Monetary Policy and Job Creation

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Replacement hires vs. new positions

- Elsby, Michaels & Ratner (2020) present evidence that the majority of hires are ‘replacement hires’
  - See also Mercan & Schoefer (2020), Acharya & Wee (2018)

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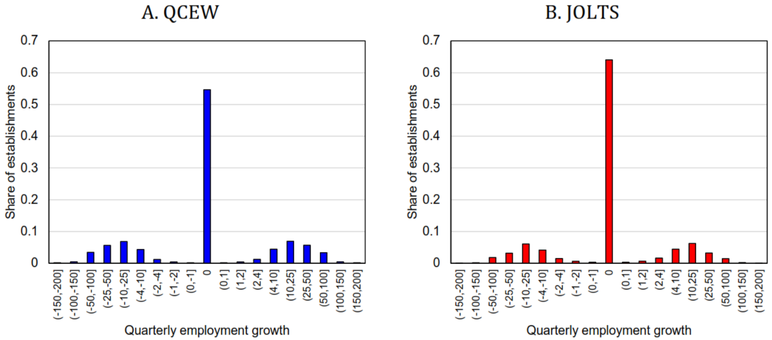

Figure from Elsby, Michaels & Ratner (2020)

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  - See also Mercan & Schoefer (2020), Acharya & Wee (2018)
- Firms keep the same number of positions for years
- They argue that creating new positions is very costly while replacement hires are much less so
- They show how this leads to *vacancy chains* – see also
  - Aggregate/firm hiring closely tracks quits: quits $\longrightarrow$ vacancies $\longrightarrow$ quits
  - Can amplify the business cycle
  - Can explain persistence of unemployment

Costs of job creation

- Creating a new team or venture is costly in more ways than investment in physical capital
  - Designing the team structure, embedding into existing work and information flows, training managers, relationship building, creating culture, creating systems and documentation, time taken to get the team up and running and productive.
  - Lots of research shows it takes an extended time for new employees to become fully productive
    - Time is shortened through relationships and relational networks (see e.g. Cross, Opie, Pryor & Rollag 2018, Lynch & Buckner-Hayden 2010)
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- Some anecdotal numbers:
  - https://blogs.worldbank.org/jobs/how-much-does-it-cost-create-job: replacement hires \$500-\$3000/job. New positions \$20,000/job
  - https://www.crimsoncup.com/coffee/how-much-does-it-cost-to-open-a-coffee-shop: opening a new Crimson Cup coffee shop costs approx \$25,000/worker.

This paper

- Study linkages between monetary policy and the labour market with costly job creation
  - To do: I plan to examine the implications under long-run uncertainty
- For now, I study the properties of a New Keynesian economy with search-match labour frictions and job creation costs
  - I find that macro conditions and policy affect unemployment rate and productivity
  - Conditions that foster reallocation of workers to most productive firms can raise unemployment
  - Small job creation costs can be beneficial by lowering unemployment via a ‘labour-hoarding’ effect
    - Although productivity does suffer
  - Reducing trend inflation can raise productivity and employment

Model environment

The starting point is a standard NK model with search-match labour market frictions

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Main (standard) ingredients:

- Sticky prices in retail sector (Calvo)
- Search-and-matching labour market frictions
- Households either work *or* don't work (no intensive margin/choice of hours)
- Full participation, no on-the-job search

Additional ingredients:

- Firm employment capacity, and costly expansion
- Firm productivity shocks

Firm worker capacity

We differentiate between existing positions (and replacement hires) and new positions

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To do so, I follow Elsby, Michaels & Ratner (2020):

- Wholesale sector use a *putty-clay* technology
- Firm i has an employment capacity $K_t(i) \geq N_t(i)$

$$Y_t^W(i) = Z_t(i) \left(\frac{N_t(i)}{K_t(i)} \right)^{\gamma} \left[K_t(i) \right]^{\alpha} \quad \gamma > \alpha \tag{1}$$

- Production is less efficient when operating below capacity (when $N_t(i) < K_t(i)$)
  - α is the curvature of production at full capacity
  - γ is the marginal loss of operating below capacity
- If workforce $N_t(i)$ is below capacity, the firm can replace workers at relatively low cost
- ... but it is costly to expand capacity

Creating jobs

I assume there are convex expansion costs:

$$C_{K,t}(i) = \begin{cases} 0 & \text{if } K_t(i) \leq (1-x)K_{t-1}(i) \\ c_K\left(\frac{K_t(i)}{(1-x)K_{t-1}(i)} - 1\right)K_t(i) & \text{if } K_t(i) > (1-x)K_{t-1}(i) \end{cases} \tag{2}$$

This simple form kills scale effects in the cost function (useful for tractability)

This assumes a constant decay of capacity x.

- This will be equal to an exogenous separation rate
- Every period, a proportion x of employees leave and their position is destroyed
- This helps match separation rates

Further assumptions

Assumptions

- Firms face iid productivity shocks
- Assume constant-returns-to-scale, i.e., $\alpha = 1$ (for tractability)
- Assume exogenous worker separation *and* capacity decay (same rate x)
- Assume capacity decays further when unused (at rate δ)

Model details 1/2

Households

$$\max_{C_t, B_t, N_t} \mathbb{E}_0 \left[\sum_{t=0}^{\infty} \beta^t u_t (C_t) \right] \tag{3}$$

$$\text{s.t.} \qquad P_t C_t + B_t \leq W_t N_t + (1 - N_t) D_t + (1 + i_{t-1}) B_{t-1} + \text{profits} \tag{4}$$

- Complete markets (pool risk)
- No endogenous participation
- W_t is an average wage rate, D_t home production
- Employment s.t. search frictions

Model details 2/2

Wholesale firms

- Employ labour (s.t. to capacity costs + labour search costs), use production function shown above
- produce homogenous good sold at nominal price P_t^W
- Subject to productivity risk, $Z_t(i) \sim$ some known distribution w/ PDF $f(Z)$

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Retail firms

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Monetary policy

- Assume Taylor rule:

$$i_t = \bar{i} + \phi(\pi_t - \pi^*) + m_t \tag{5}$$

- m_t is a monetary policy shock (follows AR(1))

Shocks

Today we will consider the following exogenous disturbances:

- Monetary policy shock
- Shock to average productivity Z_t
- (Mean preserving) productivity risk shock $\sigma_{Z,t}$

Wholesale goods firms 1/2

Taking bargaining problem separately, firms choose vacancy posting and capacity to solve

$$
\begin{aligned}
&\mathcal{W}_t\left(N_{t-1}(i), K_{t-1}(i); Z_t(i)\right) && (6)\\
&= \max_{\tilde{K}_t(i), N_t(i), v_t(i)} \left\{ \begin{array}{c} MC_t Z_t(i) N_t(i)^{\gamma} \tilde{K}_t(i)^{1-\gamma} - \kappa v_t(i) - W_t(i) N_t(i) \\ -C_{K,t}(i) + \mathbb{E}_t\left[\Lambda_{t,t+1} \int f(Z) \mathcal{W}_{t+1}\left(N_t(i), K_t(i); Z_{t+1}(i)\right) \mathrm{d}Z\right] \end{array} \right\} && (7)\\
\text{s.t.}\quad & v_t(i) \geq 0 && (8)\\
& N_t(i) \geq 0 && (9)\\
& N_t(i) \leq \tilde{K}_t(i) && (10)\\
& N_t(i) \leq (1-x) N_{t-1}(i) + v_t(i) q\left(\theta_t\right) && (11)\\
& C_{K,t}(i) = \begin{cases} 0 & \text{if } K_t(i) \leq (1-x) K_{t-1}(i) \\ c_K \left(\frac{K_t(i)}{(1-x) K_{t-1}(i)} - 1 \right) K_t(i) & \text{if } K_t(i) > (1-x) K_{t-1}(i) \end{cases} && (12)\\
& K_t(i) = \tilde{K}_t(i) - \delta\left[\tilde{K}_t(i) - N_t(i)\right] && (13)
\end{aligned}
$$

Wholesale goods firms 2/2

Firms will end up being one of:

1. **Inactive** as unprofitable (least productive) - keep capacity but lay-off all workers
2. **Active but maintain** level of employment
3. **Active and expand** capacity (most productive)

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Because of constant-returns to scale technology, linear-in-size expansion costs, and iid shocks:

- Problem is scale invariant – firms with the same productivity will make same decisions
- Expected future marginal values depend only on whether firm is active or not
- Wage rates will end up being linear in productivity

$$w_t(i) = \omega_{0,t} + \omega_{1,t} Z(i) \tag{14}$$

- Job creation rate will end up being linear in productivity

$$1 + g_t(i) \equiv \frac{K_t(i)}{(1-x)K_{t-1}(i)} = g_{0,t} + g_{1,t} Z(i) \tag{15}$$

Productivity thresholds

Firm i will expand if (whether the firm was previously active or inactive):

$$Z_t(i) \geq \bar{\bar{Z}}_t \equiv \left(\omega_{0,t} + c_K + \frac{\kappa}{q\left(\theta_t\right)} - \mathbb{E}_t\left[\Lambda_{t,t+1}\int f(Z)\mathcal{W}'_{t+1}\left(K_t(i);Z_{t+1}(i)\right)\mathrm{d}Z\right]\right)\frac{1}{MC_t - \omega_{1,t}} \quad (16)$$

An active firm i will lay off workers if:

$$Z_t(i) \leq \underline{Z}_t \equiv \left(\omega_{0,t} - \mathbb{E}_t\left[\Lambda_{t,t+1}\int f(Z)\mathcal{W}'_{t+1}\left(K_t(i);Z_{t+1}(i)\right)\mathrm{d}Z\right]\right)\frac{1}{MC_t - \omega_{1,t}} \quad (17)$$

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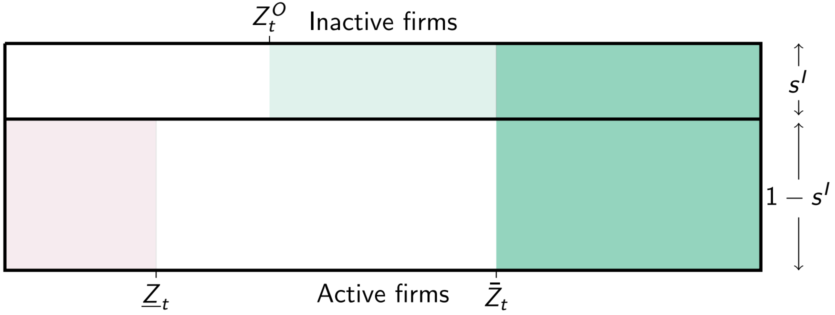
Note: The threshold Z for an inactive firm to reopen is **higher** than that for an active firm to close

Firm types and efficiency



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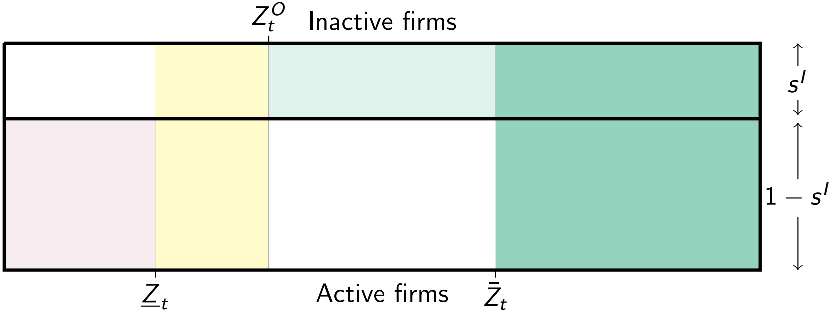

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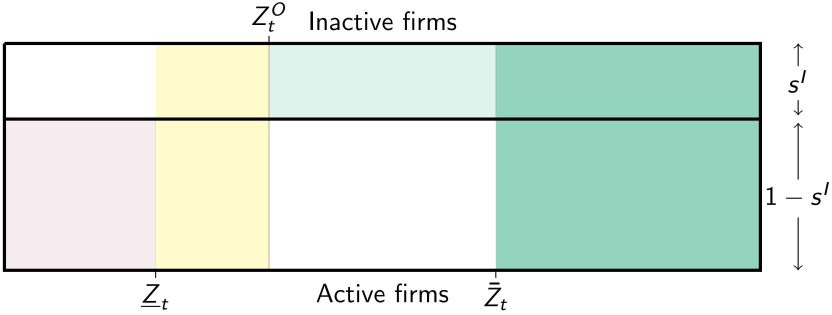

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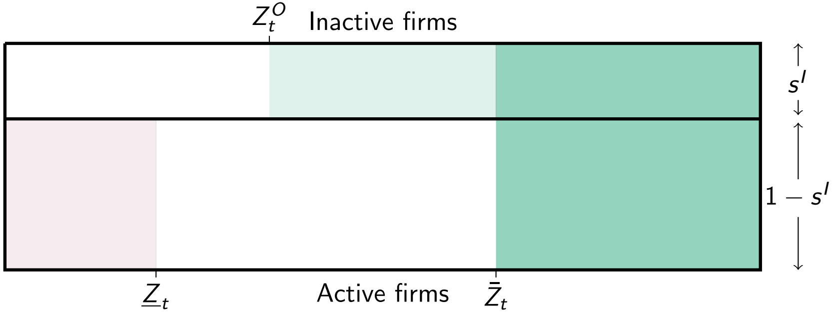

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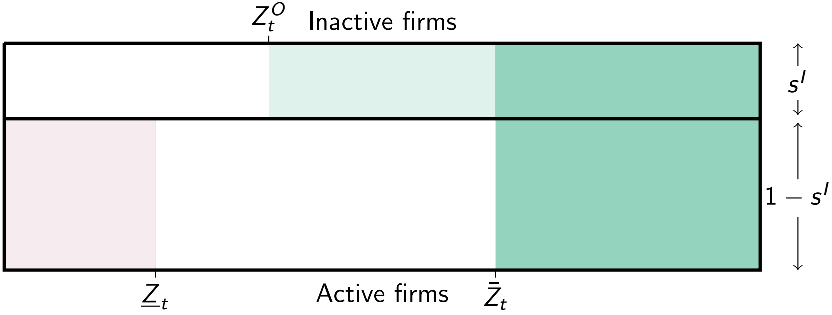


- There is a region of 'inertia': inactive (active) firms stay inactive (active)
- The size of this region depends on labour market tightness, it shrinks when it is easier to fill a position
- Overall efficiency depends on the threshholds and labour market conditions
- A trade-off emerges: shocks/policy can cause unemployment *and* productivity to both rise/fall

Bargaining outcomes

Bargaining with worker bargaining power b leads to : **firm surplus** $= (1-b)$ **total surplus**

This leads to wage terms (recalling $w_t(i) = \omega_{0,t} + \omega_{1,t} Z_t(i)$):

$$\omega_{0,t} \equiv b(1-x)\mathbb{E}_t\left[\Lambda_{t,t+1}\left(\mathcal{W}^K_{t+1} - (1-\delta)\,\mathcal{V}^K_{t+1}\right)\right] + (1-b)\left(\underline{w}_t - (1-x)\mathbb{E}_t\left[\Lambda_{t,t+1}\mathcal{S}^W_{t+1}\right]\right) \tag{19}$$

$$\omega_{1,t} \equiv bMC_t \tag{20}$$

where

$$\mathcal{W}^K_{t+1} \equiv \int_Z f(Z)\mathcal{W}'_{t+1}\left(K_t(i);Z\right)\mathrm{d}Z \qquad \text{(future marginal value of \textit{filled} capacity)}$$

$$\mathcal{V}^K_{t+1} \equiv \int_Z f(Z)\mathcal{V}'_{t+1}\left(K_t(i);Z\right)\mathrm{d}Z \qquad \text{(future marginal value of \textit{unfilled} capacity)}$$

$$\underline{w}_t \equiv \frac{D_t}{P_t} + \mathbb{E}_t\left[\Lambda_{t,t+1}p_{t+1}S^{W,E}_{t+1}\right] \qquad \text{(home production + future new match value)}$$

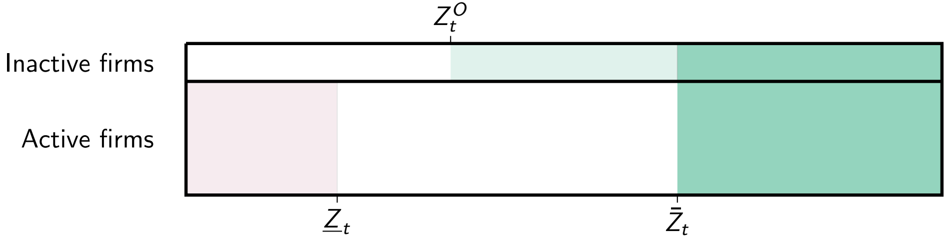
and where $\mathcal{S}^W_{t+1}$ is the $t+1$ worker surplus from still being employed at the firm

Job creation rule

Evaluating the vacancy decisions for all firms leads to a capacity growth rule:

$$\frac{K_t(i)}{(1-x)K_{t-1}(i)} - 1 \equiv g_t(Z) = \begin{cases} \frac{MC_t\,(1-b)}{2c_K}\left(Z - \bar{Z}_t\right) & \text{if } Z > \bar{Z}_t \\ 0 & \text{otherwise} \end{cases} \tag{21}$$

Some initial results



- $\bar{Z}_t \equiv \left(\omega_{0,t} + c_K + \frac{\kappa}{q(\theta_t)} - \mathbb{E}_t\left[\Lambda_{t,t+1}\mathcal{W}^K_{t+1}\right]\right)\frac{1}{MC_t(1-b)}$
- $\underline{Z}_t \equiv \left(\omega_{0,t} - \mathbb{E}_t\left[\Lambda_{t,t+1}\mathcal{W}^K_{t+1}\right]\right)\frac{1}{MC_t(1-b)}$
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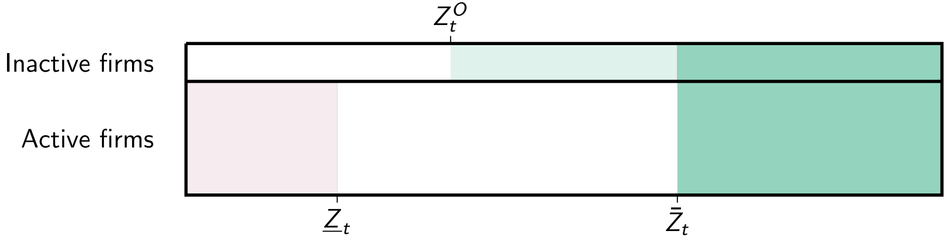

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Higher expansion costs: $c_K \uparrow$

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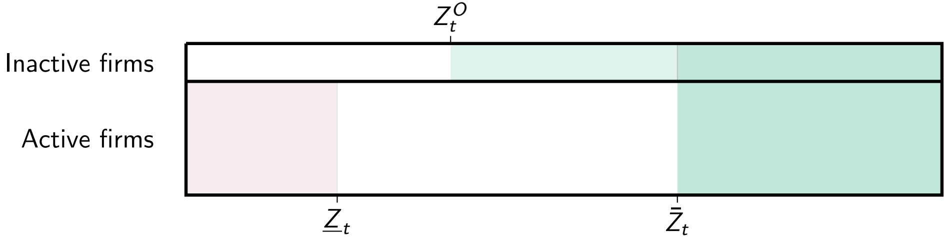

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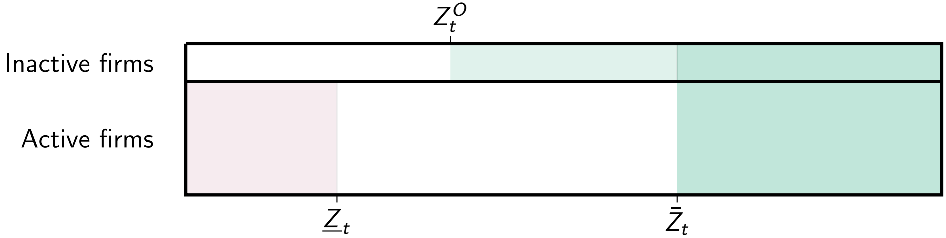

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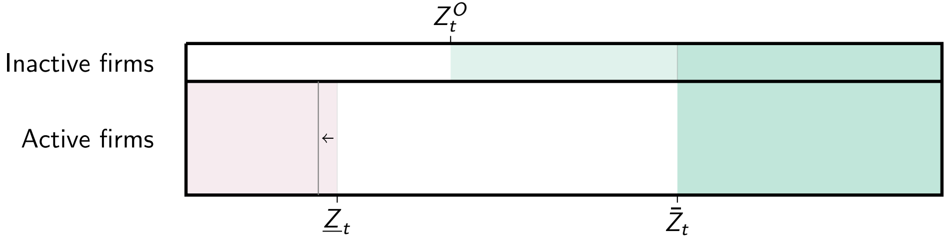

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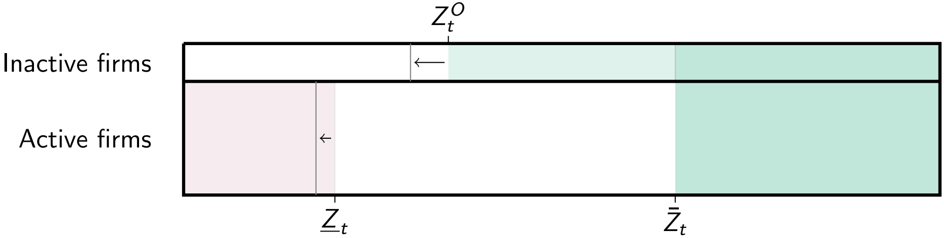

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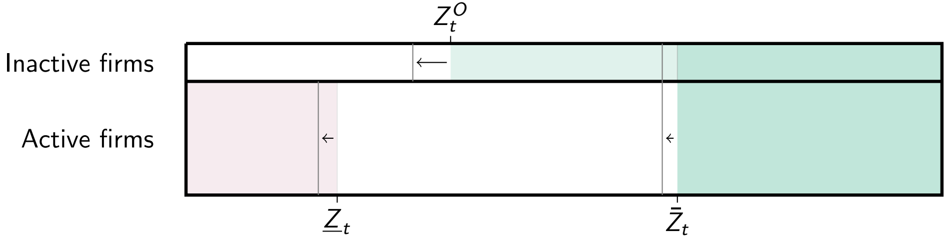
$\theta \downarrow \Rightarrow q(\theta_t) \uparrow$

$Z_t^O \downarrow$

$\bar{Z}_t, p^G \uparrow\downarrow ?$

Some initial results



- $\bar{Z}_t \equiv \left(\omega_{0,t}\downarrow + c_K\uparrow + \frac{\kappa}{q(\theta_t)\uparrow} - \mathbb{E}_t\left[\Lambda_{t,t+1}\mathcal{W}^K_{t+1}\uparrow\right]\right)\frac{1}{MC_t(1-b)}$
- $\underline{Z}_t\downarrow \equiv \left(\omega_{0,t}\downarrow - \mathbb{E}_t\left[\Lambda_{t,t+1}\mathcal{W}^K_{t+1}\uparrow\right]\right)\frac{1}{MC_t(1-b)}$
- $Z_t^O\downarrow \equiv \left(\omega_{0,t}\downarrow + \frac{\kappa}{q(\theta_t)\uparrow} - \mathbb{E}_t\left[\Lambda_{t,t+1}\mathcal{W}^K_{t+1}\uparrow\right]\right)\frac{1}{MC_t(1-b)}$
- $g_t(Z)\downarrow = \frac{MC_t(1-b)}{2c_K\uparrow}\left(Z - \bar{Z}_t\right)$ for $Z > \bar{Z}_t$

Higher expansion costs: $c_K\uparrow$

$g_t(Z)\downarrow \Rightarrow$ fewer vacancies

$v\downarrow \Rightarrow \theta\downarrow \Rightarrow \omega_{0,t}\downarrow$

$\underline{Z}_t, \rho_t\downarrow$

$\theta\downarrow \Rightarrow q(\theta_t)\uparrow$

$Z_t^O\downarrow$

$\bar{Z}_t, p^G\uparrow\downarrow?$

Increasing expansion costs: two main channels

1. Intensive margin:
   - most productive firms grow by less so hire fewer new workers
   - least productive firms less likely to close / more likely to enter

   Productivity falls

Increasing expansion costs: two main channels

1. Intensive margin:
   - most productive firms grow by less so hire fewer new workers
   - least productive firms less likely to close / more likely to enter

   Productivity falls

2. Extensive margin:
   - While vacancies fall, separation rates can also fall

   Unemployment (can) fall

What happens to output? It can rise or fall

Increasing firm risk: two main channels

We have a similar feature as we increase firm risk

- The firm growth rule does not change
- The growth threshold is higher and fewer firms expand (high-wage vacancies down)
- Firms are more likely to close and less likely to enter
- Average productivity rises
- But vacancies down and unemployment up

What happens to output? It can rise or fall

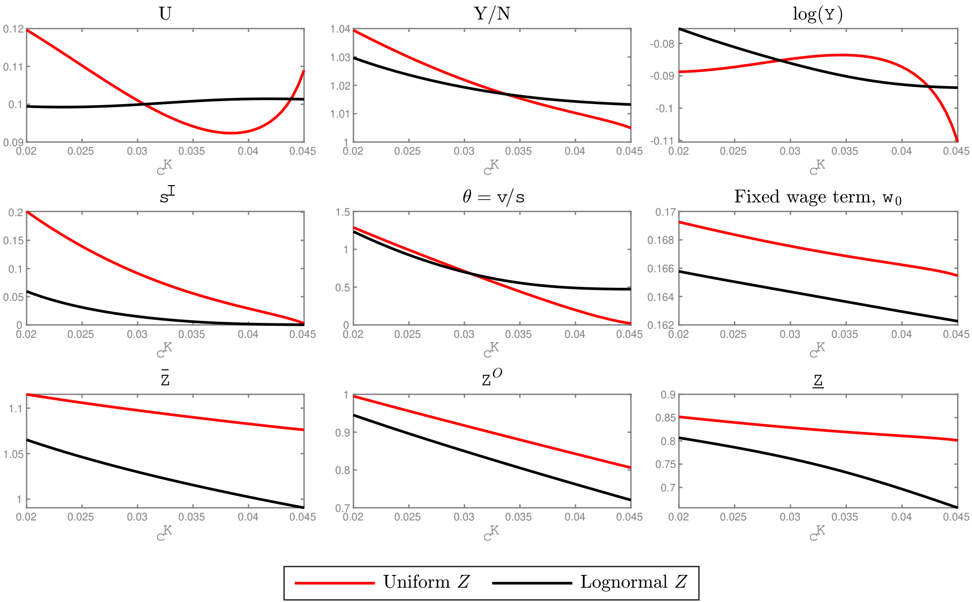
Parameters

We follow Ravenna & Walsh (2008) for the standard parameters

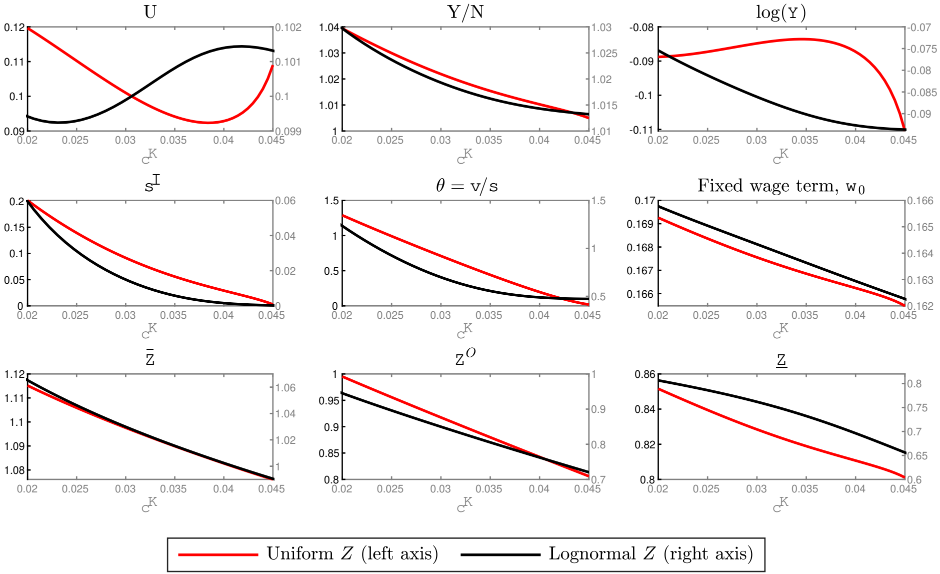
Parameter	Detail	Value	Target
β	Discount factor	0.99	4% annual real interest rate
σ	Risk aversion	2	
ε	Elasticity of subs final goods	6	Mark-up $=$ 20%
ω	Calvo parameter	0.75	1 price change per year on average
ϕ	Taylor rule weight on π	4	
b	Worker bargaining power	0.6	
q	Vacancy filling rate	0.7	
N	Employment rate	0.9	
π^*	Inflation target 0.005	2% annual rate	
x	Exogenous separation	?	Target separation rate $\rho = 10\%$

We try uniform and lognormal firm shocks and play around with $c_K = 3\%$, $\kappa = 1\%$, firm risk, $\delta = 1\%$

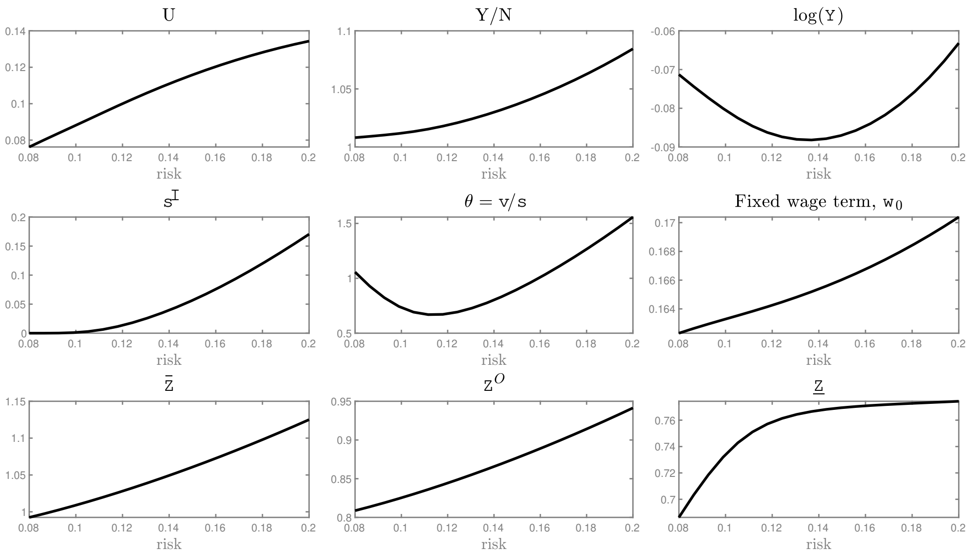
Comparative statics – changing costs of job creation



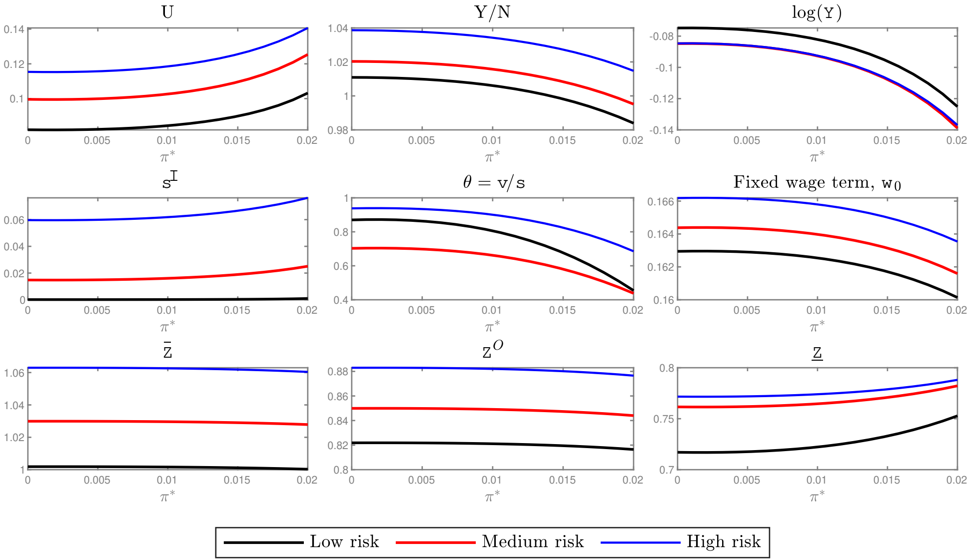
Comparative statics – changing costs of job creation



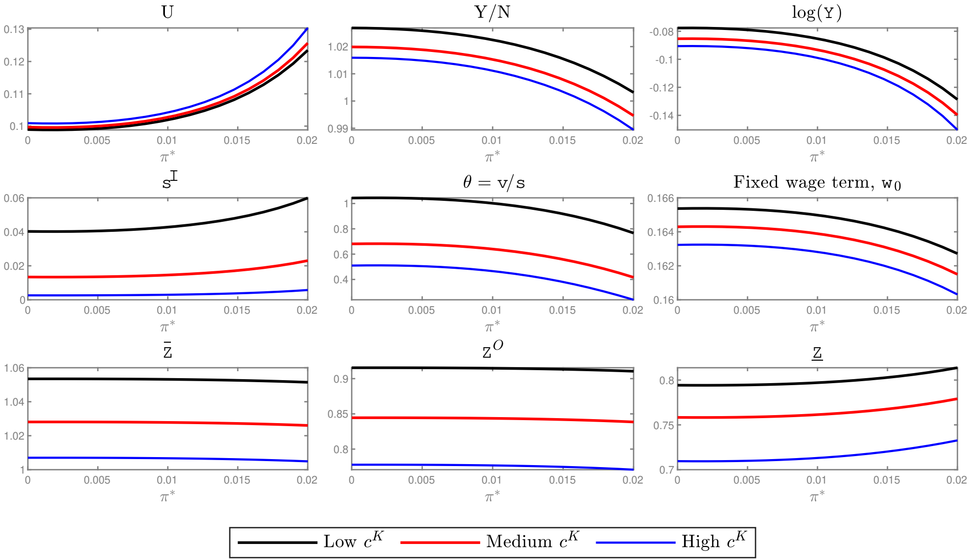
Comparative statics – changing firm risk



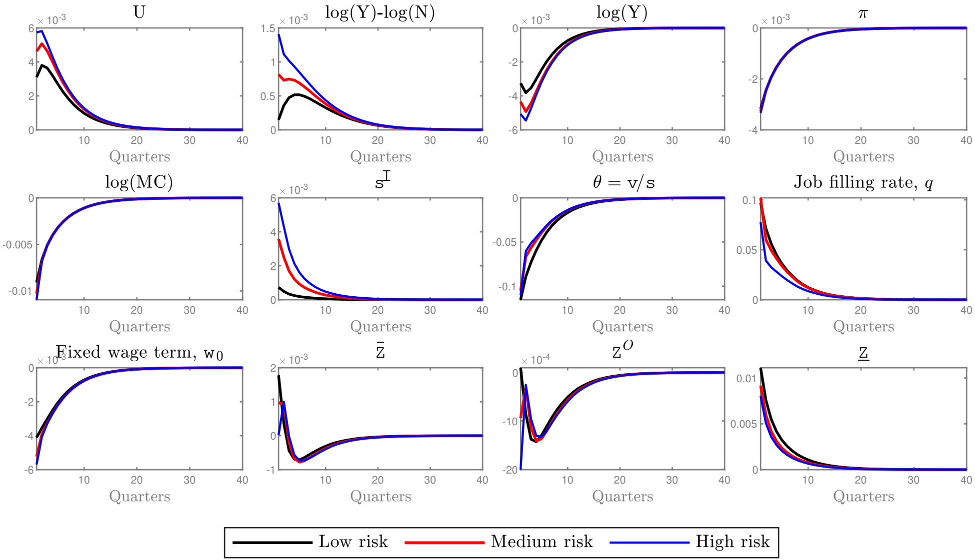
Comparative statics – inflation target



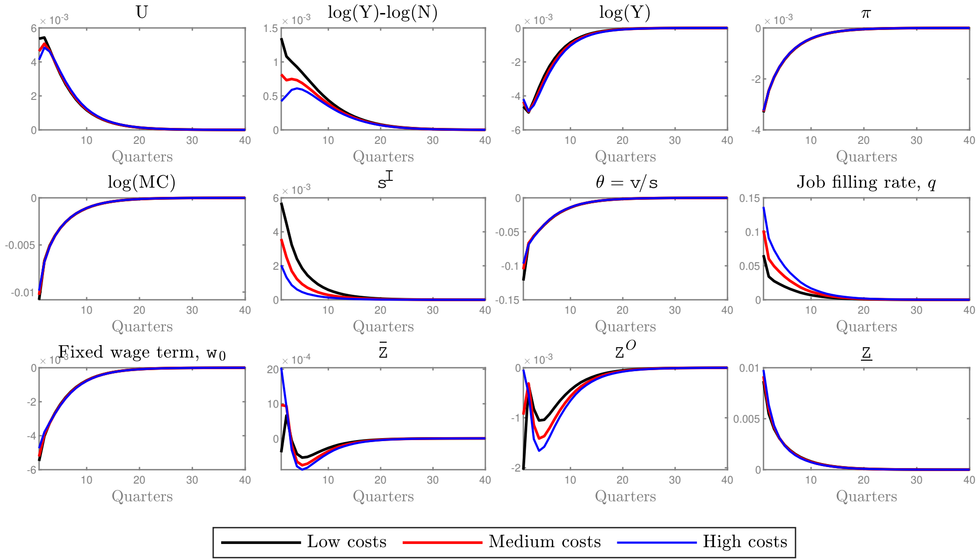
Comparative statics – inflation target



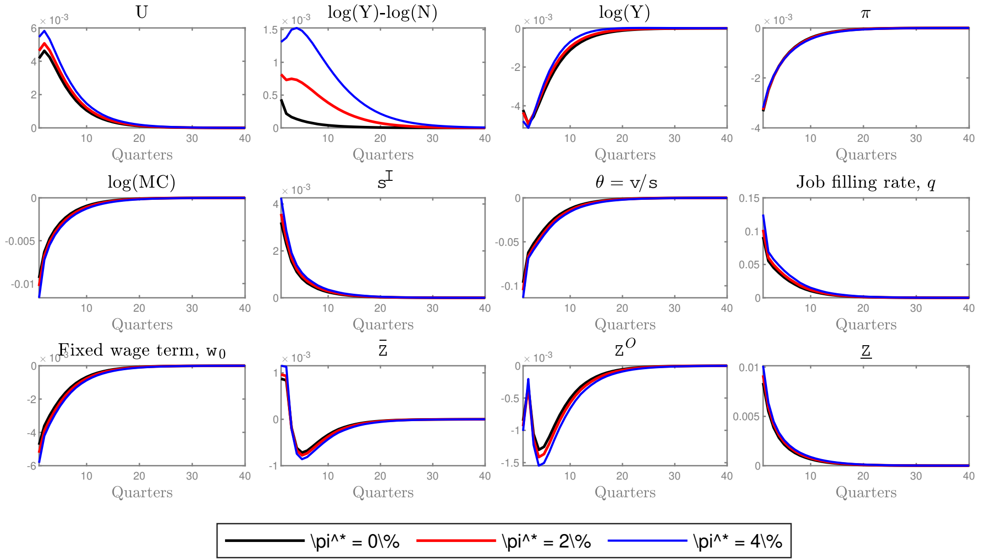
Monetary policy shock – effects of risk



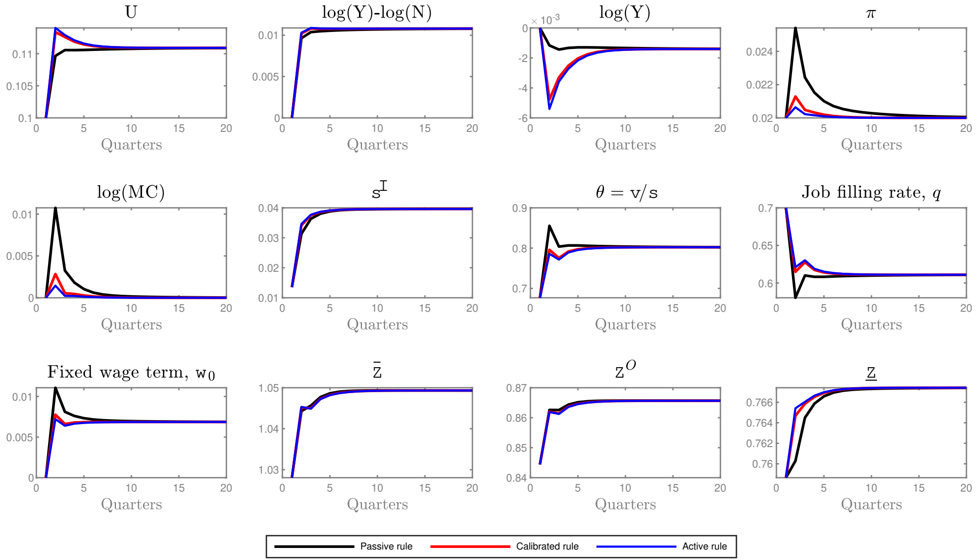
Monetary policy shock – effects of expansion costs



Monetary policy shock – effects of inflation target



Low to high risk transition



Looking ahead

There are some features that I kill with the assumptions

- The iid shocks allow easy aggregation but I lose persistence and potentially interesting scale effects
- Relaxing could help explain persistence in unemployment - hysteresis/scarring
- Uncertainty effects
- There might be different welfare and policy implications

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