Inefficient employment decisions, entry costs, and the cost of fluctuations

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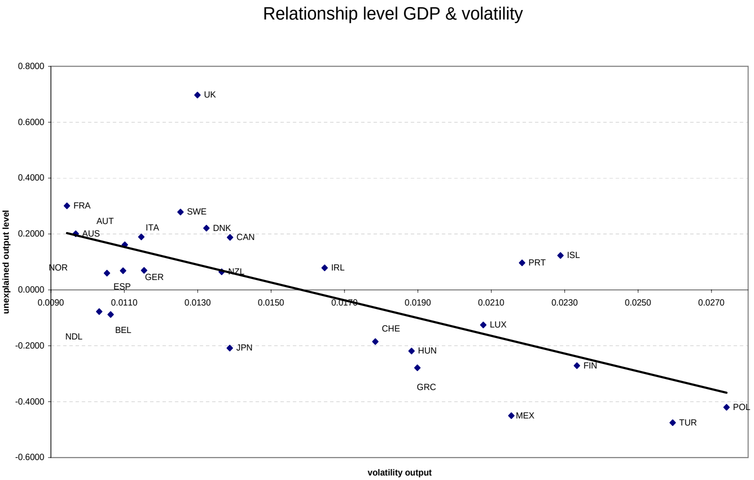
Our twist

Fluctuations have negative *level* effects

Theory applies to

- business cycle fluctuations
- sectoral fluctuations
- regional fluctuations
- etc


Relationship level GDP & volatility
0.8000
0.6000
0.4000
0.2000
0.0000
-0.2000
-0.4000
-0.6000
0.0090
0.0110
0.0130
0.0150
0.0170
0.0190
0.0210
0.0230
0.0250
0.0270
unexplained output level
volatility output
UK
FRA
SWE
AUT
AUS
ITA
DNK
CAN
NOR
NZL
IRL
PRT
ISL
GER
ESP
BEL
NDL
JPN
CHE
HUN
LUX
FIN
GRC
MEX
TUR
POL

Key ingredients of theory

1. Decision to operate "project" is not efficient
2. Entry costs
3. Heterogeneity

- Not high risk aversion (in fact, agents are risk neutral)

Quantitative assessment

Quantitative assessment is tough

- Requires info about projects that don't exist in existing world
- Construct measure to decompose GDP fluctuations into
    - extensive component
    - intensive component

Model

- a continuum of workers/projects
- characterized by
  - *permanent* idiosyncratic productivity, $\phi_p(i)$
  - *permanent* idiosyncratic entry cost, $\phi_c(i)$
- workers of type i can only work in project i

Two decisions

- decision whether to create a project
- decision whether to continue operating

Modelling production

Joint revenues equal to $\Phi_{p,t}\phi_p(i)$

- no business cycles:
  - $\Phi_{p,t} = 1$ for all t
- business cycles:
  - $\Phi_{p,t}$ stochastic with $\mathsf{E}\left[\Phi_{p,t}\right] = 1$

Modelling aggregate shocks

- $\Phi_p \in \{\Phi_{\text{high}}, \Phi_{\text{low}}\}$
- probability$\left\{\Phi_p' = \Phi_p\right\} = \pi$

Notation

- suppress (i) in $\phi_c(i)$ and $\phi_p(i)$
- ! no other parameters depend on i

Entry decision

Entry if

$$\phi_c \leq \mathsf{E}_t \sum_{j=0}^{\infty} (\beta\rho)^j \prod_{\tilde{j}=0}^{j} \left(\tilde{\rho}_{t+\tilde{j}}\right) \left(\phi_p \Phi_{p,t+j} - \mu\right)$$

where

ρ exogenous destruction project	$0 < \rho < 1$
$\tilde{\rho}_t$ destruction due to inefficiencies	$\tilde{\rho}_t \in \{0, 1\}$

$$\prod_{\tilde{j}=0}^{j} \left(\tilde{\rho}_{t+\tilde{j}}\right) = \begin{cases} 1 \text{ if } \tilde{\rho}_t = \tilde{\rho}_{t+1} = \cdots = \tilde{\rho}_{t+j} = 1 \\ 0 \text{ o.w.} \end{cases}$$

Friction I - simple & ad hoc

$$\phi_p \Phi_{p,t} \quad < \quad \chi \quad \text{relationship is not sustainable}$$

- Regulation requires minimum efficiency level

Friction II - elegant & still simple

- contractual fragility of Ramey and Watson (1997)

$$\phi_p \Phi_{p,t} + \text{value continuing relationship} <$$
$$\chi + \text{value continuing outside relationship}$$

- Reduces to

$$\phi_p \Phi_{p,t} < \chi$$

if

  - entrepreneur can simply rehire new worker after cheating
  - matching probability for worker equal to 1

Friction III - more general

$$\phi_p \Phi_{p,t} < \chi$$

$$\Longrightarrow$$

cut-off value does not depend on

other state variable ϕ_c

- Appendix: financial friction:
  - cut-off value could depend on ϕ_c
  - affects calibration, not the mechanism

Efficient and inefficient discontinuation

$\phi_p \Phi_{p,t} < \mu$	efficient to separate
$\mu < \phi_p \Phi_{p,t} < \chi$	separation leads to loss of value

Bottom line about inefficient separations

$$\Phi_p \uparrow$$

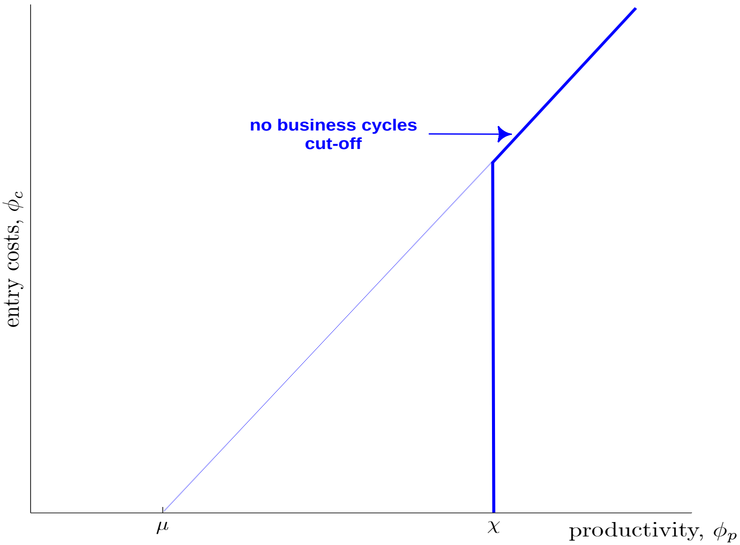
$$\Longrightarrow$$

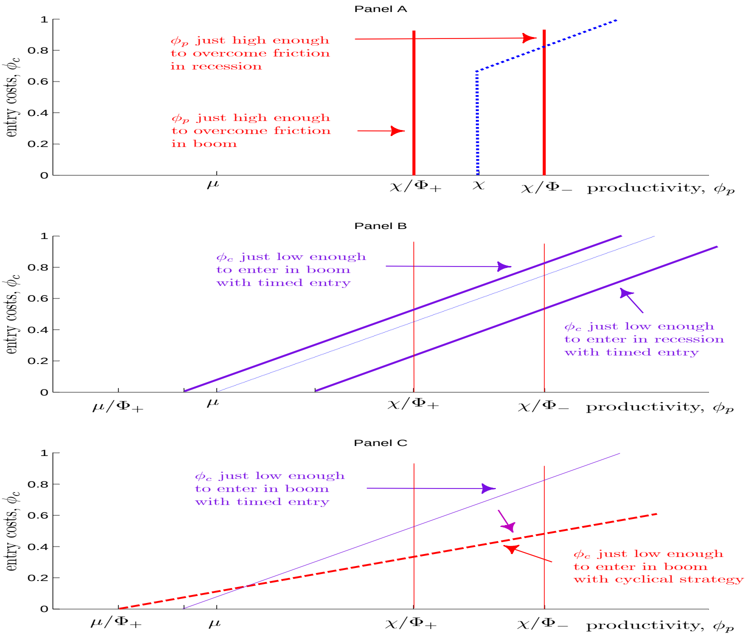
$$\#\text{ of inefficient operating decisions } \downarrow$$

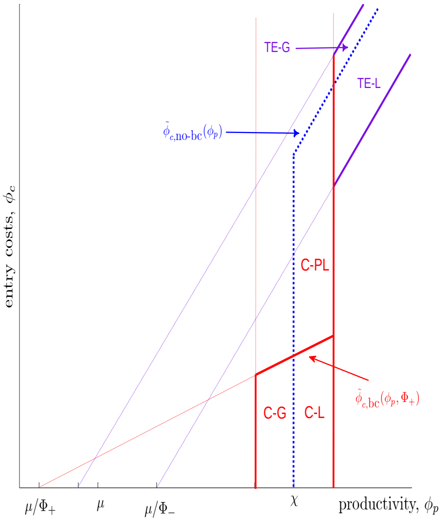
Social planner & competitive equilibrium

- Social planner does not face the friction $\phi_p \Phi_{p,t} \geq \chi$

Competitive equilibrium: No business cycles




Panel A
1
0.8
0.6
0.4
0.2
0
entry costs, ϕ_c
ϕ_p just high enough to overcome friction in recession
ϕ_p just high enough to overcome friction in boom
μ
χ/Φ_+
χ
χ/Φ_-
productivity, ϕ_p
Panel B
ϕ_c just low enough to enter in boom with timed entry
ϕ_c just low enough to enter in recession with timed entry
μ/Φ_+
Panel C
ϕ_c just low enough to enter in boom with timed entry
ϕ_c just low enough to enter in boom with cyclical strategy


TE-G
TE-L
$\tilde{\phi}_{c,\text{no-bc}}(\phi_p)$
C-PL
C-G
C-L
$\tilde{\phi}_{c,\text{bc}}(\phi_p, \Phi_+)$
entry costs, ϕ_c
μ/Φ_+
μ
μ/Φ_-
χ
productivity, ϕ_p

Two types of losses

- **C-PL: permanent loss**
- **Cyclical jobs**
  - C-G: produce more during boom
  - C-L: produce less during recession

Role of non-zero entry costs

- Business cycles are costly because

$$\text{expected duration match} \downarrow \implies \text{less entry}$$

- $\phi_c = 0 \Longrightarrow$ less production during recessions is offset by more production during booms

Role of inefficiency

Because

$$\mu < \chi$$

there are positive NPV projects that are not created

Full model

- Production requires entrepreneur and worker
- Entrepreneur:
  - pays 100% posting costs
  - only receives ω_e of surplus
  - $\implies$ inefficient entry

Comparison

- Universe 1: Without business cycles
- Universe 2: With business cycles

Result

- Timed-entry areas can be ignored
  - these areas depend on timing advantage of business cycles
  - quantitatively very tiny

Welfare calculations (sloppy notation)

Without business cycles:

$$\begin{aligned} & \text{mass}\left(\text{C-PERM-Loss}\right) && \times \left[NPV - \phi_c\right] \\ + \; & \text{mass}\left(\text{C-TEMP-Loss}\right) && \times \left[NPV - \phi_c\right] \\ + \; & \text{mass}\left(\text{C-TEMP-Gain}\right) && \times \left[\frac{\mu\phi_p}{1-\beta}\right] \end{aligned}$$

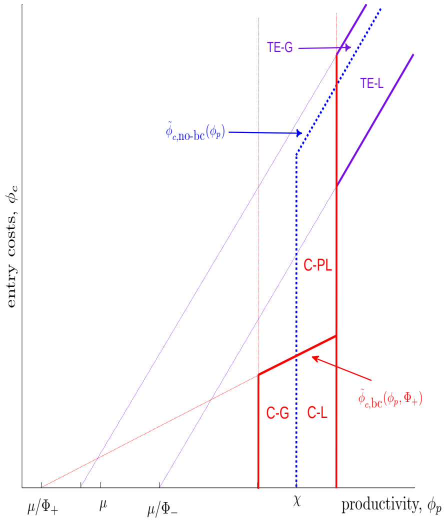
Welfare calculations (sloppy notation)

With business cycles:

$$
\begin{aligned}
& \text{mass}\,(\text{C-PERM-Loss}) && \times \left[\frac{\mu\phi_p}{1-\beta}\right] \\
+ \; & \text{mass}\,(\text{C-TEMP-Loss}) && \times \left(\begin{array}{rr} \frac{1}{2} & NPV_{\text{boom}} - \phi_c \\ + \;\; \frac{1}{2} & NPV_{\text{recession}} - \phi_c \end{array}\right) \\
+ \; & \text{mass}\,(\text{C-TEMP-Gain}) && \times \left(\begin{array}{rr} \frac{1}{2} & NPV_{\text{boom}} - \phi_c \\ + \;\; \frac{1}{2} & NPV_{\text{recession}} - \phi_c \end{array}\right)
\end{aligned}
$$

Welfare loss is a tedious straightforward function of

1. Output produced by C-L & C-G projects during a boom
   - we need *extensive* margin of GDP fluctuations
2. Mass of C-PL relative to C-L
   - (permanent loss to cyclical loss projects)
3. Structural parameters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μ/Φ_-
χ
productivity, ϕ_p

Extensive measure of GDP

$$GDP_{\text{boom}} - GDP_{\text{recession}}$$

$$\approx$$

$$\frac{\Phi_{p,\text{high}} - \Phi_{p,\text{low}}}{\Phi_{p,\text{low}}} GDP_{\text{recession}}$$

$$+$$

$$\text{mass of cyclical jobs} \times \phi_p \Phi_{p,\text{high}}$$

Extensive measure of GDP

$$\frac{GDP_{\text{boom}} - GDP_{\text{recession}}}{GDP_{\text{recession}}}$$

$$\approx \frac{\Phi_{p,\text{high}} - \Phi_{p,\text{low}}}{\Phi_{p,\text{low}}} + \frac{\text{mass of cyclical jobs } \times \ \phi_p \Phi_{p,\text{high}}}{GDP_{\text{recession}}}$$

$$= \frac{\Phi_{p,\text{high}} - \Phi_{p,\text{low}}}{\Phi_{p,\text{low}}} + \Lambda$$

Extensive margin of GDP fluctuations

1. Extensive margin of employment: Standard deviation employment (persons) $\approx 2.2\% \Longrightarrow$

$$\frac{E_{\text{boom}} - E_{\text{recession}}}{E_{\text{recession}}} = 4.4\%$$

2. Suppose value added cyclical workers $=$40% of value added non-cyclical workers
3. 1 & 2: Cyclical workers generate

$$\left(1.76 \times \Phi_{p,\text{high}} / \Phi_{p,\text{low}}\right) \% \text{ of } GDP_{\text{recession}}$$

Word of caution

- Cyclical jobs do not have to be the least productive ones
- High-producitivty could have high χ (e.g. big financing friction)
- Therefore, a direct measure is desirable

Extensive margin of GDP fluctuations

- Use wage as measure of value added
  - IAB: monthly panel from German social security and unemployment records
  - covers 80% of German labor force
- Non-cyclical worker:
  - employed 24 months ago
  - during this period less than 30 days unemployed
- Cyclical worker: the other workers

Extensive margin of GDP fluctuations

- n: the *sum* of producing cyclical workers and new entrants
  - we only observe sum
- N: other workers (constant in our framework)

Extensive margin of GDP fluctuations

$$\begin{aligned} Y_- &= n_- y_- + N\tilde{y}_- \\ Y_+ &= n_+ y_+ + N\tilde{y}_+ \end{aligned}$$

$$\begin{aligned} \frac{Y_+ - Y_-}{Y_-} &= \frac{n_+ y_+ - n_- y_-}{Y_-} + \frac{(\tilde{y}_+ - \tilde{y}_-)\,N}{Y_-} \\ &= \frac{[n_- + (n_+ - n_-)]\,y_+ - n_- y_-}{Y_-} + \frac{(\tilde{y}_+ - \tilde{y}_-)\,N}{Y_-} \\ &= \frac{(n_+ - n_-)\,y_+}{Y_-} + \frac{(y_+ - y_-)n_- + (\tilde{y}_+ - \tilde{y}_-)N}{Y_-} \end{aligned}$$

Extensive margin of GDP fluctuations

$$\frac{Y_+ - Y_-}{Y\_} = \frac{(n_+ - n_-)\,y_+}{Y_-} + \frac{(y_+ - y_-)n_- + (\tilde{y}_+ - \tilde{y}_-)N}{Y_-}$$

We measure

$$\frac{(n_+ - n_-)\,y_+}{Y_-} = \frac{n_+ y_+}{Y_-} - \frac{n_- y_-}{Y_-}$$

by looking how

$$\frac{n_t y_t}{Y_t}$$

increases if the economy gets out of a recession


recently not employed = "non-employment spell during the last 24 months
filtered unemployment (%)
filtered wage fraction (%)
10
9
8
7
6
5
17
16
15
14
13
1975
1980
1985
1990
1995
2000
2005
unemployment
contribution of recently not employed workers

Extensive margin of GDP fluctuations

Estimate for Λ: again $\approx 2\%$

Next step:

What do we now know?

- Value generated by temporary loss projects

What do we also need to know?

- Output generated by permanent loss projects

Permanent loss projects

What do we know about them?

1. Same output level as temporary loss projects
2. Maximum entry cost (simple function of structural parameters)
3. Minimum entry cost (simple function of structural parameters)

Permanent loss projects

What don't we know about them?

1. How many there are

Output generated by permanent loss projects

Assumptions

1. lower bound for $\phi_c = 0$
   - higher values will increase cost of fluctuations
2. uniform distribution ϕ_c (conditional on ϕ_p)

Output generated by permanent loss projects

$$\text{Output generated by permanent loss projects} = \left(\frac{\tilde{\phi}_{c,\text{no-bc}} - \tilde{\phi}_{c,\text{bc}}}{\tilde{\phi}_{c,\text{bc}}}\right) \times \left(\begin{array}{c}\text{Output generated}\\ \text{by temporary loss projects}\end{array}\right)$$

Parameter assumptions

- Persistence of booms and recessions:
  - $\pi = 0.875$
- Expected duration (if no business cycles)
  - $1/(1-\rho) = 2$, 3, and 10 years
- Value added outside relationship as fraction of ϕ_p:
  - $\mu = 0.2$
- Current-period payoff entrepreneur as fraction of surplus:
  - $\omega_e = 0.1$

Costs of business cycles

expected duration (years)		
2	3	10
0.56%	0.86%	2.45%

Costs corresponds to *permanent* increase in consumption as percentage of GDP

Add lower bound to entry costs

$\underline{i}$ equals lower bound on ϕ_c

(expressed as average amount of entry costs paid each period when there are no business cycles)

Costs of business cycles

	expected duration (years)		
	2	3	10
$\underline{i} = 0$	0.56%	0.86%	2.45%
$\underline{i} = 0.5\%$	0.62%	0.98%	3.54%

Concluding comment

- This is just the cost of *business cycle* fluctuations