CGE modelling of regional Australia's triple catastrophe: drought, bushfires and COVID-19

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Catastrophe 1: drought

• Nothing normal about the drought that hit NSW and southern Queensland from 2017 to 2019

Prelude: the scorching summer that started it



Maximum Temperature Anomaly (°C) 1 December 2016 to 28 February 2017 Australian Bureau of Meteorology

Decile 1 winter rains over much of NSW



Commonwealth of Australia 2018, Australian Bureau of Meteorology ID code: AWAP

Issued: 10/08/2018

The annual rainfall total flattered the season: ineffective summer rain



Commonwealth of Australia 2018, Australian Bureau of Meteorology ID code: AWAP

Issued: 12/10/2018

The drought of 2017: summary

- Annual rainfall deciles underestimate effective rainfall deficiencies
- Extreme summer heat, especially in north
- Lack of winter rainfall when effective rainfall per recorded mm is highest
- In the north, the drought was bad

Not the best start for 2018

- Distinguish seasonal signals from price signals
- In retrospect, given that 2017 was bad in the north, livestock numbers should have been reduced sooner rather than later in 2018



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It only got worse



Don't be fooled by 2018 spring "recovery"



New South Wales Rainfall Deciles 1 January to 31 March 2018 Distribution Based on Gridded Data Australian Bureau of Meteorology



New South Wales Rainfall Deciles 1 April to 30 September 2018 Distribution Based on Gridded Data Australian Bureau of Meteorology



January 2019 portended a terrible year

Maximum Temperature Anomaly (°C) December 2018 Australian Bureau of Meteorology



Commonwealth of Australia 2019, Australian Bureau of Meteorology ID code: AWAP

Maximum Temperature Anomaly (°C) January 2019 Australian Bureau of Meteorology



Commonwealth of Australia 2019, Australian Bureau of Meteorology ID code: AWAP

Issued: 01/02/2019

Bureau of Meteorology





increased

convection

El Niño WATCH = In May 2019, the possibility of an El Nino event remained.

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Temperature and rainfall records for 2019



For the record: "another drought"

2002



2019 2.5°C 20% 1.5°C 1.0°C 0.5°C 0.0°C -0.5°C Very Much Below Aver Lowest on -2.0°C -2.5°C Australian Bainfall Decile Maximum Temperature Anomaly (°C) 1 January to 31 December 2019 1 January to 31 December 2019



1900-1902: three year drought



2017-2019: three year drought CGE MODELLING OF DROUGHT AND POLICY RESPONSES

Dynamic VU-TERM, a CGE model

- Bottom-up representation of SA4 regions of NSW
- Local prices play an important role in adjustment
- But in prolonged drought, how much can local prices do?

VU-TERM regions in this study



New England-North West income-side real GDP

% deviation from base forecast **Employment** 2 2018-19 2015-16 -2 GDP =Utilized capital -4 f(L,K,1/A) -6 -8 **Real GDP** -10 -12

Jobs lost =5% or 3800 jobs;

Capital idle and some capital losses: livestock culling ... but most of the income loss is due to drought-related technological deterioration

New England-North West

Labour market



- We assume that real wages adjust sluggishly at regional level
- In prolonged drought, regional labour supply decreases we don't expect falling wages to help

All of NSW



In 2018-19 & 2019-20, more than 25,000 FTE jobs below base

How to measure welfare

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

- A consumption function links nominal household spending to nominal income net of interest payments
- CON is private consumption, GOV is government consumption
- NFL is net foreign liabilities, public and private
- *d* is sub-national region, *t* individual years and *z* the terminal year of the model run, *r* the discount rate
- Should also include change in national capital stock value in final year

How payments to households can improve welfare



- Welfare payments to households, targeted to drought-affected regions, by increasing household spending, may move drought-depressed employment back towards base (by keeping some firms operational)
- This is not simply a transfer across time: more labour (and maybe more capital) is being utilized
- \$43 billion welfare loss modelled: could be less with welfare payments
- Keynesian outcome: counter-cyclical stimulus.
- Subsidising farm inputs is inefficient, because these inputs face collapsing productivity during drought

Catastrophe 2: bushfires Sept 2019 to Jan 2020



- Bushfires has been raging in NSW for months before this map of relative soil moisture appeared
- Main message: unprecedented low soil moisture along Great Divide

Counting the costs

• Hectares burnt

TOTAL
5 1,416,743
1 3,894,412
7 32,165
3 281,404
5 5,624,723

- 3,500 homes at \$1.8 billion
- Fencing lost: 67,000 km costing \$602m to replace
- 14,000 cars at \$210 million
- 3,000 items of farm machinery =\$180 million
- 63000 sheep, 8500 cattle
- Estimated telecommunication towers damage of \$33 million
- Damage of \$110 million to electricity infrastructure
- Smoke damage to vineyards in Hunter and Canberra regions
- More than 10% of Adelaide Hills vineyards destroyed

Human and other costs

- Sydney had 35+ days of hazardous smoke levels: Rawnsley estimated \$50m /day labour productivity losses. Total loss \$1.6 bn
- PTSD is high among firefighters: assume labour productivity losses among professional and volunteer firefighters. PTSD loss \$0.3 bn
- Tourism losses, domestic and international: perhaps Australia's image, damaged by bushfires, has been superseded by COVID-19 impacts
- Not considered in this study: 34 lives lost directly and 400+ due to smoke impacts. At \$5m per human life, these losses exceed \$2 billion
- Flora and fauna losses

Insurance

- Insurance payments (which were around \$1.8 billion) reduce the impact of rebuilding on net foreign liabilities (NFL)
- But we should assume that in fire-ravaged regions, future insurance costs double
- So insurance does not provide a free lunch: it lessens the NFL impact but raises costs thereafter

Welfare impact of bushfires

- Remember that VU-TERM excludes the loss of human life costs and habitat destruction
- The modelled loss is NPV \$9 billion
- This includes tourism export losses (several billion over time) that may be superseded by COVID-19 impacts
- What value do you put on habitat destruction? 3.16 million hectares of conservation land burnt out +1.6 million hectares of forestry/plantation. Even at \$1000/ha (... low), that's \$5 billion of losses
- Thanks to John Quiggin, Quentin Grafton and Tom Kompas for exchanges on this

Catastrophe 3: COVID-19

- DECLARATION: my modelling of this was preliminary
- My CoPS colleagues have come up with better modelling than me
 - -- including the use of quarterly dynamics
 - -- a sophisticated theory of idle capital
 - -- distinctions in the labour market between jobs losses (big %) and hours lost (bigger %)
 - -- and impact of immigration (3% reduction in Victoria's mediumterm labour force relative to base)

The problem of multiple catastrophes

• Recall the following from catastrophe 1: New England-North West



- 2020-21 was supposed to be the year of recovery
- That won't happen with COVID-19
- Some farm regions will recover but bushfire affected regions will have recovery hindered by COVID-19

CGE modelling of COVID-19

- Usually price mechanisms assist in adjustment
- COVID-19 is a deep recession: collapsed demand and furloughed workers
- Inward demand and inward supply shocks:

Decreased export demands due to decrease global spending Reduced Aus expenditures and taste swing in consumers away from spending on restaurants, live performances, sports .. Inward temporary *labour supply shift (1)* My colleagues have modelled the fiscal response -- I did not In US modelling, CoPS colleagues modelled impact on seasonal horticultural produce due to a lack of pickers

Also impact on immigration: Vic pop 3% less than otherwise after resumption of "business as usual" (*permanent labour supply shift (2)*)

Headline VU-TERM results

- Even with a "snap-back" after a 4 month lockdown, welfare losses are still \$100 billion
- This assumes no fiscal intervention: and a 4 month decline in national hours worked of 20%
- With JobKeeper, hours worked have fallen by around 10%:

-- not a perfect scheme, not as equitable as it could be, as it excludes significant parts of our community, but better than nothing

• We now expect international travel and education exports to recover slowly: we may not be flying anywhere other than NZ before July 2021 and Mr Peters rejected us last week

A massive fiscal response: one in a century pandemic

- Supposing a fiscal response over 2+ years adds \$300 billion to public debt
- This is equivalent to 16% of present annual GDP
- To service this debt at a 10 year interest rate of 2.5% would be equivalent to 0.4% of GDP over this time: + the govt may wish to pay back over 20 years, requiring budget surpluses equal to 0.8% of GDP

Stocks and flows

- Think of the damage to the upcoming generation of the workforce if unemployment remains high for several years
- A fiscal response contributes to retaining a stock of knowhow
- There are *fixed costs* to firms in recruiting and training new employees:
 - JobKeeper may help avoid additional fixed costs
- Should be wary of resuming fiscal surpluses too soon
- There is a trade-off between *human capital stock* losses due to prolonged unemployment & *national debt* due to fiscal deficits

Low interest rate environment and weak labour market

• The appropriate circumstances for *sensible* infrastructure spending as we climb out of recession

