Resource allocation and industry productivity: accounting for firm turnover

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Background

- Evidence that differences in resource allocation across firms explain a substantial part of cross-country variation in aggregate productivity.
- Allocative efficiency may be related to various distortions such as entry barriers and firm level taxes and subsidies.
- These distortions should also influence firm entry and exit.
- However, we understand poorly the links between distortions, firm turnover, and allocative efficiency.
  - Models used in this literature often feature limited dynamics with respect to entry and exit.
  - Measures of allocative efficiency may be sensitive to firm turnover.

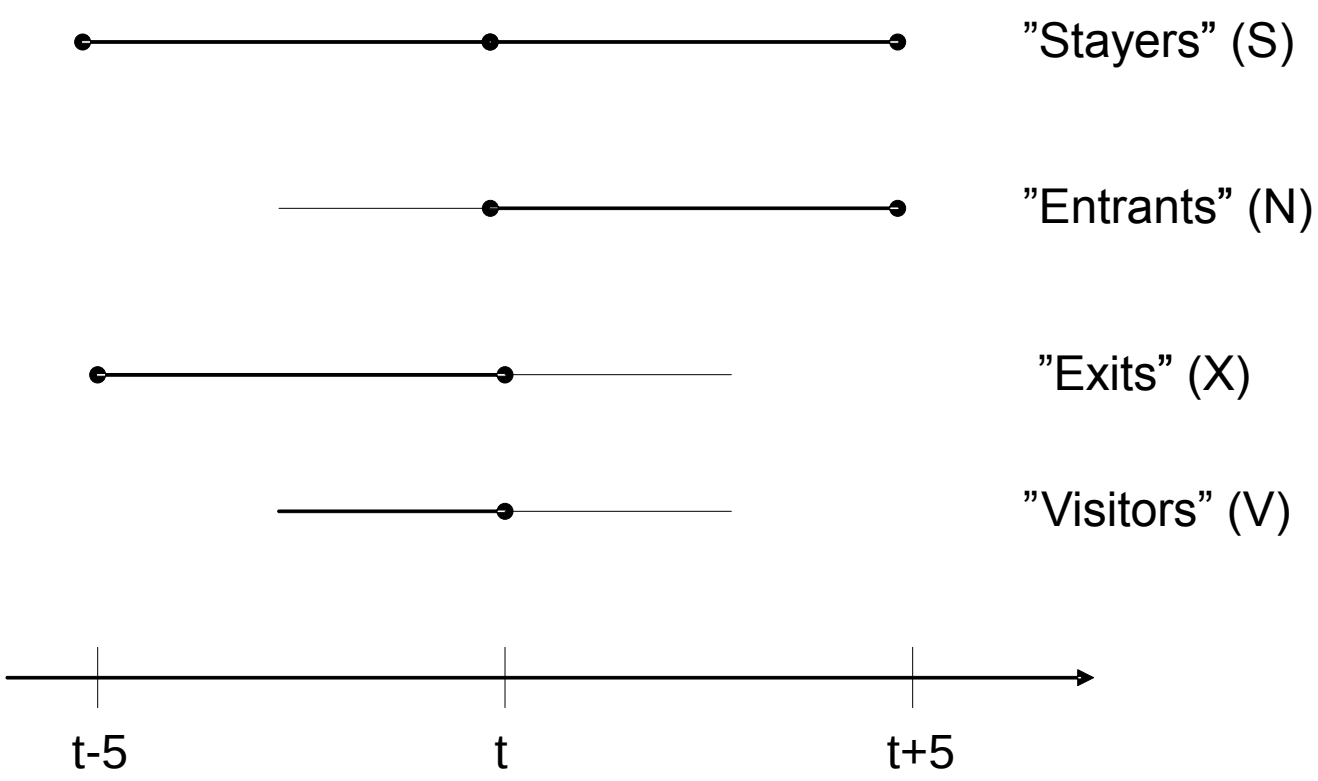
How to measure allocative efficiency?

- A popular measure is the OP covariance component (OP), i.e. the covariance between firm size and productivity.
- Higher OP associated with higher allocative efficiency:
  - Shift **some** resources from low to high productivity firms → both aggregate prod. and OP increase.
- OP does not provide information about the role entrants and exiting firms.
- With firm entry and exit, interpretation is less clear:
  - **Remove** a low productivity firm → OP decreases.

This paper

- Consider resource allocation and productivity paying special attention to firm turnover.
- 1) Develop accounting tools to measure the contribution of entry and exit to industry productivity and apply them to data (Finnish firms 1995-2008).
- 2) Build a model of firm dynamics that features endogenous entry and exit and is consistent with the main patterns revealed by our empirical decompositions.
- 3) Use the model to study how distortions affect productivity, turnover and measures of allocative efficiency.

Classifying firms



1. decomposition

- Aggregate productivity:

$$\Phi_t = \sum_{i \in \Omega} s_{it} \varphi_{it}, \; s_{it} = \frac{L_{it}}{\sum_{i \in \Omega} L_{it}}, \; \varphi_{it} = \ln \frac{Y_{it}}{L_{it}}$$

- Decomposed:

$$\Phi_t = \Phi_t^S + \sum_{j=N,X,V} \frac{L_t^j}{L_t} \left(\Phi_t^j - \Phi_t^S \right)$$

2. decomposition

- OP covariance decomposition

$$\Phi_t = \bar{\varphi}_t + \sum_i \left(s_{it} - \bar{s}_{it}\right)\left(\varphi_{it} - \bar{\varphi}_{it}\right) = \bar{\varphi}_t + \mathrm{cov}\left(s_{it}, \varphi_{it}\right)$$

- Augmented OP decomposition:

$$\mathrm{cov}_t = \mathrm{cov}_t^S + \sum_{j=N,X,V} \frac{L_t^j}{L_t}\left(\mathrm{cov}_t^j - \mathrm{cov}_t^S\right) + \sum_{j=N,X,V} \frac{N_t^j}{N_t}\left(\frac{\bar{L}_t^j}{\bar{L}_t} - 1\right)\left(\bar{\varphi}_t^j - \bar{\varphi}_t^S\right)$$

Within group effect *Between group effects*

Productivity decomposition

	Effect of the non-stayers (1)	Contribution of entrants (2)	exits (3)	Visitors (4)
Manufacturing	**-3.4**	**-1.2**	**-1.3**	**-0.9**
Construction	-5.4	-2.0	-1.0	-2.3
Services	-4.0	-1.5	-0.5	-2.0
MANUFACTURING				
Food (15-16)	-4.9	-1.6	-2.0	-1.3
Textiles (17-19)	-7.1	-2.0	-3.5	-1.7
Wood (20)	-3.9	-1.0	-1.0	-1.8
Paper (21),	-1.0	-0.4	-0.4	-0.2
Printing (22)	-3.1	-1.1	-0.9	-1.0
Chemicals (24)	-2.1	-1.0	-0.9	-0.2
…	-1.8	-0.5	-0.8	-0.5

Productivity gaps to stayers

	Entrants	Exits	Visitors
Manufacturing	**-30.8**	**-33.2**	**-53.0**
Construction	-12.7	-11.4	-28.2
Services	-10.0	-4.3	-26.5
MANUFACTURING			
Food (15-16)	-32.3	-31.7	-58.5
Textiles (17-19)	-30.0	-29.1	-44.1
Wood (20)	-11.1	-15.7	-38.7
Paper (21),	-51.9	-68.2	-91.5
Printing (22)	-20.9	-10.3	-45.1
Chemicals (24)	-29.6	-31.0	-50.0
…			

Covariance decomposition

						Components of between group effect		
	Cov, all	Cov, stayers	Difference	Within group effect	Between group effect	Entrants	Exits	Visitors
Manufacturing	**33.9**	**27.8**	**6.1**	**-1.1**	**7.2**	**2.5**	**1.0**	**3.7**
Construction	6.8	4.2	2.6	-1.6	4.2	1.6	0.0	2.6
Service	13.2	-0.4	13.7	3.2	10.5	4.3	0.5	5.7
MANUFACTURING								
Food (15-16)	33.9	25.2	8.7	-1.9	10.7	3.6	1.3	5.7
Textiles (17-19)	26.3	15.7	10.7	-0.9	11.6	3.6	1.2	6.8
Wood (20)	18.5	10.7	7.9	0.4	7.5	2.5	0.7	4.3
Paper (21),	63.8	55.9	7.9	-0.6	8.4	2.2	2.0	4.2
Printing (22)	24.7	19.1	5.5	-0.5	6.0	2.1	0.9	3.0
Chemicals (24)	44.1	31.5	12.5	0.1	12.4	5.9	2.0	4.4

Key features of the model

- Knowledge capital and R&D → it takes time to grow!
- Overhead labor → small firms are less productive
- Endog. entry and exit → we can account for changes in firm dynamics
- Free-entry condition → pins-down the wage level
- Focus on stationary equilibrium

Firm's problem

- Incumbent:

$$V(a,z) = \max_{r,l}\{\exp(z)a^{\alpha}(l-f)^{\gamma-\alpha} - w(r+l) + \max[0, \beta EV(a',z')]\}$$

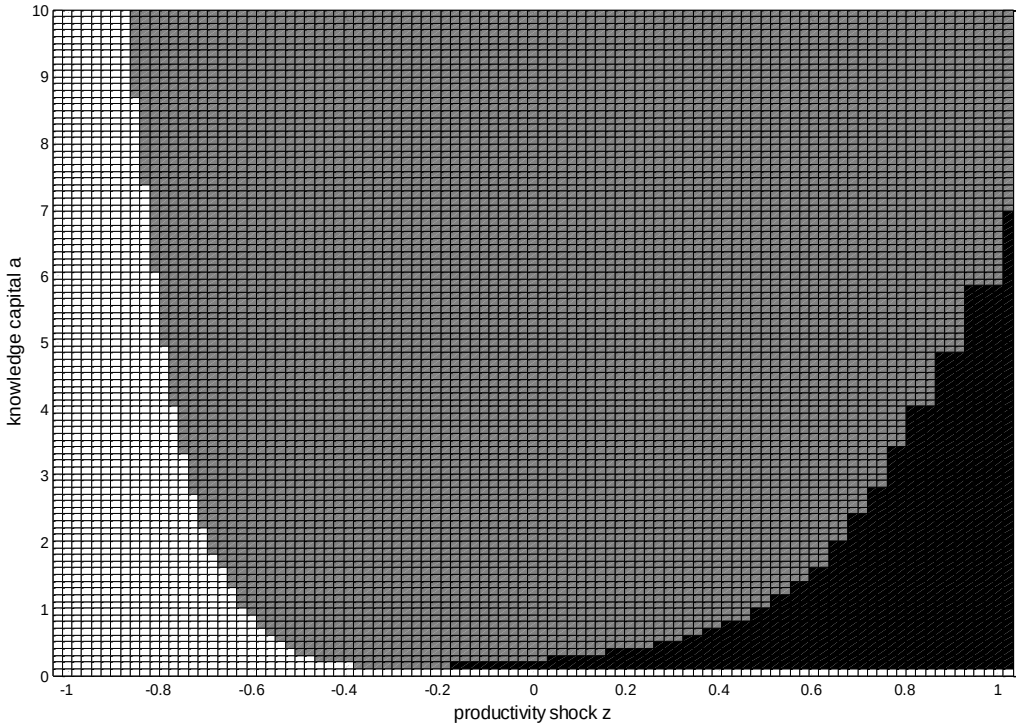
$$s.t.$$

$$a' = a^{\nu}r^{1-\nu}$$

$$z' = \rho z + \varepsilon$$

- Potential entrant:
  - Fixed initial knowledge capital
  - Needs to pay a fixed cost to learn initial producitivity shock z.
  - Given initial z, enters iff expected discounted profits are positive.

Dynamics


knowledge capital a
productivity shock z
0
1
2
3
4
5
6
7
8
9
10
-1
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1

Model vs. data: targets

Target (%)	Model	Target
covariance term	35.6	33.9
PROD GAPS RELATIVE TO STAYERS		
entrants	-32.7	-30.8
exiting firms	-35.8	-33.2
visitors	-65.2	-53.0
EMPLOYMENT SHARES		
entrants	6.8	5.3
exiting firms	5.6	5.8
visitors	1.1	2.3
R&D employment share	17.8	20.0

Note: Data refer to the empirical results concerning the manufacturing sector

Model (vs. data): decompositions

Aggregate productivity

Effect of non-stayers	entrants	exits	experimenters
-3.7 (-3.4)	-1.7 (-1.2)	-1.3 (-1.3)	-1.7 (-0.9)

Covariance

	eff. of non-stayers	Within groups effect	Between groups effect
stayers			
23 (28)	12.8 (6.1)	1.3 (-1.1)	11.5 (7.2)

Between group effect		Contribution of exit	
	entry		experimenters
11.5 (7.2)	3.4 (2.5)	4.1 (1.0)	4.0 (3.7)

Distortions

- Tax distortion: Tax firms with tfp above average and subsidize firms with tfp below average. Tax (subsidy) rate increases (decreases) with tfp and χ.
- Increase entry cost/introduce exit cost

	Benchmark	Tax and subsidy			Higher entry cost	Exit cost
		χ=0.2	χ=0.4	χ =0.8		
Change in aggregate productivity (%)	0.0	-1.9	-11.9	-50.4	-1.1	-0.9
Covariance component (%)	35.6	26.2	16.8	3.1	40.3	40.8
Std of log productivity	36.1	27.5	25.4	27.4	45.6	46.3
Employment share of stayers	86.4	78.5	62.0	42.5	98.2	97.4

Distortions and productivity (%-change)

			Contribution of			
	All	Stayers	all non stayers	entry	exit	visitors
Tax, χ=0.2	-1.9	0.0	-1.9	-0.7	-0.8	-0.5
Tax, χ =0.4	-11.9	-6.4	-5.5	-1.5	-2.3	-1.7
Tax, χ =0.8	-50.4	-44.0	-6.3	0.4	-4.3	-2.5
High entry cost	-1.1	-4.0	2.9	1.3	0.9	0.7
Exit cost	-0.9	-3.7	2.8	1.3	0.9	0.7

Distortions and covariance (%-change)

			Contribution of non- stayers	
	OP all	OP stayers	within	between
Tax, χ =0.2	-9.5	-3.2	-1.2	-5.0
Tax, χ =0.4	-18.8	-8.7	-2.1	-8.0
Tax, χ =0.8	-32.5	-19.9	-1.6	-11.0
High entry cost	4.7	12.6	-1.0	-6.9
Exit cost	5.2	13.7	-1.0	-7.5

Conclusions

- Robust pattern: entrants and exiting firms contribute negatively to aggregate productivity but positively to OP.
- Policy distortions change firm turnover substantially
  - Provide clues regarding the type of distortions in diff. countries?
- Tax and subsidy distortion decreases aggr. prod. via both stayers and non-stayers.
- Entry and exit costs decrease, in absolute terms, the negative contribution of non-stayer firms
  - Moderates the fall in aggr. productivity.
- OP captures the tax and subsidy distortion well.
- However, entry and exit costs increase OP
  - Low productivity firms less likely to exit → productivity dispersion increases → OP increases.
  - May explain why OP is actually quite high in a number of relatively poor countries.