_g, the ratio of consumer prices to the GDP deflator. The terms-of-trade are stronger in the third than second scenario (figures 2.1 and 3.1). Since consumption includes imports but not exports, and GDP includes exports but not imports, a stronger terms-of-trade ($p_{x3}/p_{m3} > p_{x2}/p_{m2}$) implies that p_c/p_g is lower in the third than second scenario ($p_{c3}/p_{g3} < p_{c2}/p_{g2}$). Since capital K is fixed in the short run, for employment L to be similar in the two scenarios (that is, the LHS of (1) is approximately equal in scenarios 2 and 3), and $p_{c3}/p_{g3} < p_{c2}/p_{g2}$, it follows that $w_3/p_{c3} > w_2/p_{c2}$. That is, real wages are higher in the 3rd scenario for a given level of employment due to stronger terms of trade.

Figure 3.2: South Australia's labour market
(% change relative to forecast)

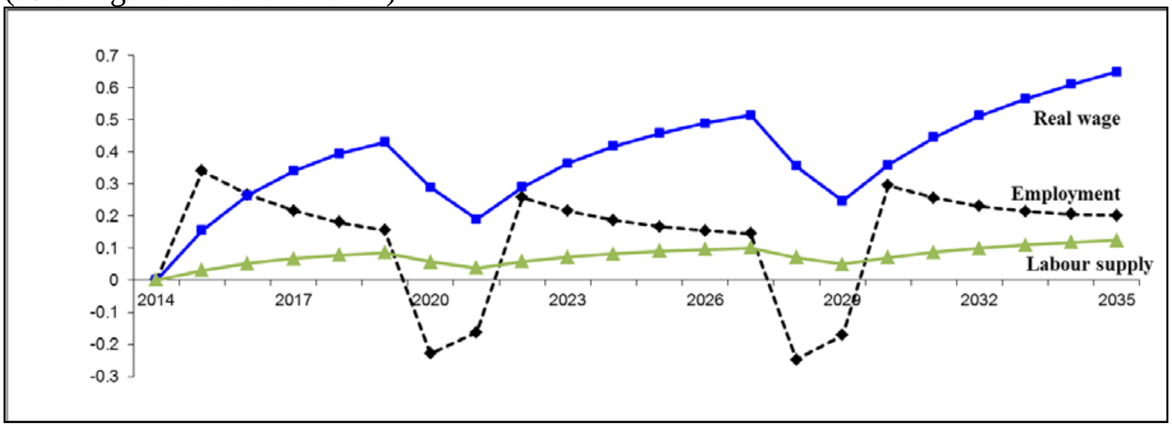


Figure 3.3 South Australia's income-side GDP
(% change relative to forecast)

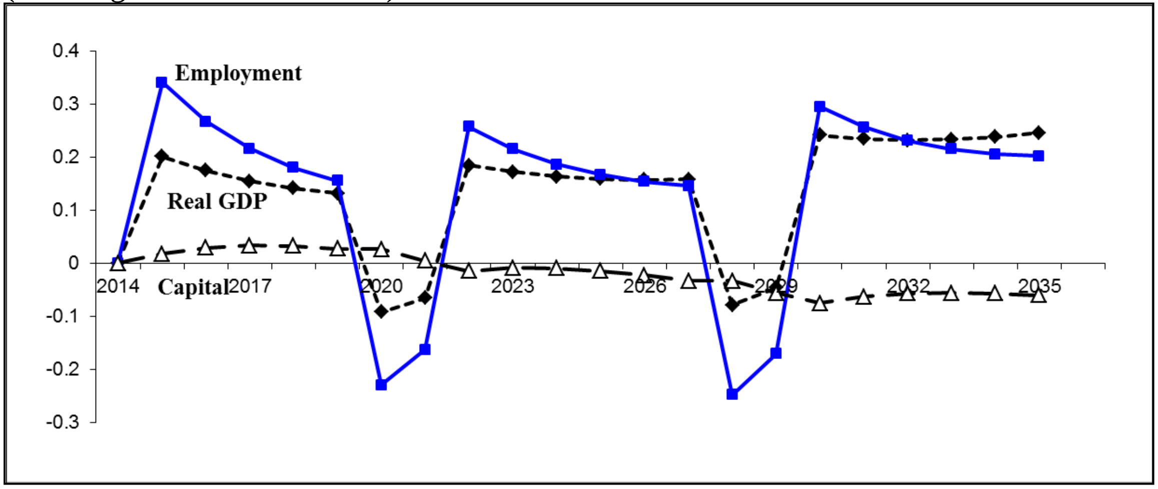


Figure 3.3 shows that income-side GDP is higher in the third than second scenario. Real GDP plateaus around 0.2% above forecast in the third scenario compared with 0.1% in the second scenario. This is because both employment and capital are larger in the third than second scenario. In drought years, there is little difference between the two scenarios.

Figure 3.4 South Australia's real consumption and investment
(% change relative to forecast)

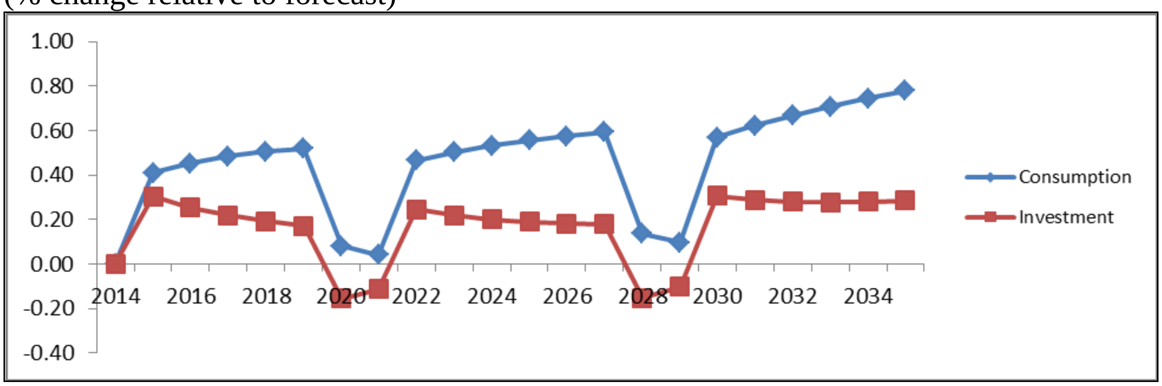


Figure 3.4 shows the impact of the third scenario on state-wide aggregate consumption and investment relative to forecast. The impact on real consumption is stronger in all years than the second scenario. This is despite real GDP being little different in drought years (comparing figures 3.3 and 2.3). Once again, the stronger terms of trade in the third scenario explain the difference. With elevated terms of trade, households and governments consume more for a given level of income.

Table 3.1: South Australia's industry outputs
($m value-added deviation relative to forecast)

	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
BrdAcrShpCtl	0.0	1.4	1.2	1.1	1.0	1.1	-1.3	-0.7	2.9	2.8	2.8	2.9	3.1	3.4	-0.5	0.3	6.4	6.6	7.0	7.6	8.3	9.3
Grapes	0.0	0.3	0.3	0.4	0.4	0.4	0.1	0.1	0.4	0.4	0.5	0.5	0.5	0.5	0.2	0.1	0.5	0.5	0.5	0.4	0.4	0.4
OthHorticult	0.0	0.2	0.2	0.1	0.1	0.0	-0.2	-0.1	0.1	0.0	0.0	-0.1	-0.1	-0.2	-0.4	-0.2	0.0	-0.1	-0.3	-0.4	-0.5	-0.6
ForestFish	0.0	0.1	-0.1	-0.3	-0.4	-0.5	-0.8	-0.5	-0.1	-0.4	-0.5	-0.7	-0.8	-0.9	-1.3	-0.9	-0.2	-0.5	-0.8	-1.0	-1.2	-1.3
Mining	0.0	0.4	-0.5	-1.5	-2.5	-3.4	-4.8	-4.7	-4.1	-4.9	-5.8	-6.6	-7.5	-8.4	-9.7	-9.5	-8.9	-9.6	-10.5	-11.5	-12.5	-13.5
FoodPrds	0.0	0.7	-0.4	-1.3	-2.0	-2.4	-3.8	-2.6	-0.4	-1.2	-1.9	-2.3	-2.6	-2.9	-4.9	-3.4	0.1	-0.8	-1.5	-1.9	-2.3	-2.5
WineSpirits	0.0	0.1	-0.3	-0.8	-1.2	-1.5	-1.9	-1.7	-1.3	-1.6	-1.9	-2.1	-2.4	-2.6	-3.0	-2.7	-2.2	-2.4	-2.8	-3.1	-3.4	-3.7
OtherManuf	0.0	1.6	-3.6	-8.0	-11.5	-14.3	-18.6	-13.4	-6.4	-10.9	-14.4	-17.4	-19.9	-22.0	-27.5	-20.2	-9.0	-14.6	-19.2	-23.0	-26.4	-29.4
NonMetMinPrd	0.0	0.5	0.2	0.1	-0.1	-0.2	-0.8	-0.5	0.2	0.0	-0.1	-0.2	-0.3	-0.4	-1.1	-0.8	0.2	0.0	-0.2	-0.3	-0.4	-0.5
MetalPrds	0.0	0.3	-0.6	-1.3	-1.8	-2.2	-2.8	-2.1	-1.1	-1.7	-2.2	-2.5	-2.9	-3.1	-3.9	-3.0	-1.6	-2.3	-2.8	-3.3	-3.7	-4.1
TransportEq	0.0	-0.8	-2.7	-4.4	-5.9	-7.1	-7.0	-5.1	-4.4	-6.1	-7.5	-8.6	-9.7	-10.6	-10.5	-7.7	-6.1	-8.2	-10.1	-11.8	-13.3	-14.7
Utilities	0.0	1.1	1.0	1.0	0.9	0.9	-0.8	-0.6	1.5	1.4	1.4	1.3	1.3	1.4	-1.1	-0.8	2.4	2.4	2.4	2.5	2.6	2.8
WaterDrains	0.0	56.9	57.2	57.2	57.2	57.1	-7.2	-6.9	50.3	50.2	49.9	49.7	49.4	49.1	-6.7	-6.3	44.8	44.6	44.4	44.1	43.9	43.6
Construction	0.0	22.7	20.5	19.1	18.2	17.4	-8.6	-7.4	20.9	20.4	20.1	20.0	20.1	20.3	-11.5	-9.1	29.8	30.1	30.7	31.8	33.1	34.7
Trade	0.0	18.5	14.5	11.5	9.2	7.5	-16.6	-12.8	15.4	13.0	11.3	10.1	9.4	9.0	-22.2	-16.7	24.5	22.8	22.1	22.1	22.8	23.9
Transport	0.0	2.2	0.3	-1.2	-2.3	-3.1	-6.7	-4.7	0.7	-0.8	-1.9	-2.7	-3.3	-3.7	-9.0	-6.1	2.5	0.9	-0.2	-0.9	-1.3	-1.4
Communicatn	0.0	2.1	1.9	1.8	1.7	1.6	-1.4	-1.1	2.8	2.7	2.6	2.7	2.8	2.9	-1.6	-0.9	5.3	5.4	5.7	6.1	6.6	7.2
BusinessSrv	0.0	15.7	5.2	-3.5	-10.8	-17.0	-40.2	-32.5	-5.0	-11.8	-17.7	-23.0	-27.6	-31.7	-60.7	-49.0	-7.0	-12.3	-17.1	-21.3	-24.8	-27.6
OwnerDwellng	0.0	0.0	3.9	8.0	12.3	16.7	21.2	21.1	20.3	24.4	28.9	33.8	38.9	44.2	49.7	48.9	47.3	53.0	59.6	66.9	75.0	83.6
GovAdminDef	0.0	15.7	17.2	18.6	19.8	20.8	2.1	0.9	21.0	23.0	24.8	26.4	28.0	29.7	5.5	4.1	32.4	35.9	39.2	42.6	46.0	49.5
Education	0.0	15.5	11.6	8.7	6.5	5.0	-15.6	-10.5	14.6	10.8	8.1	6.1	4.7	3.6	-22.5	-14.3	19.7	13.9	9.7	6.5	4.2	2.3
Health	0.0	17.2	16.3	15.8	15.5	15.5	-6.0	-4.4	20.0	19.6	19.5	19.8	20.2	20.9	-6.5	-3.8	30.0	29.9	30.4	31.4	32.8	34.5
CommuntySrv	0.0	5.0	5.5	5.9	6.3	6.6	0.5	0.1	6.6	7.2	7.7	8.2	8.7	9.2	1.4	1.0	10.0	11.0	12.0	13.0	13.9	15.0
OtherSrv	0.0	6.8	6.1	5.6	5.3	5.1	-3.9	-2.9	7.5	7.1	6.8	6.6	6.6	6.7	-5.3	-3.6	11.7	11.3	11.1	11.2	11.5	11.9

Table 3.2: South Australia's state-wide household consumption by commodity
(% deviation relative to forecast)

	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
BrdAcrShpCtl	0	0.4	0.4	0.5	0.5	0.5	0.1	0.0	0.4	0.5	0.5	0.5	0.6	0.6	0.1	0.1	0.5	0.6	0.7	0.7	0.8	0.8
Grapes	0	0.4	0.4	0.5	0.5	0.5	0.1	0.1	0.4	0.5	0.5	0.5	0.5	0.6	0.1	0.1	0.5	0.6	0.6	0.7	0.7	0.7
OthHorticult	0	0.3	0.4	0.4	0.4	0.4	0.1	0.0	0.4	0.4	0.4	0.4	0.5	0.5	0.1	0.0	0.4	0.5	0.5	0.6	0.6	0.6
ForestFish	0	0.2	0.3	0.3	0.3	0.3	0.1	0.0	0.3	0.3	0.3	0.4	0.4	0.4	0.1	0.0	0.4	0.4	0.4	0.5	0.5	0.5
Mining	0	0.4	0.5	0.5	0.5	0.5	0.1	0.0	0.4	0.5	0.5	0.5	0.6	0.6	0.1	0.0	0.5	0.6	0.7	0.7	0.8	0.8
FoodPrds	0	0.2	0.2	0.2	0.2	0.2	0.1	0.0	0.2	0.2	0.2	0.2	0.3	0.3	0.1	0.0	0.2	0.3	0.3	0.3	0.4	0.4
WineSpirits	0	0.2	0.2	0.3	0.3	0.3	0.1	0.0	0.2	0.3	0.3	0.3	0.3	0.3	0.1	0.0	0.3	0.3	0.4	0.4	0.4	0.4
OtherManuf	0	0.3	0.4	0.4	0.4	0.4	0.1	0.0	0.3	0.4	0.4	0.4	0.5	0.5	0.1	0.0	0.4	0.5	0.5	0.6	0.6	0.6
NonMetMinPrd	0	0.5	0.5	0.6	0.6	0.6	0.1	0.0	0.5	0.5	0.6	0.6	0.6	0.6	0.1	0.0	0.6	0.6	0.7	0.7	0.8	0.8
MetalPrds	0	0.4	0.4	0.5	0.5	0.5	0.1	0.0	0.4	0.5	0.5	0.5	0.6	0.6	0.1	0.1	0.5	0.6	0.6	0.7	0.7	0.8
TransportEq	0	0.4	0.4	0.4	0.5	0.5	0.1	0.0	0.4	0.4	0.4	0.5	0.5	0.5	0.1	0.0	0.5	0.5	0.6	0.6	0.6	0.7
Utilities	0	0.3	0.4	0.4	0.5	0.5	0.1	0.0	0.4	0.5	0.5	0.5	0.5	0.5	0.1	0.0	0.5	0.6	0.6	0.7	0.7	0.7
WaterDrains	0	18.1	18.1	18.0	17.9	17.7	-2.4	-2.4	15.7	15.6	15.5	15.3	15.2	15.1	-3.1	-3.0	13.4	13.3	13.2	13.0	12.9	12.8
Construction	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Trade	0	0.3	0.4	0.4	0.4	0.4	0.0	0.0	0.3	0.4	0.4	0.4	0.4	0.4	0.0	0.0	0.4	0.5	0.5	0.5	0.6	0.6
Transport	0	0.5	0.6	0.6	0.6	0.6	0.1	0.0	0.5	0.6	0.6	0.6	0.7	0.7	0.1	0.0	0.6	0.7	0.8	0.8	0.9	0.9
Communicatn	0	0.3	0.4	0.4	0.4	0.4	0.1	0.0	0.4	0.4	0.4	0.5	0.5	0.5	0.1	0.1	0.5	0.5	0.6	0.6	0.6	0.7
BusinessSrv	0	0.3	0.4	0.4	0.4	0.4	0.1	0.0	0.3	0.4	0.4	0.4	0.5	0.5	0.1	0.0	0.4	0.5	0.5	0.6	0.6	0.6
OwnerDwellng	0	0.0	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.4
GovAdminDef	0	0.4	0.4	0.4	0.4	0.4	0.0	0.0	0.4	0.4	0.4	0.4	0.4	0.4	0.0	0.0	0.4	0.4	0.5	0.5	0.5	0.5
Education	0	0.4	0.4	0.4	0.4	0.4	0.0	-0.1	0.4	0.4	0.4	0.4	0.4	0.4	0.0	0.0	0.4	0.5	0.5	0.5	0.5	0.5
Health	0	0.4	0.4	0.4	0.4	0.4	0.0	-0.1	0.3	0.4	0.4	0.4	0.4	0.4	0.0	0.0	0.4	0.4	0.4	0.4	0.5	0.5
CommuntySrv	0	0.5	0.5	0.4	0.4	0.4	-0.1	-0.1	0.4	0.4	0.4	0.4	0.4	0.4	-0.1	-0.1	0.5	0.5	0.5	0.5	0.5	0.5
OtherSrv	0	0.4	0.4	0.4	0.4	0.4	0.0	0.0	0.4	0.4	0.4	0.4	0.5	0.5	0.0	0.0	0.5	0.5	0.5	0.6	0.6	0.6

Industry results show that outcomes are stronger for sectors closely related to household and government consumption than other sectors (Table 3.1).

The price effect (falling) on South Australia's consumption of non-water goods and services now outweighs the income effect (also falling) since the negative income effect is now smaller due to smaller rise in fixed water and sewage charges imposed on households. In table 3.2, we see that consumption of all goods and services rises in South Australia relative to forecast.

The welfare impact measured at the national level is $120 million in annualized terms. Since the labour supply remains around or less than 0.1% above forecast (Figure 3.2), and aggregate consumption is around 0.5% above forecast in most years (Figure 3.4), South Australia's per capita consumption rises by at least 0.4% relative to forecast in non-drought years.

There are several issues arising in this scenario. First, does this imply that the state government must find more than $300 million from other sources? Second, does the scenario include some actual cost reductions in water supply and delivery? In answer to the first question, the South Australian economy grows by around 0.2% relative to base in non-drought years in this scenario (Figure 3.3). State government revenue totals around $15 billion per annum at present. If revenue collection grows in proportion to the economy, then revenue would be around $30 million per annum higher (=0.002 x $15 bn) from sources other than water supply in the scenario. To maintain budget neutrality and maintain the current level of public services, the state government would have to find some combination of efficiency gains in water supply and delivery or efficiency gains elsewhere in public provision, or instead raise state government tax rates.

Comments on the scenarios

Each of the scenarios examines the impacts of altering the water pricing regime used by SA Water, with more revenue in normal years being raised by fixed rather than volumetric charges.

The common finding of the first two scenarios, in which the revenue requirement of SA Water is unaltered, is that there are small welfare gains from altering the pricing regime. The additional fixed charges are paid mainly by households, reducing expenditures available for other goods and services. Consequently, although aggregate consumption rises relative to forecast in both scenarios (except in drought years in scenario 2), there is a very small decrease in consumption of goods and services other than water, as shown in tables 1.1 and 1.2. If a lower expenditure elasticity were imposed on water, the increase in household water consumption would be smaller, with smaller decreases in consumption of other goods and services.

The largest welfare gains arise in the scenario in which the revenue requirement of SA Water falls at the same time as decreased volumetric charges are introduced in normal years. A reduction in the revenue requirement of $309 million per annum raises national welfare by $80 million on an annualized basis (comparing the outcome for the 3rd with

2nd scenario). Unlike the 2nd scenario, aggregate consumption still increases relative to forecast in South Australia in drought years in the 3rd scenario.

The desalination plant has added to the fixed costs of water supply and delivery in South Australia. None of the scenarios examines the marginal impacts of increasing the utilization of the desalination plant. If in normal years, demand for water in South Australia is unlikely to grow significantly, it appears reasonable not to consider modelling an increase in utilization of the desalination plant.

Dynamic VU-TERM: depicting small regions in computable general equilibrium framework

What is a computable general equilibrium (CGE) model?

A CGE model can be an economy-wide model. In the context of the current project, it is an economy-wide model that also includes small-region representation. Another sort of model is an input-output model. The difference is that an input-output (IO) solves either for quantities or for prices, but not both at once. A CGE model solves for both prices and quantities together.

Dynamic CGE modelling

Dynamic models trace the effects of ascribed direct impacts across time periods. The theoretical basis of dynamics is in linkages between investment and capital across time, and the balance of trade and net foreign liabilities. Investment and balance of trade outcomes are flows that a comparative static model includes. Capital and net foreign liabilities are stocks that require a dynamic model.

Dynamic VU-TERM combines much of the theory of dynamic national models (see Dixon and Rimmer, 2002) with bottom-up, regional representation. That is, each region in VU-TERM has its own production functions, household demands, input-output database and inter-regional trade matrices (Figure A1 is a map of regions in this application). This enables us to model relatively local issues.

Dynamic VU-TERM

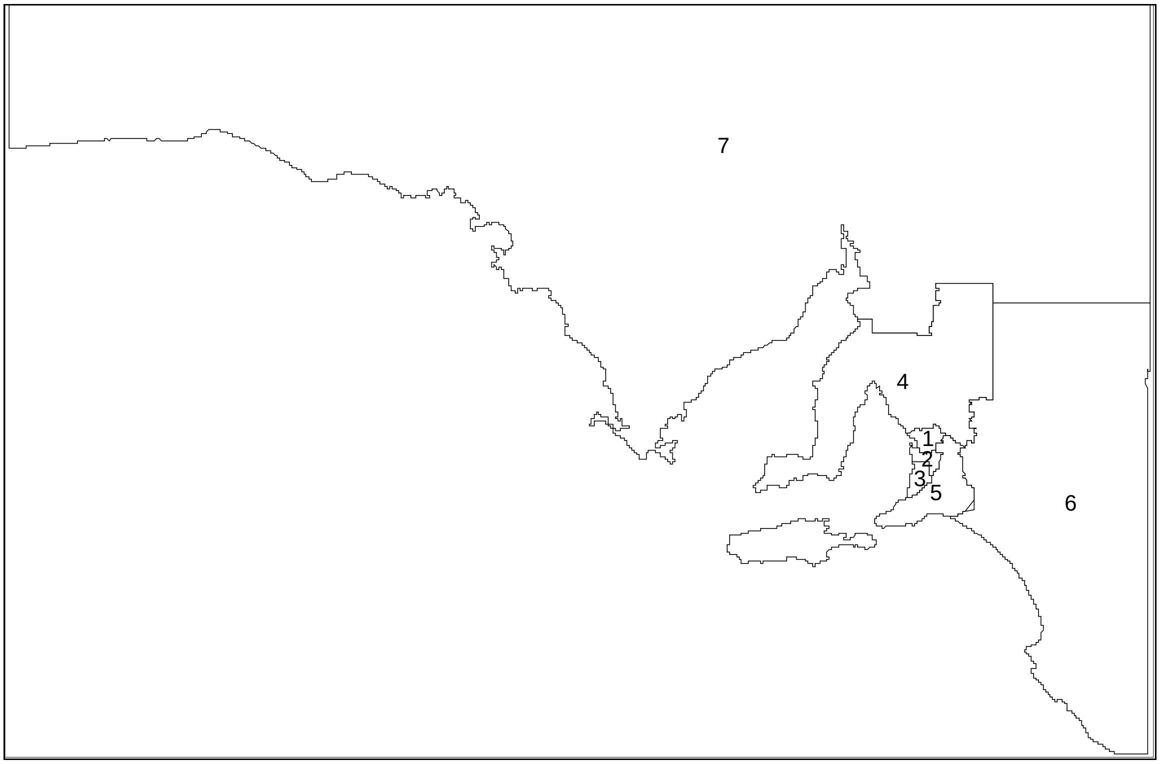
TERM was originally developed by Mark Horridge at the Centre of Policy Studies (see http://www.monash.edu.au/policy/term.htm). Since then, Glyn Wittwer has developed a dynamic version of the model, an application of which Wittwer *et al*. (2005) is an example.

In dynamic VU-TERM, we use an underlying forecast. This may be based on the macro forecasts of other agencies. The underlying forecast or baseline gives us a year-by-year "business as usual" case.

Typical variables to be reported in the policy scenario relative to a baseline forecast are regional real GDP, employment and aggregate consumption. Industry level results are also available.

Appendix

Figure A1: Bottom-up VU-TERM regions in South Australia



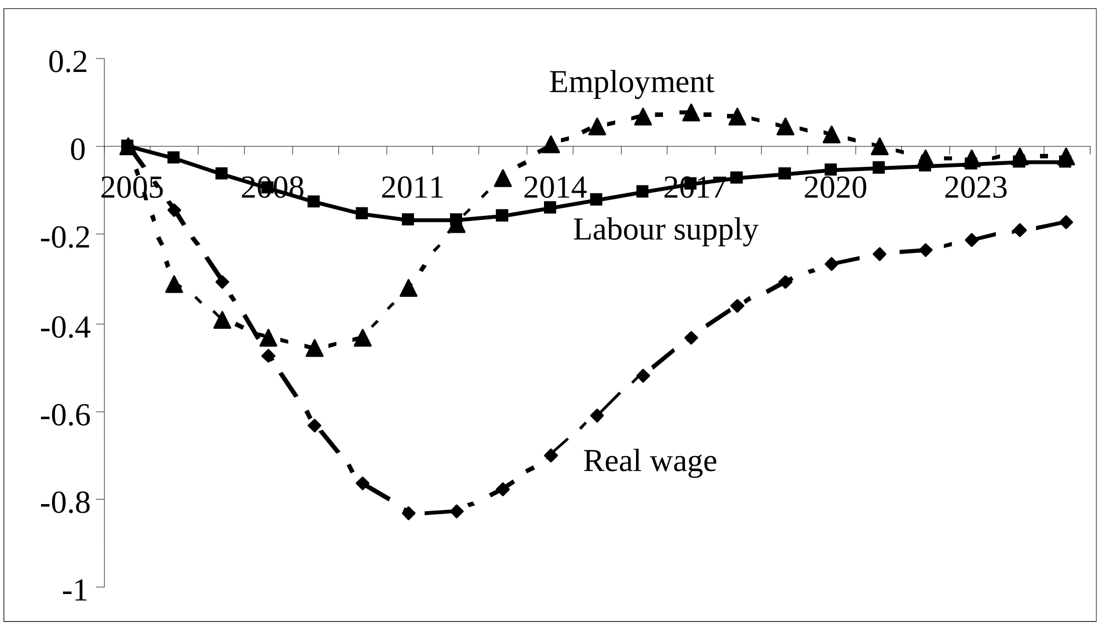
SA regions:

1 Northern Adelaide
2 Western and Eastern Adelaide
3 Southern Adelaide
4 Barossa, Lower North and Kangaroo Island
5 Adelaide Hills and Fleurieu Peninsula
6 Murray and South East
7 Rest of South Australia

Labour market – forecast v. policy scenario

In the theory of regional labour market adjustment, if regional labour market conditions improve or deteriorate relative to forecast, adjustment occurs in the short term mainly via changes in employment. Regional wages adjust sluggishly, with gradual adjustment in regional labour market supply (i.e., through migration between regions). Real wages will fall or rise to close the gap between employment and slowly adjusting labour supply. Once the deviation in employment is equal to the deviation in labour supply, real wages reach a turning point (either they bottom out, in the case of a weakening labour market, or peak, in the case of strengthened labour market conditions). Within this theory, adjustment in the longer term occurs via a combination of altered regional labour supply and real wages that deviate relative to those in other regions. Figure A2 shows an example, in which weakened labour market conditions in a region lead to unemployment in the short run and a lower real wage in the region in the long run.

Figure A2: An example of a weakened regional labour market with eventual recovery (% change from forecast)



Production technologies
VU-TERM contains variables describing: primary-factor and intermediate-input-saving technical change in current production; input-saving technical change in capital creation; and input-saving technical change in the provision of margin services (e.g. transport and retail trade).

VU-TERM's unique treatment of transport to assess the regional benefits of the project
The supply of margins originating in one region can lower the costs of moving goods between regions further afield. Previous multi-regional models (for example, Naqvi and

Peter, 1996) assign the margins supply of a sale either to the origin or destination of the sale.

GEMPACK software

Dynamic VU-TERM uses GEMPACK software for implementation (Harrison, *et al*. 2013; Harrison and Pearson, 1996).

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