Misallocation under the Shadow of Death

Daisuke Miyakawa, PhD[1]; Koki Oikawa, PhD[2]; Kozo Ueda, DPhil[2]
[1]Hitotsubashi University, [2]Waseda University

Paper URL

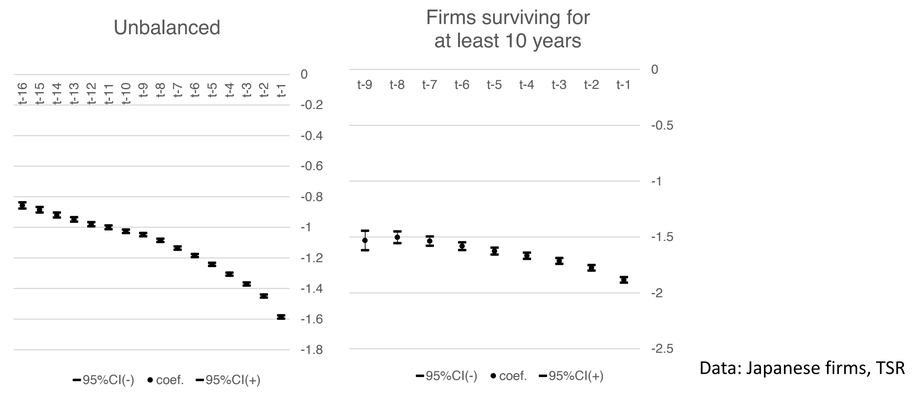
Abstract

This study focuses on a slow exit process, known as a *shadow of death*, as a new factor of inefficient resource allocation in the macroeconomy. First, we develop an endogenous growth model that incorporates firms' R&D investment and distorted exit decisions. The model shows that the exit of firms in the market equilibrium is inefficiently slow from the social viewpoint even without distortions such as corporate subsidies, which further impede the exit process. Second, our empirical analysis using Japanese firm-level data confirms that exiting firms exhibit the shadow of death in a manner that is consistent with our model. Further, the degree of the shadow of death is related to our distortion measures. Third, our simulation based on the calibrated model suggests that an increase in subsidies can help explain recent firm dynamics in Japan and worsen productivity growth and welfare, although the quantitative impacts of subsidies are limited.

Introduction

Motivating Fact: Exiting firm size gradually decreases over several years before exit.

$$\log \text{sales}_{jt} = \alpha + \sum_{h=0}^{H} \beta_h \mathbb{1}(\text{exit}_{j,t+h}) + \eta_t + \varepsilon_{jt}, \qquad \mathbb{1}(\text{exit}_{j,t+h}) = 1 \text{ if firm } j \text{ exits at } t+h.$$



Data: Japanese firms, TSR

What is the macroeconomic implication of the shadow of death?

- Static resource allocation: Freeing up workers employed by slow exiting firms may improve production efficiency in the macroeconomy.
- Dynamic effect: If firms can survive even with low performance, they may have small incentive to improve their competitiveness.

Main contents:

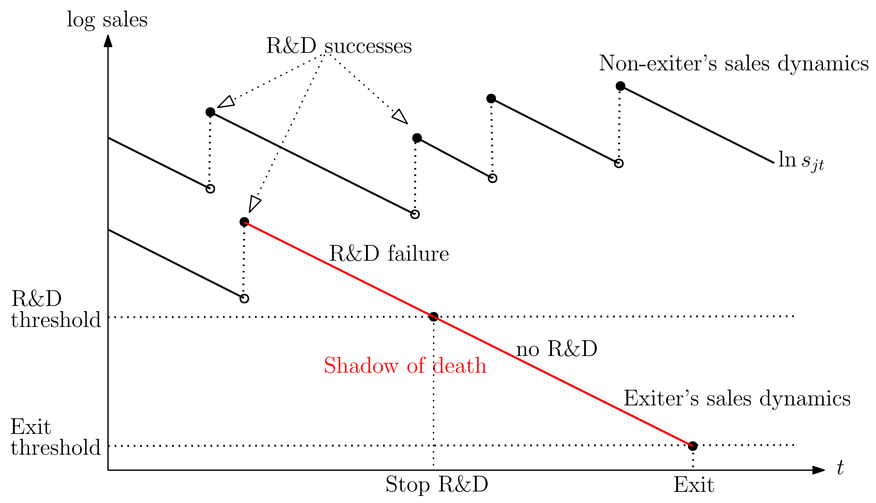
- Endogenous growth model with endogenous shadows of death.
- Check the consistency of the model to the Japanese firm-level data.
- Calibration to the Japanese economy and simulate the impact of exit distortions, e.g., subsidy for small firms.

Benchmark Model without Exit Distortion

Endogenous growth with monopolistic competition among heterogeneous firms with endogenous R&D and entry/exit.

Mechanism to generate shadow of death:

- Sales share of a firm grows when succeeding in R&D.
- The share of non-R&D firms decreases over time due to average productivity growth within industry.
- If the R&D failure lasts long enough, the firm will stop R&D, gradually lose its share of sales, and finally (due to fixed costs) exit from the market.



Properties of Competitive equilibrium:

- Efficient exit decision. Underinvestment in R&D.
- Equilibrium shadow of death is too long.
  - This inefficiency can be resolved by R&D and entry subsidies.
- No dispersion in exit threshold across firms.
  → Next: Introduce *exit distortions*.

Exit Distortions

We observe significant dispersion in sales of exiting firms unlike the benchmark model, implying idiosyncratic exit distortions that make delay of exit and longer shadows of death.

Candidates of the source of exit distortions:

- **Subsidy for small firms:**
  - ✓ Exiting firms survive longer.
  - ✓ They stop R&D earlier. (benefits from getting small)
- **Lower outside value:**
  - ✓ Exiting firms survive longer.
  - ✓ Stopping R&D is postponed. (incentive to escape from exit)

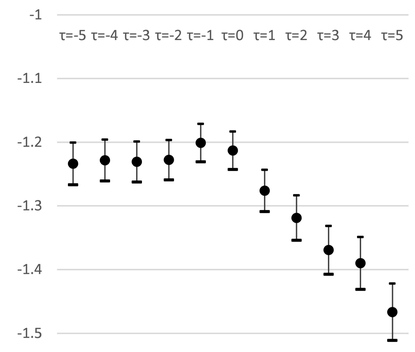
What's wrong with long shadows of death?

- Facilitating exits frees up workers employed by the exiting low-performing firms.
- Low R&D intensity at the aggregate level.

Empirical Analysis

1. Sales declines after stopping R&D, relative to R&D-continuing firms.

$$\log \text{sales}_{jt} = \gamma + \delta_h \mathbb{1}(\text{RDstop}_{j,t+h}) + \eta_t + \varepsilon_{jt}$$



$\tau = 0$: time of stopping R&D

2. Greater distortion (subsidy) is associated with slower exit and longer shadow of death.

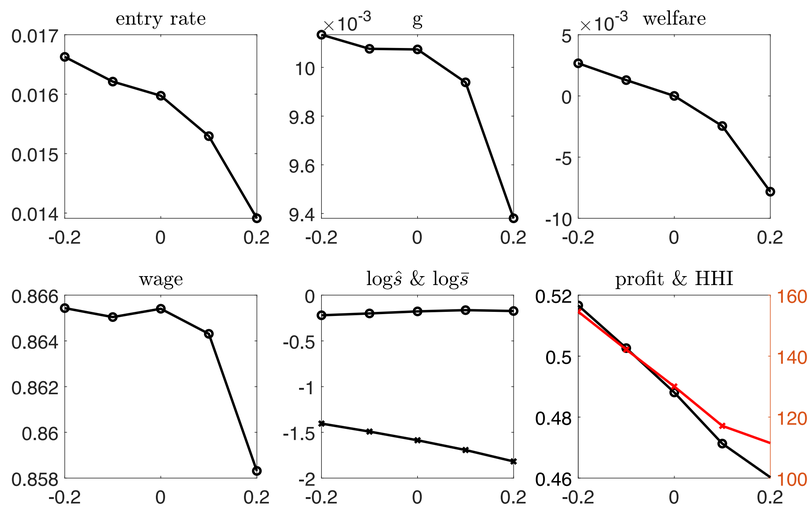
$$\log \text{sales}_{ijt} = \alpha + \beta_h \mathbb{1}(\text{exit}_{ijt+h}) + \theta \text{distortion}_{it} + \beta_h^D \mathbb{1}(\text{exit}_{ijt+h}) \times \text{distortion}_{it} + \eta_i + \eta_t + \varepsilon_{ijt}$$

$$\log \text{sales}_{ijt} = \gamma + \delta_h \mathbb{1}(\text{RDstop}_{ijt+h}) + \phi \text{distortion}_{it} + \delta_h^D \mathbb{1}(\text{RDstop}_{ijt+h}) \times \text{distortion}_{it} + \eta_i + \eta_t + \varepsilon_{ijt}$$

Distortion: Net subsidy/Value-added	Pre-exit dynamics		Pre/post-R&D stop dynamics	
	Coef.	s.e.	Coef.	s.e.
β_h	-1.443***	0.011		
β_h^D	-0.929***	0.136		
δ_h			-0.900***	0.021
δ_h^D			0.473**	0.195
Distortion	0.025	0.037	0.740	0.476
Fixed-effect				
Year	yes		yes	
Industry	yes		yes	
Number of obs.	9,064,930		80,344	
Prob>F	0.0000		0.0000	
Adj R-squared	0.1346		0.3673	

Simulation

- We calibrate the model to Japanese economy.
- Quantitative impacts of subsidy for small firms are simulated. (horizontal axis: mean of firm-level subsidies)
  - Real growth rate declines as subsidy due to smaller R&D investment and lower entry/exit rate.
  - Simulation with outside value indicates similar result for growth and welfare.



Note: Each dot is a stationary state under each distortion level.
Transition has not been examined.

Conclusions

- Too long shadows of death are harmful to growth and welfare.
- Shadow of death is inefficiently long in competitive equilibrium and exit distortions, e.g., subsidy for small firms, make it even longer.
- Facilitating exits by, e.g., subsidy for exit, improves welfare.

Contact

Koki Oikawa, PhD
Waseda University
Email: oikawa.koki@gmail.com
Website: https://sites.google.com/site/oikawakoki/