

# THE BOYNE ISLAND SMELTER: ECONOMIC IMPACT ON THE GLADSTONE REGION

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# Aluminium Industry and Boyne Smelters Limited (**BSL**)

**Australia:** energy-abundant & fully integrated Aluminium supply chain

- One of only three countries in the world along with Brazil and Venezuela.

**Qld:** Weipa Bauxite is shipped to Gladstone for Alumina refining and Aluminium Smelting at BSL (much of this supply chain is Rio Tinto)

**BSL:** consumes 1/8 of Qld's electricity

- Recent Smelter closures: Kurri Kurri 2012
  - Near miss at Tiwai Point, New Zealand in 2020-2021:
    - ``Clean`` aluminium: from hydroelectric power (alumina from Gladstone)
    - Needed a deal to keep it open with reduced price for electricity
  - Subsidies due to high energy prices (and subsidies in other countries)
- [Qld Energy and Jobs Plan:](#)
    - Sustaining heavy industry in Qld is a key part of the transition

Gladstone, Central Queensland

- Central Qld: the energy powerhouse of Qld: 4600MW (but coal-fired)
  - [Central QREZ](#): Qld Energy plans for renewables
- Gladstone (2018-19 economy, SA3/LGA), Central Qld
  - \$15.5bn aggregate output**: approx. 25% of Central Qld, 2% Qld
  - 29k FTE**: approx. 28% of Central Qld, 1.3% of Qld
  - 63k population**: highly skilled, but aging with 0.7% growth
    - Multi-commodity deep-water port plus rail and road infrastructure
- Gladstone is Qld's regional manufacturing hub:
  - \$5.5bn to \$6bn Manufacturing output**: of which approx. \$1bn is **BSL**
  - 4k to 4.5k Manufacturing FTE employees**: of which 1k at **BSL**
  - Other Heavy industry**: Ammonia, Cement, LNG, Oil refinery
  - [Growth industries](#): ag-tech, alumina for batteries, aquaculture, Mining Serv., green {...}

Computable General Eq'm  
with  
Inter-temporal, Sectoral Euler Equations

Model overview

*Forward-looking dynamics:* for 19 ANZSIC divisions in the Gladstone region:  
**Supply = Demand** (output = med + con + inv + xpo) at each time  
**Output** is a function of capital, labour, intermediates (with imports) and a fixed factor.  
**Capital** depreciates and is optimally replenished to grow the economy.

*Balanced growth paths:* via technological growth and optimisation  
**Growth rate** is similar for output and capital: each sector grows in range 1% to 2%  
**Technological progress** is fixed-factor augmenting

*Euler eq'ns:* novel application at the *sectoral* level  
**Testable:** ``value capital today'' = ``**expected value** of capital in the future''

- We tend to smooth consumption across time
- Absent in intersectoral models: CoPS; Atalay; Cesa-Bianchi et al; Baqaee and Farhi

Transition to net zero: Euler eq'ns unlikely to hold, but important implications for whether shock propagate and economy can transform.

The data



## Data sources:

*Jobs in Australia* ABS data: labour per sector for Gladstone 2019.

*Input-output flows* between sectors: ABS tables 5 and 8 for Australia

*Investment flows* between sectors:

- investment flows tables from the US Bureau of Economic Analysis
- ABS Gross Fixed Capital Formation by Industry by type of Asset

*BLADE (and Remplan)*: for output per sector for Gladstone 2019

*Gladstone Port* data for Bauxite, Alumina, Aluminium and Coal

- Eg. Bauxite imports

*Rio Tinto* accounts

*Studies* on aluminium production e.g.

Gagne and Nappi 2000, Best Available Techniques 2017

## Data: initial conclusions

- Gladstone Bauxite imports less than half of Weipa production
- QAL and Yarwun: Alumina sales to BSL is 15% of total output

*No obvious major threats to overall supply chain: Rio Tinto is majority owner*

### *Gladstone economic impact*

- BSL is between one-quarter and one-sixth of the manufacturing sector
- 80% of Aluminium is exported via Gladstone port
- Subsidy is likely to be over \$250 million

## Data: regionalising the Australian input-output table

- Modify certain parameters to match estimates e.g. Utilities flows to Manufacturing
- *Within-model tuning* of parameters to approximate observed Gladstone proportions for variables such as *output* and *labour remittances*.

# Experiments and shocks

## Experiment Type (1): Euler eq'ns hold

1st phase: tune parameters to regionalise *and satisfy Euler eq'ns*

2nd phase: capital evolves towards a balanced growth path

3rd phase: continue along same path and generate

- ``status quo'' path
- ``shock'' (BSL closure) path

## Type (a) shock: one-off “MIT shock” agents don't see coming

- One quarter decrease in Manufacturing productivity, capital and exports
- 5/6 decrease in Utilities (energy and water) purchases by Manufacturing
- No decommissioning or replacement activity
- Labour is mobile

Main message: depends on which experiment we run

# Experiment (1a) Results Summary

- If Euler eq'ns hold, then the impact is more permanent.

## Sectoral breakdown of initial -\$1.56bn drop in Aggregate Output

Manufacturing	Utilities	Construction	Transport	Others
-\$1.47bn	-\$45m	-\$23m	-\$4m	-\$17.5m

- Closure causes energy and water prices to fall which stimulates Agriculture, Mining and Consumption.
  - But Gladstone is connected to NEM, so the fall in energy prices would be less significant as benefits are spread over a much larger region.

## Experiment Type (2): Euler eq'ns needn't hold.

- Three phases as above
- Intended to capture Gladstone as an economy in transition with major uncertain changes relating to emissions targets given its current industry.

## Type (b) shock: labour is immobile

Main message: the shock is worse and permanent

## Type (c) shock: the agents know in advance and can plan for it

- Distinguishes the model from the CoPS approach

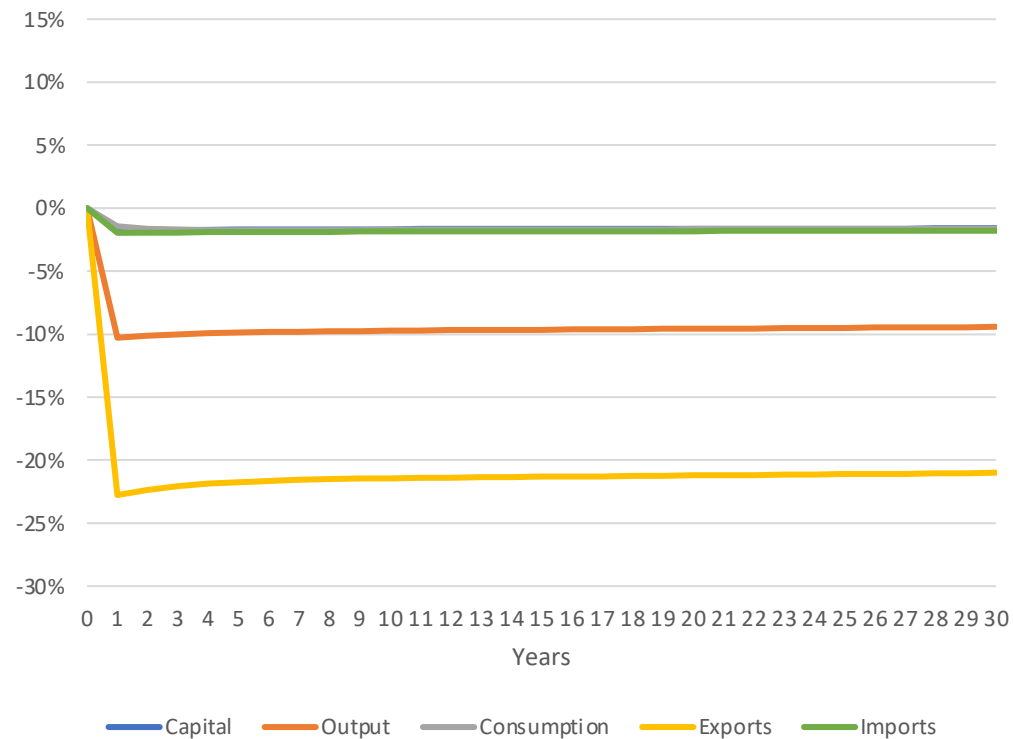
Main message: it is optimal to build up capital in advance of the closure

# Comparison of experiments:

(1a)

(2a)

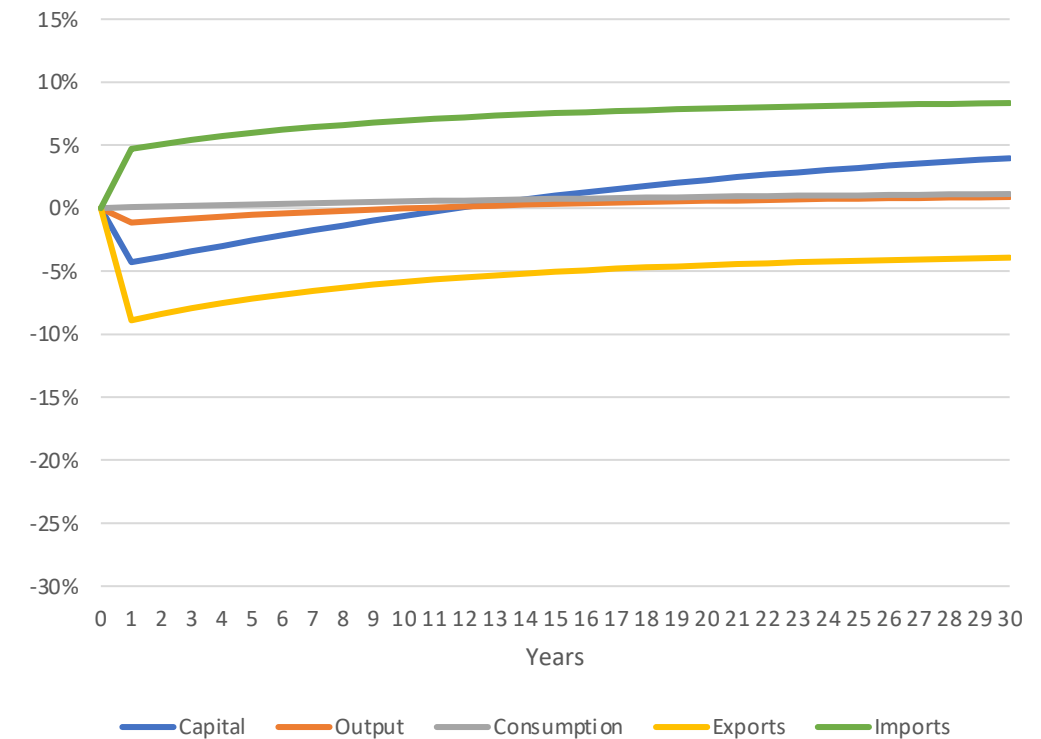
## Experiment-shock (1a): % change relative to status quo, Aggregates



Aggregate Output permanently down by 10% or \$1.5bn  
in accordance with productivity shock

Aggregate Capital permanently down by 1.6-1.7%

## Experiment-shock (2a): % change relative to status quo, Aggregates

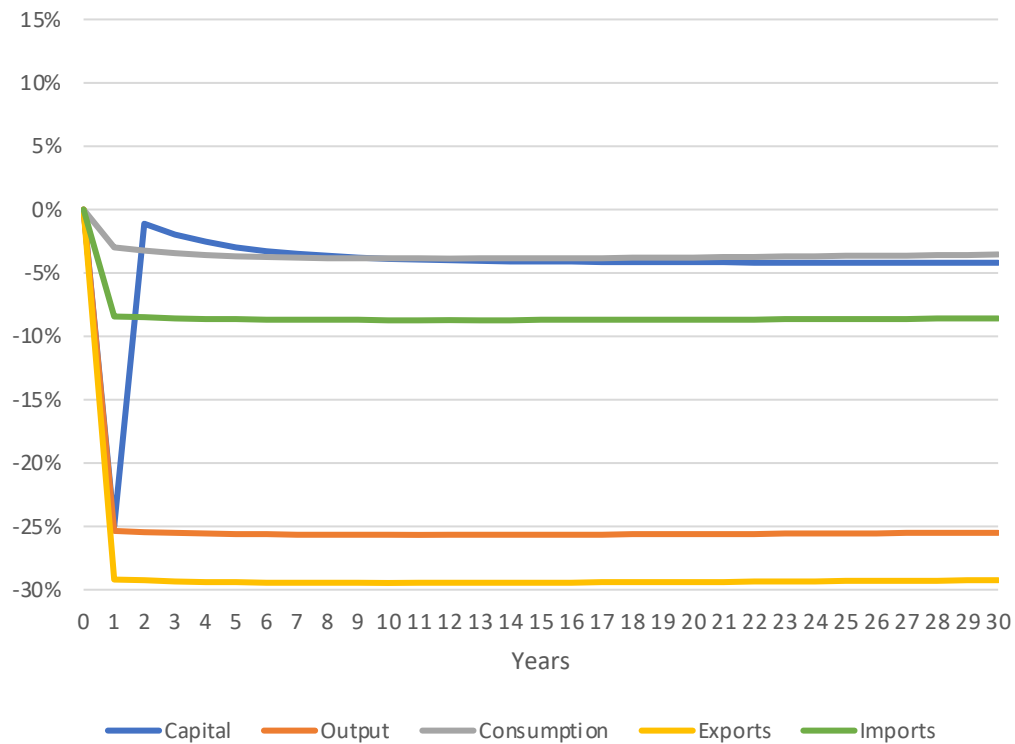


Output falls by 1% or \$0.15bn before converging to 0;  
impact is transitory (unlike the productivity shock).

Consumption is up by 1% in the long run

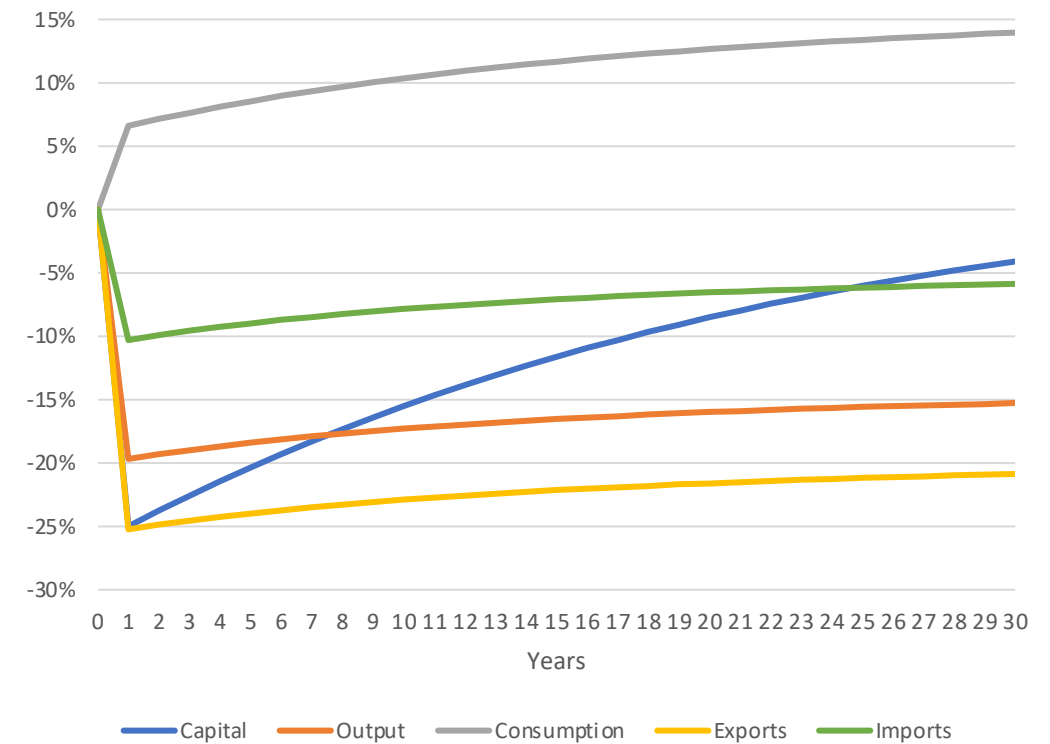


## Experiment-shock (1a): % change relative to status quo, Manufacturing



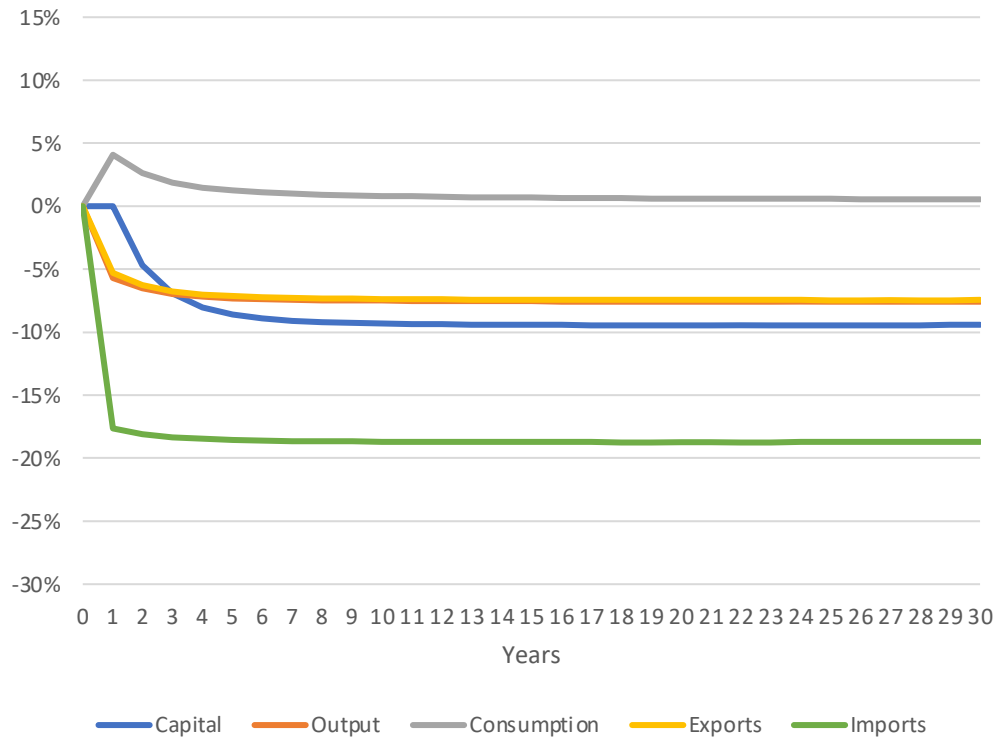
Manufacturing capital immediately returns close to optimal levels: a quick response is optimal.

## Experiment-shock (2a): % change relative to status quo, Manufacturing



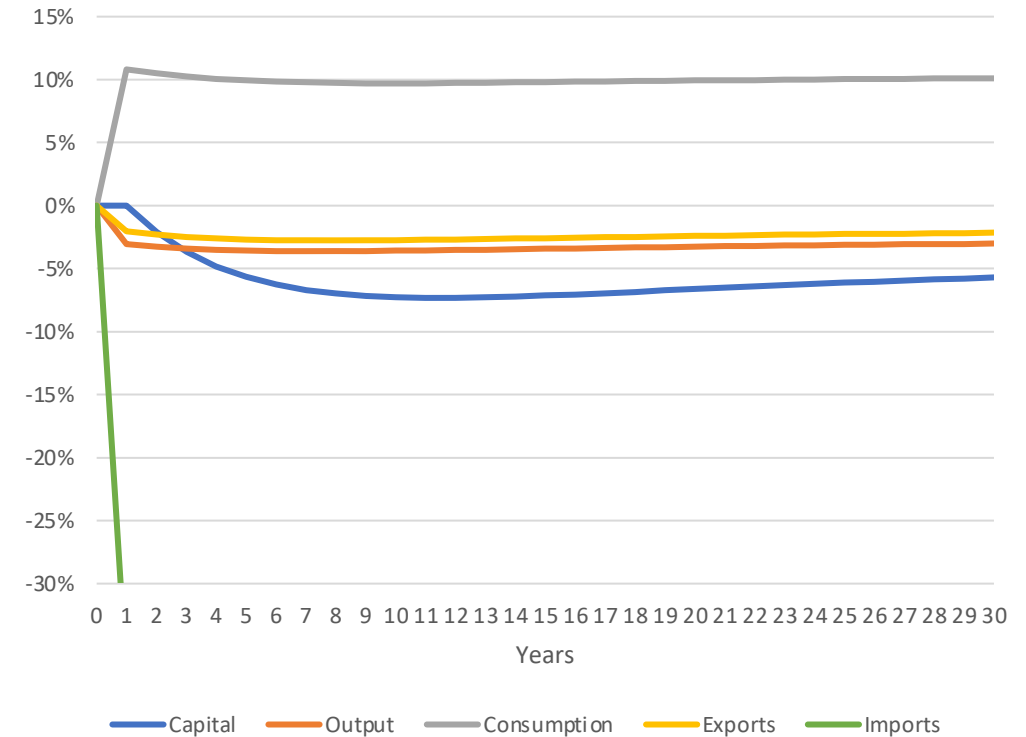
Manufacturing capital takes much longer to return to previous levels as they were not as efficient.

## Experiment-shock (1a): % change relative to status quo, Utilities



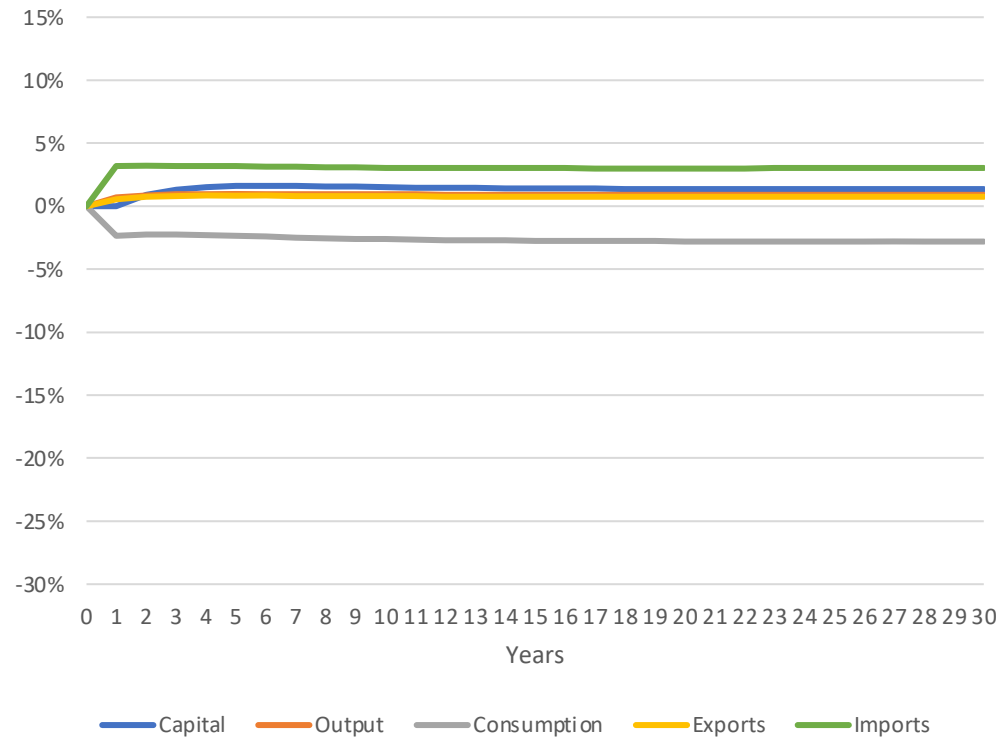
Utilities (Energy and Water) price initially fall by 4%;  
 Consumption up compensating for falls elsewhere;  
 Capital down by 9% in the long run.

## Experiment-shock (2a): % change relative to status quo, Utilities



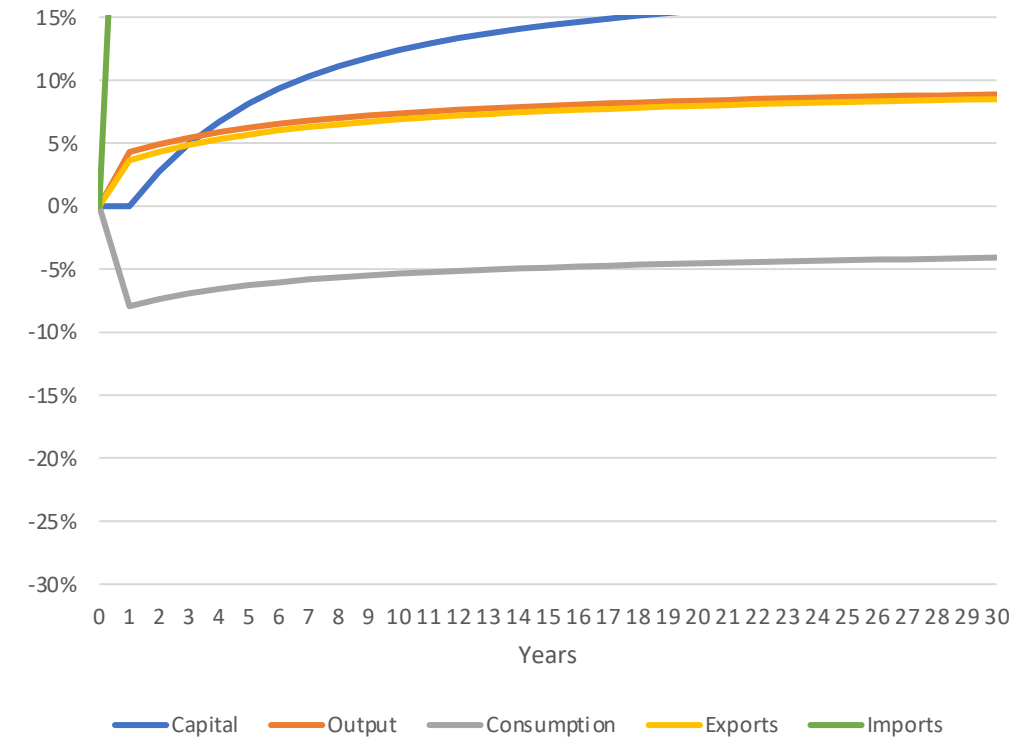
Utilities price down by 10% and remains there;  
 Capital down by 6% in the long run;  
 As prop'n of output: imports down from 12.5% to 8%

## Experiment-shock (1a): % change relative to status quo, **Agriculture** (Similar pictures for Mining.)



Cheaper energy and water prices cause Capital, Output, Exports and Imports to rise.  
Consumption falls due to increases in other demand.

## Experiment-shock (2a): % change relative to status quo, **Agriculture**



Similar, but more extreme:  
Capital up by over 15% in the long run.  
As prop'n of output: imports up from 10% to 15%

# Key takeaways

# Key takeaways

- *Sectoral* Euler eq'ns matter for shock propagation and economic response
  - If they hold, then the shock is more sector-specific (less macroeconomic).
- Transition: uncertainty and out-of-date capital, so sectoral Euler equations unlikely to hold
  - greater propagation of shocks, but also opportunity for change
- By allowing sectoral Euler equations to fail in ways that reflect the current transition:
  - we can explore ways to transform the economy
- BSL is important to Gladstone's economy
  - Transition needs to be handled with care as it is a major consumer of energy
  - Needs a backup supply of energy (currently Gladstone Power Station)
  - Early decisions are valuable: e.g. Kurri Kurri closure 2012; power station approval in 2021
- With right energy transition, Gladstone Aluminium is internationally competitive
  - [June 2022](#): Rio Tinto calls for clean Gladstone Aluminium by 2030.
  - [September 2022](#), Qld Energy Plan: supergrid can keep Gladstone in proximity of power supply

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