The Dynamic Effects of Fiscal Stimulus in a Two Sector Open Economy

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The Return of Fiscal Fundamentalism

- prior to the North Atlantic banking crisis support for fiscal activism had waned

- hundreds of US academic economists agreed in 2009 that increasing government spending to counter recession was "a triumph of hope over experience" and that "More government spending by Hoover and Roosevelt did not pull the US economy out of the Great Depression."
Budget deficits, % GDP, 2010

Fiscal Multipliers: Theory

- the case for fiscal stimulus rests on the presumption that multipliers are positive, along lines first proposed by Keynes

- yet, a range of alternative perspectives suggest fiscal multipliers are small or ≤0

- for example, the Mundell-Fleming model (floating exchange rate version) and permanent income model suggest fiscal multipliers are zero or negative in the short run
Fiscal Multipliers: Evidence

- different methods yield mixed results about fiscal multipliers across time and countries

- estimates can differ not merely in degree but in sign with a range that is “almost embarrassingly large” (Auerbach et al 2010 JEP)
Dynamic Fiscal Multiplier

Following Uhlig (2010)

\[
\varphi_t = \frac{\sum_{j=1}^{t} \Delta Y_j \left(1 + r_j \right)^{1-j}}{\sum_{j=1}^{t} \Delta G_j \left(1 + r_j \right)^{1-j}}
\]

Stimulus occurs in year 1.

Multiplier at time \( t \) is the discounted sum of output changes from year 1 to year \( t \) divided by discounted sum of stimulus spending from year 1 to \( t \).
The Model

- This model simulates the macroeconomic impact of fiscal stimulus on output, employment, interest rates and the real exchange rate for a two sector open economy producing tradables and non-tradables.

- It focuses on increased government consumption of non-tradable public sector goods and services.
The Model

• OLG
• two goods: T goods – relatively capital intensive; N goods – relatively labour intensive (Based on Obstfeld and Rogoff, 1996, Ch. 4)
• representative one person household of each generation
• representative firm
• single tax rate on all income
• agents know the future with certainty, except for the unanticipated fiscal stimulus
Firms

\[ X_{T,j} = A_T K_{T,j}^{\gamma_1} L_{T,j}^{1-\gamma_1} \quad X_{N,j} = A_N K_{N,j}^{\gamma_2} L_{N,j}^{1-\gamma_2} \]

set
\[
\begin{align*}
MPK_T &= r + \delta \quad \text{(firms take } r \text{ as given)} \\
\text{MPL}_T &= w \\
\text{e.MPL}_N &= w \quad \text{(e }= \text{ } \frac{P_N}{P_T} = \text{ real exch rate)} \\
\text{e.MPK}_N &= r + \delta
\end{align*}
\]

4 eq’s in 4 endogenous variables:
\[ w, e, (K/L)_T, (K/L)_N \]

Note: MPK and MPL are the marginal value added product of capital and labour respectively.
Households

One person households formed at age 15
Start work at age 15, retire at age 70 and die on their 85\textsuperscript{th} birthday with certainty
i.e. 70 overlapping generations of working households alive at any time.

Maximise:

\[ U = \sum_{i=1}^{h} \frac{M_i^{1-\beta}}{1-\beta} (1+\theta)^{1-i} \]

\[ M_i = \left[ \mu^{1/\psi} C_{T,i}^{(\psi-1)/\psi} + (1-\mu)^{1/\psi} C_{N,i}^{(\psi-1)/\psi} \right]^{\psi/(\psi-1)} \]

subject to lifetime budget constraint:

\[ \sum_{i=1}^{h} \left( C_{T,i,j} + e_j C_{N,i,j} \right) \left( \frac{1}{1+r_j (1-t_j)} \right)^{i-1} = \sum_{i=1}^{h} \left( w_{i,j} L_{i,j} (1-t_j) + G_{i,j}^T \right) \left( \frac{1}{1+r_j (1-t_j)} \right)^{i-1} \]
Households

Euler eq for intertemporal consumption path

\[ \frac{M_{i,j}}{M_{i-1,j-1}} = \left[ \frac{1 + r_j (1 - t_{y,j})}{1 + \theta} \left( \frac{P_{i-1,j-1}}{P_{i,j}} \right) \right]^{1/\beta} \]

\[ P_{i,j} = \left[ \mu + (1 - \mu) p_{i,j}^{1-\psi} \right]^{1/(1-\psi)} \]

\[ C_{i,j} = \mu \left( \frac{1}{P_{i,j}} \right)^{-\psi} M_{i,j} \]

\[ S_{i,j} = (1 - \mu) \left( \frac{p}{P} \right)_{i,j}^{-\psi} M_{i,j} \]

*P* is the price of a unit of the consumption index.

*p* is the relative price leisure.
Stimulus shock is an increase in government consumption expenditure on $N$ goods of 2% of GDP in each of 3 years.

Debt is then repaid gradually through a higher tax rate.

$$t_j = t_0 \left(1 + \varepsilon \left[ \left( \frac{D}{Y} \right)_j - \left( \frac{D}{Y} \right)_0 \right] \right)$$

The interest rate depends on government debt to GDP

$$r_j = \bar{r} + \lambda \left( \frac{D}{Y} \right)_{j-1}$$
Assume stimulus works in the short run.

The short run employment multiplier is assumed to be 0.5.

Our focus is on the medium to long run effects of stimulus.
Simulation Results

Figure 2. GDP. Impulse response

Short run: Partial crowding out of L & K in T sector.
2% increase in G, 1% increase in total L.

Medium-Long run:
• Stimulus withdrawn
• Higher interest rate reduces investment
• Higher tax rate reduces labour supply

Bigger drop in GDP when T goods capital intensive.
Why? Crowding out of L from T sector causes relatively large drop in investment & therefore future output.
Dynamic fiscal multiplier

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\varphi_t = \frac{\sum_{j=1}^{t} \Delta Y_j \left(1 + r_j \right)^{1-j}}{\sum_{j=1}^{t} \Delta G_j \left(1 + r_j \right)^{1-j}}
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# Sensitivity simulations

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Intergenerational Welfare

The unanticipated fiscal stimulus has differential effects on cohorts, through changes to their wage income, the tax rate and the interest rate.

When the stimulus shock arrives, individuals re-optimise, determining their optimal consumption of goods and leisure over the remainder of their lifetimes.

The effect on utility for the remainder of lifetime is compared with the counterfactual: the change in utility that would have occurred without the fiscal stimulus.
## Results for intergenerational welfare

**Table 2a. Utility**

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*A negative value denotes generations unborn at 2010. E.g. "-5" denotes the generation to be born in 2015*

The winners are the generations about to retire at the time of the stimulus, and the oldest of the retirees.

The losers are those about to start their working lives at the time the stimulus is introduced.
Results for intergenerational welfare

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* A negative value denotes generations unborn at 2010. E.g. "-5" denotes the generation to be born in 2015

The winners are the generations about to retire at the time of the stimulus, and the oldest of the retirees.

The losers are those about to start their working lives at the time the stimulus is introduced.
Conclusion

- Even assuming a positive short run fiscal multiplier, over the medium to longer term the fiscal multiplier can become negative due to the crowding out effect of higher interest rates and labour supply disincentives caused by higher tax rates.

- And there is an intergenerational transfer of utility from younger to older generations.