Boyne Smelters

Economic Impact on the Gladstone Region and Queensland

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Aluminium Industry and Boyne Smelters (BSL)

- Australia: one of three energy-abundant countries with a fully integrated Aluminium supply chain (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)

- Yet BSL consumes approximately 1/8 of Qld's energy supply
  - Recent Smelter closures: Kurri Kurri 2012
  - Near miss at Tiwai Point NZ 2020-2021:
    - Clean aluminium: from hydroelectric power
    - Yet it needed a deal to keep it open with a reduced price for electricity
- Subsidies due to high energy prices (and subsidies in other countries)

- June 2022: Rio Tinto calls for clean Gladstone Aluminium by 2030

Gladstone, Central Queensland

- Gladstone (SA3 region) contains the capital, Gladstone, of Central Qld

  2018-2019 economy:

  - $15.5bn Gross Output; $5.8bn Manufacturing; $1bn from BSL
  - 30k FTE in fiscal year FY2019; 4.5k in Manufacturing; 1k at BSL
  - 63k population
- Manufacturing (ex Aluminium) consists of heavy industry:
  - explosives, cement, LNG, Oil refinery
- Nearby coal resources and four coal-fired power stations
  - Gladstone Power Station has a variable load to support the smelter
- Multi-commodity deep-water port and road and rail infrastructure
- New industries: wind farms, mining services, green hydrogen, high-purity alumina for batteries, aquaculture

Computable
Inter-{regional, sectoral and temporal} Euler
General Eq'm

Model overview

Focus on dynamics and uncertainty across 19 ANZSIC divisions where:

- Supply equals Demand (output = med + con + inv + xpo) at each time
- Output is a function of kap, lab, med (including imports) and a fixed factor.
- Capital depreciates and is optimally replenished to grow the economy.

Technological growth and optimisation lead to *balanced growth paths*

- technological progress is fixed-factor augmenting
- output and capital grow at similar rate: each sector grows in range 1%-2%

Novel application of Euler eq'ns to a multisectoral economy

- "value of capital today" = "expected value of capital tomorrow"
- *Expected value across all states of the world*
- Absent in intersectoral models: CoPS, Atalay, Cesa-Bianchi and Baqaee—Farhi

Euler eq'ns provide a measure of *resilience* and *adaptive capacity*:

if some EE do not hold, then shocks lead to larger movements in other sectors.

The data

Data sources

- *Jobs in Australia* ABS data: labour per sector for Gladstone 2019.
- *BLADE:* output per sector for Gladstone 2019
- Australian input-outputs table 5 and 8
- Gladstone Port data for Bauxite, Alumina, Aluminium and Coal
  - Eg. Bauxite imports
- Rio Tinto accounts
- Studies on aluminium production e.g. Gagne and Nappi 2007
- Handbook

Data: initial conclusions

- Amrun mines: 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

Allows us to focus more on broader Gladstone economic impact

- BSL is between one-quarter and one-sixth of the manufacturing sector
- 80% of Aluminium is exported via Gladstone port: *subsidy goes to exports*
- 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: tune capital to obtain a balanced growth path

3rd phase: continue along same path and generate

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

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 (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 whether Euler Eq’ns hold

Type (b) shock: labour is immobile

- Preferences are Leontief in labour: fixed proportions of each type of labour

Main message: the shock is worse and permanent

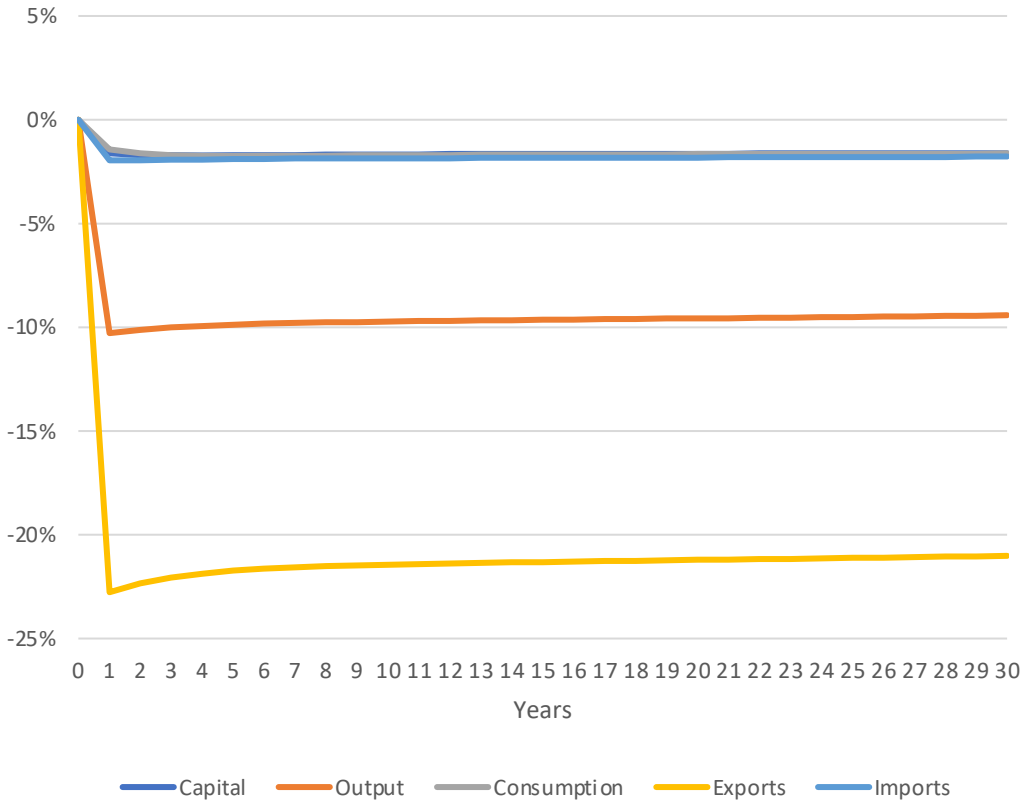
Type (c) shock: the agents know in advance and can plan for it

- Distinguishes the model from the Centre of Policy Studies approach

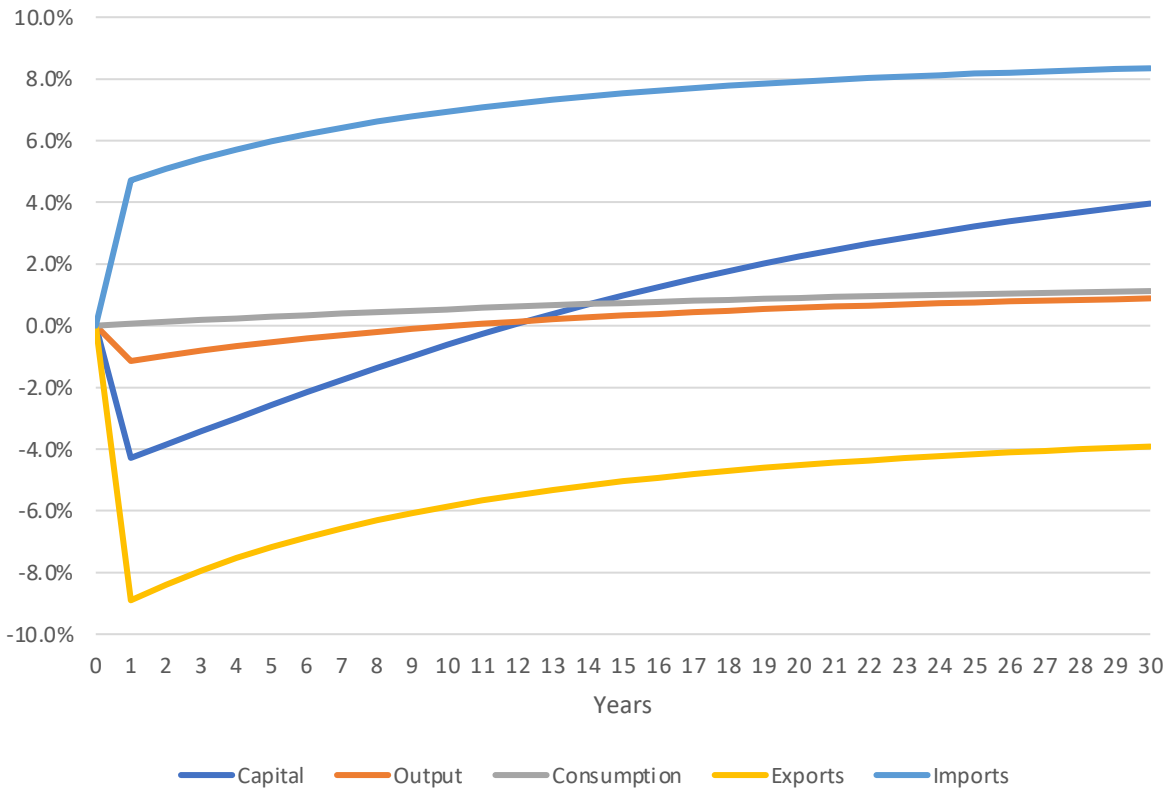
Main message: it is optimal to build up capital in advance of the closure

Results from experiments (1a) and (2a)

Experiment-shock (1a): **% change for aggregates**



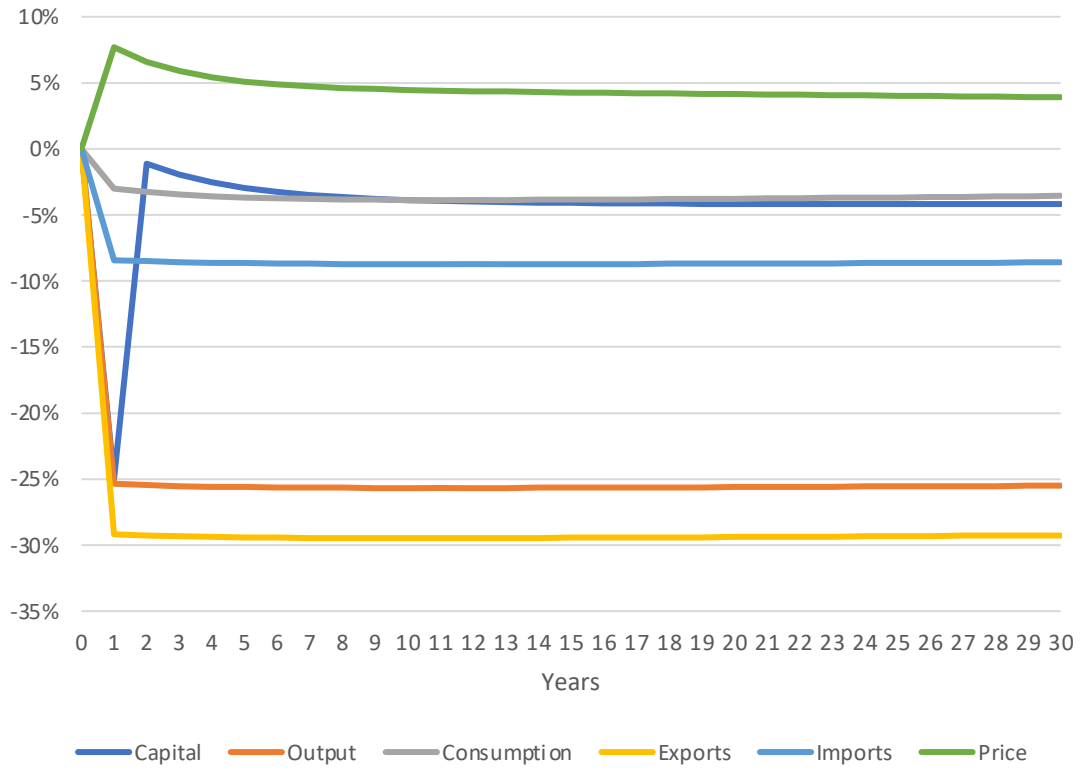
Experiment-shock (2a): **% change for aggregates**



In (1a), the Euler eq'ns hold and impact is permanent in accordance with the productivity shock.

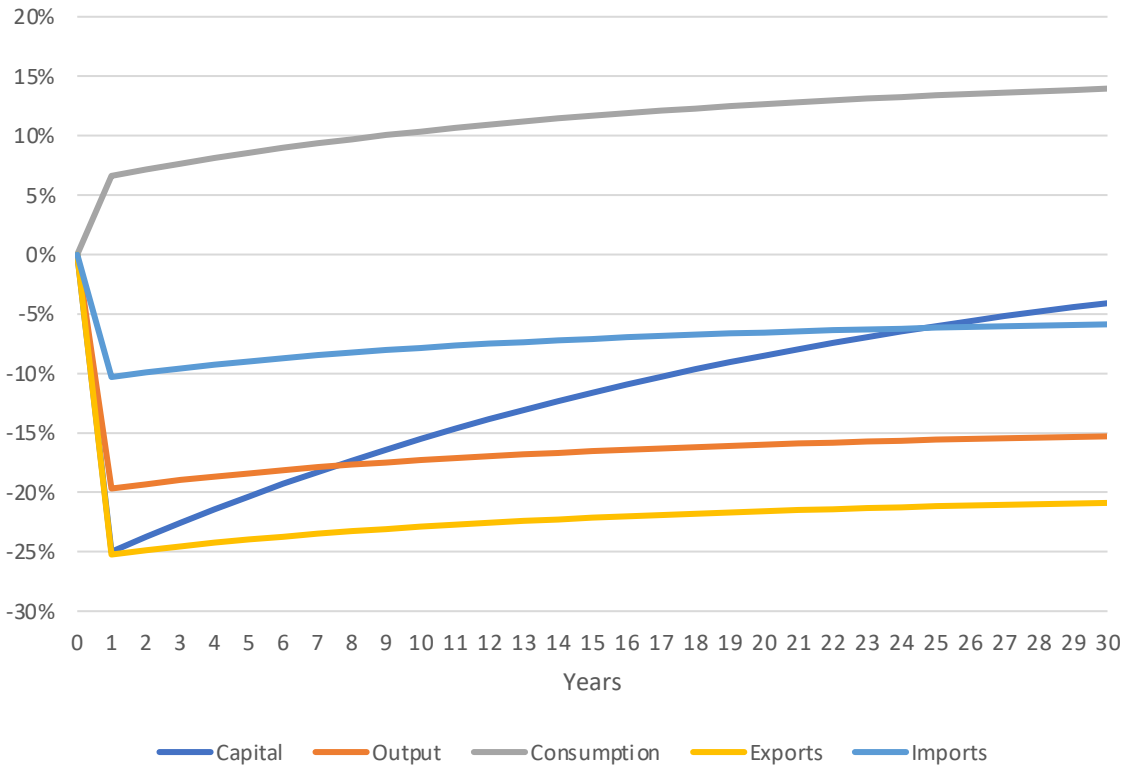
In (2a), the Euler eq'ns do not hold and impact is transitory unlike the productivity shock.

Experiment-shock (1a): **% change for Manufacturing**



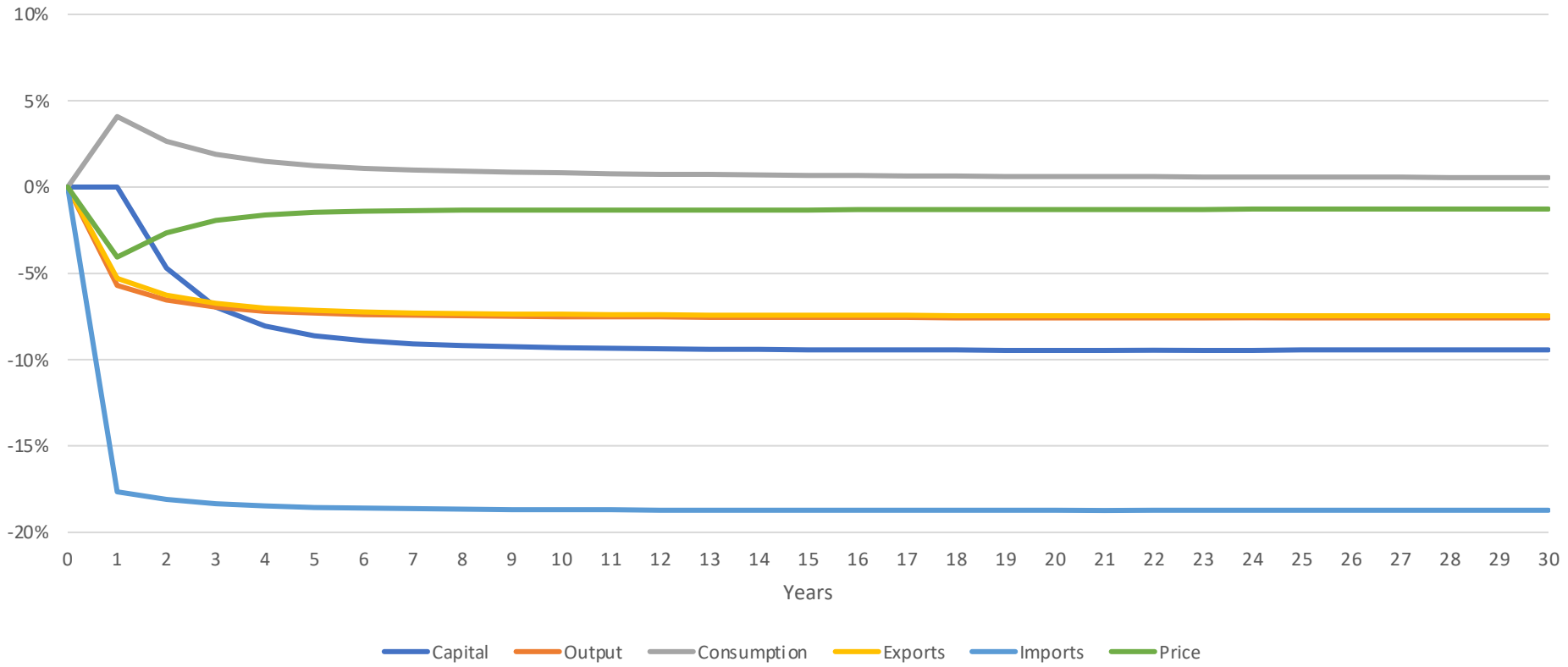
In (1a), Manufacturing capital immediately returns close to optimal levels: a quick response is optimal.

Experiment-shock (2a): **% change for Manufacturing**



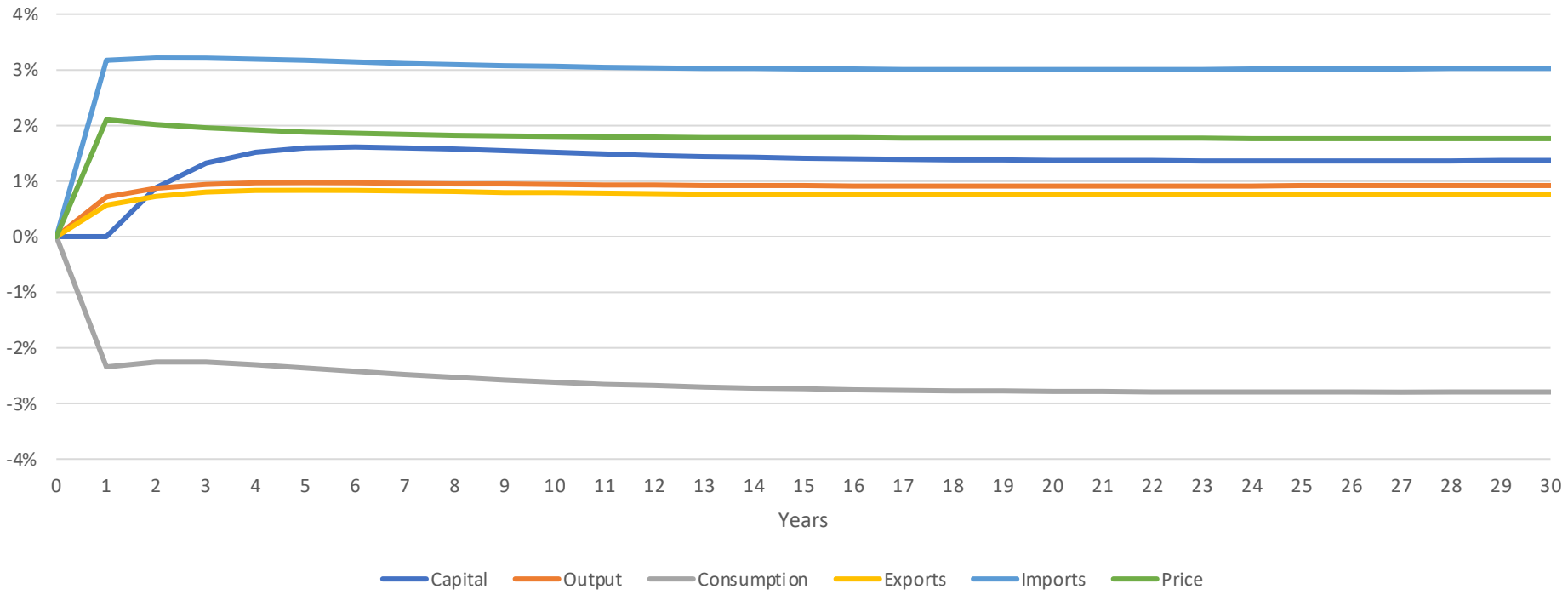
In (2a), Manufacturing capital takes much longer to return to previous levels as they were not as efficient.

Experiment-shock (1a): **% change for Utilities**



In (1a), Utility price initially fall by 4%; consumption moves in opposite direction compensating for reduced consumption elsewhere. In (2a), Utilities price falls by 10%.

Experiment-shock (1a): **% change for Agriculture**



In (1a), Agriculture capital, output, exports, imports and even price increase. In (2a), the picture is similar, but more extreme. A similar picture applies to Mining.

Key takeaways

- Extent of capital fitness-for-purpose determines extent of spill overs:
  - Gladstone: positively (as in Agriculture & Mining), or negatively (as in Utilities)
  - When Euler eq'ns hold, current capital is perceived as fit-for-purpose:
    - shocks do not propagate (across sectors)
    - the economy is stable/entrenched, so also less opportunity to adapt

- In the context of transition to net zero, capital is out-of-date, so
  - Euler eq'ns are unlikely to hold due to multitude of states, so shocks are likely to propagate, but economy is also more likely to respond.
  - in this context, a flexible and mobile workforce is especially valuable.

- Early decisions giving agents valuable time to prepare and look ahead
  - Kurri Kurri closure 2012; decommissioned 2017; approval for power station 2021
  - Give the opportunity for investors/firms to plan and workers to retrain in advance.

References

- To come