

Japan- Korea Workshop on Productivity Analysis

***Some Stylized Facts
on the Firm Size Distribution in Korea***

***Jeong-Dong Lee and Junho Na
Seoul National University
2012. 12. 7.***

Contents

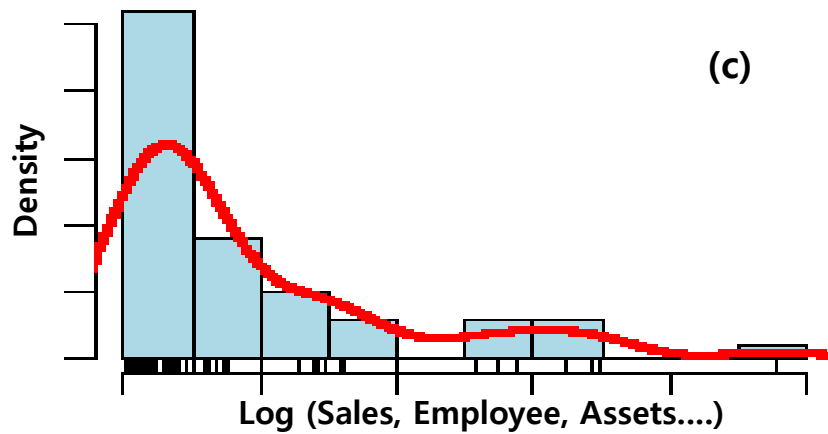
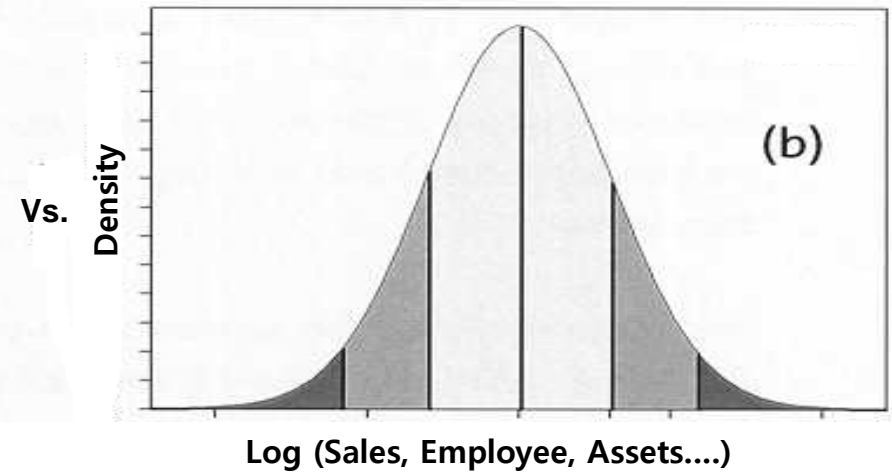
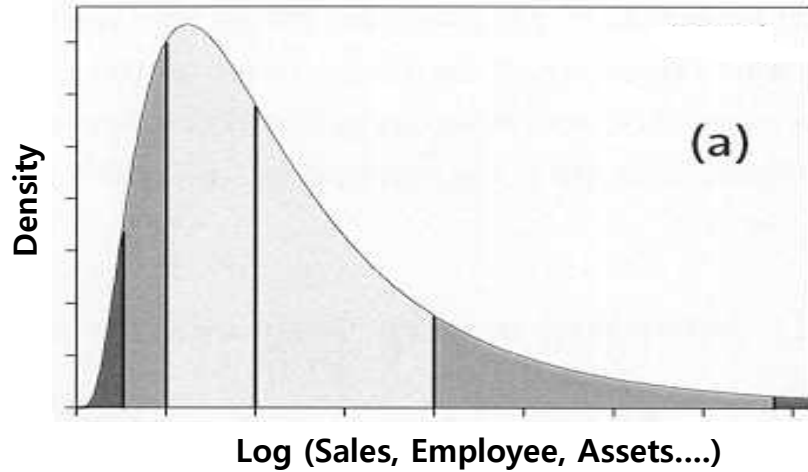
I. Background

II. Some Stylized Facts on the Firm Size Distribution in Korea

III. Change of Firm Size Distribution over time

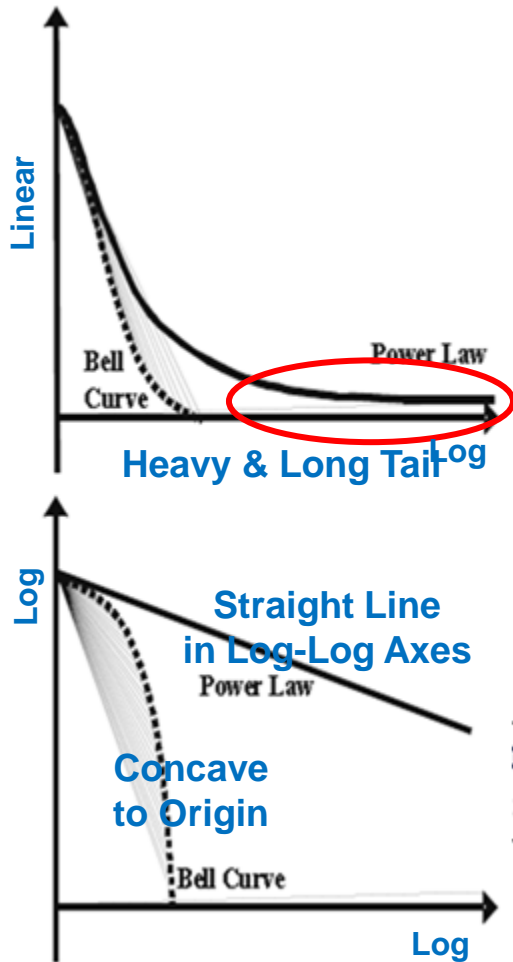
I. Background

Comparison of Firm Size Distributions



Log-Normal vs. Pareto

Better fit of Pareto distribution to the right-skewed, fat-tailed population

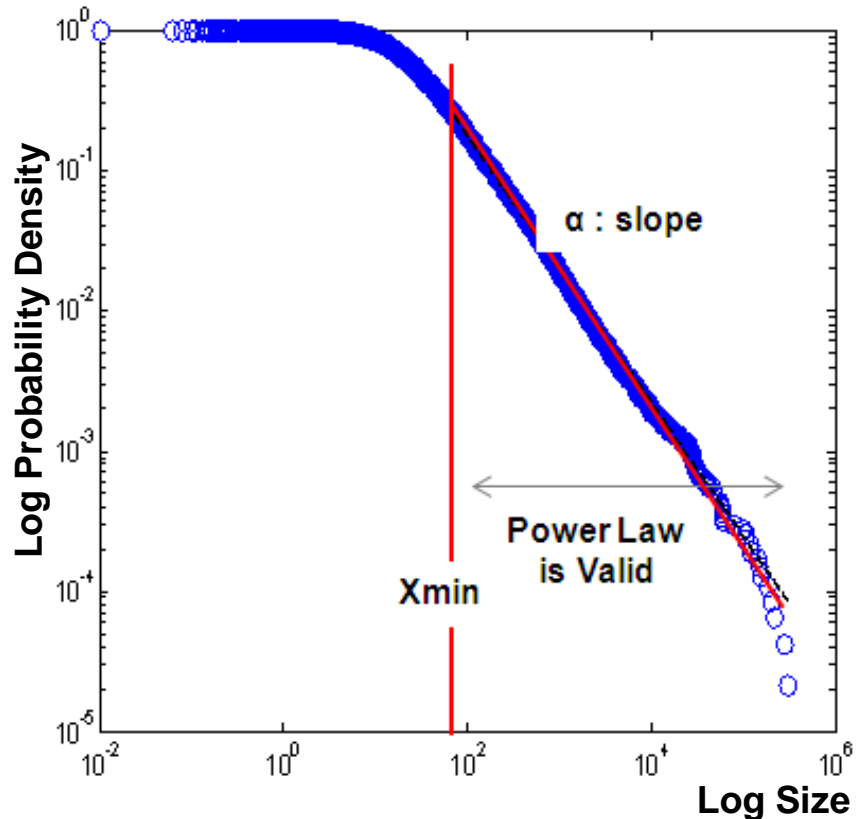


Log-Normal		Pareto
Stable	Mean	Unstable
Finite	Variance	Potentially Infinite
Clearly defined	Confidence Interval	often hard-to-tell
Vanishing Tail	Tail	Long & Fat Tail
Average Value	Important Variables	Extreme Value
Independence, Homogeneity	Assumption	Interdependence, Heterogeneity
Linearity, Randomness, Equilibrium	Relevant Concepts	Mutually Causal, Emergent Nonlinear Dynamics, Coevolution, Diversity

* Source : Andriani & McKelvey (2009)

Interpretation of Pareto Distribution

Pareto CDF



Interpretation

- Pareto Distribution can be drawn in the form of PDF or CDF

$$\text{PDF} : p(x) = \Pr(X = x) = Cx^{-\alpha}$$

$$\text{CDF} : P(x) = \Pr(X \geq x) = Cx^{-a}$$

- OLS or MLE fitting
- α : exponent of power law
= slope of power law line
 - ▶ α of PDF = a of CDF + 1
 - ▶ Usu. $2 < \alpha < 3$ in nature,
a little broader range in economics
 - ▶ Decrease of α = Existence of bigger firms
- X_{min} : smallest value of range where power law is valid = MES (Minimum Efficient Scale)

Asymmetric & Right-skewed

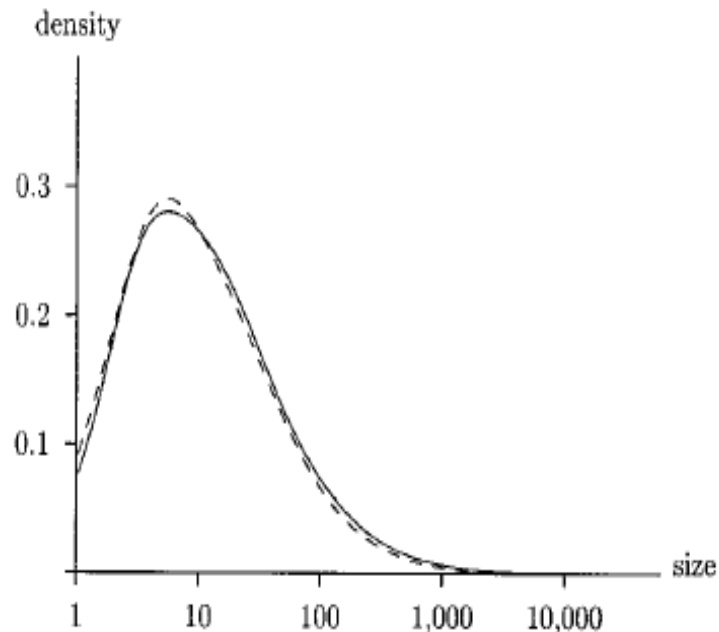


FIGURE 2. FIRM SIZE DISTRIBUTION IN 1983 (SOLID LINE) AND 1991 (DASHED LINE), BASED ON EMPLOYMENT DATA FROM THE *QUADROS DO PESSOAL* DATA SET

Robust over time

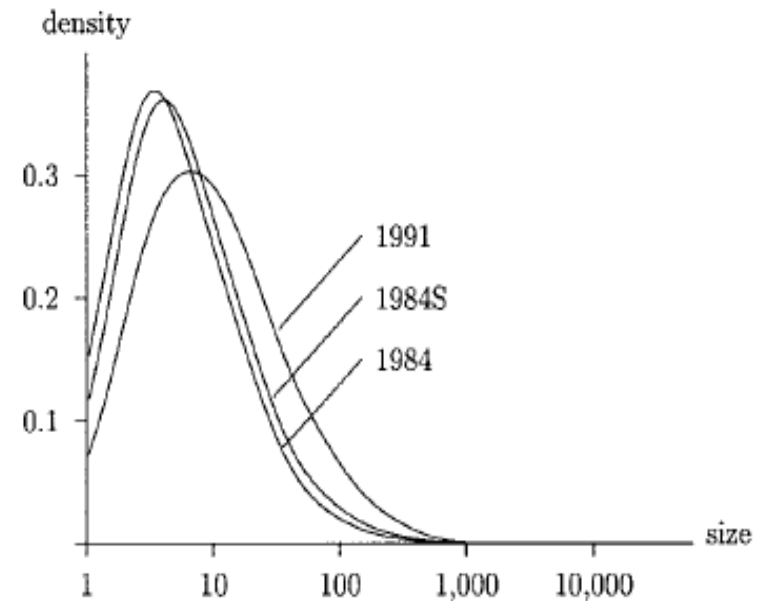
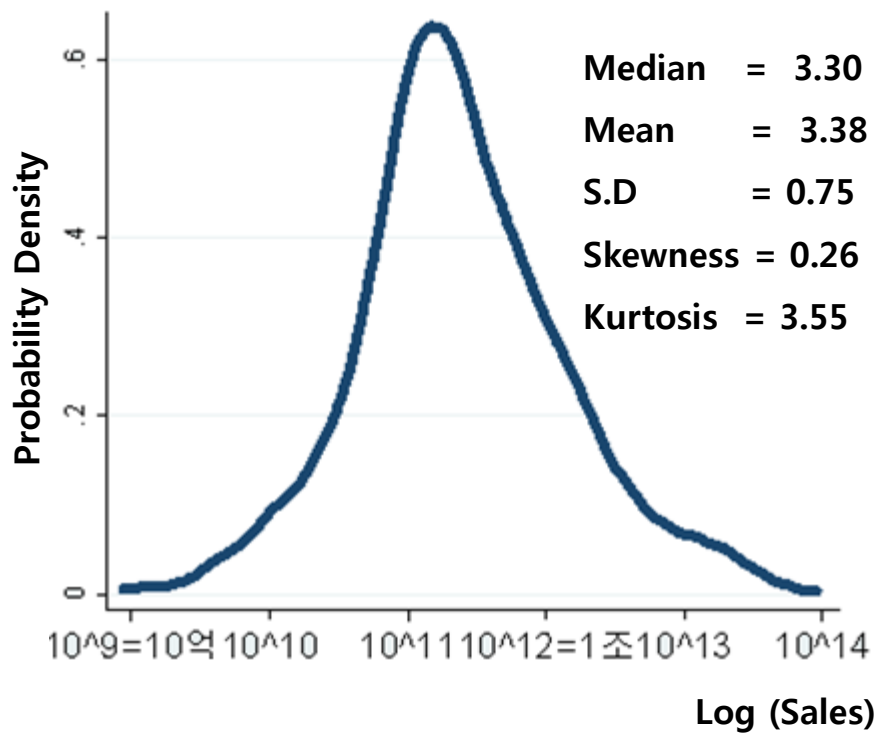


FIGURE 4. SIZE DISTRIBUTION OF THE 1984 COHORT OF ENTRANTS: DENSITIES BASED ON 1984 AND 1991 DATA AS WELL AS 1984 DATA FOR THE FIRMS THAT SURVIVED THROUGH 1991

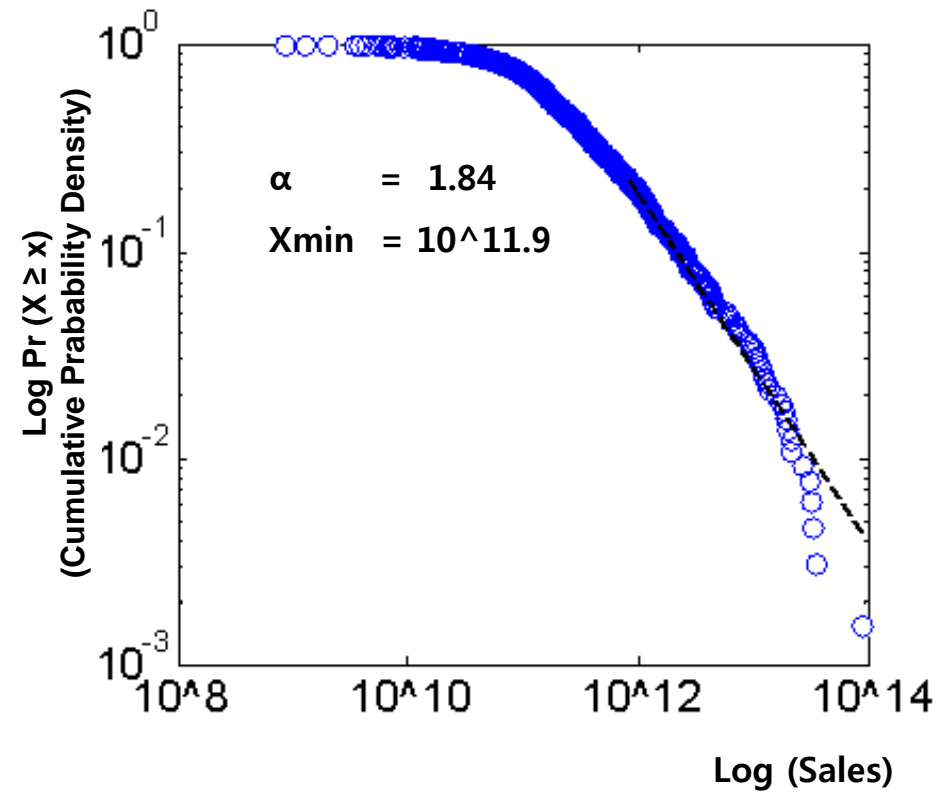
II. Firm Size Distributions in Korea

KOSPI firms
(2009, non-financial, Size=Sales, N=651)*

DF (Log-real form)



CDF (Log-log form)



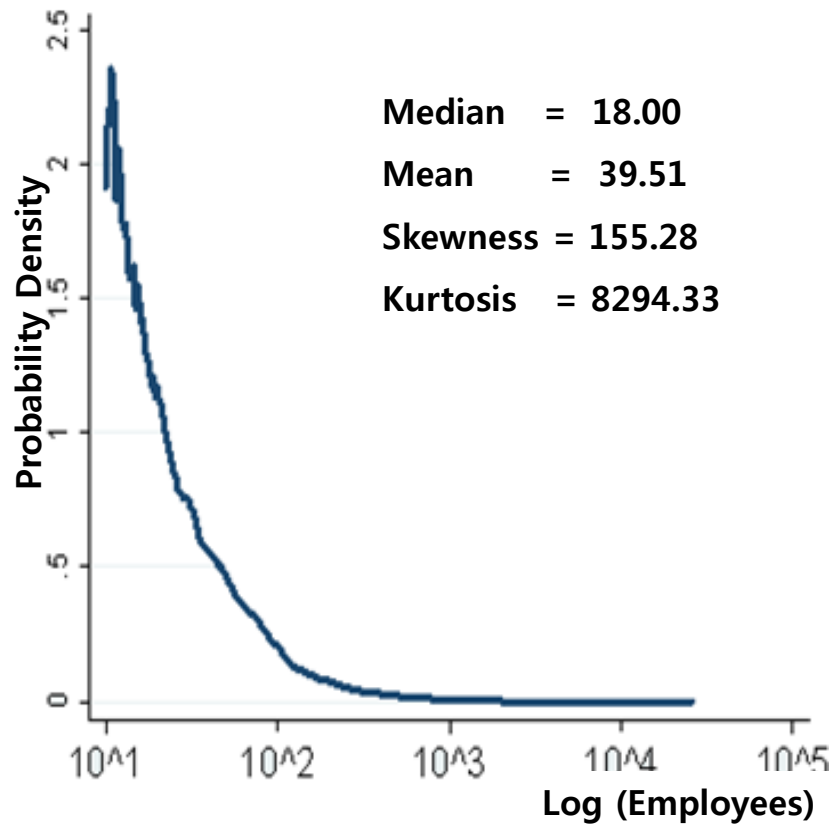
* Data Source : KIS Value

FSD of the whole enterprise population

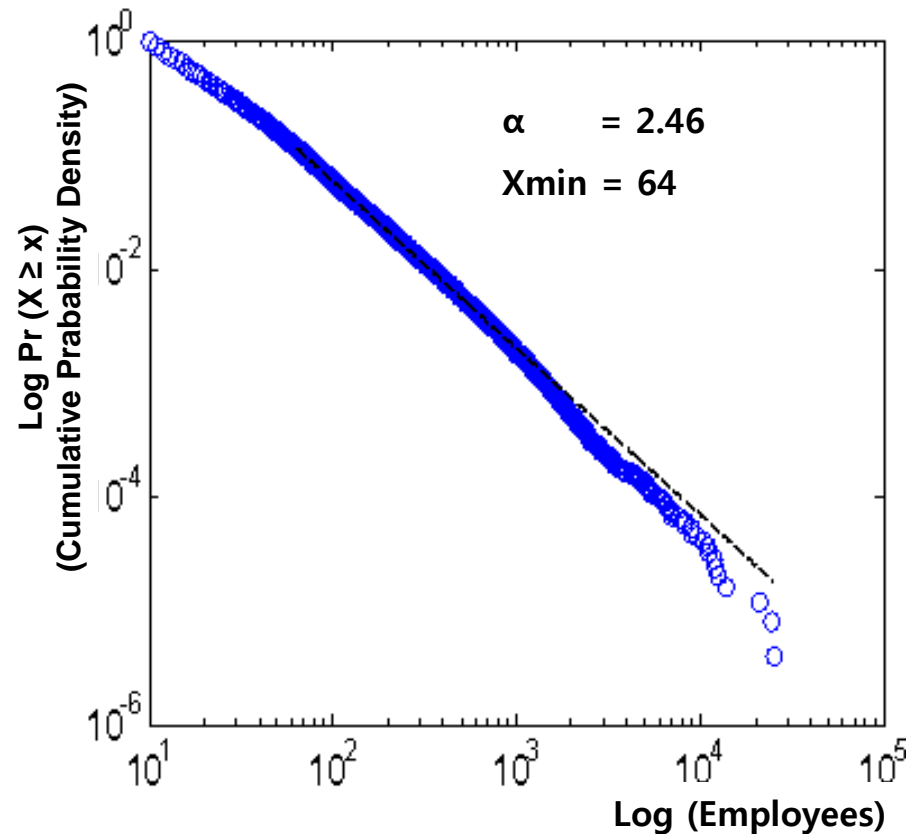
Power law holds... and strongly

Nationwide enterprise survey
(2009, over 10 employees, Size=Employees, N=236,269)*

DF (Log-real form)



CDF (Log-log form)

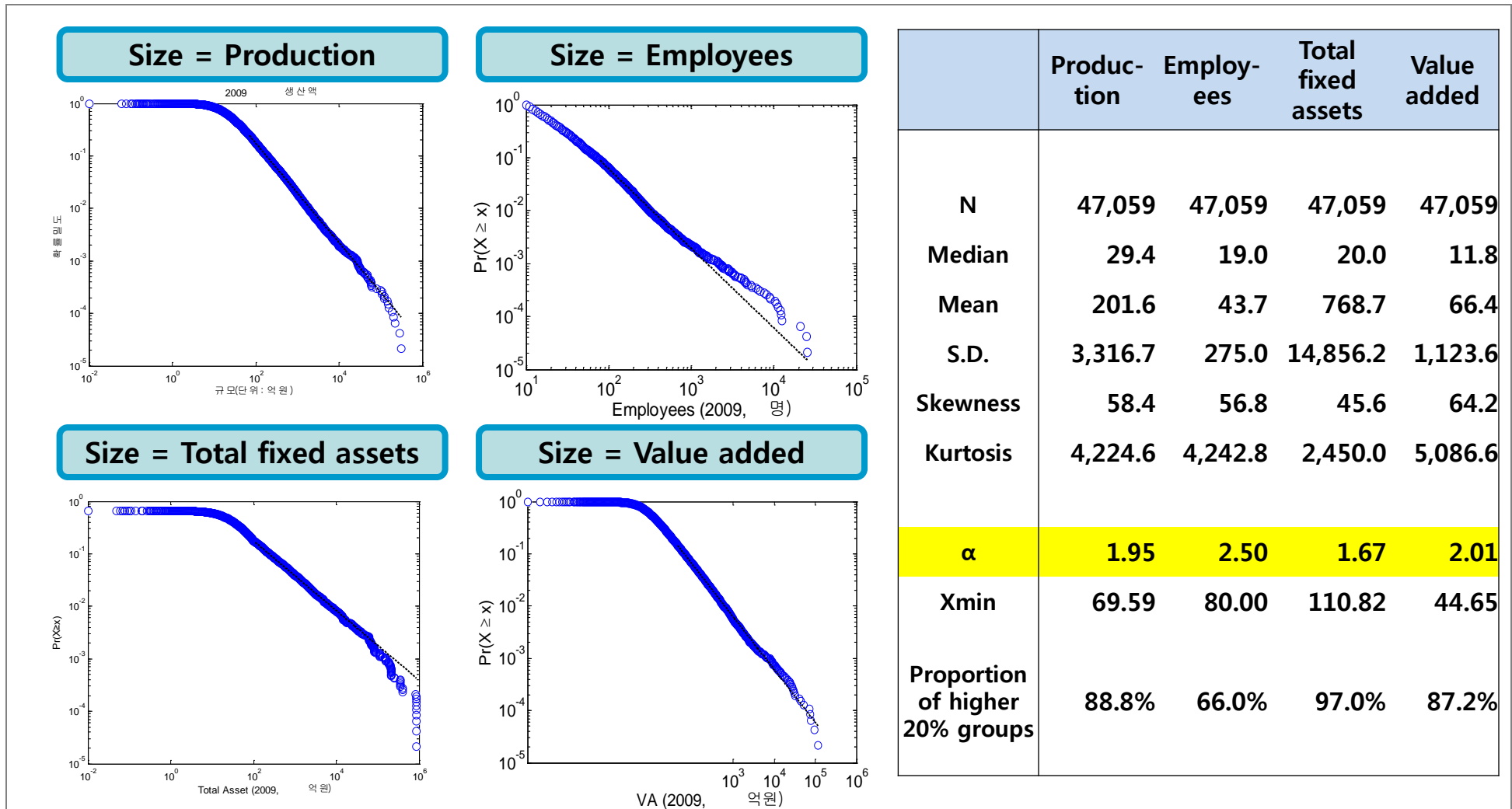


* Data Source : Korea Statistics Bureau.

FSD of manufacturing plants (1)

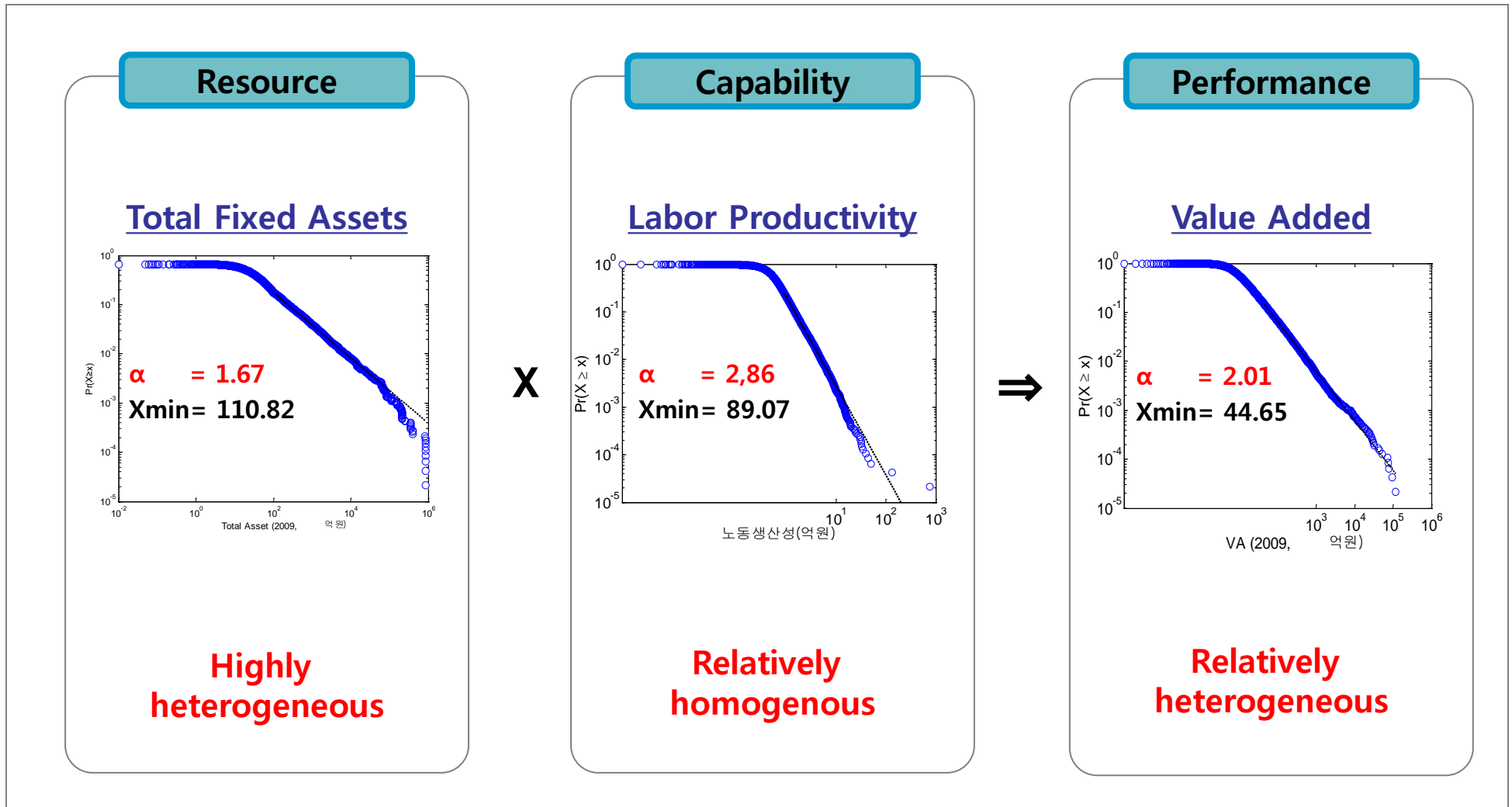
Pareto distribution across diverse proxy measures on size

Korea mining & manufacturing survey (2009, over 10 employees, N=47,059)

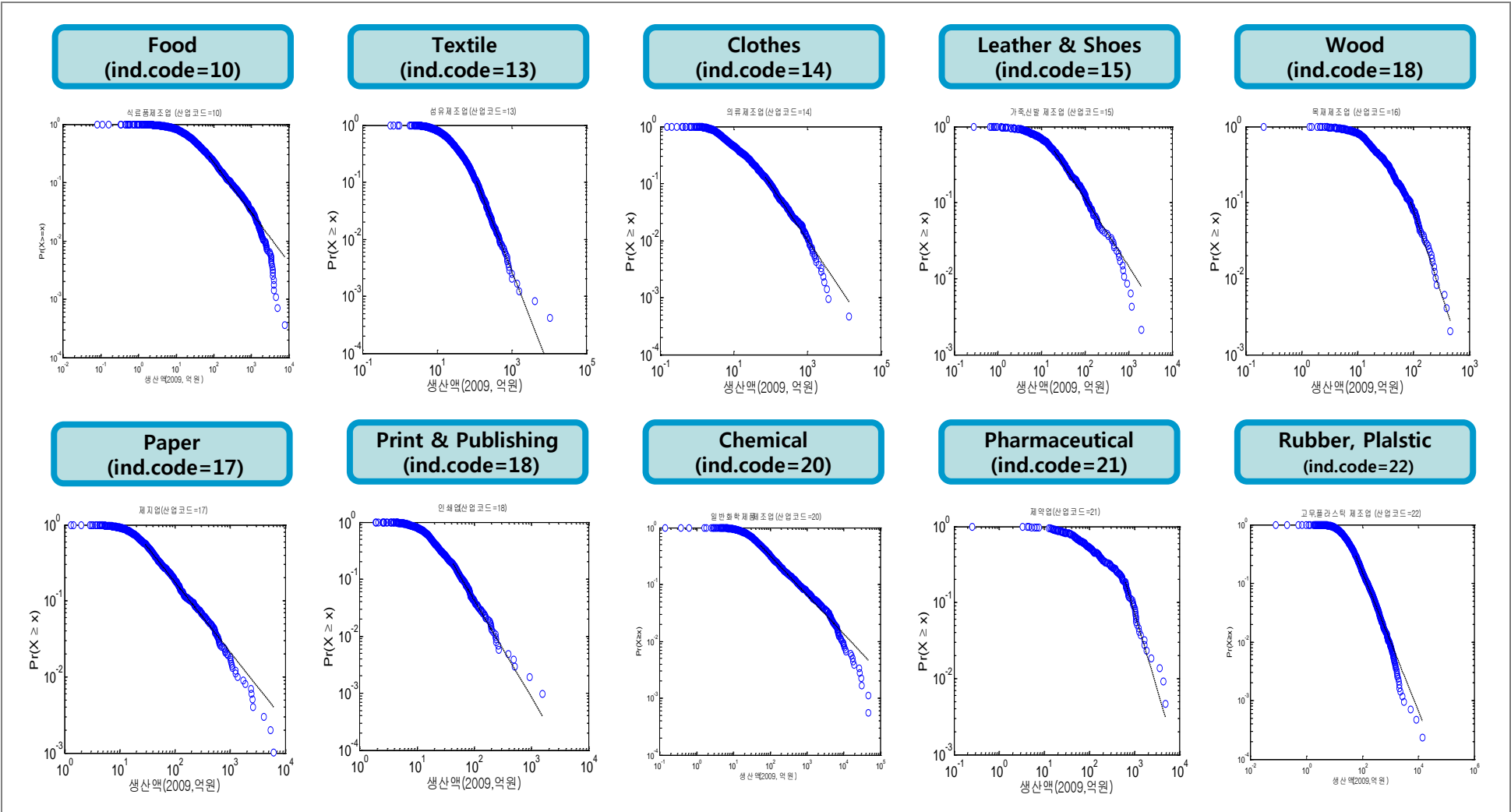


* Measuring units of production, fixed assets, value added = 100 million won

Korea mining & manufacturing survey (2009, over 10 employees, N=47,059)

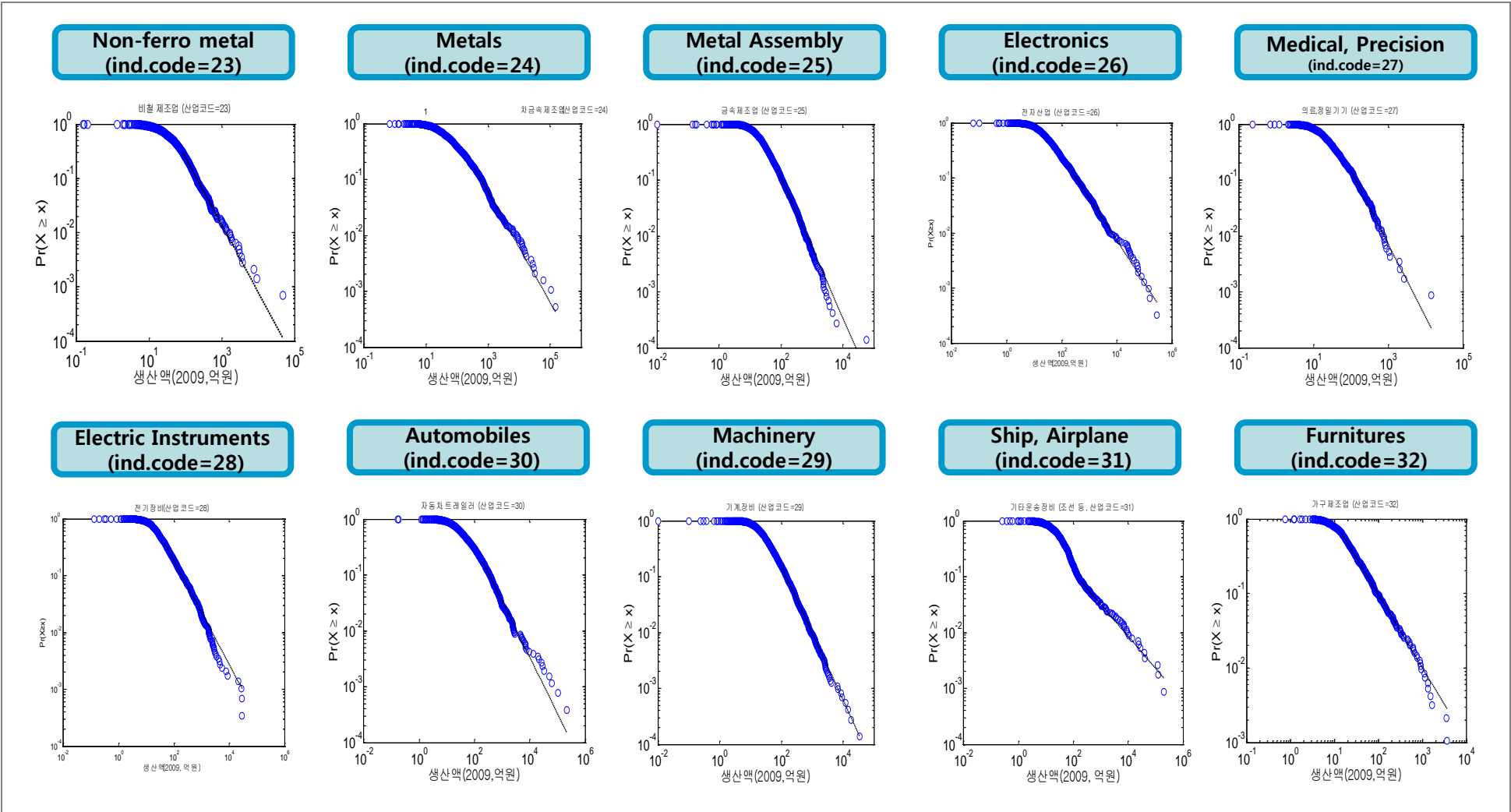


Korea mining & manufacturing survey (2009, over 10 employees, Size = Production)



FSD by Sectors (1)

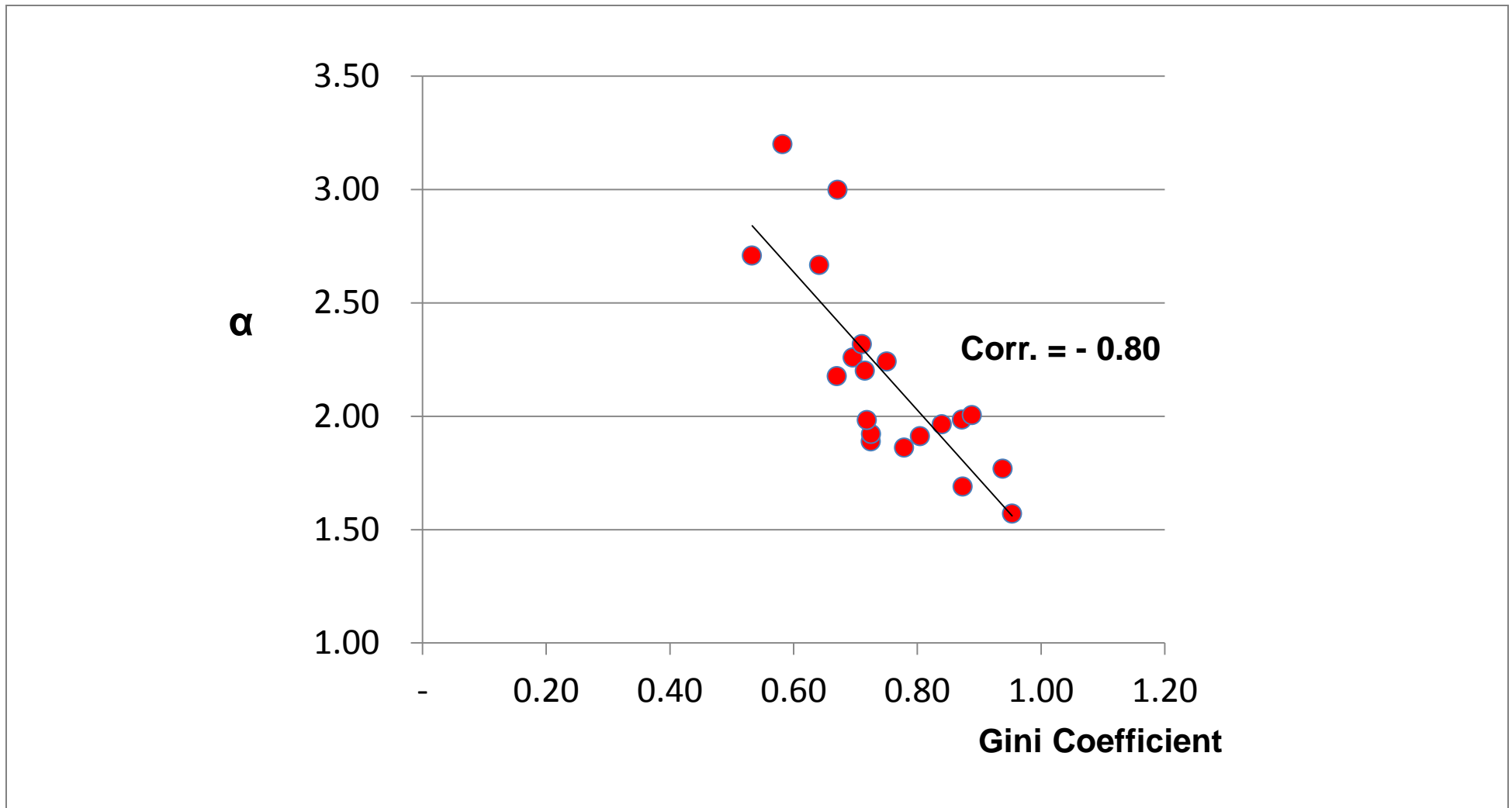
Korea mining & manufacturing survey (2009, over 10 employees, Size = Production)



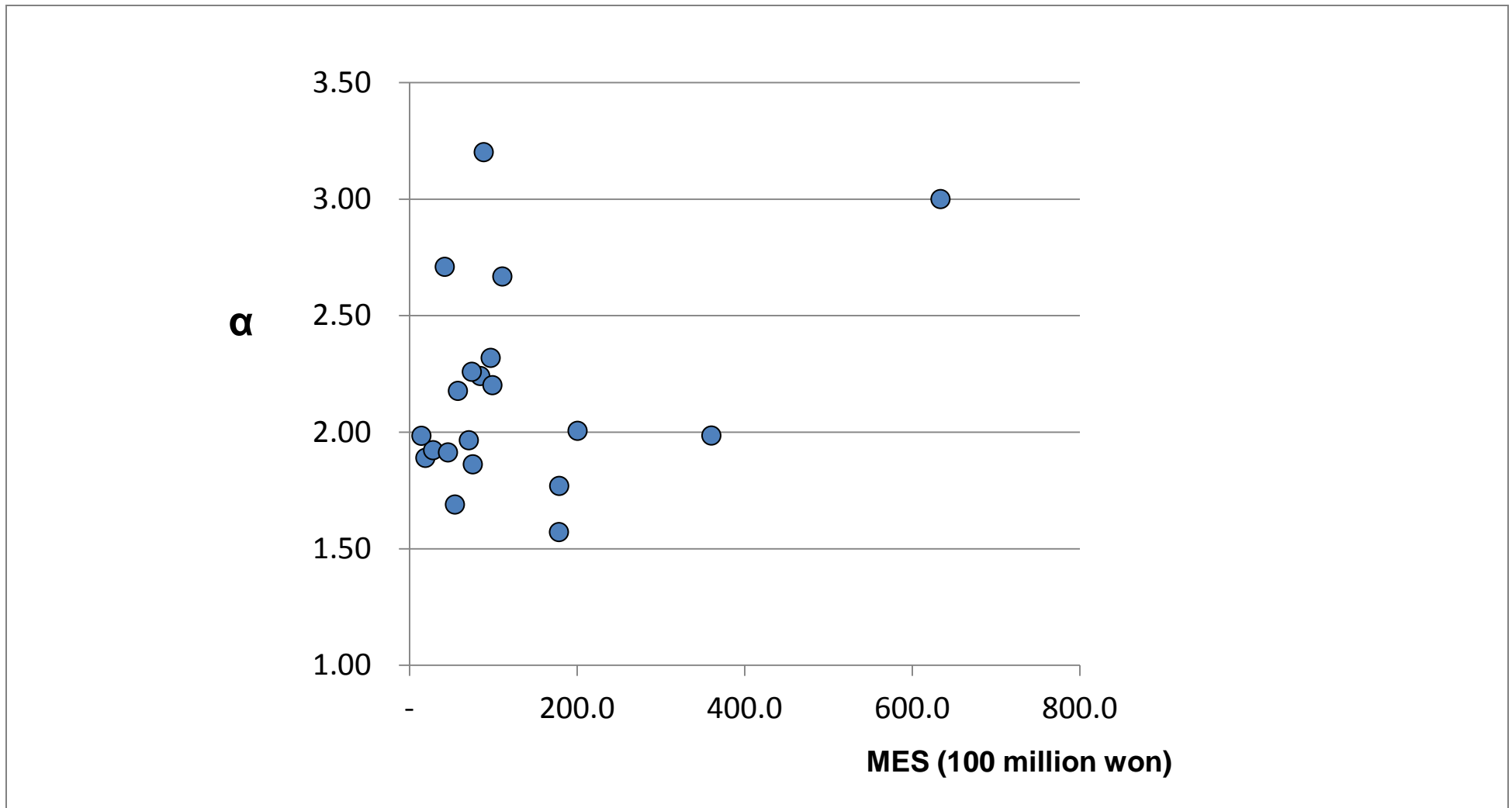
alpha, Xmin (MES), Gini

ind.code	Sector	No. of observation	α	Xmin (MES)	Gini Coefficient	HHI
10	Foods	2,803	1.86	75.8	0.78	0.003
13	Textiles	2,434	2.67	111.1	0.64	0.008
14	Clothes	2,132	1.96	71.2	0.84	0.016
15	Leather & Shoes	469	1.89	19.4	0.72	0.017
16	Woods	480	3.20	88.9	0.58	0.010
17	Pulps & Papers	999	1.92	28.5	0.73	0.012
18	Printing & Publishing	1,030	2.71	42.3	0.53	0.005
20	Chemicals	1,807	1.69	54.5	0.87	0.014
21	Pharmaceuticals	217	3.00	634.0	0.67	0.019
22	Rubber & Plastic	4,265	2.18	58.1	0.67	0.004
23	Non-ferro Metals	1,428	2.24	84.8	0.75	0.055
24	Metals	1,912	1.98	360.5	0.87	0.042
25	Metal Assembly	7,296	2.26	74.8	0.70	0.014
26	Electronics	3,115	1.77	178.8	0.94	0.047
27	Medical, Precision Instruments	1,167	2.32	97.2	0.71	0.028
28	Electric Instruments	2,932	1.91	46.1	0.80	0.017
29	Machineries	7,254	2.20	99.3	0.72	0.006
30	Automobiles	2,587	2.01	200.9	0.89	0.069
31	Shipbuilding & Airplanes	1,147	1.57	178.7	0.95	0.122
32	Furniture	950	1.98	14.5	0.72	0.014
	Total	46,424				

Correlations between Gini efficient and Pareto coefficient (α)



Correlations between MES and Pareto efficient (α) *



* MES are measured by Xmin in Pareto CDF

FSD by Firm Characteristics

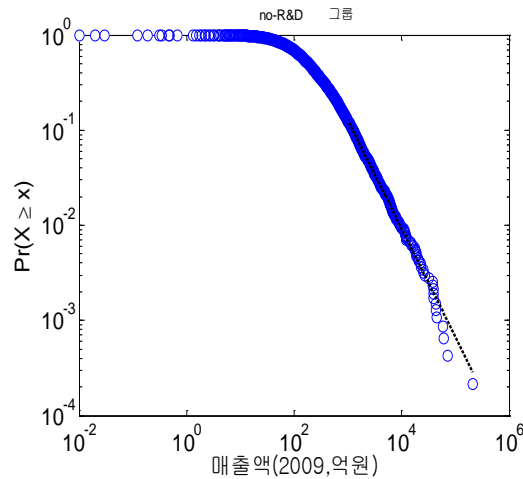
(1) R&D vs. No-R&D

Effort for innovation makes the population more heterogeneous

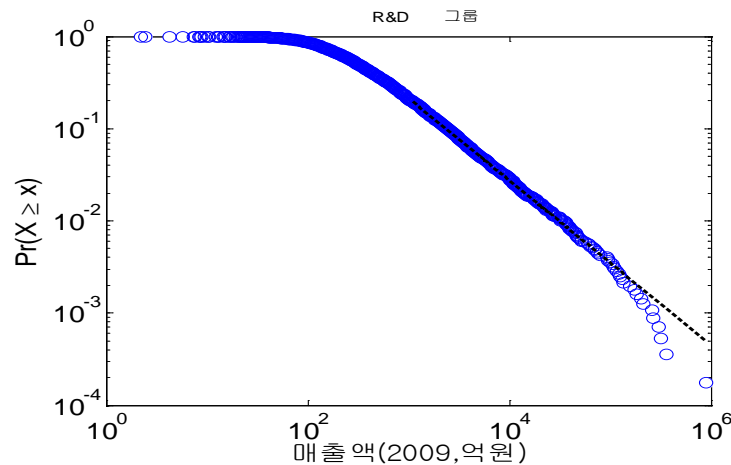
Firm Activity Survey

(2009, all industries, over 50 employees, N=10,319)

No-R&D Groups



R&D Groups



	No-R&D Groups	R&D Groups
N	4,681	5,638
Median	183.4	313.6
Mean	756.9	2,172.2
S.D	4,214.7	17,384.2
Skewness	31.1	30.8
Kurtosis	1,396.2	1,351.3
α	2.14	1.89
Xmin	1,059.3	1,101.4

FSD by Firm Characteristics

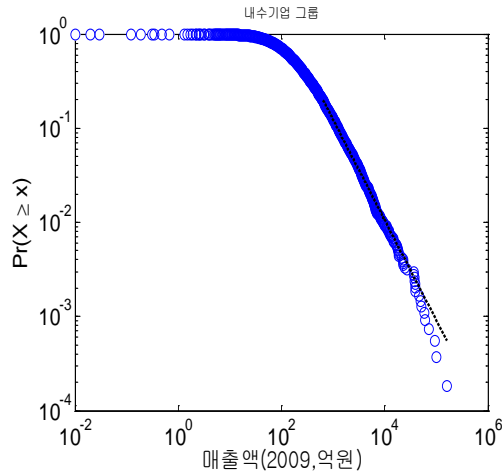
(2) Export vs. Domestic

Export market makes the population more heterogeneous

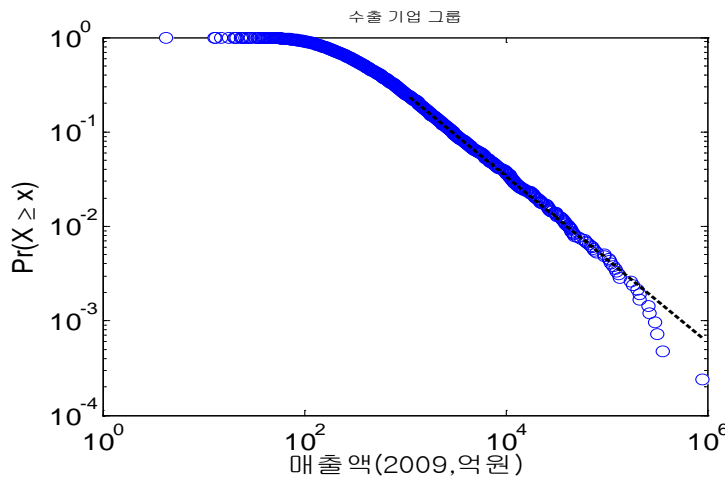
Firm Activity Survey

(2009, all industries, over 50 employees, N=10,319)

Domestic-only Groups



Export Groups



	Domestic-only Groups	Export Groups
N	5,411	4,191
Median	179.3	395.7
Mean	719.2	2,715.9
S.D	3,765.7	20,113.1
Skewness	22.6	26.8
Kurtosis	714.5	1,013.5
α	2.07	1.88
Xmin	636.4	1,094.3

FSD by Firm Characteristics

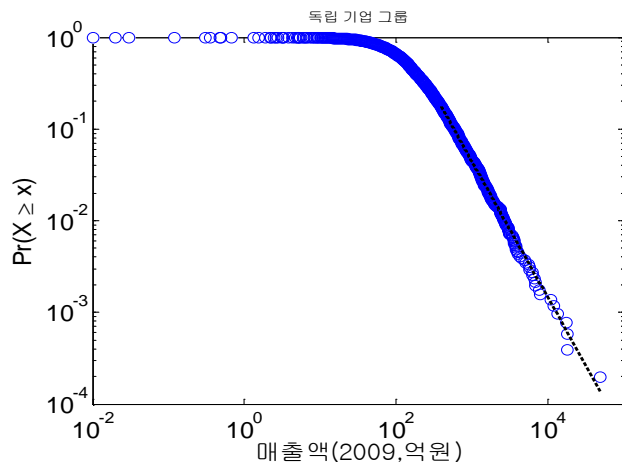
(3) Affiliated or Independent

Affiliation makes the population more heterogeneous

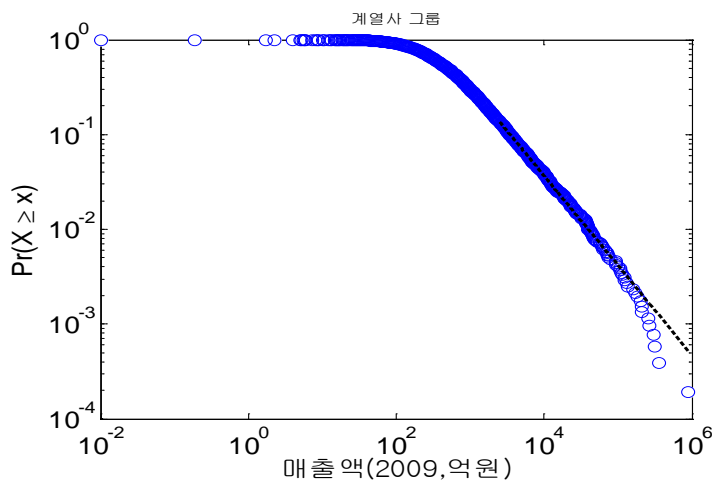
Firm Activity Survey

(2009, all industries, over 50 employees, N=10,319)

Independent Groups



Affiliated Groups



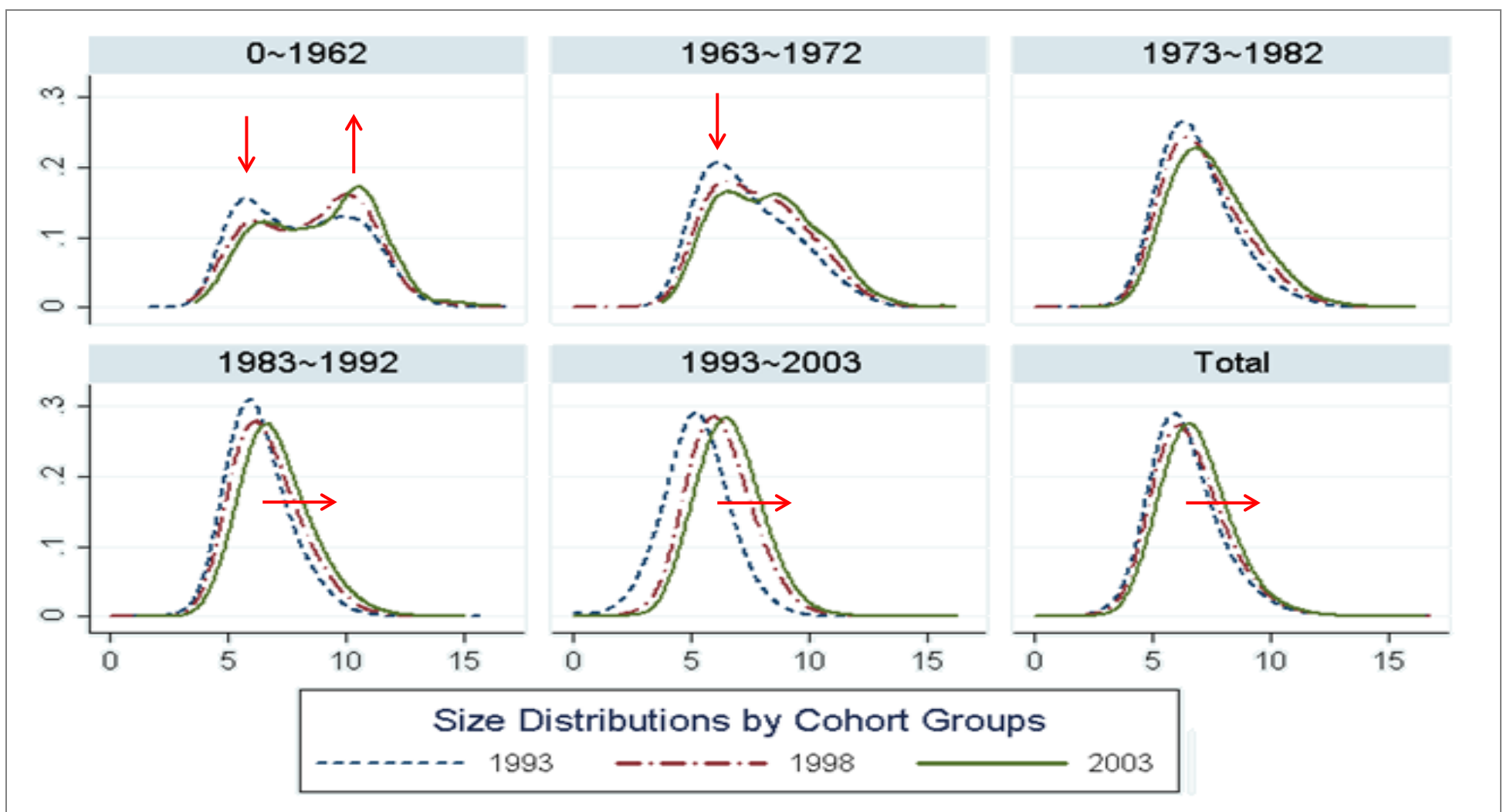
	Independent Groups	Affiliated Groups
N	5,145	5,174
Median	144.8	491.5
Mean	305.3	2,748.2
S.D	974.1	18,505.7
Skewness	28.5	28.1
Kurtosis	1,224.0	1,146.6
α	2.48	1.95
Xmin(=MES)	392.5	2,501.4

III. FSD over time

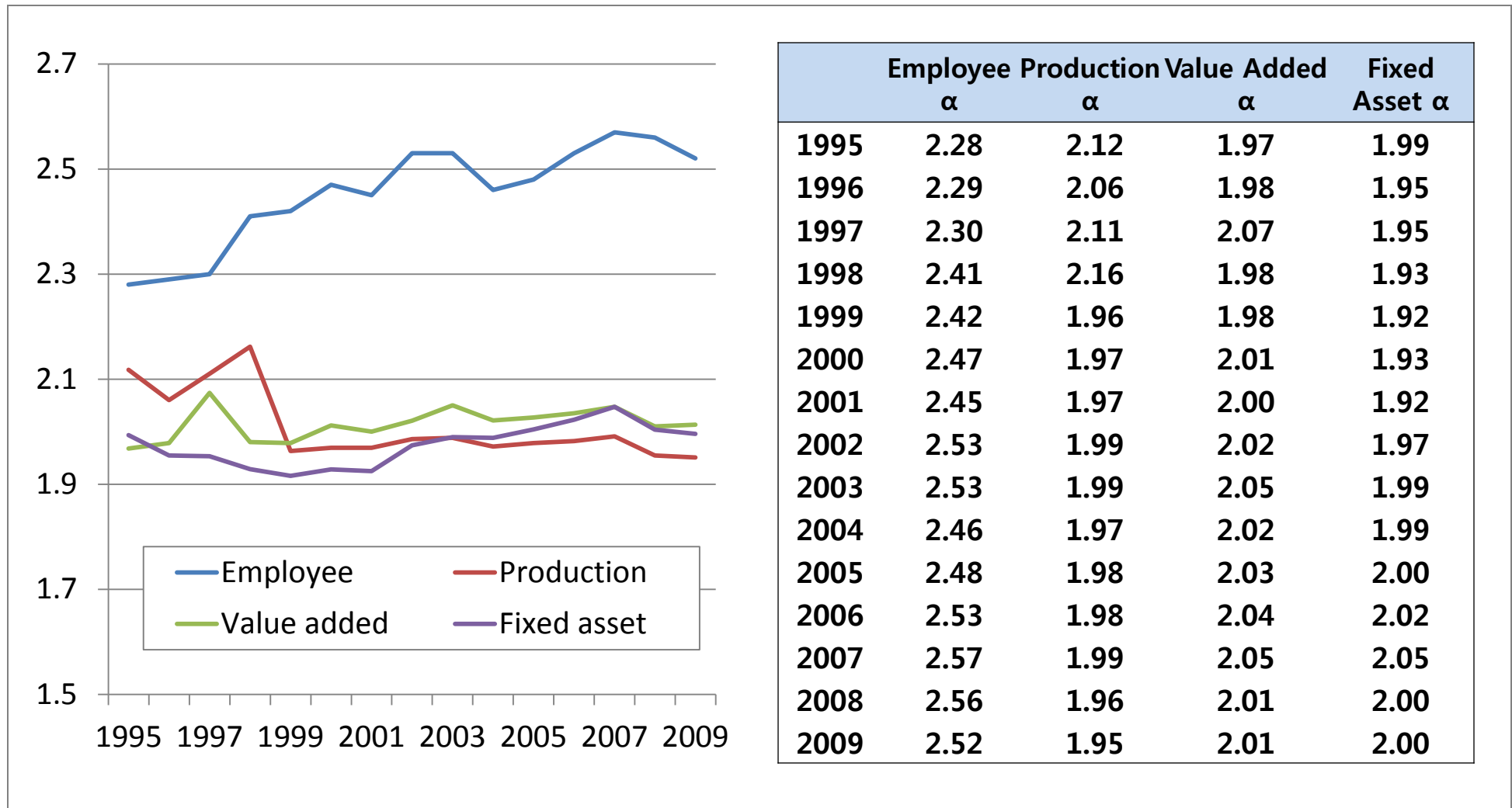
FSD by cohorts over time

Cohort effect for older firms

Korea mining & manufacturing survey
(1993~2003, over 5 employees, Size = Employees)



Changes of α values over time (1995~2009)



Thank you !