Fiscal Policy in an Unemployment Crisis

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September 3, 2014

The new-Keynesian view

1. $G_t \uparrow \Rightarrow P_t \uparrow$
2. Only a small fraction of firms can adjust prices, with a larger mass able to do so in the future (Calvo pricing)
3. $\Rightarrow P_{t+1} > P_t$.
4. Real interest rate $r_t \approx -\pi_t \downarrow$
5. Private spending $C_t \uparrow \Rightarrow Y_t \uparrow$

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1. Rinse and repeat

This paper

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2. Downward nominal wage rigidity:
3. $\Rightarrow W_t/P_t \downarrow$.
4. NPV profits $J_t \uparrow$
5. $u_t \downarrow$ and $u_{t+1} \downarrow$
6. Since $u_{t+1} \sim C_{t+1}$, consumption smoothing implies $C_t \uparrow \Rightarrow Y_t \uparrow$

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Differences

- Transmission mechanism
  - Spending out of lower real interest rate
  - Spending out of getting a job that lasts
- Predictions

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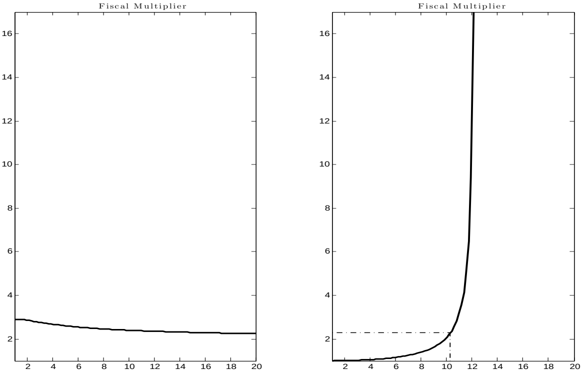


Differences

Empirical evidence

- Bachmann et al. (2014): Willingness to spend in response to an increase in inflation expectations
  - Statistically insignificant when not in a liquidity trap
  - Statistically significant but negative in a liquidity trap
- Dupor and Li (2014)
  - No link between a forecasters view of government spending and expected inflation
  - Inflation responds negatively to a rise in government spending

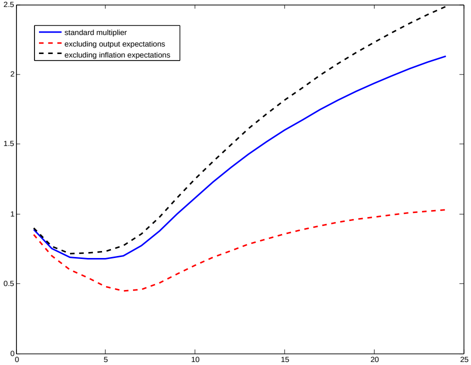
Differences

Empirical evidence

- Bachmann and Sims (2012)
  - Half of the rise in output of government spending due to a causal rise in "confidence"
- Monacelli et al. (2010)
  - Government spending increases employment, labor market tightness, and lowers unemployment
- Chodorow-Reich et al. (2012)
  - $100,000 ARRA spending generated 3.8 job-years

Differences

- Joint work with Saleem Bahaj (BoE)



A stylized model

- Starting point: Krugman (1998)

$$u'(c_t) = \beta(1 + i_{t+1})\frac{p_t}{p_{t+1}}u'(c_{t+1})$$

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- For some y^*, $y_{t+1} \leq y^* \Rightarrow i_{t+1} = 0$
- Krugman's (1998) results follow

A stylized model

- With CRRA preferences

$$y_t = \left(\frac{y_{t+1}}{y^*}\right)^{\frac{\gamma-1}{\gamma}}$$

and

$$\lim_{\gamma\to\infty} y_t = \frac{y_{t+1}}{y^*}$$

A stylized model

- Suppose that output is produced as $y_t = z_t n_t$, with $z_t = z_{ss} = 1$ and $n_{ss} = 1$
- Then for $z_{t+1} < z^*$ with $z^* = y^*$ the economy is in a liquidity trap with $n_t < 1$

A stylized model

- Suppose that output is produced as $y_t = z_t n_t$, with $z_t = z_{ss} = 1$ and $n_{ss} = 1$
- Then for $z_{t+1} < z^*$ with $z^* = y^*$ the economy is in a liquidity trap with $n_t < 1$
- Assume further that employment is frictional such that $n_{t+1} = n_t^{\alpha}$
- ($\alpha = 0$ collapses the model to that of Krugman (1998))

A stylized model

- Then for $z_{t+1} < z^*$ we have

$$u'(y_t - g_t) = \beta \frac{y_{t+1}}{m_{t+1}} u'(y_{t+1})$$

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- Then for $z_{t+1} < z^*$ we have

$$u'(y_t - g_t) = \beta \frac{z_{t+1} y_t^\alpha}{m_{t+1}} u'(z_{t+1} y_t^\alpha)$$

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$$\lim_{\gamma\to\infty} y_t = \left(\frac{z_{t+1}}{z^*}\right)^{\frac{1}{1-\alpha}}, \quad \lim_{\gamma\to\infty} y_t = \frac{z_{t+1}}{z^*}$$

A stylized model

- With CRRA preferences

$$\frac{\partial y_t}{\partial g_t} = \frac{1}{1-\alpha(1-\frac{1}{\gamma})} \in [1, \gamma]$$

- Thus

$$\lim_{\alpha \to 1} \frac{\partial y_t}{\partial g_t} = \gamma > 1$$

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$$\lim_{\alpha \to 1} \frac{\partial y_t}{\partial g_t} = \gamma > 1$$

- And one can show

$$\sum_{s=0}^{\infty} \frac{\partial y_{t+s}}{\partial g_t} \geq \frac{1}{1-\alpha} \frac{\partial y_t}{\partial g_t}$$

Model

The model largely follows the previous framework but with equilibrium unemployment and endogenous α

- Continuum of households of measure one
- Continuum of potential firms
- A government

Model

- Two physical commodities
  - Cash, m_t, storable but not edible (numeraire)
  - Output, y_t, edible but not storable (trade at p_t)
- Cash in fixed supply $m_t = m$
- Time is discrete, $t = 0, 1, 2 \ldots$, and the horizon infinite
- Investments, but no capital

Model: Households

- Households search for jobs inelastically
- Employment denoted n_t, so $u_t = 1 - n_t$
- Nominal wage-rate is denoted $\tilde{w}_t$
- Total income, w_t, is labor income, $n_t \times \tilde{w}_t$, and dividends $q_t^t \times \tilde{d}_t$
- q_t^t is the quantity of asset held in time t (subscript) purchased in time t (superscript)

Model: Households

- Only a fraction of the firms survive from one period to the next: $q^t_{t+1} = (1-\lambda)q^t_t$
- Interpretation: q^t_t is a diversified asset portfolio of which λ firms go belly-up each period
- Will use a Lucas (1982;1984) Cash-in-Advance timing
  - w_t paid out by the end of the period t
  - Thus, w_t is disposable first in period $t+1$
  - Need cash to go out shopping

Model: Households

- Period budget constraint

$$b_t(1+i_t) + p_t J_t(q_t^{t-1} - q_t^t) + (M_{t-1} - p_{t-1}c_{t-1}) \\ + w_{t-1} - T_t = M_t + b_{t+1}$$

- With CIA constraint

$$p_t c_t \leq M_t$$

- For simplicity, define $x_{t+1} = M_t - p_t c_t$ (excess cash)

Model: Households

- Period budget constraint

$$b_t(1+i_t) + p_t J_t(q_t^{t-1} - q_t^t) + x_t + w_{t-1} - T_t = M_t + b_{t+1}$$

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- With CIA constraint

$$0 \leq x_{t+1}$$

- For simplicity, define $x_{t+1} = M_t - p_t c_t$ (excess cash)

Model: Households

- Problem: Given prices and taxes pick feasible $\{c_t, b_{t+1}, q_t^t, x_{t+1}\}$ to maximize

$$U(\{c_t\}_{t=0}^{\infty}) = E\sum_{t=0}^{\infty}\beta^t u(c_t)$$

- E denotes the (mathematical) expectations over future processes

Model: Households

- Three first order conditions

$$u'(c_t) = \beta(1 + i_{t+1})E_t\left[\frac{p_t}{p_{t+1}}u'(c_{t+1})\right]$$

$$u'(c_t) = \beta E_t\left[\frac{p_t}{p_{t+1}}u'(c_{t+1})\right] + \mu_t$$

$$J_t = \beta E_t\left[\frac{u'(c_{t+1})}{u'(c_t)}\left(\frac{p_t z_t - \tilde{w}_t}{p_{t+1}} + (1-\delta)J_{t+1}\right)\right]$$

- With $x_{t+1} \geq 0$, $\mu_t \geq 0$, and $x_{t+1} \times \mu_t = 0$

Model: Households

- So really only two

$$u'(c_t) = \beta(1 + i_{t+1})E_t\left[\frac{p_t}{p_{t+1}}u'(c_{t+1})\right]$$
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- With $x_{t+1} \geq 0$, $i_{t+1} \geq 0$, and $x_{t+1} \times i_{t+1} = 0$

Model

- The asset values of an employed agent and unemployed agent are

$$V_t = \beta E_t \left[\frac{u'(c_{t+1})}{u'(c_t)} \left(\frac{\tilde{w}_t}{p_{t+1}} + (1 - \delta(1 - f_{t+1}))V_{t+1} \right.\right.$$
$$\left.\left. + \delta(1 - f_{t+1})U_{t+1} \right) \right]$$
$$U_t = \beta E_t \left[\frac{u'(c_{t+1})}{u'(c_t)} \left(\frac{b}{p_{t+1}} + f_{t+1}V_{t+1} + (1 - f_{t+1})U_{t+1} \right) \right]$$

Model

- Nash bargaining

$$\tilde{w}_t = \text{argmax}\{J_t^{1-\omega}(V_t - U_t)^{1-\omega}\}$$

- Law of motion for employment

$$n_t = (1 - n_{t-1} + \delta n_{t-1}) f(\theta_t) + (1 - \delta) n_{t-1}$$

- Free entry ("equity supply")

$$\kappa = h(\theta_t) J_t$$

Model

Given a fiscal plan $\{d_t, g_t, T_t\}$, an equilibrium is a process of prices $\{w_t, p_t, i_{t+1}, J_t\}$ and allocations $\{c_t, q_t, x_t, y_t, n_t, \theta_t\}$ such that

1. The above equations are satisfied
2. Bond market clears; $b_t = d_t$
3. Equity market clears; $q_t = n_t$
4. Goods market clears; $y_t = z_t n_t = c_t + g_t + I_t$, with $I_t = \kappa v_t$

Walras law implies money market clearing $m\hat{v}_t = p_t y_t$, with $\hat{v}_t = \frac{m - x_{t+1}}{m}$

Experiment

- The economy is in its steady state in period t
- Unexpectedly agents receive news that labor productivity will fall by 5% in $t+1$ with probability q
- With the complementary probability nothing happens to labor productivity in $t+1$, but with probability q labor productivity falls by 5% in $t+2$, and so on.
- $\Rightarrow$ liquidity trap with expected duration $1/q$

Experiment

- Nominal wages are assumed to be downwardly rigid *throughout* the duration of the shock, but not thereafter
- I will analyze the effect of the economy
- and analyze the effect of an increase in government spending:
  - A one-shot burst in spending
  - vs. a committed rise in spending lasting throughout the duration of the shock

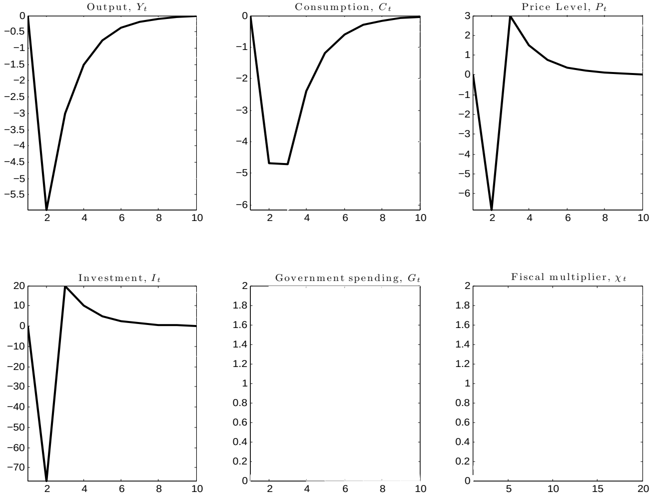
Calibration

Table 1: Calibrated parameters

Parameter	Interpretation	Value	Source/steady state target
γ	Inverse of EIS	2	Convention
β	Discount factor	0.993	Annual real interest rate of 3%
φ	Efficiency of matching	0.615	Unemployment rate of 6%
δ	Separation rate	0.136	Literature/JOLTS
ω	Workers bargaining power	0.7	Steady state profit margin of 3.3%
η	Elasticity of $f(\theta)$	0.765	Hall (2005)
κ	Vacancy posting cost	0.19	Steady state θ normalized to one
$\tilde{b}$	Unemployment benefits	0.5	Chetty (2008)
$\bar{g}$	Steady state fiscal spending	0.188	20% of GDP

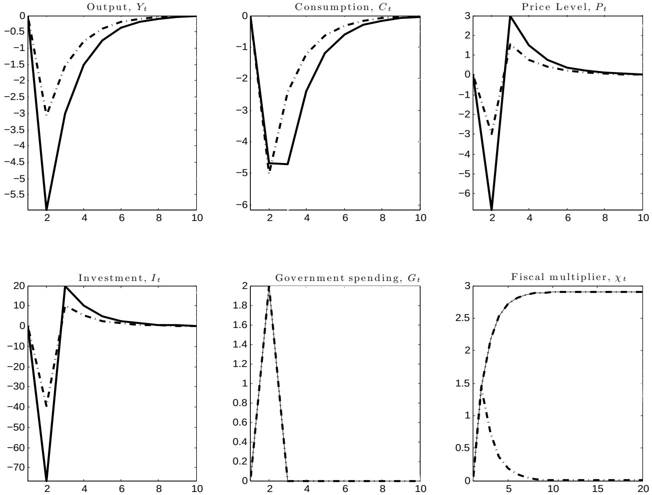
Notes. This table lists the parameter values of the model. The calculations and targets are described in the main text. One period in the model corresponds to one quarter.

Results, $q = 1$



Output, Y_t
Consumption, C_t
Price Level, P_t
Investment, I_t
Government spending, G_t
Fiscal multiplier, χ_t

RESULTS, $q = 1$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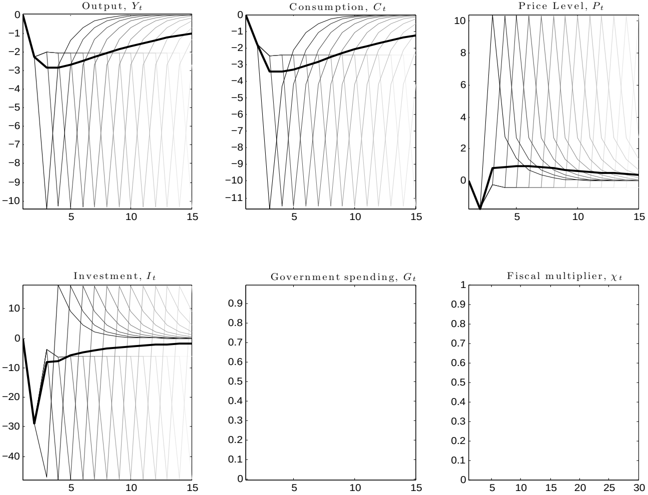
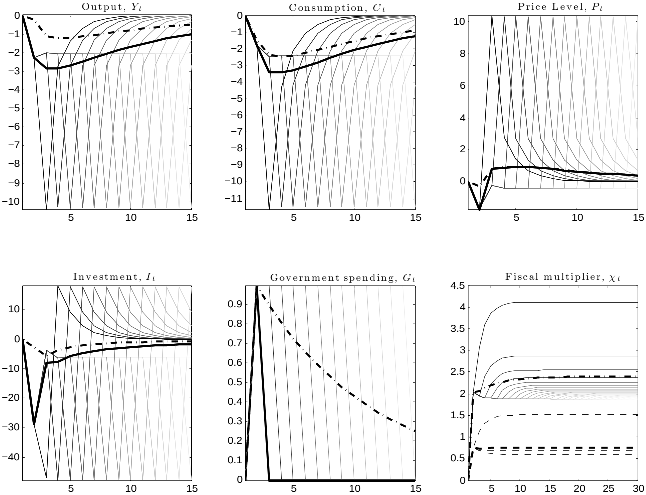
Results, $q = 0.1$



Output, Y_t
0
−1
−2
−3
−4
−5
−6
−7
−8
−9
−10
5
10
15
Consumption, C_t
0
−1
−2
−3
−4
−5
−6
−7
−8
−9
−10
−11
5
10
15
Price Level, P_t
10
8
6
4
2
0
5
10
15
Investment, I_t
10
0
−10
−20
−30
−40
5
10
15
Government spending, G_t
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
5
10
15
Fiscal multiplier, χ_t
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
5
10
15
20
25
30

Results, $q = 0.1$

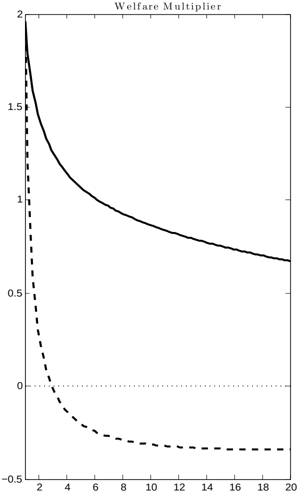

Output, Y_t
Consumption, C_t
Price Level, P_t
Investment, I_t
Government spending, G_t
Fiscal multiplier, χ_t

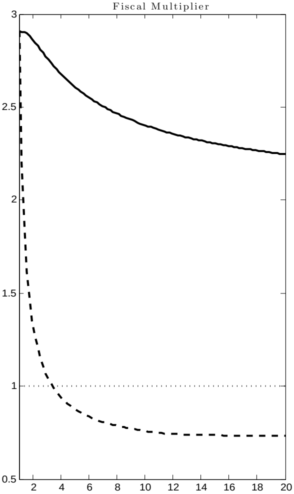
Welfare

- Let $c(g)$ denote a constant level of consumption which would render an agent indifferent between experiencing a liquidity trap with policy g, or consuming $c(g)$ for perpetuity.
- I will then define welfare as

$$W = \frac{\partial c(g)}{\partial g} \frac{1}{1-\beta}$$

Welfare


Welfare Multiplier
2
1.5
1
0.5
0
−0.5
2
4
6
8
10
12
14
16
18
20


Fiscal Multiplier
3
2.5
2
1.5
1
0.5
2
4
6
8
10
12
14
16
18
20

Conclusions

- In a liquidity trap with downwardly nominal wages and persistent unemployment the fiscal multiplier can be large
- The associated welfare effects are often positive and non-negligible
- Fiscal policy is not efficacious, however, because the government pays out income to workers (hole-digging policy not viable)
- But because the government create jobs that lasts
  - Government spending should therefore focus on goods and services that would be provided in the economy had the crisis not interfered with the macroeconomic equilibrium