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Trade Liberalization and Wage Inequality - The Case for Korea

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1. Introduction

1) **Korea's trade policy has pursued "openness" since the 1960s.**
2) **More specifically, export-oriented.**
3) **Imports were relatively restricted using various measures.**

- These interventions distorted the economy and increased inefficiency.
- However, in the long run, Korea has been moving towards a more open economy, in terms of both exports and imports.
- Freer trade has been removing distortions and enhancing efficiency.

1. Introduction

- Reduction of distortion would make "rent-seekers" unhappy.
- Many rent-seekers do not recognize that they are rent-seekers, and accept distorted situations as natural.
- "Sentiment" added to this ignorance blames that trade liberalization would increase income (wage) inequality.

- **Questions regarding recent debates in Korea**

1) **Does trade hurts unskilled labor? (Does trade increase income (wage) inequality?)**
2) **Are (wage inequalities in) specific sectors affected more by trade liberalization?**
3) **If so, are they all bad – so bad that trade liberalization shouldn't be introduced?**

2. Trade Liberalization and Income Inequality

1) Domestic income inequality has worsened in many countries in the recent past.

2) Researchers tried to find reasons for this worsening.

- Expansion of trade
- Innovation and expansion of technology
- Institutions, etc.

3) In many cases, they combined and affected income inequality.

- Eg: Trade is a vehicle of technology transfer.

4) Among them, 'technology' has been appointed as the most significant factor of widening income inequality .

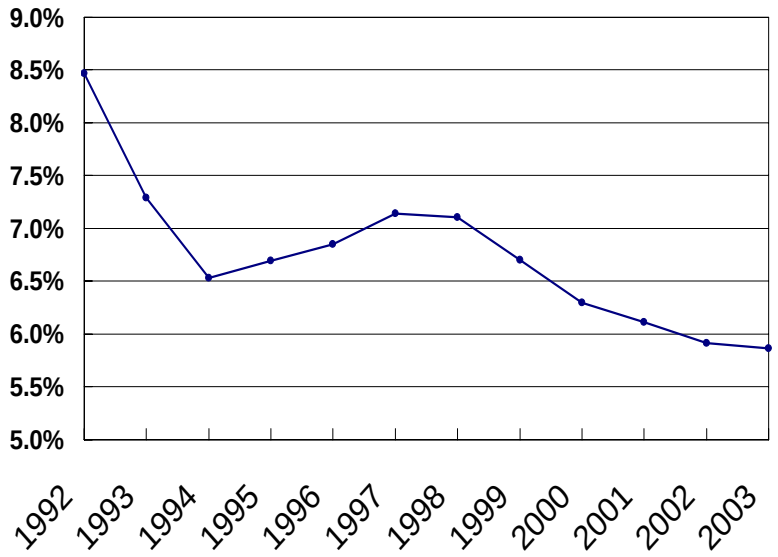
2. Trade Liberalization and Income Inequality

1) Korea has liberalized its import markets.

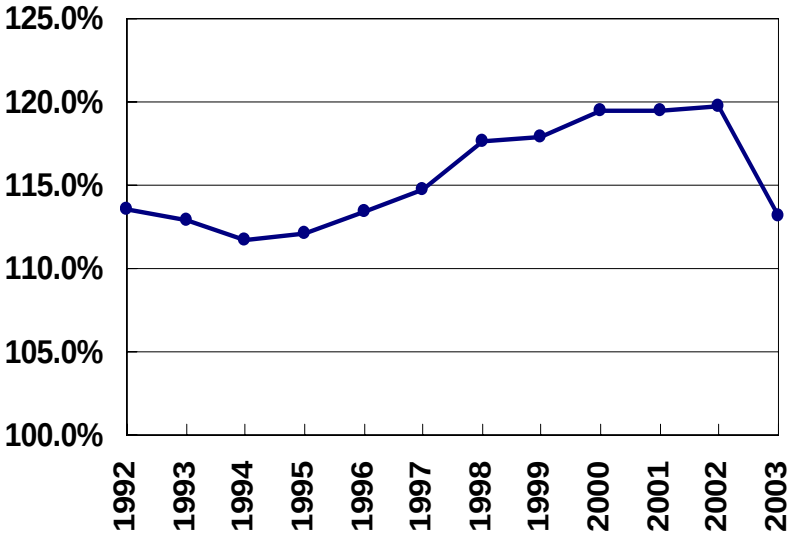
2) Wage inequality (between non-production and production workers) has been extended.

3) Some argue that trade liberalization caused wage inequality

Changes in Average Tariff (1992-2003)



Wage Inequality (NP/P, 1992-2003)

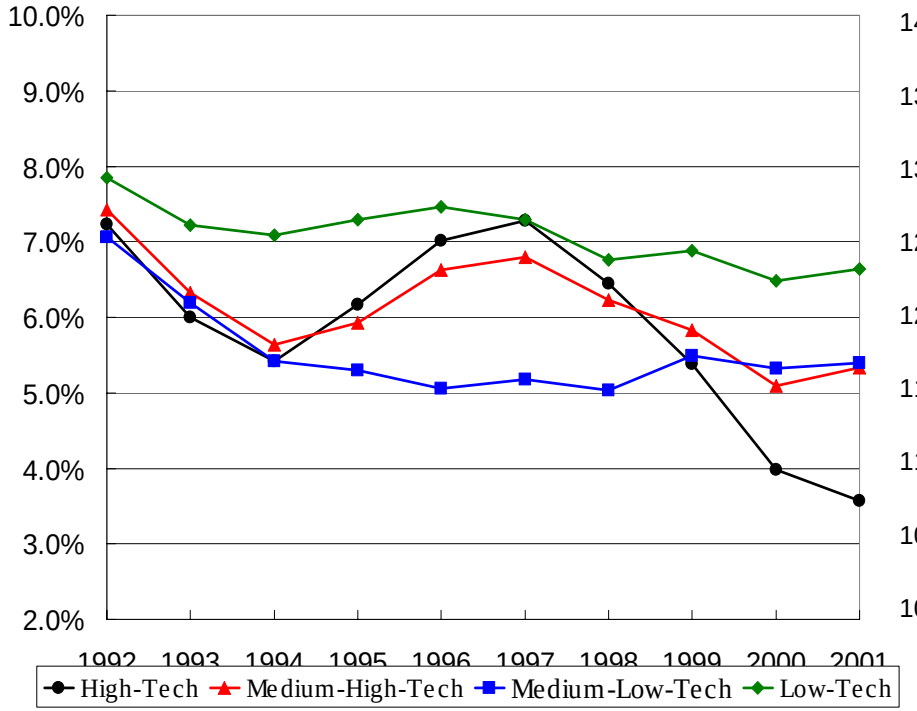


2. Trade Liberalization and Income Inequality

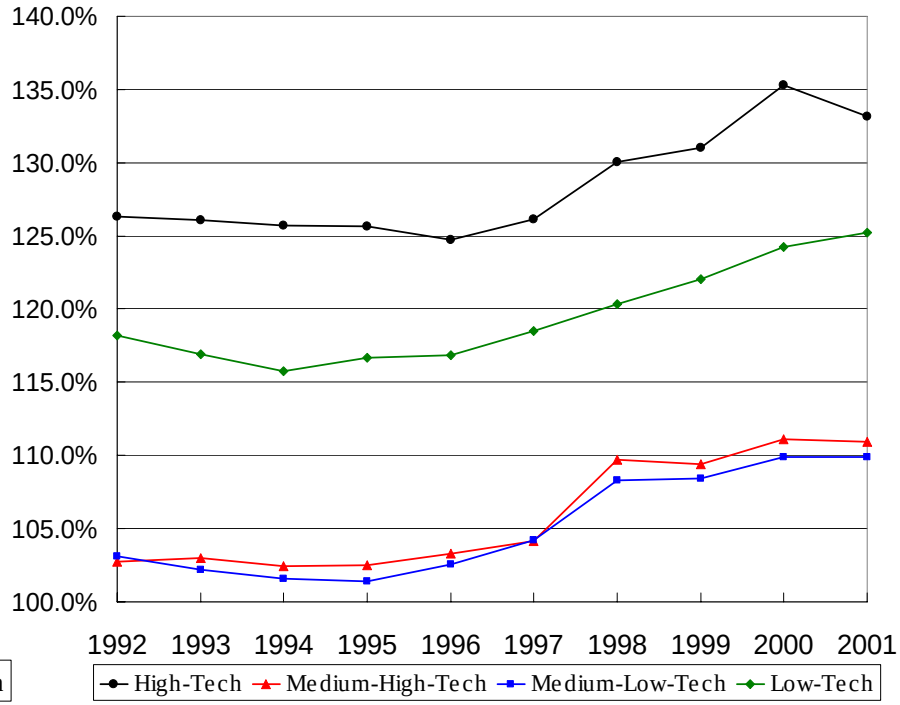
1) In Korea, tariff cut has been different across industries.

2) Wage inequality also has been different across industries

Average Tariff (1992-2003)



Wage Inequality (NP/P, 1992-2003)



Classification of Industry

OECD Class.	KDI claas.		KSIC-3 digit
High tech	12	Semiconductor	321
	13	Electronics and parts	311, 312, 313, 314, 315, 319, 321
	14	IT equipment	300, 322, 323
Medium -high tech	6	Chemical products	233, 241, 242, 243, 244, 251, 252, 372
	11	General machinery	291, 292, 293, 294
	15	Home appliances	295
	16	Automobiles	341, 342, 343
	18	Precision instruments	331, 332, 333, 334
Medium -low tech	7	Petrol & Coal products	231, 232
	8	Non-ferrous metal products	261, 262, 263, 269,
	9	Basic metal products	271, 272, 273, 371
	10	Metal products	281, 289
	17	Other transport equipment	351, 352, 353, 359
	19	Other manufacturing	201, 202, 361, 369,
Low tech	2	Mining	101, 131, 132, 141, 142
	3	Food and beverage	151, 152, 153, 154, 155, 160
	4	Textile & Cloth	171, 171, 172, 173, 174, 179, 181, 182, 191, 192, 193
	5	Paper, printing and publication	211, 212, 221, 222, 223

2. Trade Liberalization and Income Inequality

- While tariff rates overall decreased, High-tech industries experienced the fastest decrease.
- Low-tech industries remained as the most protected industry.
- While wage inequality overall increased, High-tech industries remained as the industry with the highest wage inequality.
- Low-tech industry showed the second highest growth in wage inequality.

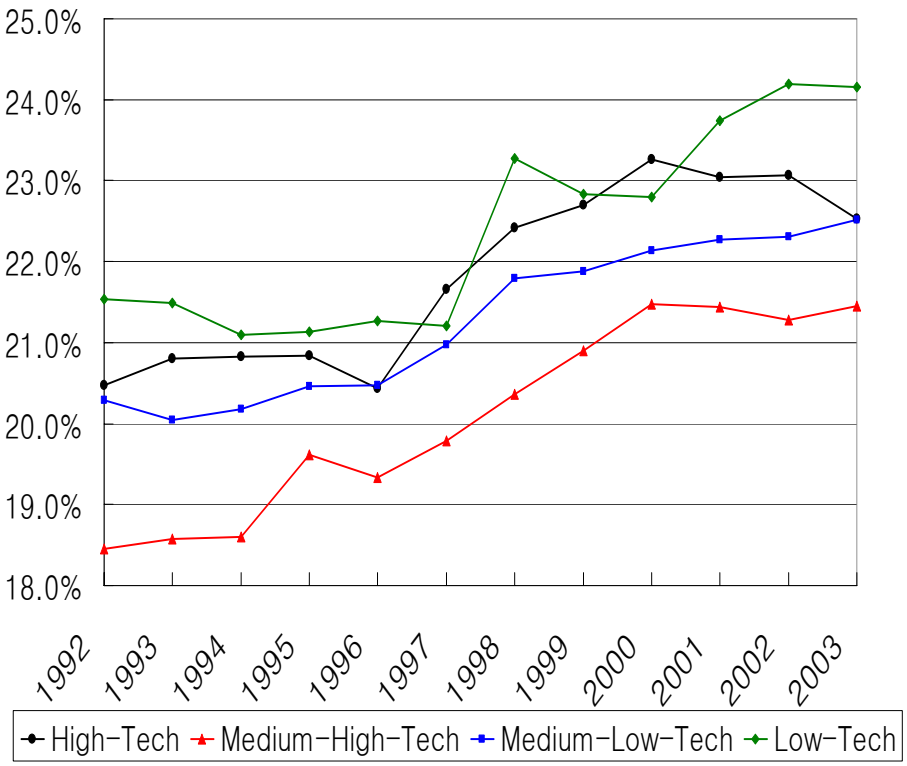
- **How is trade liberalization related with wage inequality in plants?**
- **Did trade liberalization affect wage inequality in plants in different industry categories?**
- **How was the effect of trade with major partners?**

2. Trade Liberalization and Income Inequality

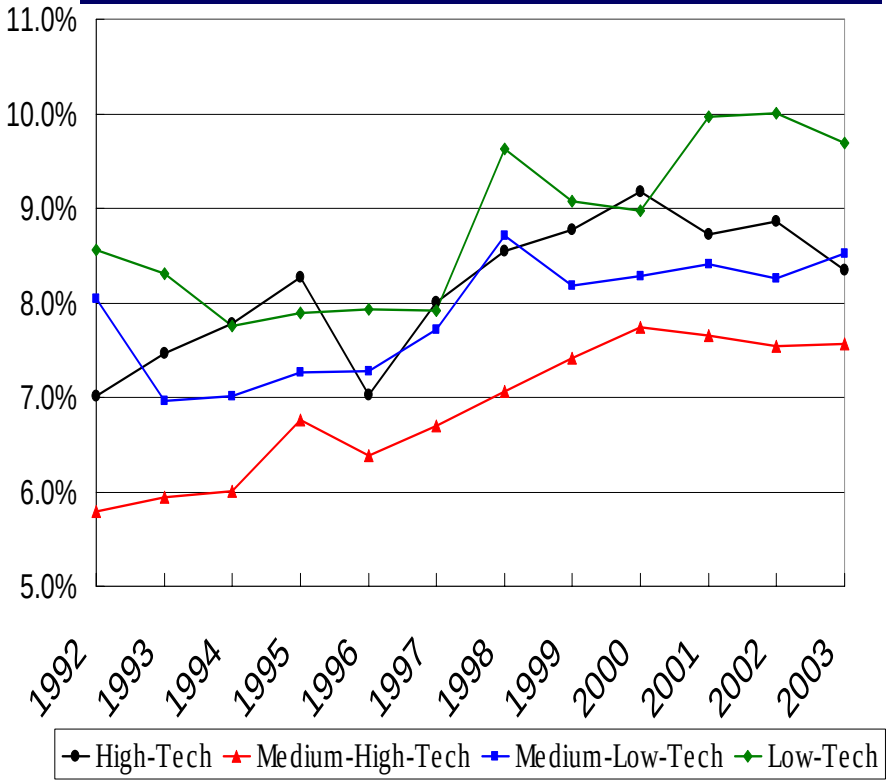
3) Wage inequality across industries also has increased.

4) In general, wage distribution is the most unequal in Low-tech.

Wage Inequality (Gini)



Wage Inequality (Theil)



3. Effects of Trade Liberalization on Wage Inequality in Korea

1) Research Question

- What are determinants of plant's wage inequality over time?
- How did trade liberalization affect wage inequality across industries?

2) Data

- Plant level variables: wages, capital formation, employment, plant age, sales, mark-up, etc…. Mining & Manufacturing Statistical Survey
- Industry level variables: averages, market shares, etc. Mining & Manufacturing Statistical Survey
- Trade related variables: tariffs, import values by origins and industries, etc….Export-Import Statistics
- Different codes from different sources are matched.
- Period: 1992-2003

3) Panel Analysis

$$\frac{W_{ijt}^{W}}{W_{ijt}^{B}} = \beta_o + PT_{ijt} \times \beta_{PT} + IT_{jt} \times \beta_{IT} + TV_{jt} \times \beta_{TV}$$
$$+ \beta_Y \times YD + I_j + \lambda_i + \varepsilon_{ijt}$$

where Wijt: wage in plant i in industry j at time t,
superscript W: white collar, B: blue collar,
PT: vector of plant characteristics (factor intensity, age, employment, sales, mark-up),
IT: vector of industry characteristics (averages, TECH etc)
- How to measure TECH?: productivity, R&D, employment…

TV: vector of trade related variables (tariffs, import share etc),
YD: time dummy (economic crisis),
I: industry dummy, λ: fixed effects.

4) Results

Plant characteristics: all sig. except plant factor intensity

Var.	When overall tariff used				When Tariff on the US and China used			
	TAF(t-1)		TAF(t, t-1)		TAF(t-1)		TAF(t, t-1)	
	Coeff.	T-stat.	Coeff.	T-stat.	Coeff	T-stat.	Coeff	T-stat.
PKL	-0.00658 (0.0082)	-0.81	-0.00662 (0.0082)	-0.81	-0.00673 (0.0082)	-0.82	-0.00675 (0.0082)	-0.83
PMU	**-0.14024*** (0.0056)**	-25.28	**-0.14025*** (0.0056)**	-25.28	**-0.14000*** (0.0056)**	-25.23	**-0.13997*** (0.0056)**	-25.23
PNE	**0.00581*** (0.0004)**	14.04	**0.00581*** (0.0004)**	14.03	**0.00582*** (0.0004)**	14.05	**0.00581*** (0.0004)**	14.04
PAG	**0.00035*** (0.0001)**	3.50	**0.00035*** (0.0001)**	3.50	**0.00035*** (0.0001)**	3.49	**0.00035*** (0.0001)**	3.49
TPR	**-0.00981*** (0.0009)**	-10.56	**-0.00980*** (0.0009)**	-10.55	**-0.00982*** (0.0009)**	-10.57	**-0.00981*** (0.0009)**	-10.56

4) Results

Industry characteristics: some sig. but not TECH

Var.	When overall tariff used				When Tariff on the US and China used			
	TAF(t-1)		TAF(t, t-1)		TAF(t-1)		TAF(t, t-1)	
	Coeff.	T-stat.	Coeff.	T-stat.	Coeff	T-stat.	Coeff	T-stat.
IMKL	**0.80548*** (0.1891)**	4.26	**0.76994*** (0.1905)**	4.04	**0.75576*** (0.1924)**	3.93	**0.73852*** (0.1926)**	3.83
IMMU	**0.27241*** (0.0406)**	6.71	**0.26693*** (0.0408)**	6.55	**0.26592*** (0.0411)**	6.48	**0.25395*** (0.0415)**	6.13
IMNE	0.01128 (0.0116)	0.97	0.01150 (0.0116)	0.99	0.01153 (0.0116)	1.00	0.01177 (0.0116)	1.02
IMAG	-0.00010 (0.0013)	-0.08	-0.00050 (0.0013)	-0.38	-0.00012 (0.0013)	-0.09	-0.00068 (0.0014)	-0.50
TECH	-0.01495 (0.0280)	-0.53	-0.01384 (0.0280)	-0.49	-0.02438 (0.0277)	-0.88	-0.02593 (0.0278)	-0.93
IMTPR	**-0.06737** (0.0339)**	-1.99	**-0.06692** (0.0339)**	-1.98	**-0.06675** (0.0339)**	-1.97	**-0.06680** (0.0339)**	-1.97
CR3	**-0.07861*** (0.0209)**	-3.76	**-0.07918*** (0.0209)**	-3.79	-0.08348*** (0.0208)	-4.01	**-0.08336*** (0.0209)**	-4.00

4) Results

Trade characteristics: overall, tariff cut decreased wage inequality.

Var.	When overall tariff used				When Tariff on the US and China used			
	TAF(t-1)		TAF(t, t-1)		TAF(t-1)		TAF(t, t-1)	
ALL (t)			0.15215 (0.0985)	1.54				
ALL (t-1)	**0.33354*** (0.0739)**	4.52	0.23641 (0.0970)	2.44				
UST (t)							0.07769 (0.0818)	0.95
CNT (t)							**0.05588* (0.0319)**	1.75
UST (t-1)					0.08189 (0.0672)	1.22	0.04930 (0.0774)	0.64
CNT (t-1)					**0.14807** (0.0274)**	5.41	**0.11522*** (0.0325)**	3.54
YD	**0.06447*** (0.0024)**	26.39	**0.06515*** (0.0025)**	26.25	**0.06471*** (0.0024)**	26.51	**0.06553*** (0.0025)**	26.10
Const.	1.11299*** (0.0137)	81.33	1.11191*** (0.0137)	81.14	1.12476*** (0.0128)	87.61	1.12460*** (0.0129)	87.28
R^2	0.0536		0.0536		0.0536		0.0536	

4) Results: summaries

	Plant char't.	Industry char't.	Trade char't.	YD
All	-: PMU, TPR +: PNE, PAG	-: IMTPR +: IMKL, IMMU	+: ALL(-1), CNT, CNT(-1)	+
High tech	-: PKL, PMU, PAG +: PNE	-: IMAG +: IMMU (TECH?)	+: ALL(-1), UST(-1)	+
M-high	-: PMU, TPR +: PKL, PNE, PAG	-: IMTPR, CR3 +: IMKL, IMMU	+: ALL, ALL(-1), CNT, CNT(-1)	+
M-low	-: PMU, TPR +: PNE, PAG	-: IMTPR +: IMKL, IMAG	-: ALL +: UST	+
Low tech	-: PMU, TPR +: PNE, PAG	-: IMNE, IMAG, CR3 +: IMMU	+: CNT(-1)	+

4) Results

- Most **plant characteristics** are significant.
  - Wage inequality was lower in plants with higher PMU and TPR.
  - Wage inequality was higher in plants with higher PNE and PAG.
- Most **industry characteristics** are significant.
  - Effects were different across industries.
  - TECH was marginally important in High tech only.
- Wage inequality for each and all industries has worsened significantly as the economy experienced **Economic crisis** (increased about 6-7%).

4) Results: Trade Liberalization

- **Tariff cut** in general did not worsen wage inequality.
  - If any, it more likely reduced wage inequality.
  - Using imports share instead of tariff presented similar results.)
- Why did CNT turn out to be positive? (i.e., tariff cut for imports from China decreased wage inequality)

A1) Imports from China substituted skilled labor more than unskilled labor in medium and low tech industries.
A2) Low tech industries remained protected
A3) Plants with high wage inequality were damaged by imports from China and may have closed down.
A4) Negative effects from China may have concentrated on small sized plants with less than five employees.

: Needs further investigation.

4) Results

- **Then, what are major determinants of worsening wage inequality?**

  - Plant and industry characteristics

  - Structural changes after economic crisis

  - The role of technological progress?

  A1) New technologies may have been introduced mainly in High tech industries.

  A2) New technologies were introduced in other industries as well, however, skilled labors were supplied sufficiently, and their wages did not increase substantially.

  A3) May need another variable representing tech. progress.

4. Effects of Trade Liberalization on Industries' Gini Coefficients

1) Research Question

- How have industries' wage inequalities (distribution) changed over time?
- How did trade liberalization and technology affect this wage inequality (distribution) in each industry?

2) Data

- The same data were used.
- Gini coefficients for each industry were computed for each year, using average wage level of each plant in each industry.

4. Effects of Trade Liberalization on Industries' Gini Coefficients

3) Methods

$$G_{jt} = \beta_o + \beta_1 lnw_{jt} + \beta_2 (lnw_{jt})^2 + IT_{jt} \times \beta_I + TV_{jt} \times \beta_T + YD \times \beta_Y + IC \times \beta_C + \nu_j + \varepsilon_{jt}$$

where Gjt: Gini coefficient for the industry j

wjt: average wage in industry j at time t,

IT: vector of industry characteristics (averages, TECH etc)

- How to measure TECH?: productivity, R&D, employment…

TV: vector of trade related variables (tariffs, import share etc),

YD: time dummy (economic crisis),

IC: industry dummy vector by technology (H, MH, ML),

ν: fixed effects.

4. Effects of Trade Liberalization on Industries' Gini Coefficients

4) Results

- Wage level for each industry has right signs but insignificant.
- Industries with higher IMKL, IMNE, **TECH** turn out to experience higher wage inequalities among plants.
- Industries with higher IMTPR turn out to experience lower wage inequalities among plants.
- YD is significant: Industry's wage inequality increased by economic crisis.
- Tariff reduction decreased industry's wage inequality among plants: In the same industry, wages of plants tend to converge as they are exposed to imports (?).
- M-H and M-L tech industries showed lower wage inequality among plants compared to H and L tech industries.

5. Conclusion

1) Wage inequality between non-production and production workers has increased in Korea, accompanied with tariff reduction.

2) However, there is no statistical evidence that the expansion of trade (or trade liberalization) affected this increase.

3) If any, trade liberalization appeared to reduce wage inequality between non-production and production workers, and among plants in the same industry.

   - There is possibility that plants with higher wage inequality were more substantially affected by trade liberalization and closed down.

   - Trade liberalization should not be blamed as a main source of widening wage inequality.

5. Conclusion

4) Most plant and industry characteristics played significant roles in determining wage inequality.

5) Economic crisis brought structural changes in wage inequality: it significantly jumped since economic crisis.

- **Future Research Issues**

1) More analyses on "why?"
2) Characteristics of plants that closed down during the period
3) Analyses including small-sized plants or analyses by plant size.
4) Looking for a better proxy for technological innovation

- Thank you -

Appendix: Def. of Variables and Basic Statistics

Plant Characteristics

Var.	OECD Class.	Statistics		Def.	Ref.
		Mean	St.Dev.		
WRT	High tech	1.282	0.618	Wage inequality	•[Non-production worker's wage]/ [Production worker's wage]
	M-high tech	1.066	0.506		
	M-low tech	1.069	0.515		
	Low tech	1.228	0.622		
PKL	High tech	0.030	0.055	Factor intensity (K/L)	•[Tangible fixed capital]/ [No. of employees×1000] •Real figure with 2000 as base year
	M-high tech	0.037	0.106		
	M-low tech	0.047	0.112		
	Low tech	0.051	0.091		
PMU	High tech	0.128	0.150	Mark-up	•[Shipment - variable cost]/ shipment •Variable cost includes raw material cost, remuneration, fringe benefit, energy cost, etc.
	M-high tech	0.132	0.139		
	M-low tech	0.138	0.147		
	Low tech	0.136	0.158		
PNE	High tech	0.660	4.181	No. of employees	• in one hundred
	M-high tech	0.404	3.411		
	M-low tech	0.360	2.799		
	Low tech	0.411	1.039		

Appendix: Def. of Variables and Basic Statistics

Plant Characteristics

PAG	High tech	7.987	7.112	Plant's age	t – year of establishment
	M-high tech	8.245	8.816		
	M-low tech	8.462	7.609		
	Low tech	9.645	8.860		
TPR	High tech	0.135	1.816	Plant's revenue	in one hundred billion won
	M-high tech	0.067	1.292		
	M-low tech	0.078	1.402		
	Low tech	0.056	0.228		

Industry Characteristics

Var.	Mean	St.Dev.	Def.	Ref.
Gini_WTT	0.216	0.030	Gini coeff. for each industry	•Computed from each plant's average wage
IMKL	0.026	0.026	Median of PKL	for each industry
IMMU	0.125	0.054	Median of PMU	for each industry

Appendix: Def. of Variables and Basic Statistics

Industry Characteristics

Var.	Mean	St.Dev.	Def.	Ref.
IMAG	6.217	2.551	Median of PAG	for each industry
TECH	0.301	0.076	Technological progress	•[No. of non-production workers]/ [No. of production workers] for each industry
IMTPR	0.049	0.371	Median of TPR	for each industry
CR3	0.340	0.252	Concentration rate	•Sum of market shares of the three largest market sharer
ALL	0.068	0.038	Tariff rate	•[Total tariff revenue]/[Total value of imports (cif.)]
UST	0.063	0.035	Tariff rate on imports from the US	•[Tariff revenue from imports from the US]/[Value of imports the US (cif.)]
CNT	0.084	0.073	Tariff rate on imports from China	•[Tariff revenue from imports from China]/ [Value of imports from China (cif.)]