An Exploration of Optimal Stabilization Policy

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Approach

Question: How should policy respond to low aggregate demand?

Simple, tractable model with maximizing households and firms
  - No bells or whistles
  - Two periods, allowing for sticky and flexible prices

Contributions:
  - Derive a "hierarchy" of policy responses
  - Compare "bang-for-the-buck" and welfare-based measures of efficacy
  - Reconcile two opposing intuitions: Keynesian and Classical
Households maximize lifetime utility:

$$\max \{ u(C_1) + v(G_1) + \beta (u(C_2) + v(G_2)) \} ,$$

subject to the lifetime budget constraint:

$$P_1 (\Pi_1 - T_1 - C_1) + \frac{P_2 (\Pi_2 - T_2 - C_2)}{(1 + i_1)} = 0,$$

so that bonds pay the interest rate $i_1$. 
Firms maximize profit

\[
\max_{K_2} \left\{ P_1 \Pi_1 + \frac{P_2 \Pi_2}{(1 + i_1)} \right\},
\]

where full depreciation implies:

\[
\Pi_t = Y_t - I_t = Y_t - K_{t+1}.
\]

Production is:

\[
F(A_t, K_t) = A_t K_t.
\]
Model: money and monetary policy

- Monetary policy consists of two instruments
  - Short-term nominal interest rate \( i_1 \)
  - Long-term money supply \( M_2 \)

- Money is required for consumption purchases

\[ M_t = P_t C_t \]

- Note that \( M_1 \) is set passively, based on demand
Model: fiscal policy

- Fiscal policy consists of three instruments
  - Government purchases $G_t$
  - Lump-sum tax revenue $T_t$
  - Investment subsidy $s$

- Useful to define

\[ g_t = \frac{G_t}{A_t K_t}. \]
Model: shock

- Negative shock lowers expected technology from $\hat{A}_2$ to $A_2$
- Shock to expected future technology = confidence
- In sticky price setting, $P_1$ is set before shock is realized
Flexible price equilibrium

- Two key optimality conditions:
  - Intertemporal Eulers for private and public consumption:
    \[ u'(C_1) = \beta A_2 u'(C_2), \]
    \[ v'(G_1) = \beta A_2 v'(G_2), \]
  - Intratemporal tradeoff between private and public consumption:
    \[ u'(C_t) = v'(G_t) \text{ for all } t. \]
Flexible price equilibrium

- Assume

\[
u(C) = \frac{C_t^{\frac{1}{1-\frac{1}{\sigma}}} - 1}{1 - \frac{1}{\sigma}}
\]

\[
v(G_t) = \theta^{\frac{1}{\sigma}} u(G_t)
\]

- We assume \( \sigma < 1 \) throughout.

- Directional changes relative to pre-shock equilibrium:

<table>
<thead>
<tr>
<th>Flexible prices</th>
<th>( C_1 )</th>
<th>( I_1 )</th>
<th>( G_1 )</th>
<th>( Y_1 )</th>
<th>( C_2 )</th>
<th>( G_2 )</th>
<th>( Y_2 )</th>
<th>( P_1 )</th>
<th>( P_2 )</th>
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</tbody>
</table>
First-period price level $P_1$ is fixed; $P_2$ is flexible.

All consumption, investment, output levels depend on ratio:

$$\frac{M_2}{(1 + i_1)P_1}$$

Summary of policy position of the central bank.

For example,

$$Y_1 = 1 + \left( \frac{1}{\beta A_2} \right)^\sigma A_2 (1 - g_2) \frac{M_2}{(1 + i_1)P_1} + G_1.$$
When conventional monetary policy is sufficient

- Conventional monetary policy \((i_1)\) restores the flexible-price equilibrium if:

\[
A_2 \geq A_2|_{conventional} = \left( \frac{1}{\beta \hat{A}_2} \right)^{\sigma} \hat{A}_2 - \hat{i}_1 \left( \frac{1}{\beta} \right)^{\sigma} (1 + \hat{i}_1) \left( \frac{1}{1 - \sigma} \right)
\]

- Note that larger shocks can be offset if start with higher \(\hat{i}_1\).

- Inflation falls because \(M_2\) is fixed and lower \(i_1\) raises potential output.
When unconventional monetary policy is required

- Unconventional monetary policy ($M_2$) is sufficient for all $A_2$
  - Set:
    \[
    \frac{M_2}{P_1} = \frac{1}{(1 + \theta) \left(1 + \left(\frac{1}{\beta A_2}\right)^\sigma A_2\right)} A_1 K_1.
    \]
  - Lower $A_2$ raises the optimal $M_2$, given $i_1$.

- May be difficult politically to commit to future monetary expansion.
When monetary policy is restricted

- Assume

\[ A_2 < A_2|_{\text{conventional}}, \ i_1 = 0, \text{ and } M_2 = \hat{M}_2. \]

- Implies first-period output:

\[
Y_1 = 1 + \left( \frac{1}{\beta A_2} \right)^\sigma A_2 (1 - g_2) \frac{\hat{M}_2}{(1 - g_2)} \frac{\hat{M}_2}{P_1} + G_1,
\]
When monetary policy is restricted: G and T

- Satisfy intertemporal Eulers on private and public consumption:
  \[ u'(C_1) = \beta A_2 u'(C_2), \]
  \[ v'(G_1) = \beta A_2 v'(G_2), \]

- Not intratemporal tradeoff between private and public consumption:
  \[ u'(C_t) > v'(G_t) \text{ for all } t. \]

- Intuitively, G puts idle resources to use, even if it is inefficiently high:
  \[ G_t^{\text{sticky}} > G_t^{\text{flex}} \text{ for all } t. \]
When monetary policy is restricted: Investment subsidy

- Add investment subsidy $s$, so cost of capital is $(1 - s)$
- Implies first-period output:

$$Y_1 = \frac{1 + \left( \frac{(1-s)}{\beta A_2} \right)^{\sigma} A_2 (1 - g_2) \hat{M}_2}{(1 - g_2) (1 - s) \frac{\hat{P}_1}{P_1}} + G_1,$$

- Let $\sigma \to 0$, so real interest rate does not affect consumption
  - Then, can restore flexible price equilibrium by setting

$$s = -i_1$$

the negative interest rate that would yield the flexible price equilibrium.
Alternative metrics to evaluate fiscal policy

Table 1: Alternative Metrics to Evaluate Fiscal Policies

<table>
<thead>
<tr>
<th>Measure</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>Flexible price eqm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Welfare</td>
<td>G₁</td>
<td>G₁, G₂</td>
<td>s</td>
<td>G₁, G₂, s</td>
<td></td>
</tr>
<tr>
<td>BFTB</td>
<td>1.0</td>
<td>1.2</td>
<td>1.1</td>
<td>0.6</td>
<td>na</td>
</tr>
</tbody>
</table>

(σ=0.5; θ=0.24; shock=25%)

- Robust across parameter choices:
  - Policy with largest BFTB never generates largest welfare gain.
  - Policy best for welfare is the worst according to the multiplier.
Extensions: Three periods and Government Investment

- Long-term interest rates provide a third monetary policy tool
- Government investment:

\[ Y_t = A_t \left( K^F_t + \kappa \left( K^G_t \right) \right), \]

- Under both flexible and sticky prices, the following holds:

\[ \kappa' \left( K^G_2 \right) = 1. \]

- Public investment does not displace public consumption as stimulus
- Intuitively, fully crowds out private investment by raising the real rate.
Extensions: Non-Ricardian Households

- Share $\lambda$ of consumption is chosen by rule-of-thumb:

$$C_t^R = \rho (Y_t - T_t),$$

- In flexible-price equilibrium, raise $T_1$ to suppress rule-of-thumb $C_1^R$
- In sticky-price equilibrium, output has "Keynesian" multipliers:

$$Y_1 = \frac{1}{1 - \lambda \rho} G_1 - \frac{\lambda \rho}{1 - \lambda \rho} T_1 + \psi \left( G_2, T_2, \frac{M_2}{(1 + i_2) P_1}, \lambda, \rho \right)$$

- Can do better than in Ricardian model:
  - Use taxes to stimulate $C_1^R$; rely less on $G$
  - If investment subsidy is available, can achieve flexible-price outcome.
Conclusion

- Hierarchy of policy responses to low aggregate demand
  1. If the ZLB is not binding, lower short-term nominal rates and set fiscal policy based on classical principles of cost-benefit analysis
  2. If the ZLB is binding, use unconventional monetary policy and set fiscal policy based on classical principles
  3. If monetary policy is constrained, use fiscal policy to spur investment, just as monetary policy would if it could
  4. If both monetary and fiscal tools are limited, put idle resources to use with government spending and lower taxes

- The commonly used “bang for the buck” metric of policy evaluation is a potentially misleading guide to welfare improvements

- If sufficient policy flexibility is available, calls for public consumption to move with private consumption in recessions are not without merit.