Keynesian Micromanagement by Ghassibe and Zanetti: discussion by Paweł Kopiec (NBP)

Q: What is the optimal response of fiscal policy to large and asymmetric shocks in a multi-sector economy?

Intro

Q: What is the optimal response of fiscal policy to large and asymmetric shocks in a multi-sector economy?

Keynesian Micromanagement by Ghassibe and Zanetti:

- Model:
    - search frictions
    - multiple sectors
- Results:
    - optimal fiscal policy
    - search frictions $\sim$ TFP changes

Optimal sector-specific spending in Ghassibe and Zanetti

- Government maximizes:

$$\max_{\{G_i\}_{i=1}^{N}} \mathcal{U}\left[D_1\left(C_1, G_1\right), ..., D_N\left(C_N, G_N\right)\right]$$

- Subject to:

$$\forall_{i\in\{1,\ldots,N\}}\ \left(1+\gamma_i\left(x_i\right)\right)\cdot\left(C_i+G_i+\sum_{j=1}^{N} Z_{ji}\right)=f_i\left(x_i\right)\cdot K_i$$

$$\sum_{i=1}^{N} L_i=\bar{L},\ M=\bar{M}, +\text{optimality conditions}$$

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My assumptions

- Competitive equilibrium (CE) given G
- Special case:
  - $\sigma = 1$ (log-log utility)
  - $\bar{L} = 1$ (unit mass of workers)
  - $N = 1$ (one sector)
  - $r = 1$ (fixprice equilibrium as in Michaillat and Saez [2015])
  - $\psi^h = 1$ (matching standardization)
  - $\theta = 1$ (Cobb-Douglas production function)
  - $\delta = 0$ (no taste for public goods)

CE given G

- Households:

$$\max_{C,\,M} \log C + \mu \cdot \log M$$

$$P \cdot (1 + \gamma(x)) \cdot C + M \leq W \cdot \bar{L} + \bar{M} + \Pi - T$$

- Firms:

$$\Pi = \max_{L,\,Z} \left\{ P \cdot f(x) \cdot L^{1-\alpha} \cdot Z^{\alpha} - W \cdot L - P \cdot (1 + \gamma(x)) \cdot Z \right\}$$

- Government:

$$P \cdot (1 + \gamma(x)) \cdot G = T$$

- Price-setting, wage-setting, market clearing - labor/numeraire:

$$P = \text{const.},\ x,\ W - \text{flexible},\ L = \bar{L},\ M = \bar{M}$$

- Market clearing - manufactured goods:

$$(1 + \gamma(x)) \cdot (C + G) = \underbrace{f(x) \cdot L^{1-\alpha} \cdot Z^{\alpha} - (1 + \gamma(x)) \cdot Z}_{\equiv Y}$$

CE given G: a characterization

CE under **optimal policy** $G = 0$:

$$\underbrace{\frac{\bar{M}}{\mu \cdot P}}_{=(1+\gamma(x))\cdot C} = \underbrace{\frac{f(x)^{\frac{1}{1-\alpha}}}{(1+\gamma(x))^{\frac{\alpha}{1-\alpha}}} \cdot \left(\alpha^{\frac{\alpha}{1-\alpha}} - \alpha^{\frac{1}{1-\alpha}}\right)}_{=Y(x)} \quad (1)$$

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Proposition. *$Y(x)$ is a single-peaked curve with $Y'\left(x^P\right) = 0$ where $x^P \equiv \left[\frac{\alpha\cdot\rho\cdot\eta}{1-\eta} + \rho\right]^{-\frac{1}{\eta}}$. If $G = 0$ (optimal policy) then:*

- *If $\frac{\bar{M}}{\mu\cdot P} > Y\left(x^P\right)$ then (1) has **no** solutions.*
- *If $\frac{\bar{M}}{\mu\cdot P} = Y\left(x^P\right)$ then (1) has **a unique** solution,*
- *If $\frac{\bar{M}}{\mu\cdot P} \in \left(0, Y\left(x^P\right)\right)$ then (1) has **two** solutions,*

CE given G: a characterization

CE under **optimal policy** $G = 0$:

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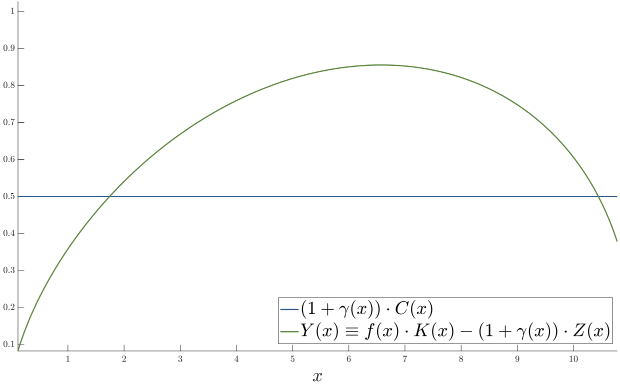
Proof: ▸ details

CE given G: graphical illustration when $\delta > 0$, $G = 0$



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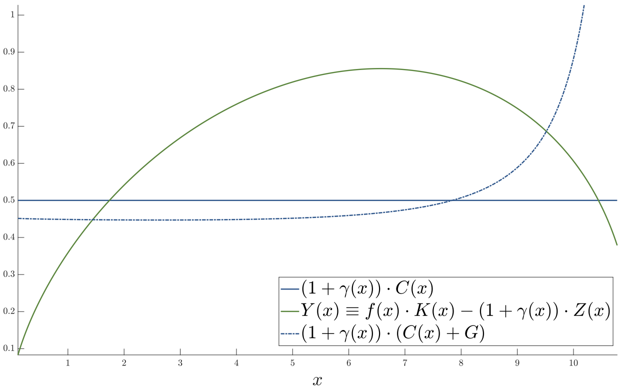

Three questions and three answers

- **Q1:** Can the government guarantee that the preferred equilibrium materializes?
- **A1:** Not really, after choosing G the economy may suffer from a coordination failure.

- **Q2:** Which of the two equilibria is preferred by the government?
- **A2:** The 'low x' CE is strictly preferred (at least in the neighborhood of $G = 0$).

- **Q3:** Are the stimulus effects in the 'low x' equilibrium realistic?
- **A3:** It may occur that $\delta > 0$ leads to $\frac{dY}{dG} < 0$...

More details on A1-A3: details

Related literature

- Networks in macro:
  - theoretical: Acemoglu et al. [2012], Taschereau-Dumouchel [2017], Baqaee [2018], Baqaee and Farhi [2019], Baqaee and Farhi [2020]
  - empirical: Cox et al. [2020], Ghassibe [2021], Barattieri et al. [2023]
- Frictional product market:
  - theory: Michaillat and Saez [2015]
  - TFP/demand: Storesletten et al. [2011]
- Optimal fiscal policy with:
  - search frictions: Michaillat and Saez [2019]
  - search frictions + **multiple sectors**: Ghassibe and Zanetti [2023]
  - search frictions + **default risk**: Kiiashko and Kopiec [2023]

Thank you for your attention!

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Let us first derive equation (1). To this end, notice that the household's first order condition is:

$$(1+\gamma(x))\cdot C=\frac{M}{P\cdot\mu}. \tag{2}$$

when $\delta=0$. Firm's optimality conditions are:

$$P\cdot f(x)\cdot(1-\alpha)\cdot L^{-\alpha}\cdot Z^{\alpha}=W \tag{3}$$

$$P\cdot f(x)\cdot\alpha\cdot L^{1-\alpha}\cdot Z^{\alpha-1}=P\cdot(1+\gamma(x)) \tag{4}$$

Analogously to Michaillat and Saez [2015], combining the market clearing for numeraire good with (2) yields:

$$(1+\gamma(x))\cdot C=\frac{\bar{M}}{P\cdot\mu}. \tag{5}$$

Proof ii

Combining (4) with the labor market clearing condition (i.e., $L = \bar{L} = 1$) gives:

$$Z = \left[\frac{\alpha \cdot f(x)}{1+\gamma(x)}\right]^{\frac{1}{1-\alpha}}. \qquad (6)$$

Now, plugging (5) and (6) into the consumption goods market clearing condition yields:

$$\frac{\bar{M}}{P \cdot \mu} + (1+\gamma(x)) \cdot G = f(x) \cdot \left[\frac{\alpha \cdot f(x)}{1+\gamma(x)}\right]^{\frac{\alpha}{1-\alpha}} - (1+\gamma(x)) \cdot \left[\frac{\alpha \cdot f(x)}{1+\gamma(x)}\right]^{\frac{1}{1-\alpha}}$$

which, after reformulation, gives:

$$\frac{\bar{M}}{\mu \cdot P} + G \cdot (1+\gamma(x)) = \frac{f(x)^{\frac{1}{1-\alpha}}}{(1+\gamma(x))^{\frac{\alpha}{1-\alpha}}} \cdot \left(\alpha^{\frac{\alpha}{1-\alpha}} - \alpha^{\frac{1}{1-\alpha}}\right) \qquad (7)$$

which is equation (1). Notice that x pins down the equilibrium value(s) of x, which can be then used for computing the remaining equilibrium objects (Z from (6) given x, W from (3) given Z and $L = \bar{L} = 1$, C from (5), etc.). Let us turn to the proof of the Proposition. Note that we consider a special case when $G = 0$ (as explained later, this corresponds to the optimal fiscal policy in the economy when $\delta = 0$). All this implies that (7) becomes:

$$\frac{\bar{M}}{\mu \cdot P} = \frac{f(x)^{\frac{1}{1-\alpha}}}{(1+\gamma(x))^{\frac{\alpha}{1-\alpha}}} \cdot \left(\alpha^{\frac{\alpha}{1-\alpha}} - \alpha^{\frac{1}{1-\alpha}}\right). \tag{8}$$

The LHS of (8) is a constant. The RHS of (8) is a function of x and is denoted by $Y(x)$. Let us investigate the monotonicity of $Y(x)$. To this, end, let us compute the derivative:

$$Y'(x) = \frac{d}{dx}\left(\frac{f(x)^{\frac{1}{1-\alpha}}}{(1+\gamma(x))^{\frac{\alpha}{1-\alpha}}} \cdot \left(\alpha^{\frac{\alpha}{1-\alpha}} - \alpha^{\frac{1}{1-\alpha}}\right)\right)$$

Proof iv

$$= \frac{\left(\alpha^{\frac{\alpha}{1-\alpha}} - \alpha^{\frac{1}{1-\alpha}}\right)}{\left((1+\gamma(x))^{\frac{\alpha}{1-\alpha}}\right)^2} \cdot \left(\frac{1}{1-\alpha} \cdot f(x)^{\frac{1}{1-\alpha}-1} \cdot f'(x) \cdot (1+\gamma(x))^{\frac{\alpha}{1-\alpha}}\right.$$

$$\left. - f(x)^{\frac{1}{1-\alpha}} \cdot \frac{\alpha}{1-\alpha} \cdot (1+\gamma(x))^{\frac{\alpha}{1-\alpha}-1} \cdot \gamma'(x)\right)$$

$$= \frac{\left(\alpha^{\frac{\alpha}{1-\alpha}} - \alpha^{\frac{1}{1-\alpha}}\right)}{\left((1+\gamma(x))^{\frac{\alpha}{1-\alpha}}\right)^2} \cdot \frac{f(x)^{\frac{1}{1-\alpha}} \cdot (1+\gamma(x))^{\frac{\alpha}{1-\alpha}}}{1-\alpha}$$

$$\cdot \left[\frac{f'(x)}{f(x)} - \alpha \cdot \frac{\gamma'(x)}{1+\gamma(x)}\right].$$

It is clear that the term outside the square bracket is positive because $\alpha \in (0,1)$, $f(x) > 0$, $\gamma(x) > 0$ (the last inequality follows, because as argued by Michaillat and Saez [2015], the equilibrium in the model is well-defined if $q(x) > \rho$, i.e., for $x \in (0, \bar{x})$ where

Proof v

$q(\bar{x}) = \rho$). All this implies that the sign of $Y'(x)$ is equal to the sign of the following term:

$$\frac{f'(x)}{f(x)} - \alpha \cdot \frac{\gamma'(x)}{1 + \gamma(x)}$$

$$= \frac{f'(x)}{f(x)} - \alpha \cdot \frac{\left(-\frac{\rho \cdot q'(x)}{(q(x)-\rho)^2}\right)}{1 + \frac{\rho}{q(x)-\rho}}$$

$$= \frac{f'(x)}{f(x)} + \alpha \cdot \rho \cdot \frac{q'(x)}{q(x) \cdot (q(x) - \rho)}$$

$$= \frac{(1-\eta) \cdot x^{-\eta}}{x^{1-\eta}} + \alpha \cdot \rho \cdot \frac{-\eta \cdot x^{-\eta-1}}{x^{-\eta} \cdot (x^{-\eta} - \rho)}$$

$$= \frac{1}{x} \cdot \left(1 - \eta - \frac{\alpha \cdot \rho \cdot \eta}{x^{-\eta} - \rho}\right)$$

Proof vi

given that $\frac{1}{x}$ is always strictly positive for $x \in (0, \bar{x})$, the sign of $Y'(x)$ is the same as the sign of:

$$1 - \eta - \frac{\alpha \cdot \rho \cdot \eta}{x^{-\eta} - \rho}. \tag{9}$$

Note that term (9) converges to a positive value of $1 - \eta$ as $x \to 0$ and it converges to $-\infty$ as $x \to \bar{x}$ (observe that $q(x) = x^{-\eta} \to \rho$ when $x \to \bar{x}$). Moreover, it is obvious that (9) is a strictly decreasing function of x for $x \in (0, \bar{x})$. All this implies that, (9) attains the level of zero only once and that $Y(x)$ achieves maximum at $x = x^P$ that satisfies:

$$1 - \eta - \frac{\alpha \cdot \rho \cdot \eta}{x^{-\eta} - \rho} = 0$$

$$\Leftrightarrow x = x^P = \left[\frac{\alpha \cdot \rho \cdot \eta}{1 - \eta} + \rho\right]^{-\frac{1}{\eta}}$$

and that $Y(x)$ is a single-peaked function. Now, given that the LHS of (8) is constant and that $Y(x)$ is single-peaked with the maximum equal to $Y\left(x^P\right)$, (8) has two solutions for $\frac{\bar{M}}{\mu \cdot P} \in \left(0, Y\left(x^P\right)\right)$, one solution for $\frac{\bar{M}}{\mu \cdot P} = Y\left(x^P\right)$ and no solutions for $\frac{\bar{M}}{\mu \cdot P} > Y\left(x^P\right)$. To see that $G = 0$ is indeed optimal (more precisely: it guarrantees that the best possible outcome is among the resulting equilibria), consider the only interesting case when $\frac{\bar{M}}{\mu \cdot P} \in \left(0, Y\left(x^P\right)\right)$ (notice that if $\frac{\bar{M}}{\mu \cdot P} \geq Y\left(x^P\right)$ then $G > 0$ implies that there are no equilibria because $1 + \gamma(x) > 0$). Suppose that, by contradiction, $G > 0$: this implies that curve $(1 + \gamma(x)) \cdot G$ is added to $\frac{\bar{M}}{\mu \cdot P}$ in condition (7) and both resulting equilibria (if G is not too large) feature higher x than the equilbrium characterized with 'low x' when $G = 0$ (it is useful to use the properties of Y to see this fact) which coupled with (2) implies lower consumption and lower welfare in those equilibria when $G > 0$.Q.E.D.

Proof viii

back

QA: details i

A1: The convention in the model is as follows: government sets G and then the market forces shape the ultimate outcome/allocation. The problem is that there can be (as argued in my discussion) two equally possible outcomes achieved by those forces (for a given value of G). The question is whether the government can fix things by making agents believe that the preferred equilibrium (e.g. the 'low x' one) is the one that will actually materialize. This certainly requires some additional assumptions on the government's impact on agents' expectations that would allow for avoiding the coordination failure.

A2: Note that, when $G = 0$, $Y(x)$ is equal in both equilibria. At the same time, the amount of resources spent on wasteful search activities is larger in the 'high x' equilibrium because $\gamma(x)$ is an increasing function. Therefore, the 'high x' equilibrium should not be preferred by the government because the total amount resources that can be spent on private consumption C and government spending G is strictly lower than in the 'low x' equilibrium.

QA: details ii

A3: The problem with $\frac{dY}{dG} < 0$ is that there is a broad consensus that fiscal multipliers are positive. $\frac{dY}{dG} < 0$ may occur when $\delta > 0$ because C and G may be regarded by households as substitutes and thus higher G makes them consume less C. Note also that when $\delta = 0$ the multipliers are always positive.

◂ back