# What Assets Should the Central Bank Purchase in a Quantitative Easing Program

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## Motivation

### Research question

In a multi-sector economy with heterogeneous production sectors, whether different asset purchases have different aggregate and sectoral effects?

### Policy relevance

- The Federal Reserve has implemented Quantitative Easing (QE) again in response to COVID-19. QE is expected to be used in the future recession.
- Under input-output linkage, sector heterogeneity including price rigidity influences the transmission of monetary policy shocks (Bouakez et al., 2014; Pasten et al., 2020).

## Theoretical Model

Sectors are heterogeneous in price rigidity, production function, and agency costs, and interact with each other in the market for intermediate goods.

Our DSGE model builds on previous work by Gertler and Karadi (2011, 2013) and Sims and Wu (2021). The economy consists of:
- Households composed of workers and bankers
- Production network with 4 layers
  - Competitive goods-producing firms in $S$ sectors with heterogeneous production functions.
  - Differentiated retailers that repackage the goods-producing firm's output and are subject to Calvo rigidity
  - Competitive firms that aggregate repackaged goods into sectoral output
  - Competitive firms that aggregate sectoral output into final output
- Firms that produce physical capital
- Financial intermediaries subject to the agency problem

$$E_t\left(\frac{excess\ return\ of\ bond\ A}{excess\ return\ in\ bond\ B}\right) = \frac{agency\ cost\ of\ bond\ A}{agency\ cost\ of\ bond\ B}$$

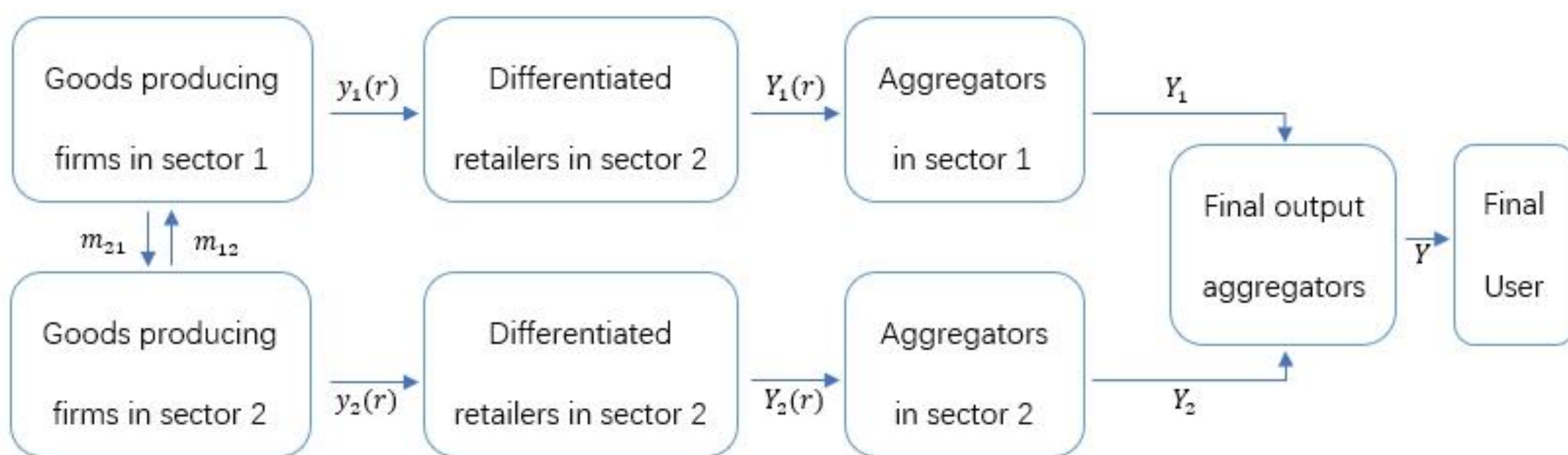- A government composed of fiscal authority and central bank



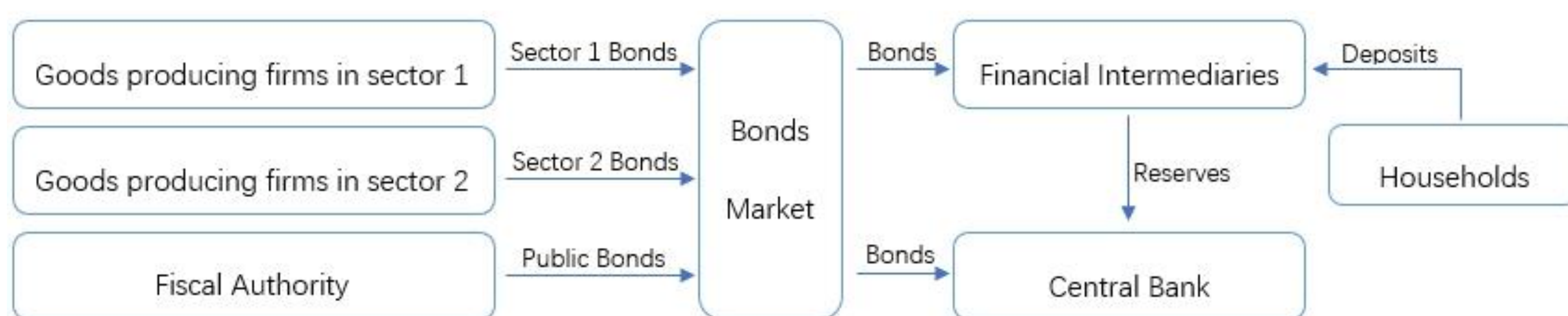**Figure 1.** Production Network (e.g. 2 sectors)



**Figure 2.** Financial Structure (e.g. 2 sectors)

## Calibration and Solution

Label the two sectors as manufacturing and services in our benchmark calibration and experiments.
- Production function calibration
  - input-output database (KLEM) by Dale Jorgenson, 1960 – 2005, annual data
- Input-output Calibration
  - BEA input-output accounts, 1997 – 2019, annual data
- Prices are fixed for about 4 months in Manufacturing and 12 months in Services.
- Solution: Linear approximation about the non-stochastic steady state, with Occbin (Guerrieri and Iacoviello, 2015) at ZLB

| Sector | Labor Share Estimates | s.e. | Intermediate Share Estimates | s.e. | Capital Share Estimates | s.e. |
|---|---|---|---|---|---|---|
| Manufacturing | 0.278* | 0.012 | 0.597* | 0.011 | 0.125* | 0.013 |
| Services | 0.395* | 0.011 | 0.387* | 0.014 | 0.218* | 0.007 |

**Table 1.** Production Function Calibration

| Producer | Consumer Manufacturing Estimates | s.e. | Services Estimates | s.e. |
|---|---|---|---|---|
| Manufacturing | 0.678* | 0.021 | 0.195* | 0.015 |
| Services | 0.322* | 0.021 | 0.805* | 0.015 |

**Table 2.** Input-Output Calibration

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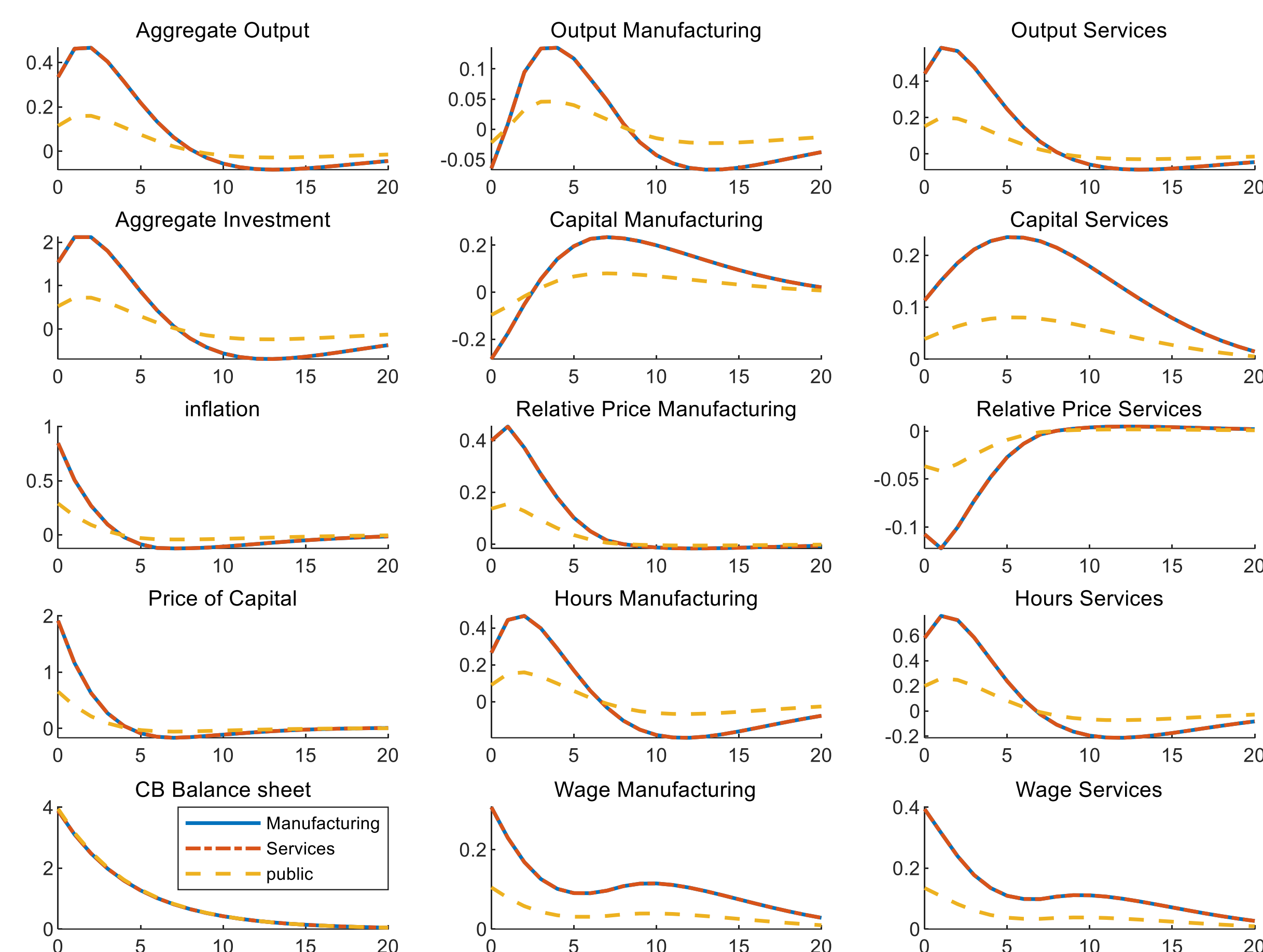Phone: +86 13194644146/ +1 514-578-3927

**Figure 3.** Benchmark Calibration

## Results

a) Benchmark agency cost $\Longrightarrow$ manufacturing: services: public = 3:3:1.
- Private bonds are more expansionary than public bonds in the short-run but become contractionary as firms deleverage in the medium run.
- Firms in the more flexible price sector (manufacturing) raise their prices and relative price increases, which limits the output expansion in manufacturing.
- The co-movement of sectoral output following QE is driven by the input-output structure.
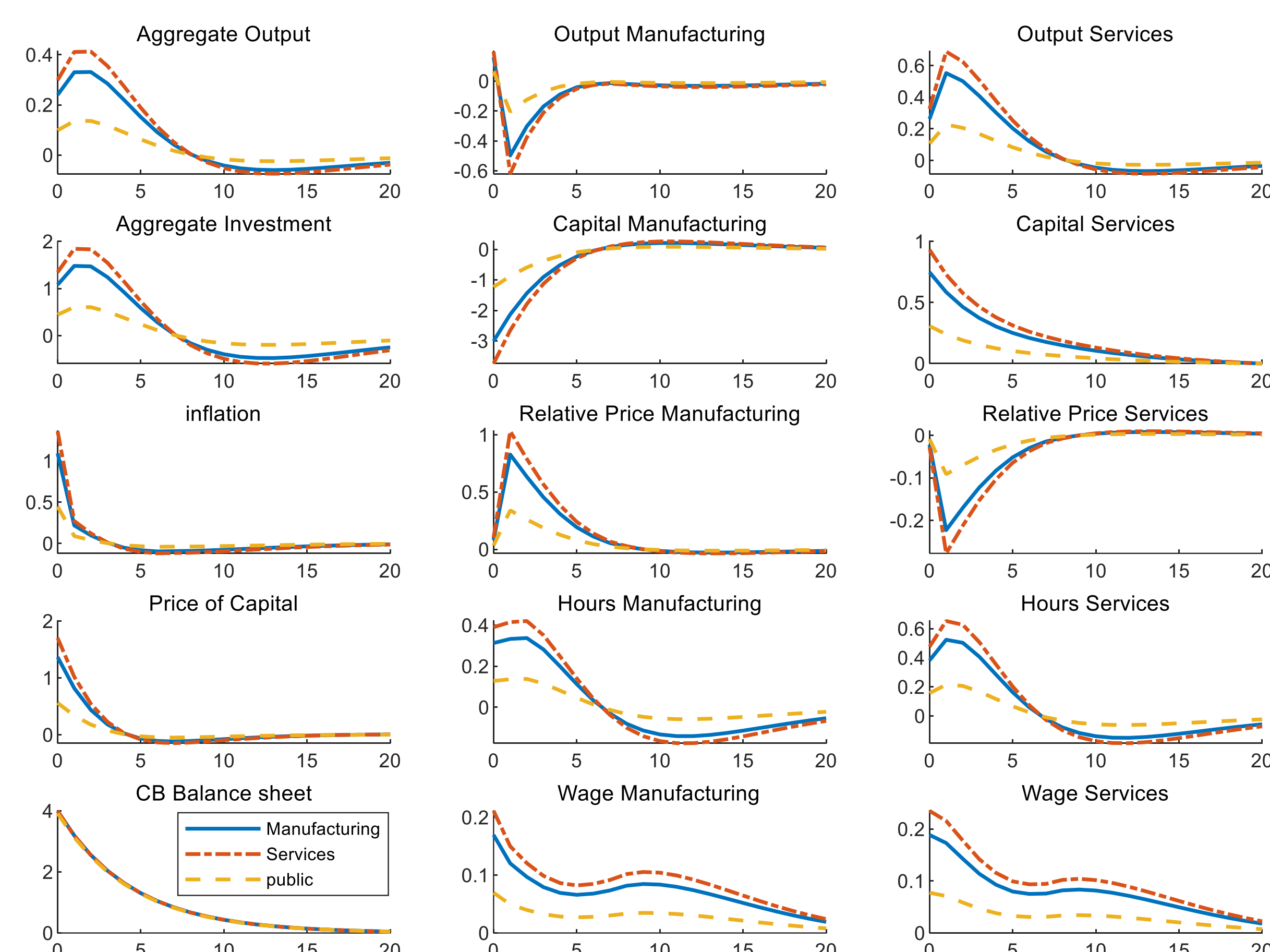


**Figure 4.** Higher Agency Cost in Services

b) Higher agency cost in services $\Longrightarrow$ manufacturing: services: public = 2.4:3:1.
- The incentive constraint is tighter for bonds from services and, thus financial intermediation by the central bank is more effective when undertaken via purchases of these bonds.
- QE policy tends to benefit the sector with higher agency costs the most and amplifies the effects of heterogeneity in price rigidity.

## Conclusions

- Price rigidity is a key source of heterogeneity in the effects of the QE policy. The sector with the most rigid prices benefits the most from the expansionary policy.
- Input-output interactions lead to the co-movement of output and investment across sectors despite the effects of different price rigidity across sectors and dampen the heterogeneity in sectoral responses.
- The central bank faces an intertemporal trade-off when deciding what bonds to purchase in a quantitative easing program because of the expansionary and contractionary effects.

## References

1. Bouakez, Hafedh, Emanuela Cardia, and Francisco Ruge-Murcia. 2014. "Sectoral price rigidity and aggregate dynamics." European Economic Review 65:1–22.
2. Gertler, Mark and Peter Karadi. 2011. "A model of unconventional monetary policy." Journal of Monetary Economics 58 (1):17–34.
3. Gertler, Mark and Peter Karadi. 2013. "Qe 1 vs. 2 vs. 3...: A framework for analyzing large-scale asset purchases as a monetary policy tool." 29th issue (January 2013) of the International Journal of Central Banking
4. Guerrieri, Luca and Matteo Iacoviello. 2015. "OccBin: A toolkit for solving dynamic models with occasionally binding constraints easily." Journal of Monetary Economics 70:22–38.
5. Pasten, Ernesto, Raphael Schoenle, and Michael Weber. 2020. "The propagation of monetary policy shocks in a heterogeneous production economy." Journal of Monetary Economics 116:1–22.
6. Sims, Eric and Jing Cynthia Wu. 2021. "Evaluating central banks' tool kit: Past, present, and future." Journal of Monetary Economics 118:135–160.