

CREATIVE ACCOUNTING OR CREATIVE DESTRUCTION? FIRM-LEVEL PRODUCTIVITY GROWTH IN CHINESE MANUFACTURING

EE 462 Development Macroeconomics

Semester 1/2022

Reference: Brandt, L., Van Biesebroeck, J., & Zhang, Y. (2012). Creative accounting or creative destruction? Firm-level productivity growth in Chinese manufacturing. *Journal of development economics*, 97(2), 339-351.

Summary

- Objective:

To examine firm-level productivity estimates for Chinese manufacturing firms (SOEs and non-SOEs).

- Method:

- Calculate TFP growth
- Consider the cases of benchmark, enter & exit, resource reallocation

- Findings:

- Firm-level TFP growth of manufacturing firms is $\sim 2.85\%$ for a gross-output production function and 7.96% for a value-added production function.
- TFP of new firms are higher than that of incumbent.

Productivity Measurement

- Productivity growth:

$$TFPG_{it}^{IN} = (q_{it} - q_{it-1}) - \bar{s}_{it}(l_{it} - l_{it-1}) - (1 - \bar{s}_{it})(k_{it} - k_{it-1}), \quad (3)$$

- Multilateral productivity measure:

$$\ln TFPG_{it}^{IN} = (q_{it} - \bar{q}_t) - \tilde{s}_{it}(l_{it} - \bar{l}_t) - (1 - \tilde{s}_{it})(k_{it} - \bar{k}_t). \quad (4)$$

- Productivity level for firm i at time t is:

$$a_{it}^P = q_{it} - \hat{\alpha}_L^S l_{it} - \hat{\alpha}_K^S k_{it}, \quad (5)$$

Q: Explain the above equations. Which ones are used to estimate in the analysis in the paper?

Data

Q: Which data sets are used? Which year of the analysis? How have the firms changed over time (incumbent, new firms, etc.)?

Table 1

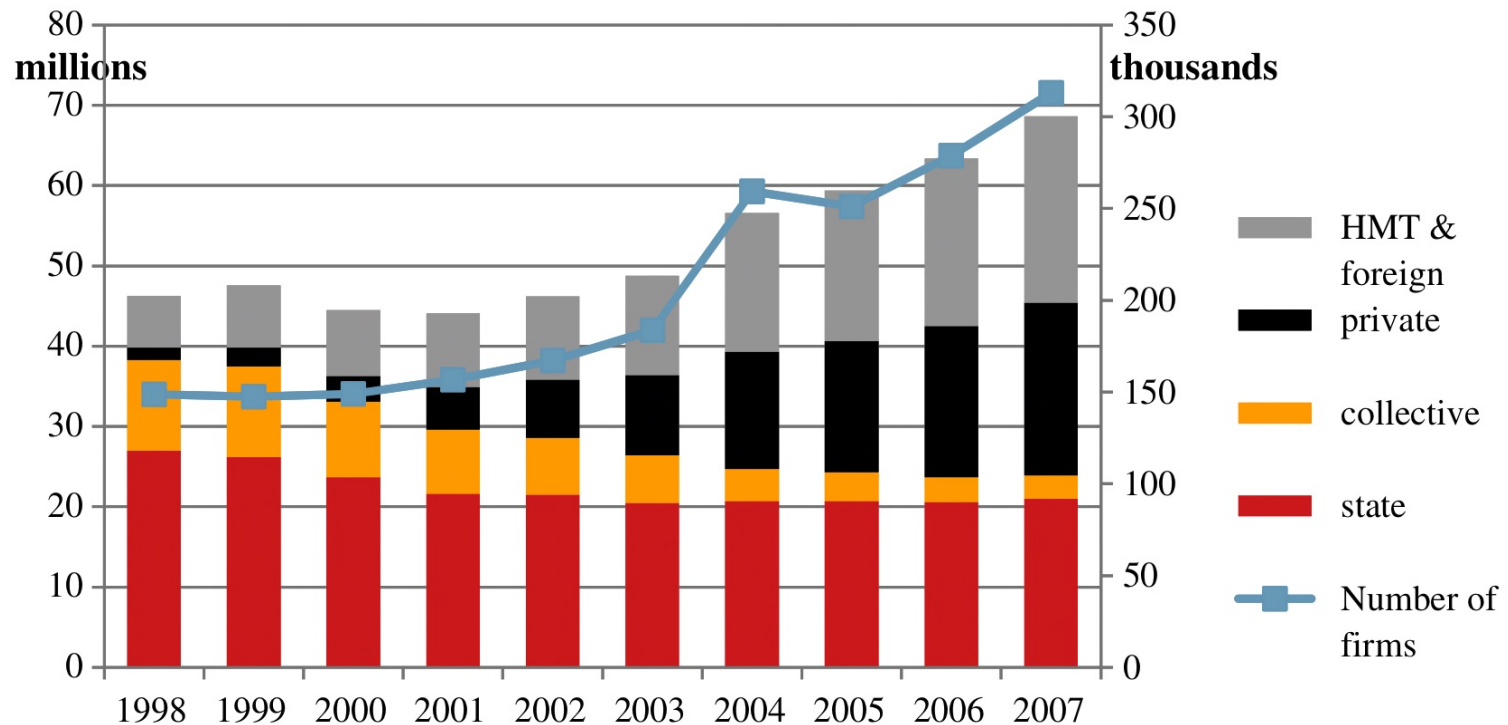
Summary statistics on the underlying firm-level data set.

Year	Number of firms	Value added	Sales	Output	Employment	Export	Net value of fixed assets
1998	165,118	1.94	6.41	6.77	56.44	1.08	4.41
1999	162,033	2.16	6.99	7.27	58.05	1.16	4.73
2000	162,883	2.54	8.42	8.57	53.68	1.46	5.18
2001	169,030	2.79	9.24	9.41	52.97	1.61	5.45
2002	181,557	3.30	10.95	11.08	55.21	2.01	5.95
2003	196,222	4.20	14.32	14.23	57.49	2.69	6.61
2004	279,092	6.62	20.43	20.16	66.27	4.05	7.97
2005	271,835	7.22	24.69	25.16	68.96	4.77	8.95
2006	301,961	9.11	31.36	31.66	73.58	6.05	10.58
2007	336,768	11.70	39.97	40.52	78.75	7.34	12.34

Notes: all values are denoted in trillion RMB and employment in millions of workers. All industrial firms are included while the analysis in the paper is limited to firms in the manufacturing sector. A comparison with corresponding values in the China Statistical Yearbook, the China Statistical Abstract, and the 1995 and 2004 Census is in the online Appendix.

Number of firms and employment

(a) Number of firms (right scale) and employment (left)



Q: Explain the pattern of firms and employment over time

Entry and Exit

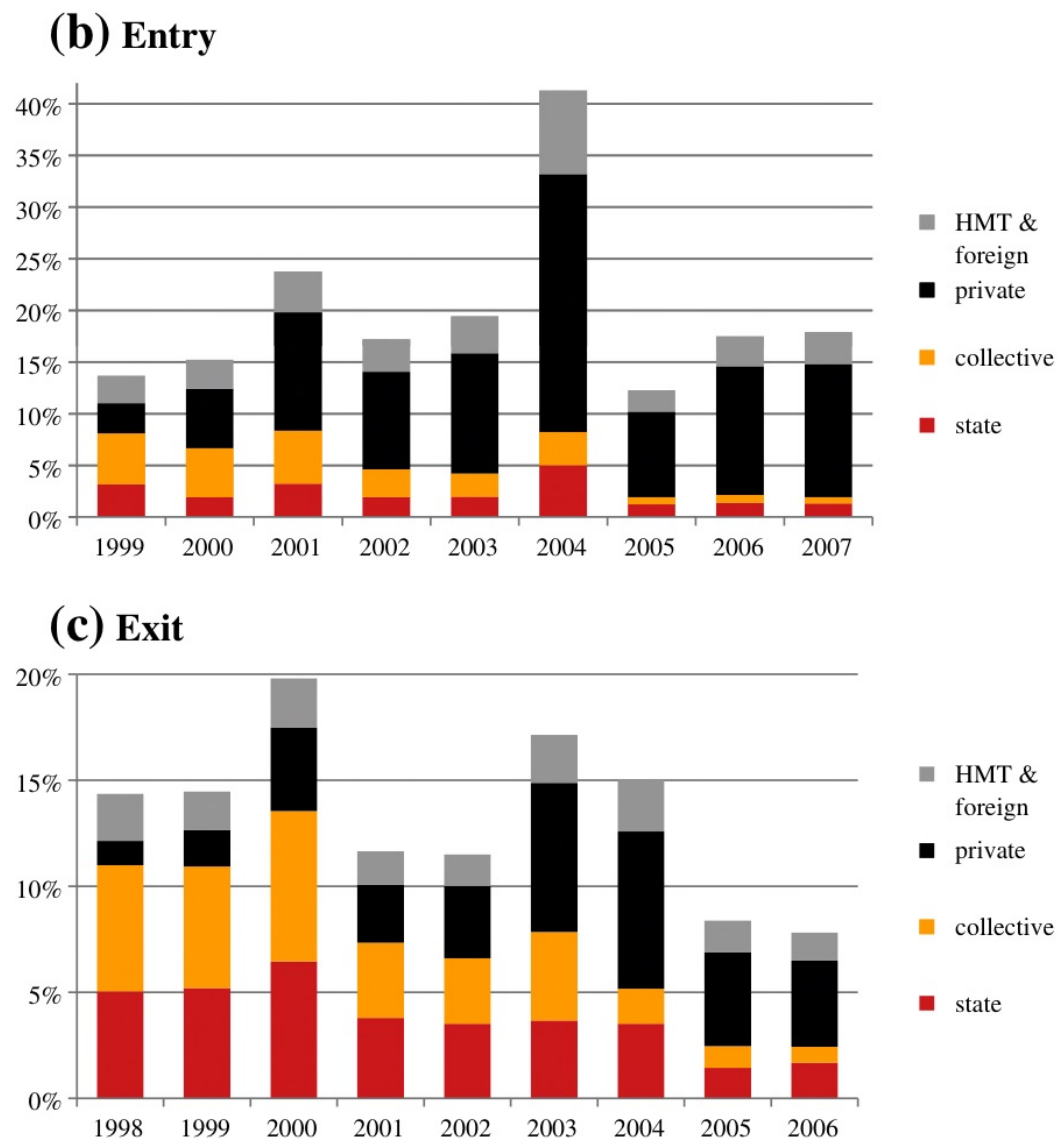
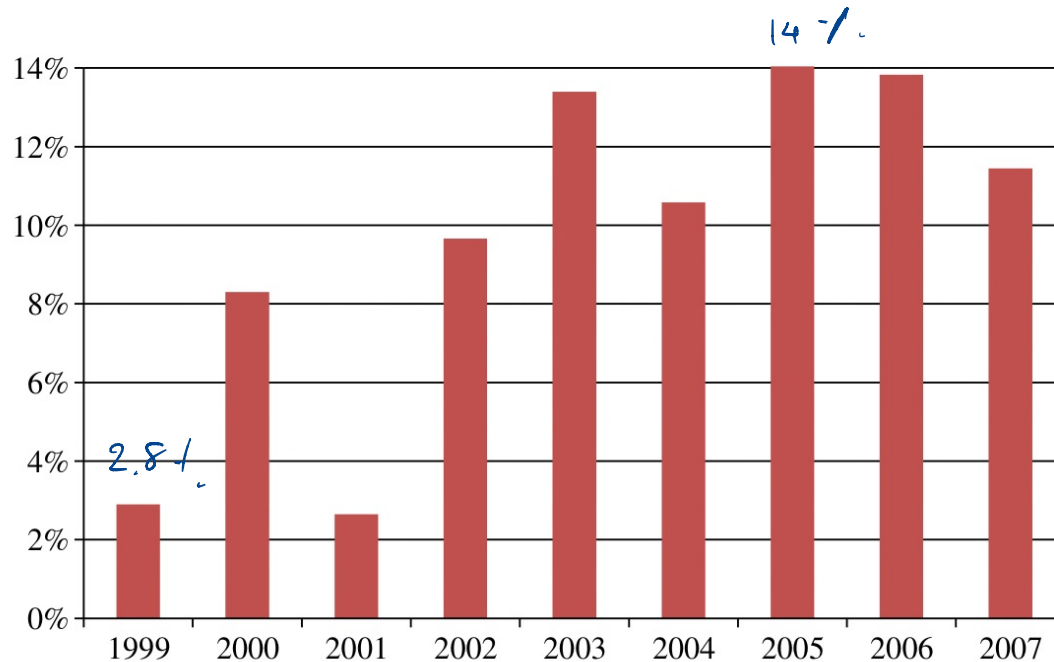


Fig. 1. Employment, entry and exit by ownership type.

Q: Explain the pattern of entry and exit over time.

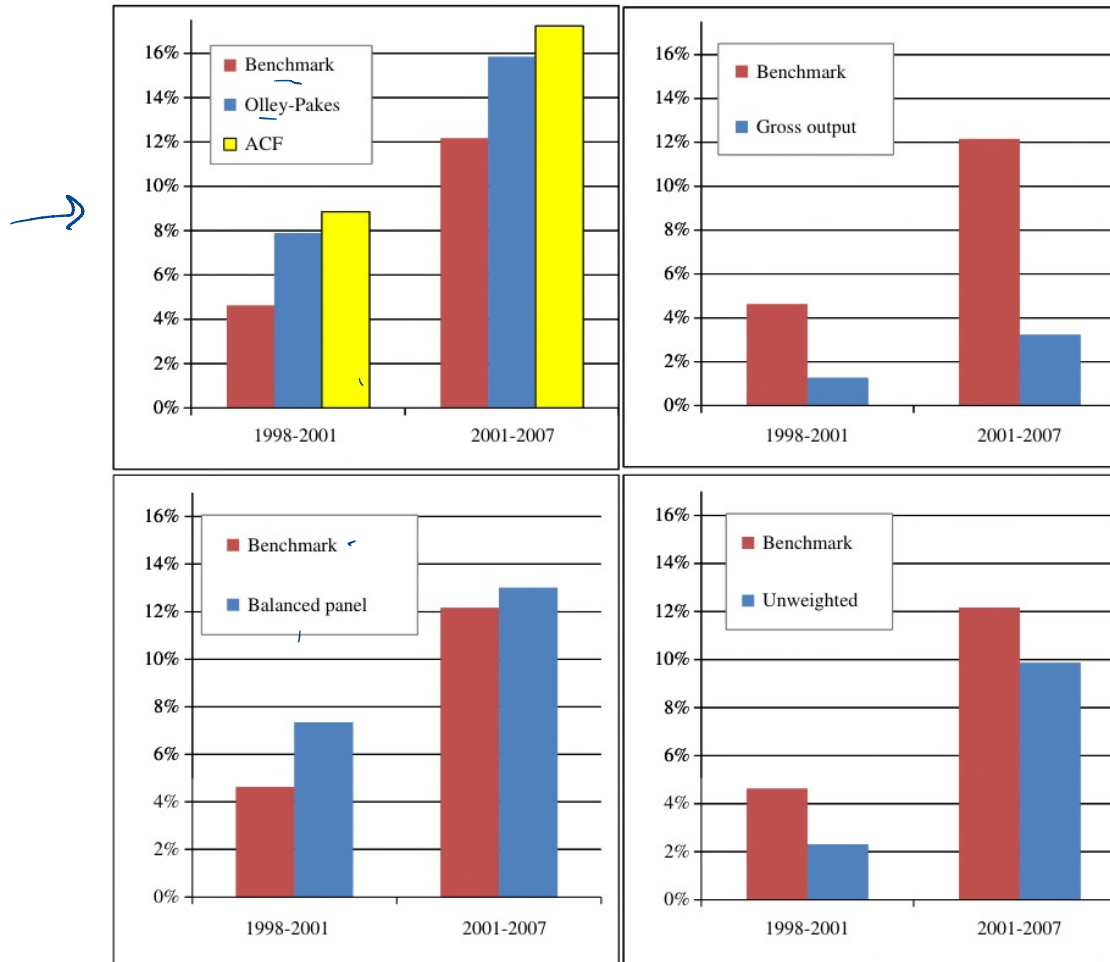
Result: Firm-Level Productivity Growth



Note: Value-added weighted average of firm-level year-on-year TFP growth estimates obtained using the index number methodology on the full unbalanced sample of Chinese manufacturing firms.

Fig. 2. Benchmark firm-level TFP growth estimates.

Q: Explain the benchmark firm-level TFP growth. Which equation is this estimate from? → eq 3



Note: The benchmark estimates always use the index numbers to calculate productivity (instead of the Olley-Pakes parametric methodology); use value added weights (instead of unweighted averages); are calculated on the full sample of firms (instead of the balanced panel); and use a value added production function (instead of gross output). The alternative calculations in the four panels use the alternative assumptions indicated in brackets here.

Fig. 3. Alternative TFP growth estimates.

Q: What do each of these alternative TFP growth estimates suggest?

Table 2

Average TFP growth in different countries.

Country	Study	Period	Sector	TFP growth
<i>Firm-level: value added production function</i>				
China		1998–2007	Manufacturing	0.080
Slovenia	De Loecker and Konings (2006)	1994–2000	Manufacturing	0.085
Vietnam	World Bank (2007)	2001–2003	Manufacturing	0.073
U.S.	Baily et al. (1992)	1982–1987	Selected manufacturing sectors	0.031
Chile	Pavcnik (2002)	1979–1986	Manufacturing	0.028
<i>Firm-level: gross output production function</i>				
China		1998–2007	Manufacturing	0.028
Korea	Ahn et al. (2004)	1990–1998	Manufacturing	0.035
Taiwan	Aw et al. (2001)	1986–1991	9 manufacturing sectors	0.021
Mexico	Tybout and Westbrook (1995)	1984–1990	Manufacturing	0.019
U.S.	Haltiwanger (1997)	1982–1987	Manufacturing	0.017
Japan	Ahn et al. (2004)	1994–2001	Manufacturing	0.003

Note: where published productivity growth estimates for other countries are available for several time periods, we have taken those from cyclical expansions to be comparable with the Chinese macroeconomic situation. The Chinese averages are the “preferred” estimates incorporating three adjustments on the benchmark estimates, as at the bottom of Fig. 4.

Q: How do Chinese TFP growth compare with those in other countries?

Result: Entering and exiting firms

- What method is used to estimate the productivity evolution for entering and exiting firms?
- What are the dependent variable, explanatory variables, and control variables?

$$\textcircled{1} \text{ TFP growth} = \beta_0 + \beta_1 T_{t+1} + \beta_2 T_{t+2} + \dots + \gamma X$$

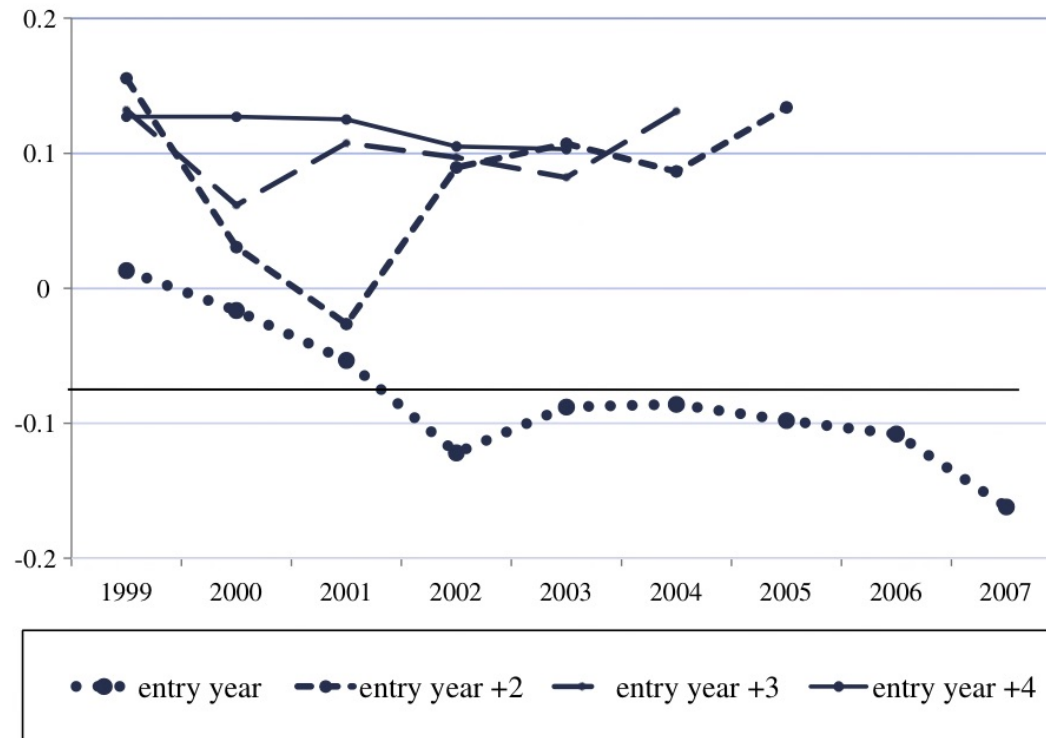
$$\textcircled{2} \text{ TFP} = d + \alpha_0 T_0 + \alpha_1 T_{t+1} + \alpha_2 T_{t+2}$$

Table 3
Productivity evolution.

Relative to	(a) Entering firms			(b) Exiting firms		
	Full sample		Balanced sample	Full sample		Balanced sample
	TFP growth (1)	TFP level (2)	TFP level (3)	TFP growth (4)	TFP level (5)	TFP level (6)
t_0 (entry) 1999		0.031 (α_0) (0.004)	-0.047 (0.005)	t_0 (exit) 2004 -0.145 (0.002)	-0.141 (0.003)	-0.258 (0.004)
$t+1$ 2000	0.139 (β_1) (0.003)	0.147 (α_1) (0.004)	0.073 (0.005)	$t-1$ 2003 -0.005 (0.003)	-0.079 (0.003)	-0.169 (0.004)
$t+2$ 2001	0.016 (0.003)	0.130 (α_2) (0.004)	0.058 (0.005)	$t-2$ 2002 -0.042 (0.003)	-0.065 (0.003)	-0.154 (0.004)
$t+3$ 2002	-0.014 (0.003)	0.086 (0.004)	0.017 (0.006)	$t-3$ 2001 0.009 (0.003)	-0.019 (0.003)	-0.108 (0.004)
$t+4$ 2003	-0.001 (0.004)	0.053 (0.005)	-0.022 (0.006)	$t-4$ 2000 0.024 (0.004)	-0.007 (0.004)	-0.091 (0.004)

Note: OLS regressions of TFP level and growth rates on dummies for the entry and post-entry years, in columns (1)–(3), and exit and pre-exit years in columns (4)–(6). Province and sector-year fixed effects are included. These results use the index number estimates of productivity; comparable results using the Olley–Pakes and Akerberg–Caves–Frazer productivity measures are in the Appendix.

Q: Explain the TFP growth for entering firms and exiting firms.

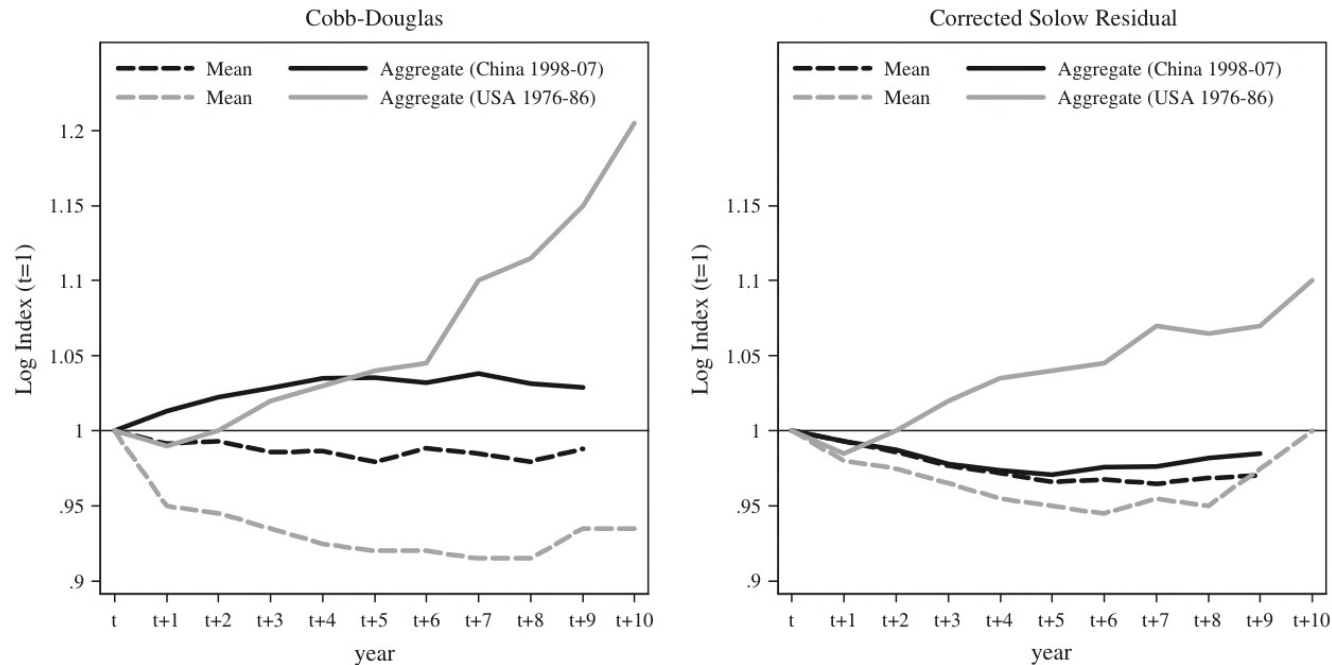


Note: The markers represent coefficient estimates for productivity levels in post-entry years relative to balanced panel firms, comparable to those in column (3) of Table 3. Estimates are performed separately by entry cohort and the two-year moving average of coefficients is plotted. Productivity is estimated using the index number method; only recently-founded firms (at most 2 years ago) are counted as entrants; the year of entry and the first complete post-entry years are lumped together.

Fig. 5. Evolution of relative productivity levels for new entrants.

Q: What can you say about the relative productivity level for new entrants?

Result: Resource reallocation between active firms



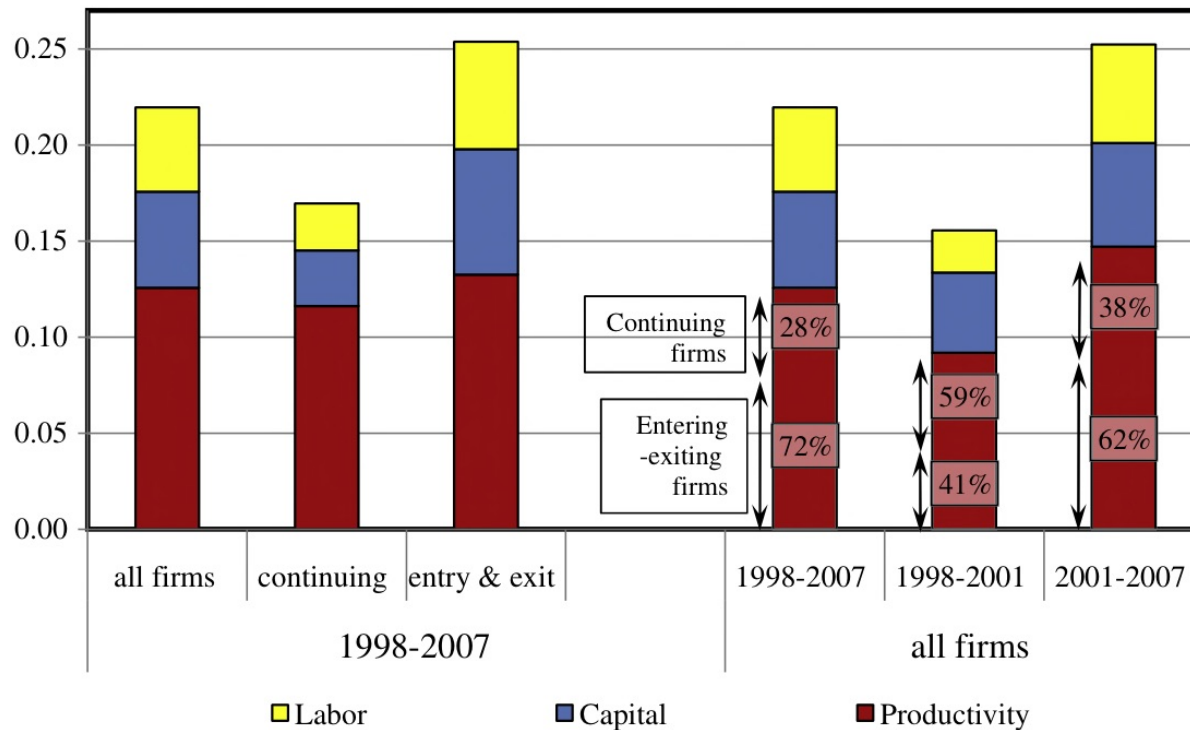
Source: U.S. results are from Figure 1 in Bartelsman and Dhrymes (1998); for consistency, we apply the same methodology for Chinese firms.

Notes: Cobb-Douglas productivity measures are calculated from a production function estimated by least squares. Solow Residuals refer to a Tornqvist index number using the wage share as weight on labor input and the material share for materials; in the United States a "capital share" is observed, while in China constant returns to scale are assumed. Both productivity measures are purged from year and 4-digit industry effects, and residuals are used. The dashed lines are unweighted averages, the solid lines weigh plants or firms by their aggregate input ($L^{\alpha_L} M^{\alpha_M} K^{1-\alpha_L-\alpha_M}$) share.

Fig. 6. Productivity contribution of resource reallocation between active firms.

- Q: - What are the methods used to compute productivity contribution to resource allocation between firms?
- How do resource allocation differ between China and USA?

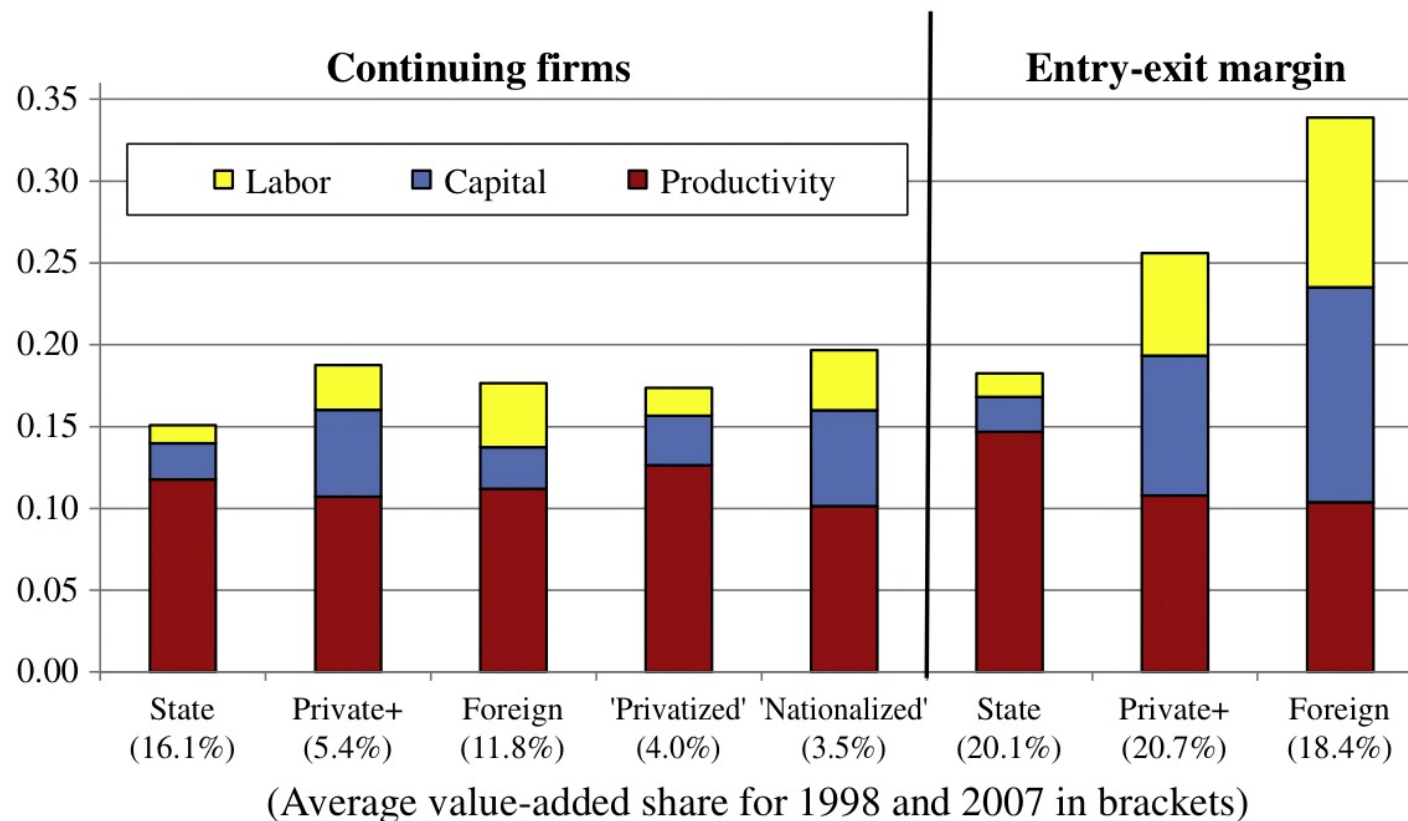
Result: From micro to macro level



Note: The bars indicate the different components in a standard Solow growth decomposition showing average annual changes in log points. The weight on labor input growth is 0.42, the average of the firm-level sample average and that in the national accounts. The percentages on the right decompose productivity growth into changes at intensive and extensive margins, as discussed in the text.

Fig. 7. Output and productivity growth decompositions.

Q: What do we know about the decomposition of the TFP growth?



Note: Private+ combines collective-owned firms (and other hybrids) and purely private firms. The nationalized firms are those switching to majority state ownership, the privatized category are those switching from state to one of the other two or switches within the private category.

Fig. 8. Growth decomposition by ownership categories (1998–2007).

Q: How do TFP growth differ across different types of firms?