Part 2: Measuring Misallocation

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Misallocation and Aggregate Productivity
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Goal

- Use establishment data to measure degree of misallocation:
  - dispersion in the marginal products of capital and labor
  - impact of such dispersion on aggregate TFP
- Need to assume (or estimate) production function(s)
  - Even with data on MPK_i and MPL_i, need to aggregate distortions
  - Establishment-level exogenous variation in k, l rarely available
- Also want to understand sources of misallocation

Hsieh-Klenow 2009

- Monopolistic competition so firm prices differ (so far: $p_i = 1 \ \forall i$)
- Allow capital and labor distortions
- Use wedges in FOCs (Chari-Kehoe-McGrattan) to uncover distortions

Technology

- S sectors index by s. Final good Cobb-Douglas over output of each:

$$Y = Y_1^{\omega_1} Y_2^{\omega_2} ... Y_S^{\omega_S}$$

  - Cost-minimization implies $P_s Y_s = \omega_s P Y$
  - $P = \text{const} \times P_1^{\omega_1} P_2^{\omega_2} ... P_S^{\omega_S}$

- Measure M_s firms indexed by i in sector s. Y_s is CES over output of each:

$$Y_s = \left(\int_0^{M_s} Y_{s,i}^{\frac{\sigma-1}{\sigma}} \mathrm{d}i \right)^{\frac{\sigma}{\sigma-1}}, \qquad \sigma > 1$$

  - Cost-minimization implies $Y_{s,i} = \left(\frac{P_{s,i}}{P_s} \right)^{-\sigma} Y_s$
  - $P_s = \left(\int_0^{M_s} P_{s,i}^{1-\sigma} \mathrm{d}i \right)^{\frac{1}{1-\sigma}}$

Technology

$$Y_{s,i} = A_{s,i} K_{s,i}^{\alpha_s} L_{s,i}^{1-\alpha_s}$$

- Factor shares differ across industries, but not for firms within industry
- Firms face revenue tax $\tau_{Y,s,i}$ and capital tax $\tau_{K,s,i}$

$$\max (1 - \tau_{Y,s,i}) P_{s,i} Y_{s,i} - W L_{s,i} - (1 + \tau_{K,s,i}) R K_{s,i}$$

- Note: $P_{s,i} \sim Y_{s,i}^{-1/\sigma}$. Model equivalent to span-of-control with $\eta = 1 - 1/\sigma$

Decision Rules

- Optimal price:

$$P_{s,i} = \frac{\sigma}{\sigma - 1} \left(\frac{R}{\alpha_s} \right)^{\alpha_s} \left(\frac{W}{1 - \alpha_s} \right)^{1-\alpha_s} \frac{1}{A_{s,i}} \frac{(1 + \tau_{K,s,i})^{\alpha_s}}{1 - \tau_{Y,s,i}}$$

- Capital-labor ratio:

$$\frac{K_{s,i}}{L_{s,i}} = \frac{\alpha_s}{1 - \alpha_s} \frac{W}{R} \frac{1}{1 + \tau_{K,s,i}}$$

- Employment:

$$L_{s,i} \sim \frac{(1 - \tau_{Y,s,i})^{\sigma}}{(1 + \tau_{K,s,i})^{\alpha_s(\sigma-1)}} A_{s,i}^{\sigma-1}$$

- Output:

$$Y_{s,i} \sim \frac{(1 - \tau_{Y,s,i})^{\sigma}}{(1 + \tau_{K,s,i})^{\alpha_s \sigma}} A_{s,i}^{\sigma}$$

Marginal Revenue Products

- Labor:

$$\mathrm{MRPL}_{s,i} = \frac{\partial(P_{s,i}Y_{s,i})}{\partial L_{s,i}} = (1-\alpha_s)\frac{\sigma-1}{\sigma}\frac{P_{s,i}Y_{s,i}}{L_{s,i}} = W\frac{1}{1-\tau_{Y,s,i}}$$

- Capital:

$$\mathrm{MRPK}_{s,i} = \alpha_s\frac{\sigma-1}{\sigma}\frac{P_{s,i}Y_{s,i}}{K_{s,i}} = R\frac{1+\tau_{K,s,i}}{1-\tau_{Y,s,i}}$$

- As earlier, dispersion MRPs is the source of misallocation

- With Cobb Douglas, MRP $\sim$ Average Revenue Product

TFP losses

- TFPQ vs. TFPR:

$$\mathrm{TFPQ}_{s,i} = A_{s,i} = \frac{Y_{s,i}}{K_{s,i}^{\alpha} L_{s,i}^{1-\alpha_s}}$$

$$\mathrm{TFPR}_{s,i} = \frac{P_{s,i} Y_{s,i}}{K_{s,i}^{\alpha} L_{s,i}^{1-\alpha_s}}$$

- Note: $P_{s,i}$ rarely observed. So researchers usually report TFPR

- Sometimes interpret TFPR is a measure of productivity (A) which is wrong

- Wrong because TFPR is a measure of distortions, not productivity:

$$\mathrm{TFPR}_{s,i} \sim \left(\mathrm{MRPK}_{s,i}\right)^{\alpha_s} \left(\mathrm{MRPL}_{s,i}\right)^{1-\alpha_s} \sim \frac{\left(1+\tau_{K,s,i}\right)^{\alpha_s}}{1-\tau_{Y,s,i}}$$

TFP Losses

- Let $K_s = \int_0^{M_s} K_{s,i} \mathrm{d}i$, $L_s = \int_0^{M_s} L_{s,i} \mathrm{d}i$
- As earlier, output in sector s is also Cobb-Douglas:

$$Y_s = \mathrm{TFP}_s K_s^{\alpha_s} L_s^{1-\alpha_s}$$

$$\mathrm{TFP}_s = \left(\int_0^{M_s} \left(A_{s,i} \frac{\overline{\mathrm{TFPR}}_{s,i}}{\mathrm{TFPR}_{s,i}} \right)^{\sigma-1} \mathrm{d}i \right)^{\frac{1}{\sigma-1}}$$

- $\overline{\mathrm{TFPR}}$ is (approx.) weighted average of $\mathrm{TFPR}_{s,i}$. See footnote 11
- With log-normality:

$$\log \mathrm{TFP}_s = \frac{1}{\sigma-1} \log \left(\int_0^{M_s} (A_{s,i})^{\sigma-1} \mathrm{d}i \right) - \frac{\sigma}{2} \mathrm{variance}(\mathrm{TFP}_{s,i})$$

Datasets

- India: ASI. Only keep manufacturing
  - 1988-1995. Census: all plants > 50 wks & 1/3 > 10 wks
  - 40,000 per year
  - Variables:
    - 4-digit ISIC industry code, age
    - labor compensation (wages + bonuses + benefits)
    - book value of capital stock
    - value added
- Drop outliers (top and bottom 1% by productivity, TFPR)

Datasets

- China: ASIP (Data on *firms*, not plants). Only keep manufacturing
  - 1998-2005. Census: all state + private if revenue > $600,000
  - 100,000 in 98 to 200,000 in 2005
  - Variables:
    - 4-digit ISIC industry code, age
    - wage payments (impute benefits to match 50% labor share)
    - book value of capital stock
    - value added
- Drop outliers (top and bottom 1% by productivity, TFPR)

Datasets

- US: Census of Manufacturers
  - 1977-(5)-1997. Census: all plants
  - 160,000
  - Variables:
    - 4-digit ISIC industry code, no age (impute from entry year)
    - compensation (wages + benefits)
    - book value of capital stock
    - value added
  - Drop outliers (top and bottom 1% by productivity, TFPR)

Calibration

- Assume parameters identical in all countries:
  - $R = 0.10$ (argue not important)
  - $\sigma = 3$ (lower bound of estimates)
  - $\alpha_s = 1 -$ labor share in industry s in U.S.

Recover distortions and productivity

- Use first-order conditions

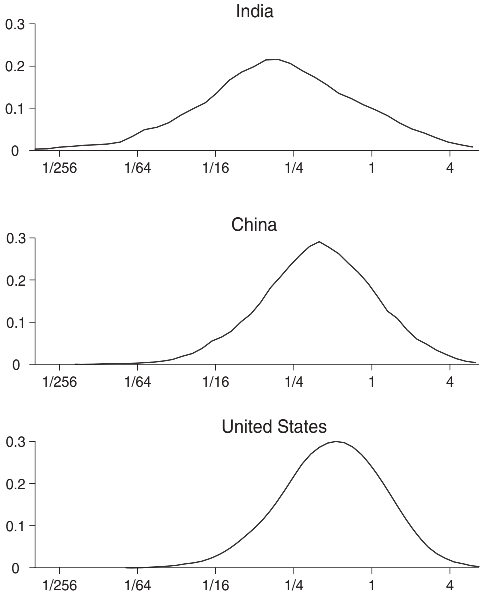
$$1 + \tau_{K,s,i} = \frac{\alpha_s}{1-\alpha_s} \frac{WL_{s,i}}{RK_{s,i}}$$

$$1 - \tau_{Y,s,i} = \frac{\sigma}{\sigma - 1} \frac{WL_{s,i}}{(1-\alpha_s) P_{s,i} Y_{s,i}}$$

$$A_{s,i} = \kappa_s \frac{(P_{s,i} Y_{s,i})^{\frac{\sigma}{\sigma-1}}}{K_{s,i}^{\alpha} L_{s,i}^{1-\alpha}}$$

  - $P_{s,i} Y_{s,i}$: nominal value added (sales net of cost of materials, energy etc.)
  - $WL_{s,i}$: nominal labor compensation to control for skill differences
  - $K_{s,i}$: book value of K
  - κ_s: function of P_s and Y_s. Set to 1 since does not affect reallocation gains

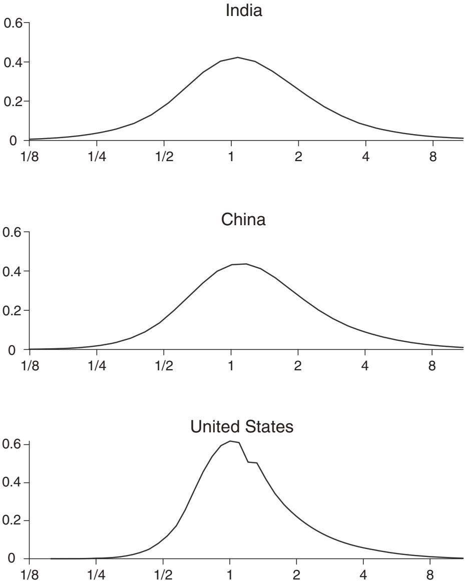
Distribution of TFPQ



Distribution of TFPQ

China	1998	2001	2005
S.D.	1.06	0.99	0.95
75 − 25	1.41	1.34	1.28
90 − 10	2.72	2.54	2.44
N	95,980	108,702	211,304
India	1987	1991	1994
S.D.	1.16	1.17	1.23
75 − 25	1.55	1.53	1.60
90 − 10	2.97	3.01	3.11
N	31,602	37,520	41,006
United States	1977	1987	1997
S.D.	0.85	0.79	0.84
75 − 25	1.22	1.09	1.17
90 − 10	2.22	2.05	2.18
N	164,971	173,651	194,669

Distribution of TFPR



Distribution of TFPR

China	1998	2001	2005
S.D.	0.74	0.68	0.63
75 − 25	0.97	0.88	0.82
90 − 10	1.87	1.71	1.59
India	1987	1991	1994
S.D.	0.69	0.67	0.67
75 − 25	0.79	0.81	0.81
90 − 10	1.73	1.64	1.60
United States	1977	1987	1997
S.D.	0.45	0.41	0.49
75 − 25	0.46	0.41	0.53
90 − 10	1.04	1.01	1.19

Sources of TFPR variation

Percent Sources of TFPR Variation within Industries

	Ownership	Age	Size	Region
India	0.58	1.33	3.85	4.71
China	5.25	6.23	8.44	10.01

Notes. Entries are the cumulative percent of within-industry TFPR variance explained by dummies for ownership (state ownership categories), age (quartiles), size (quartiles), and region (provinces or states). The results are cumulative in that "age" includes dummies for both ownership and age, and so on.

Losses from Misallocation

TFP GAINS FROM EQUALIZING TFPR WITHIN INDUSTRIES

China	1998	2001	2005
%	115.1	95.8	86.6
India	1987	1991	1994
%	100.4	102.1	127.5
United States	1977	1987	1997
%	36.1	30.7	42.9

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Much larger in China and India

Losses from Misallocation

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Falling in China: accounts 1/3 of TFP growth

Losses from Misallocation

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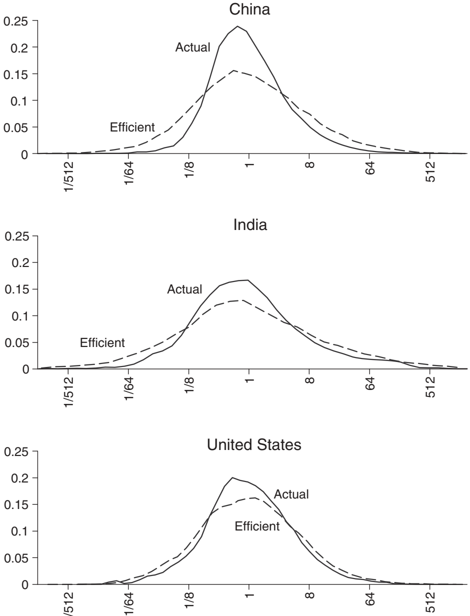
Increasing in India: reason for much smaller TFP growth?

Efficient Size Distributions



Measurement error

- Argue can't be only story: why is it so much worse in China & India?
- Results change little if trim top/bottom 2% outliers
- Argue TFPR much lower for state-owned & exiting so isn't entirely noise
  - But we saw ownership explains very little
- Much less variance in input growth (though much more in revenue growth)

Growth Rate Dispersion

Dispersion of Input and Revenue Growth

	Inputs	Revenue
China		
S.D.	0.45	1.00
75 − 25	0.34	0.93
India		
S.D.	0.28	0.70
75 − 25	0.24	0.60
United States		
S.D.	0.68	0.43
75 − 25	0.43	0.32

Can't rule out large measurement error in Revenue (value added)

Midrigan-Xu 2009

- "Accounting for Plant-Level Misallocation"
- Argue capital, not labor/interm. inputs most distorted
- Most dispersion MRPK: permanent differences across firms
- Limited role for adjustment costs

Data

- Use Korean Annual Mining & Manufacturing Survey $'91$ to $'98$
- All establishments 5+ workers
- Revenue (Y), labor (WL), materials (PM), capital (K)
- Detailed data on investment
  - Construct K (buildings + equipment) using PI method
  - Also compare to book value

Dispersion in $\ln(Y/K)$ larger than other factors

	All plants	Top 80 % revenue
var $\ln(\frac{Y}{K})$	1.23	1.06
var $\ln(\frac{Y}{WL})$	0.35	0.30
var $\ln(\frac{Y}{PM})$	0.40	0.20
plant-year obs.	592996	49464

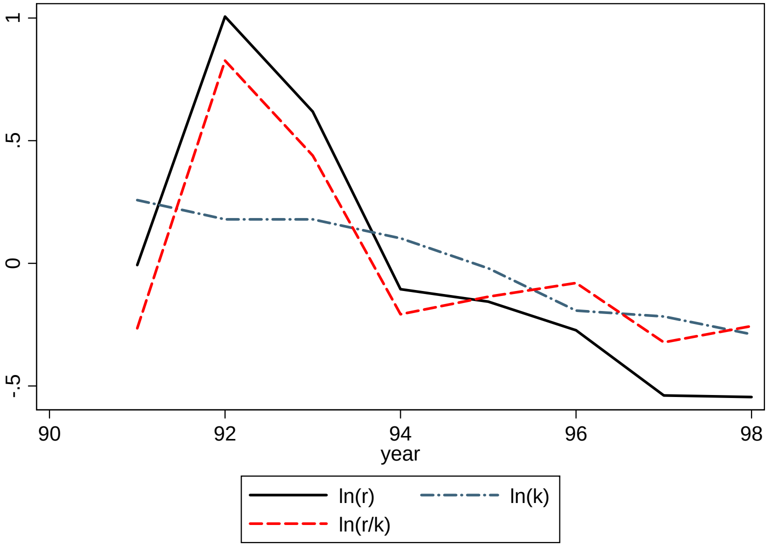
Decompose dispersion $\ln(Y/K)$

- Fraction of variance $\ln(Y/K)$ due to:

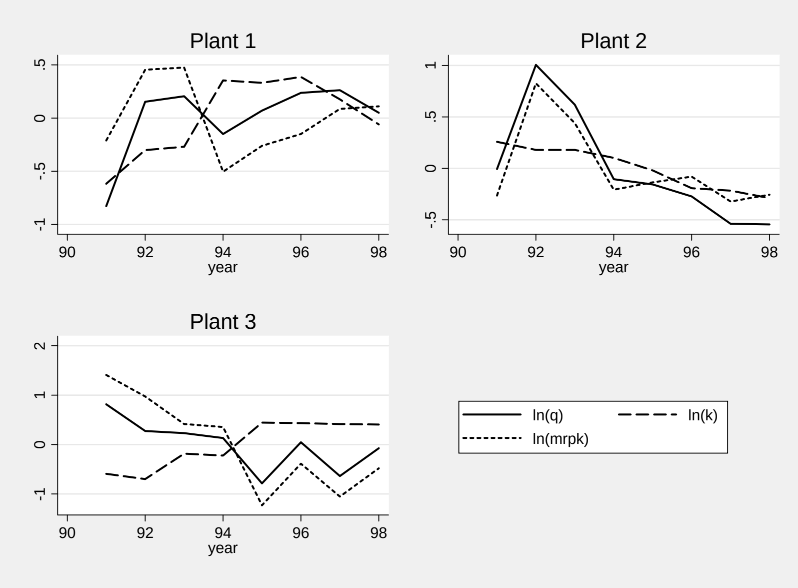
year dummies	0.00
5-digit industry dummies	0.14
plant dummies (survive all years)	0.72

- Conditional on surviving 91-98:
  - median within-plant time-series var. : 0.16

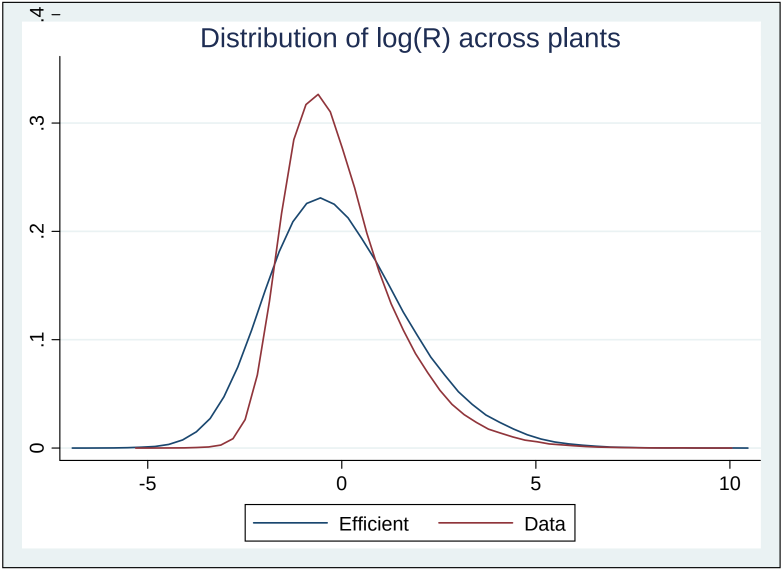
An example of a plant



More plants


Plant 1
Plant 2
Plant 3
.5
0
-.5
-1
1
2
90
92
94
96
98
year
ln(q)
ln(k)
ln(mrpk)

Efficient size distribution



Measurement Error in Capital

- We construct K using perpetual inventory method:

$$K_{it} = K_{it-1} + I_{it} - Dep_{it}$$

  - Use book value of K to initialize $K_{i,91}$. Measurement error?

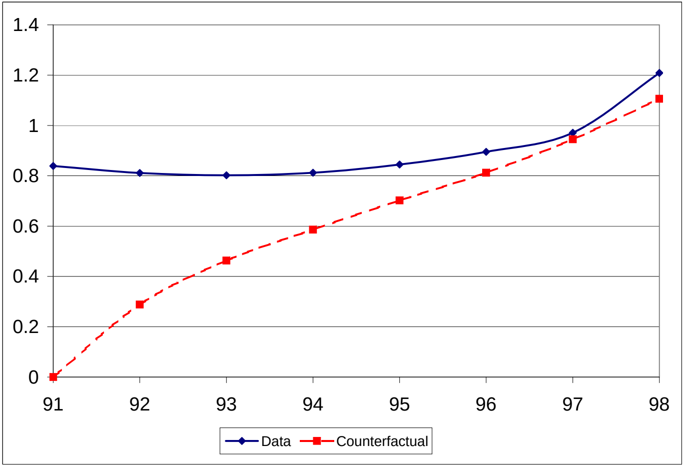
- Ask: can measurement error in $K_{i,91}$ account for dispersion $\ln(Y/K)$?

- Counterfactual: choose $K_{i,91}$ s.t. $\sigma\left(Y/K\right) = 0$ in 1991

- Use perpetual inventory method subsequent years.

- Keep plants in sample 1991-1998

Measurement of Initial Capital Stock



Omitted Rental Capital

- Some plants (esp. small) rent equipment and structures
- Add Rent/R to K
- var($\ln Y/K$) declines from 1.23 to 0.85.
- Smallest 25% rent 1/3 K. Largest 25% rent 1/10 K.

Use electricity use as proxy for capital services

- K-stock $\neq$ K-services
- e.g. variable K-utilization
- Use electricity consumption instead of K (Leontieff)
- $\text{var}(\ln Y/E) = 1.10$ v.s. $var(\ln Y/K) = 1.23$
- $\text{corr}(\ln(E), \ln(K)) = 0.77$

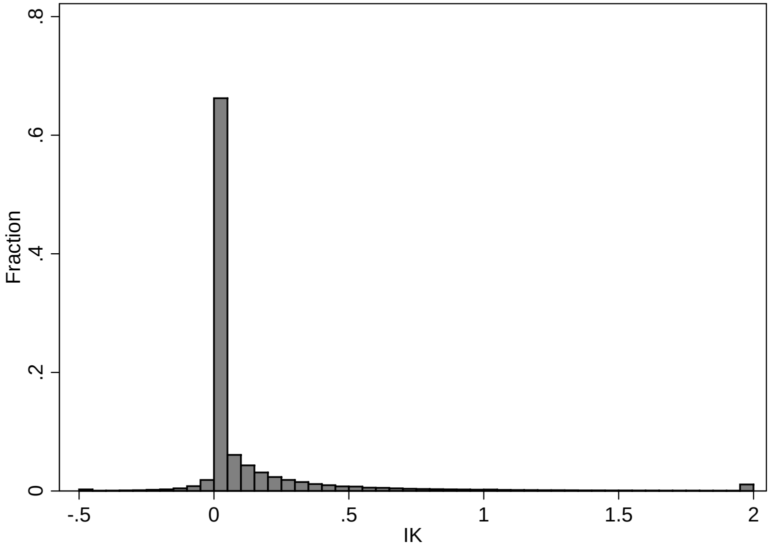
Measurement of Revenue

- Use data on materials use to purify $y = a + \alpha k + u$
- Olley-Pakes (96) and Levinsohn-Petrin (03): $m = G(k, a)$
- Nonparametric regression of y on k and m: purified revenue y^p
- $var(y^p - k) = 1.04$

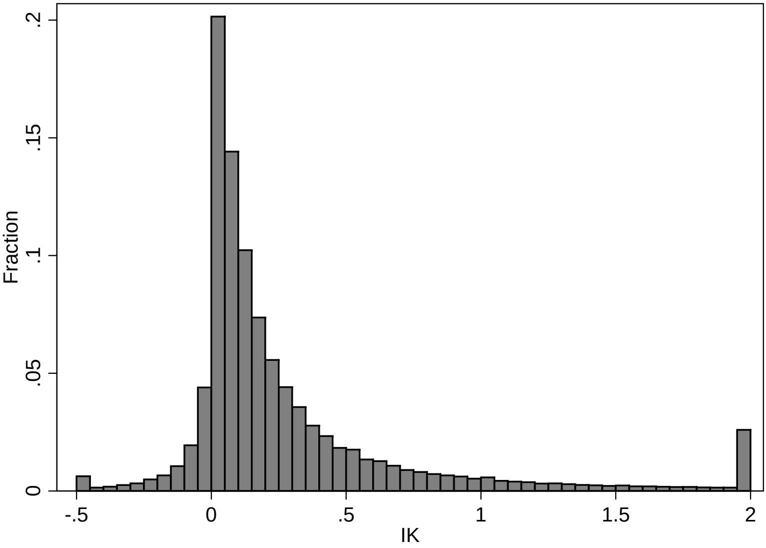
Is dispersion in MRPK due to adjustment costs?

- Distribution of plant-level I/K:
  - Inaction: many plants $I = 0$
  - Irreversibility: few $I < 0$
  - Spikes: large I episodes

Unconditional



Conditional on $IK \neq 0$



Additional motivation for adjustment costs

- Buildings vs. Machinery
  - Buildings: $I \neq 0$ every 5 years. $\text{var}(Y/K) = 2.34$
  - Machinery: $I \neq 0$ every 2 years. $\text{var}(Y/K) = 1.18$

Model

- PE problem of a plant:
    - Idiosyncratic productivity: independent Markov process
    - Fixed costs of producing, sunk costs of entering
    - Capital adjustment frictions
        - Partial irreversibility (lower sale price of K)
        - Fixed installation cost

Technology

- Revenue net labor and materials payments

$$\Pi = \max_{M,L} PY - wL - pM = \exp(x)K^{\alpha}$$

- Fixed, per-period operating cost $\xi \sim \text{iid} \left(\frac{\xi - 0}{\xi_{max} - 0}\right)^{\eta}$

- Productivity: $x = a + z$

  - $a = \rho a_{-1} + \varepsilon$, $\varepsilon \sim N(0, \sigma_a^2)$

  - $z \sim N(0, \sigma_z^2)$

Adjustment Costs & Entry/Exit

- Adjustment Costs
  - Time-to-build: 1-period lag btw investment and use
  - Installing (selling) capital: fixed cost κ
  - Partial irreversibility: selling price $P_s < 1$

- Entry/Exit:
  - Entrant pays sunk cost, ϕ_e, draw $a \sim N\left(0, \frac{\sigma_a^2}{1-\rho^2}\right)$, invests
  - To continue: pay fixed cost ξ
  - Exit: produce, sell K

Dynamic Program:

$$V(K, a, z, \xi) = \max\left(V^a, V^n, P_s(1-\delta)K + \exp(a+z)K^\alpha\right)$$

- Value of adjusting K:

$$V^a = \max_{K'} \exp(a+z)K^\alpha - \kappa - \xi - \underbrace{\left(K' - (1-\delta)\,K\right)}_{I} \times$$

$$\left(1 \times (I > 0) + P_s\,(I < 0)\right) + \beta \int V(K', a', \xi', z')dF(a', \xi', z'|a)$$

- Value of not adjusting K:

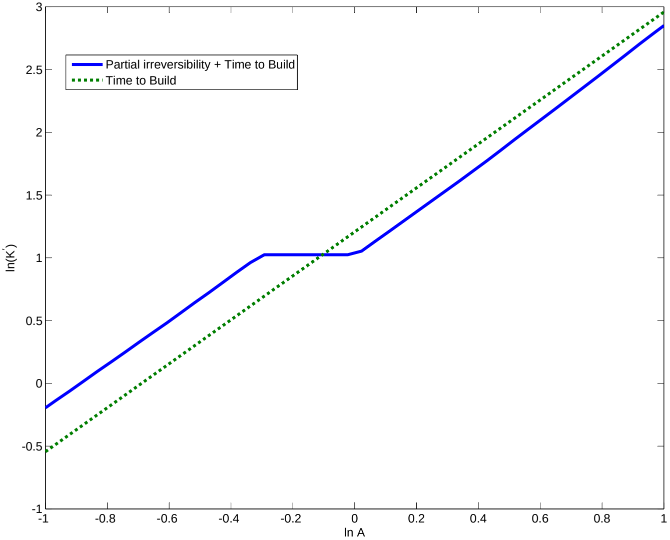
$$V^n = \exp(a+z)K^\alpha - \xi + \beta \int V((1-\delta)K, a', \xi', z')dF(a', \xi', z'|a)$$

Value of entering

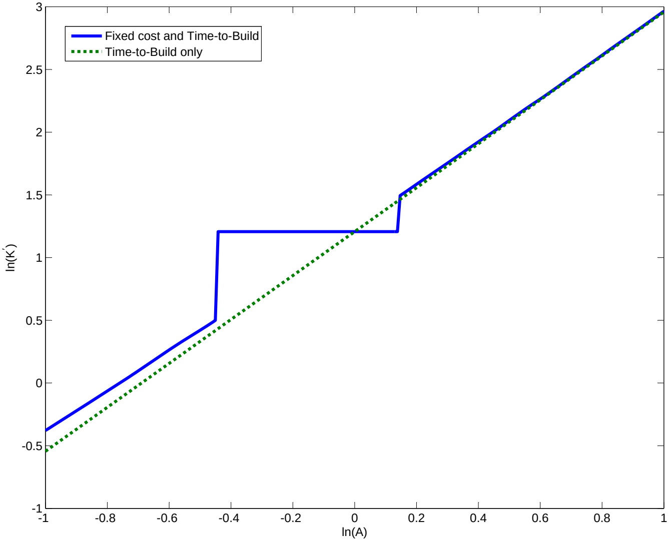
$$V^o = -\phi_e + \int_a \left[\max_{K(a)} -K(a) + \beta \int\limits_{a' \times z' \times \xi'} V(K, a', z', \xi') dF(a', z', \xi' | a) \right] d\Phi(a)$$

- Entry/exit does not distort capital accumulation decision

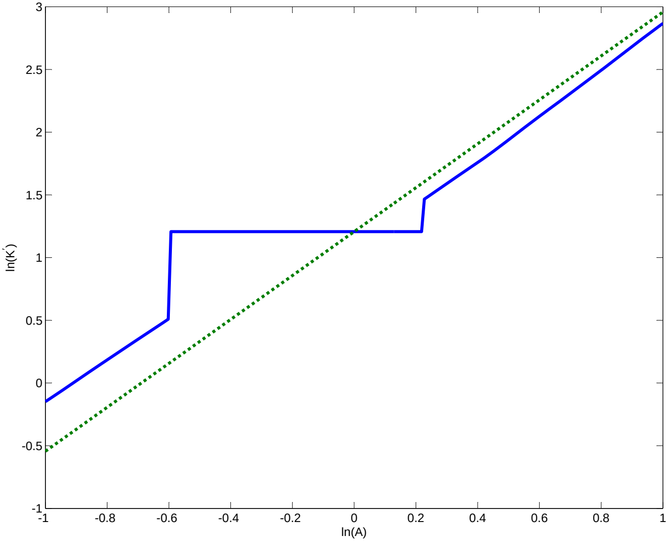
Optimal Policy Rules: Partial Irreversibility



Optimal Policy Rules: Fixed Cost



Optimal Policy Rules: PI & Fixed Cost



Parametrization

- Assigned parameters:
    - $\alpha = 0.45$ (from $\theta = 0.85$) and L, M shares
    - $\beta = 0.925$ (real corporate bond rate Korea 1990-1998 = 8%)
- Calibrate rest

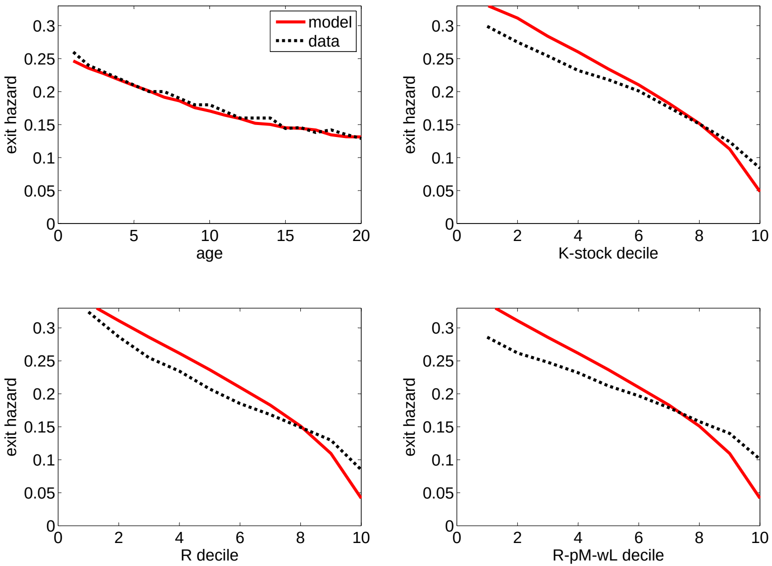
Calibration Strategy: moments

- Productivity: ρ, σ_a, σ_z
  - $var(y_{it})$, $corr(y_{it}, y_{it-1})$, $\frac{corr(y_{it}, y_{it-2})}{corr(y_{it}, y_{it-1})}$
- Adjustment costs: P_s, κ
  - distribution of I/K: skewness, inaction, freq. < 0
- Fixed cost: ξ_{max}, η
  - exit hazard (ages 1-5, 6-10, 11-20)
- Depreciation: δ:
  - mean I/K

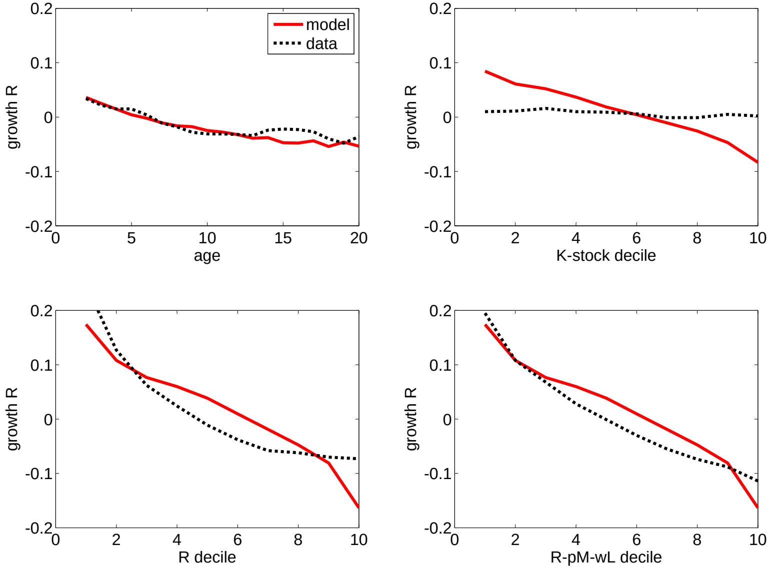
Moments used in calibration

	Data	Model
var y	2.06	2.06
autocorr. y	0.942	0.943
corr y_{-2}/corr y_{-1}	0.972	0.973
mean I/K	0.13	0.13
median I/K	0.00	0.00
std. dev. I/K	0.38	0.33
skeweness I/K	5.01	3.20
fraction $I/K \leq 0$	0.04	0.04
fraction $I/K \leq mean/4$	0.67	0.74
mean IK if $IK \leq 0$	-0.13	-0.16
autocorr. IK	0.08	0.14

Exit Hazards



Scale-dependent growth



Parameter values

δ	0.055
ρ	0.949
σ_ϵ	0.235
σ_z	0.30
P_s	0.81
κ, % mean I	0.89
ξ_{max}, rel. to mean π	14.7
η	0.089

Misallocation

	Data	Model
var r/k	1.23	0.17
median var r/k_i	0.16	0.14
$\Delta \log A \times 100$	-39.5	-6.7

Role of K-adj. costs?

- Set $P_s = 1$ and $\kappa = 0$

	Data	Benchmark	No adj. costs
skewness I/K	5.01	3.20	1.28
fraction $I/K \leq 0$	0.04	0.04	0.46
fraction $I/K \leq mean/4$	0.67	0.74	0.50

Misallocation

	Data	Benchmark	No adj. costs
var r/k	1.23	0.17	0.13
median var r/k_i	0.16	0.14	0.13
TFP losses misllocation, %	-39.5	-6.7	-4.9

Bottomline

- Adj. costs generate temporary/small gap $(k - k^*)$
  - Optimal to pay cost to close persistent/large gap
    - Can account within-plant var R/K (0.14 vs. 0.16)
    - Cannot account persistent R/K differences across plants
  - Selection: most inaction reflects small wedges in Euler equation

Working with Plant Level Data

	plant	year	revenue	valueadded	workers	wages	benefits	capital
1	111	91	23833	2938	259	1825	272	2013
2	103	91	6834	2782	230	1299	133	1601
3	114	91	4875	2470	162	1356	156	840
4	113	91	2854	1581	123	669	15	647
5	119	91	2487	824	30	224	15	106
6	112	91	1607	419	46	232	8	278
7	106	91	1578	272	17	118	2	75
8	101	91	1334	481	29	280	32	842
9	109	91	918	781	45	300	47	51
10	115	91	759	216	21	90	7	80
11	105	91	435	143	12	68	5	279
12	110	91	418	135	8	49	3	346
13	117	91	409	247	13	120	10	390
14	116	91	228	112	12	45	5	571
15	102	91	223	130	15	95	1	125
16	118	91	220	53	8	25	0	200
17	104	91	135	70	5	35	1	18
18	108	91	112	81	7	40	0	40

Stata Code, part 1

```
clear all;
cd "/Users/virgiliu/Dropbox/NYU Teaching/Santiago Misallocation/Data";
set more off;

use korea91.dta;

g k             = capital;              /* book value of fixed capital be
g y             = revenue;              /* total revenue */
g v             = valueadded;           /* value added = total revenue -
g l             = workers;              /* number of workers */
g wl            = wages + benefits;     /* labor compensation =  wages +

egen meanwl     = mean(wl);
egen meanv      = mean(v);

g alphai        = 1 - meanwl/meanv;
sum alphai;

scalar alpha    = r(mean);

scalar R        = 0.10;
scalar sigma    = 3;

g mrpl          = (1-alpha)*(sigma-1)/sigma*v/wl;
g mrpk          = alpha*(sigma-1)/sigma*v/k;
```

Stata Code, part 2

```
g mrpk          = alpha*(sigma-1)/sigma*v/k;

g tauk          = alpha/(1 - alpha)*(wl/(R*k)) - 1;
g tauy          = 1 - sigma/(sigma - 1)*wl/v/(1-alpha);
g tfpr          = v/(k^alpha*wl^(1-alpha));

sum tauk, d;
drop if tauk < r(p1) | tauk > r(p99);

sum tauy, d;
drop if tauy < r(p1) | tauy > r(p99);

g lmrpk         = log(mrpk);
g lmrpl         = log(mrpl);

sum lmrpk, d;
sum lmrpl, d;

g tfpq          = v^(sigma/(sigma-1))/(k^alpha*wl^(1-alpha));

sum tfpq; g ltfpq = log(tfpq/r(mean)); /* log deviation from mean */
sum tfpr; g ltfpr = log(tfpr/r(mean)); /* log deviation from mean */

sum ltfpq, d;
sum ltfpr, d;
```

Distribution of MRPK and MRPL

```
. sum lmrpk, d;

                            lmrpk
-------------------------------------------------------------
      Percentiles      Smallest
 1%    -2.513686      -3.029519
 5%    -1.904804       -2.98183
10%     -1.55977      -2.927003       Obs                2346
25%    -.9518149      -2.881955       Sum of Wgt.        2346

50%    -.2746194                      Mean           -.2835461
                        Largest       Std. Dev.       .9625074
75%     .3751883       2.382207
90%     .9625468       2.392693       Variance        .9264205
95%     1.269794       2.546051       Skewness       -.0449119
99%     1.862708       2.873147       Kurtosis        2.737777

. sum lmrpl, d;

                            lmrpl
-------------------------------------------------------------
      Percentiles      Smallest
 1%    -1.238591      -1.473636
 5%    -1.049109      -1.469049
10%    -.9677312      -1.459699       Obs                2346
25%    -.8024676      -1.407422       Sum of Wgt.        2346

50%    -.5843476                      Mean           -.5455033
                        Largest       Std. Dev.       .3589509
75%    -.3382006       .6227952
90%    -.0471194       .6279284       Variance        .1288457
```

Distribution of TFPR and TFPQ

Results

```
> sum ltfpq, d;

                            ltfpq
-------------------------------------------------------------
      Percentiles      Smallest
 1%    -2.432918      -3.084136
 5%    -1.898453      -3.020736
10%    -1.550505       -2.96788       Obs                2346
25%    -1.035106      -2.965415       Sum of Wgt.        2346

50%    -.4715088                      Mean          -.4243243
                        Largest       Std. Dev.      .8996761
75%     .1663022       2.511358
90%     .7475417       2.520749       Variance        .809417
95%      1.09964        2.61379       Skewness       .1557391
99%     1.785786       2.665667       Kurtosis       3.083587

. sum ltfpr, d;

                            ltfpr
-------------------------------------------------------------
      Percentiles      Smallest
 1%    -1.607386      -1.989568
 5%     -1.20624      -1.979576
10%    -.9677902      -1.909127       Obs                2346
25%    -.5640338      -1.856353       Sum of Wgt.        2346

50%    -.1690641                      Mean          -.1821097
                        Largest       Std. Dev.      .6046524
75%     .2104715        1.58913
90%     .5692927       1.604662       Variance       .3656045
```

Stata Code, part 3

```
sum v;
g share = v/r(mean);

g term1 = R/alpha*(1+tauk)/(1-tauy)*share;
g term2 = 1/(1-alpha)*1/(1-tauy)*share;

sum term1;
scalar t1      = r(mean)^alpha;

sum term2;
scalar t2      = r(mean)^(1-alpha);

scalar tfprbar = t1*t2;

g term3        = (tfpq*tfprbar/tfpr)^(sigma-1);
sum term3;
scalar t3      = r(mean);

scalar tfp     = t3^(1/(sigma-1));

g term4        = (tfpq)^(sigma-1);
sum term4;
scalar t4      = r(mean);

scalar tfpe    = t4^(1/(sigma-1));
scalar tfploss = log(tfpe/tfp);
```

TFP loss from misallocation

```
tfploss =  .46861337
   tfpe =  78.744364
    tfp =  49.283697
tfprbar =  1.5604118
  sigma =          3
      R =         .1
  alpha =  .58913022
```