

Data Structure and Productivity Estimates of Korea Productivity Database

Workshop on Productivity Database in China, Japan, and Korea

July 23, 2007

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I. Introduction

- Data structure for
 - Capital
 - Labor
 - Output & intermediate input (E,M,S)
- Changes in the pattern of sectoral growth after the 1997 crisis
- Growth Accounting

II. Labor Input

Source data

- Persons engaged
 - Economically Active Population Survey (NSO): 1970(6 sectors), 2004(20 sectors)
 - Survey Report on Wage Structure (MOL)
: 1971(54 sectors), 2004(60 sectors)

- Working hours
 - Survey Report on Wage Structure (MOL)
 - Report on Monthly Labor Survey (MOL)
: 1970(17 sectors), 2004(57 sectors)
- Wage
 - Survey Report on Wage Structure (MOL)
- Labor Compensation
 - National Accounts (B.O.K)

Classification of Labor(18 types)

- Gender: (1) male, (2) Female
- Age : (1) below 30, (2) 30-49, (3) above 50
- Skill (Education):
 - (1) Low-skilled (middle school under)
 - (2) Middle-skilled (high school)
 - (3) High-skilled (above college)

III. Gross Output, Value Added, and Intermediate Inputs (E,M,S)

- Compare old vs. EUKLEMS method
- Remaining issues: E,M,S
- Real value added

Previous Approach

- Using U & V tables to get GO, VA, II, and II (E,M,S)

Sources

- National Accounts
 - Nominal GO, VA, II (1970-2005, 21 industries)
- Use table
 - Real, 1985-2002 (Using RAS, 1970-1984 & 2003-2005 estimated)
- Make table
 - Nominal and real, 1985-2002 (Using RAS, 1970-1984 & 2003-2005 estimated)

Following EUKLEMS Method

Two Step Method

- First step: Use detailed BOK (internal) NA data to get GO, VA, II for 72 industries
- Second step: Use U & V tables to divide II into E,M,S

Two Step Method

- First step: Use detailed BOK NA data to get GO, VA, II for 72 industries
 - National Accounts nominal GO, VA, II (1970-2005, 21 industries)
 - Nominal and real GO, VA, II (1970-2005, 78 industries).
 - Use BOK *internal* data: Nominal and real GO (1970-2005, 397 industries)
- Second step: Use U & V tables to divide II into E,M,S

Other Issues: E,M,S

- Inconsistency between (GO,VA, II) and (E,M,S)
 - Using EMS share in 1985 U table to get 1970-1984)
- Possibly use IO tables for 1970-1984 (and 2003-2005) period.

Other Issues: Real Value-Added

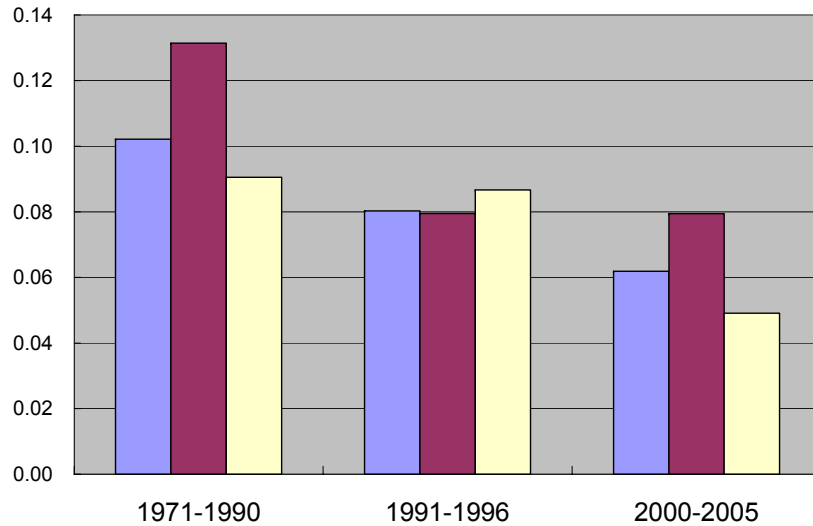
- Double deflation (DD) method
 - Real value added using Laspeyres DD
 - DD for most industries except finance, insurance, real estate, and public administration (53-57, 63)
- Tornqvist vs. Laspeyres index

IV. Changes in the Sectoral Contribution to Output Growth: Focusing on the Service Sector

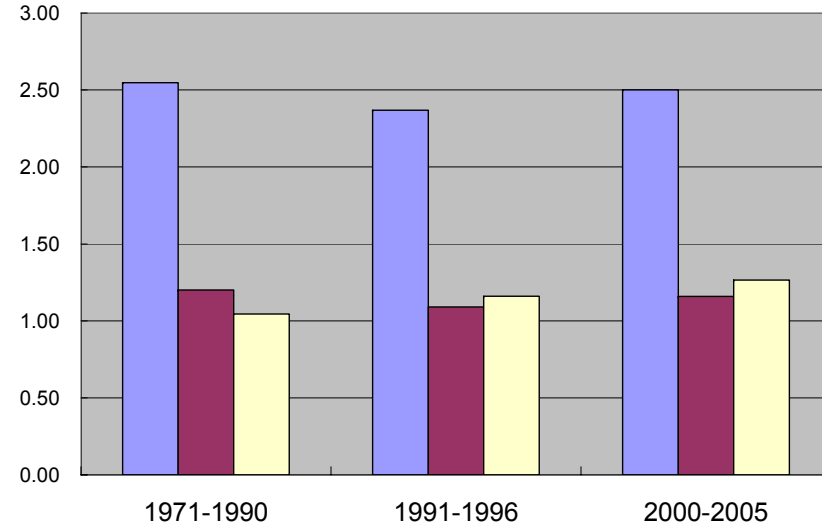
- Before and After the 1997 financial crisis
- After the crisis, resurgence in the manufacturing sector's output growth, but no resurgence in service sector's output
- Overall output growth rate declined.

Changes in Sectoral Contribution to Output Growth (Gross Output)

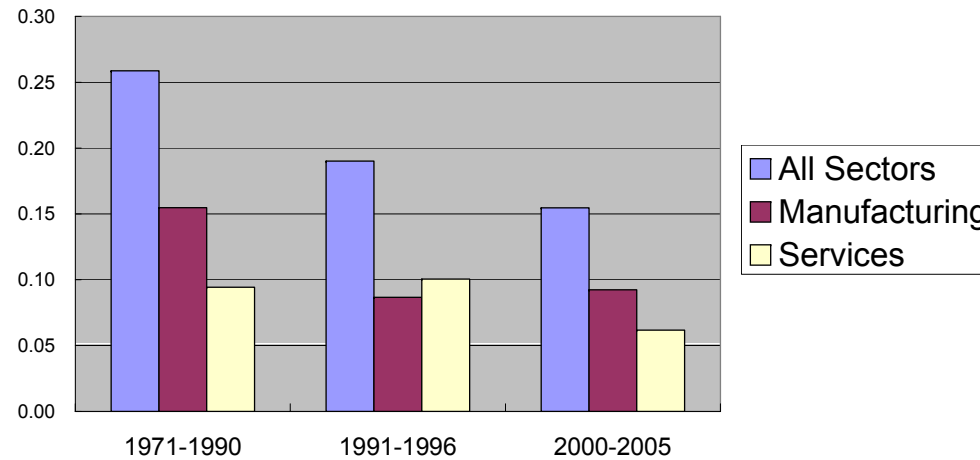
Growth Rate of Gross Output



Domar Weight

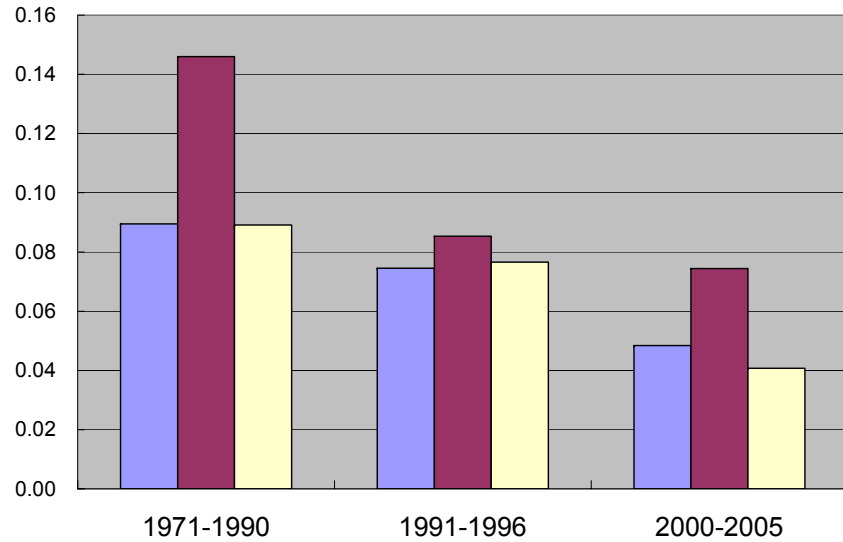


Sectoral Contribution to Aggregate Gross Output Growth (Domar weighted)

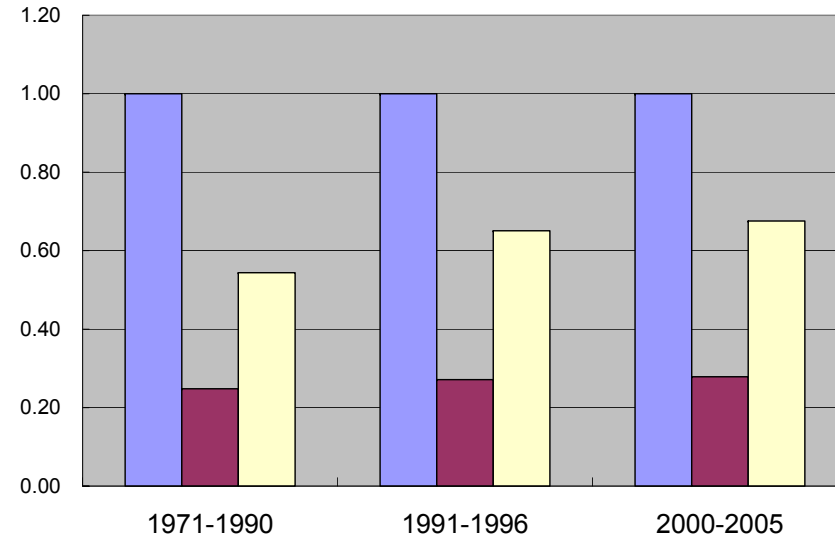


Changes in Sectoral Contribution to Output Growth (Value-Added)

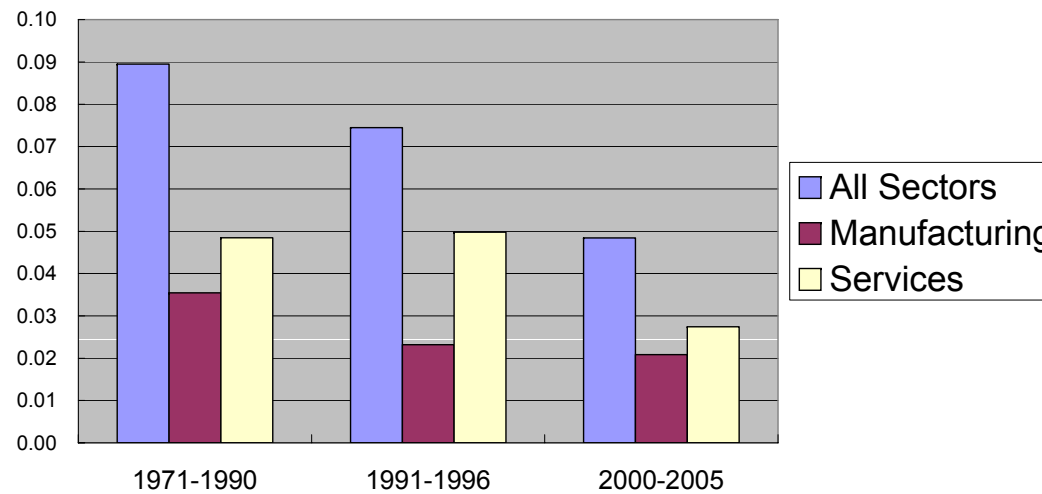
Growth Rate of Value Added



Share of Value Added



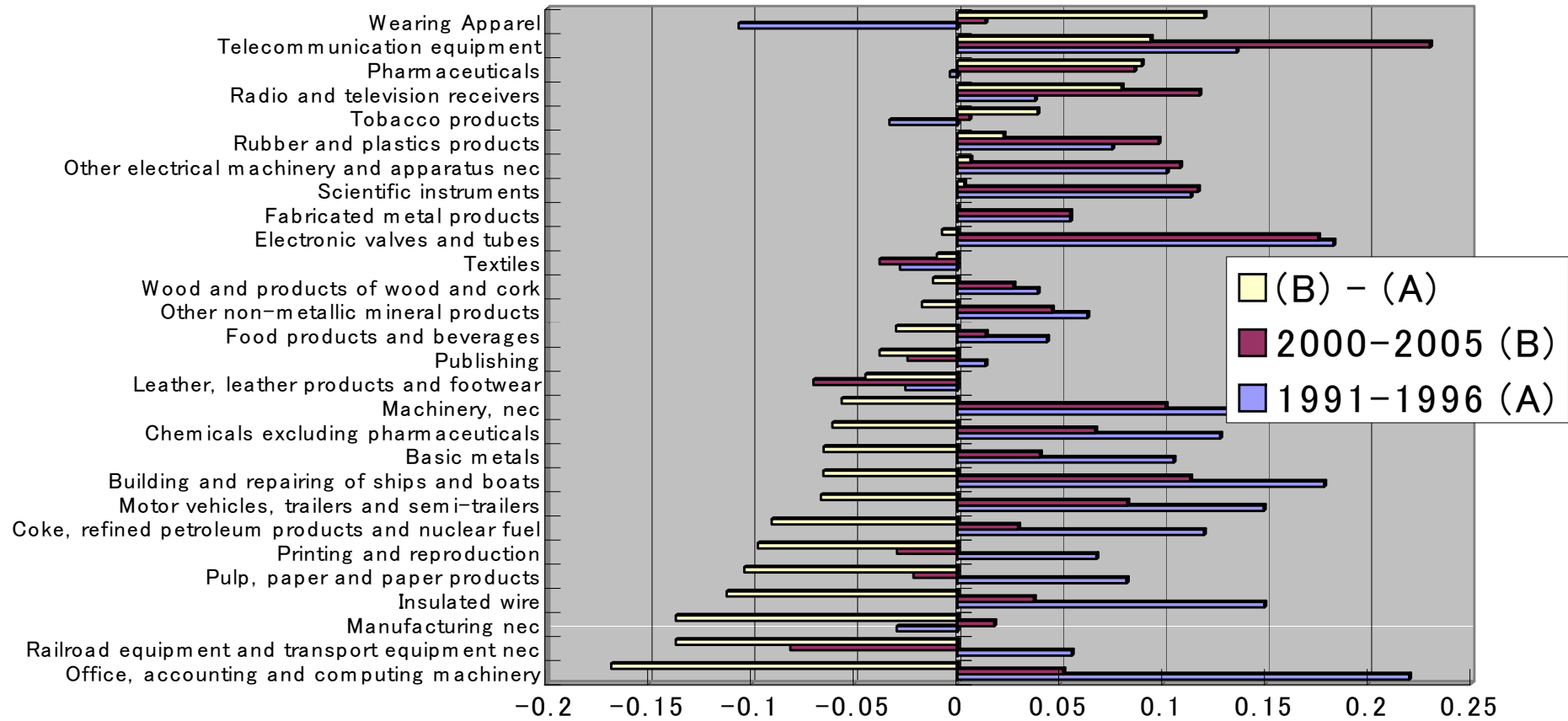
Sectoral Contribution to Aggregate Value Added Growth (Value-added share weighted)



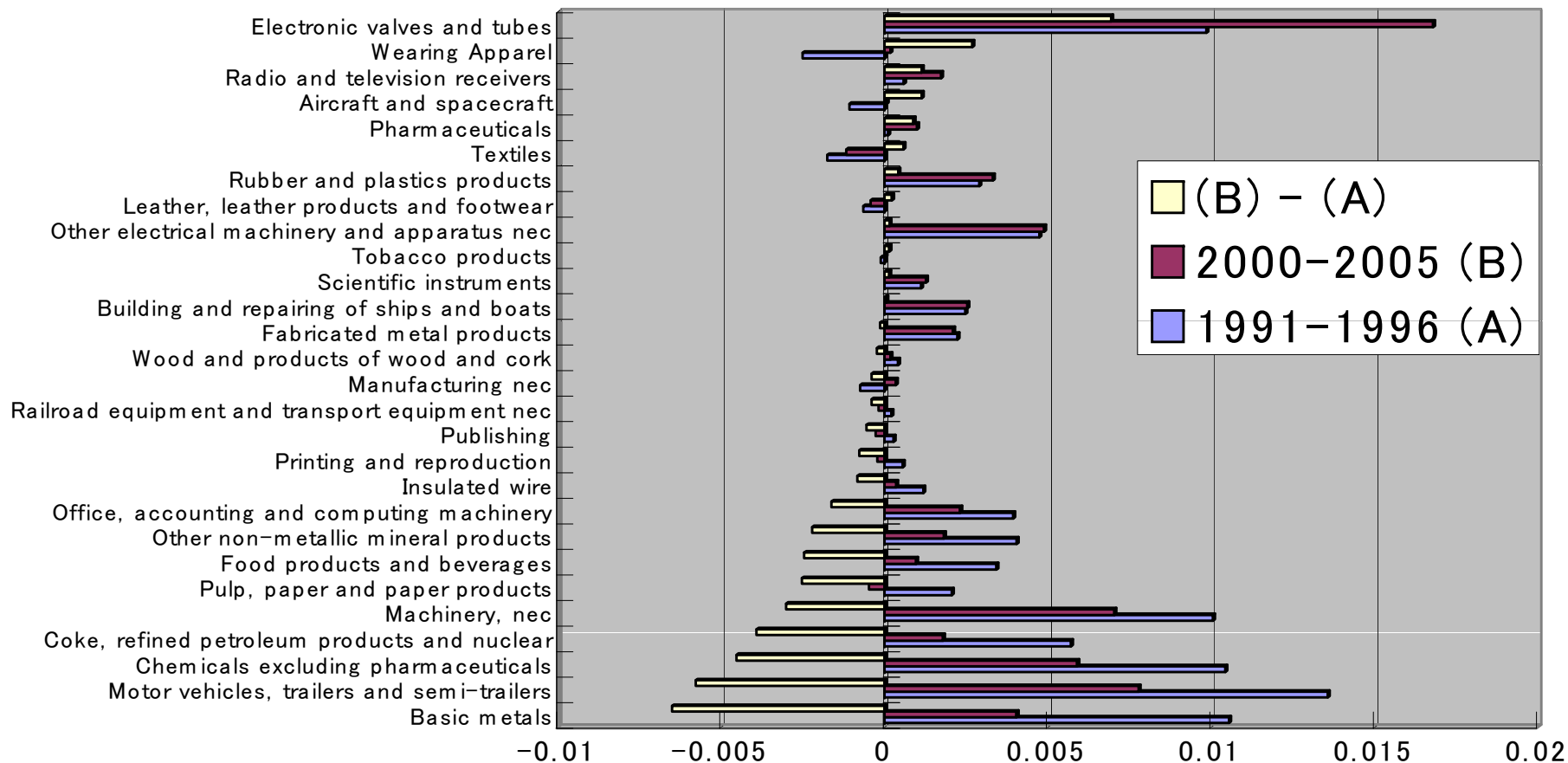
Looking at Detailed Industries: 1991-1996 vs. 2000-2005

- Changes in the pattern of value-added growth rates
- Changes in the contribution to value added growth (including within sector share effects)
 - Resurgence across most MFG industries?
 - Decline across most Non-MFG industries?

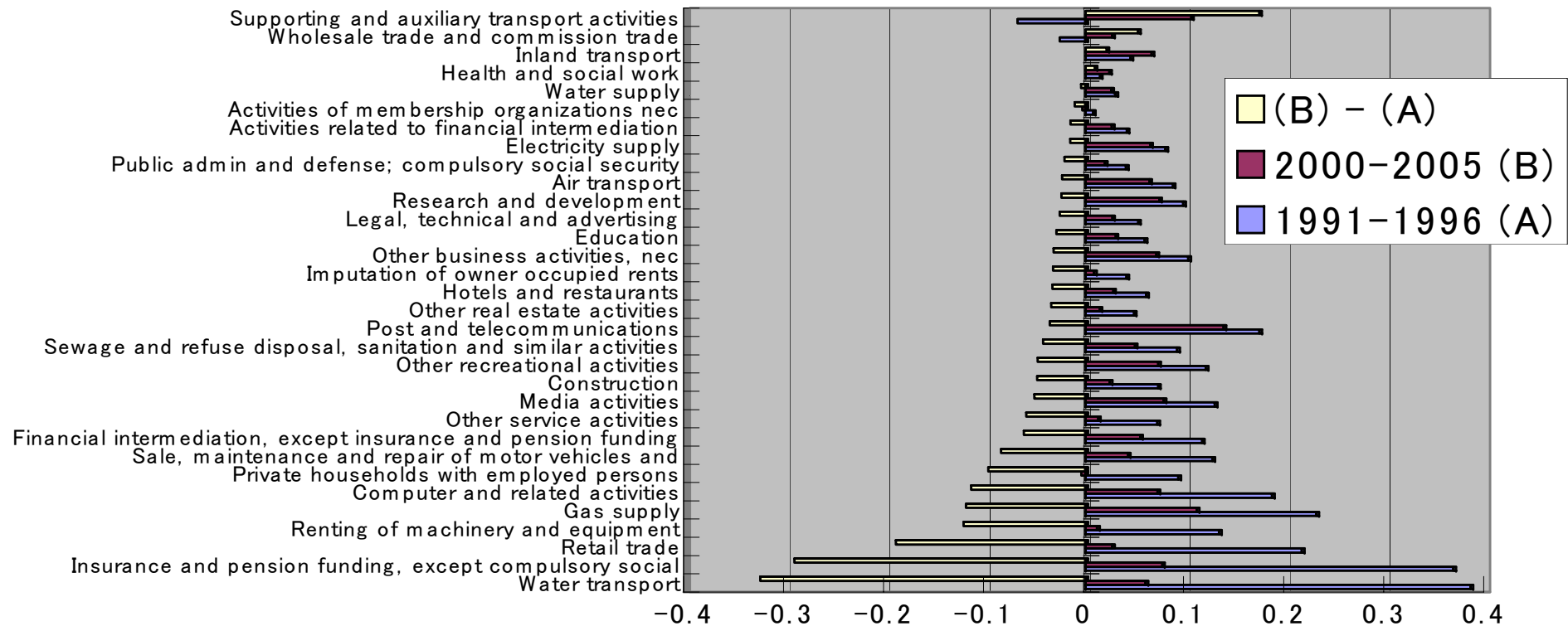
Changes in Value Added Growth Rate in the Manufacturing Sector: 1991–1996 vs. 2000–2005



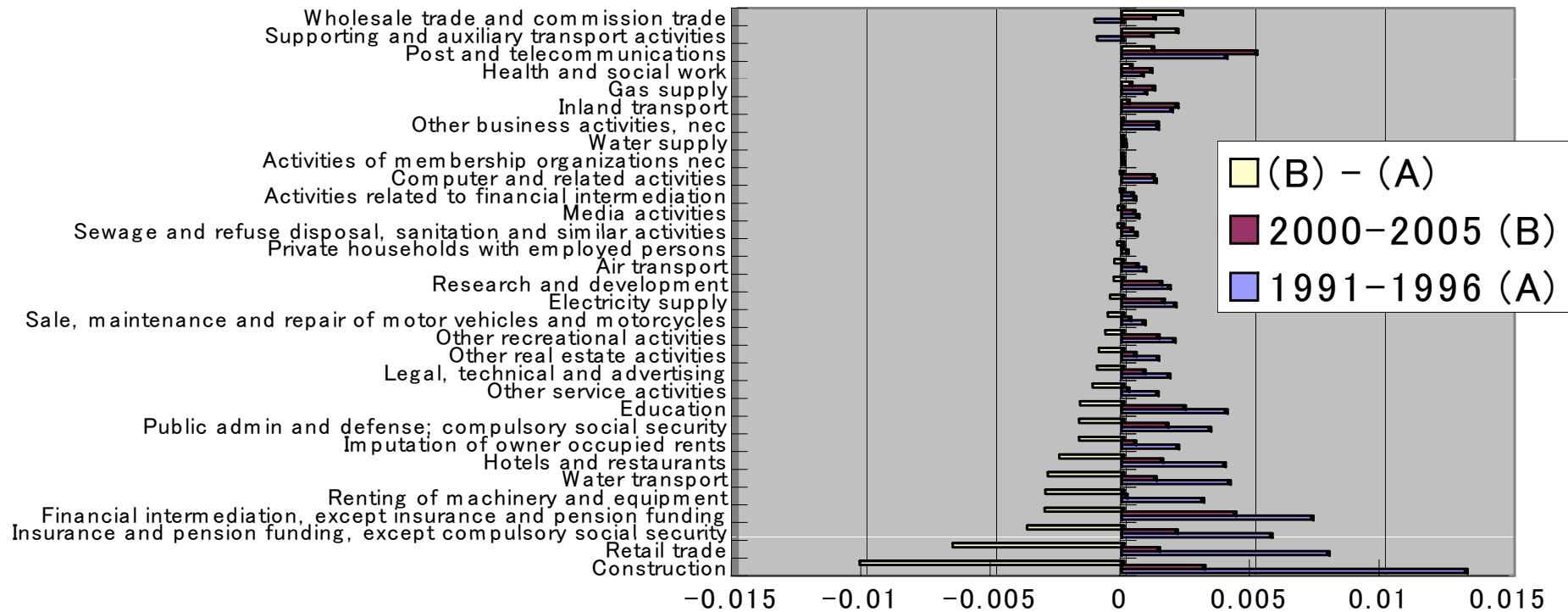
Changes in Contribution to Manufacturing Sector's Value Added Growth: 1991–1996 vs. 2000–2005



Changes in Value Added Growth Rate in the Service Sector: 1991–1996 vs. 2000–2005



Changes in Contribution to the Service Sector's Value Added Growth: 1991–1996 vs. 2000–2005



Searching for Underlying Causes of Lower Growth in the Service Sector through Growth Accounting

	Output	Capital	Labor	Energy	Materials	Service	MFP
(A) 1991-1996	0.084	0.034	0.019	0.004	0.014	0.025	-0.013
(B) 2000-2004*	0.052	0.018	0.013	0.003	0.009	0.017	-0.009
(B)-(A)	-0.032	-0.016	-0.006	-0.001	-0.006	-0.008	0.004
Contribution to (B-A) (%)	100.0%	48.7%	18.5%	2.0%	18.3%	25.1%	-12.6%

Input vs. Productivity Growth

Growth Accounting results suggest that decline in output growth in the service sector is

- Mainly because of declines in input growth
- Not because of changes in productivity growth

Preliminary Answers for Decline in Input Growth

- Lower demand for services by firms and/or households (Demand)
- Regulation → Lower entry

To answer the above, need to look at more detailed industries

The following two factors related to both input and TFP growth

- Low investment in IT
- Mismatched skills

V. Growth Accounting

- Gross output accounting and TFP growth: Manufacturing versus. Services
- Cumulative contribution of sectors to TFP growth
- Relations labor productivity, gross output and TFP growth

1. Gross Output Growth Accounting and TFP Growth

Table 1. Gross Output Growth Accounting and TFP Growth in Manufacturing

<growth rates(%)>

Period	Gross Output	Capital input	Labor input			Energy Input	Material Input	Service Input	TFP
			Total input	Quantity input	Quality input				
71-'79	15.14	1.42	1.11	0.94	0.16	2.00	8.78	0.94	0.89
80-'89	10.27	1.29	0.54	0.39	0.14	1.03	6.44	0.64	0.34
90-'99	7.02	1.00	-0.12	-0.37	0.25	0.76	3.35	1.07	0.97
00-'04	8.16	0.53	0.32	0.21	0.11	0.40	4.66	1.12	1.15
90-'98	5.65	1.08	-0.18	-0.46	0.28	0.70	2.49	0.93	0.64
99-'04	10.03	0.48	0.33	0.24	0.09	0.54	5.73	1.32	1.62
71-'04	10.29	1.13	0.46	0.29	0.18	1.11	5.89	0.92	0.79
Contribution to output growth									
71-'79	100.0	9.4	7.3	6.2	1.1	13.2	58.0	6.2	5.9
80-'89	100.0	12.5	5.2	3.8	1.4	10.1	62.7	6.2	3.3
90-'99	100.0	14.2	-1.7	-5.3	3.6	10.8	47.7	15.2	13.8
00-'04	100.0	6.5	3.9	2.5	1.4	4.8	57.0	13.7	14.0
90-'98	100.0	19.1	-3.1	-8.2	5.0	12.3	44.0	16.4	11.3
99-'04	100.0	4.8	3.3	2.4	0.9	5.4	57.1	13.2	16.2
71-'04	100.0	10.9	4.5	2.8	1.7	10.8	57.2	8.9	7.7

**Table 2. Gross Output Growth Accounting and TFP growth
in Service**

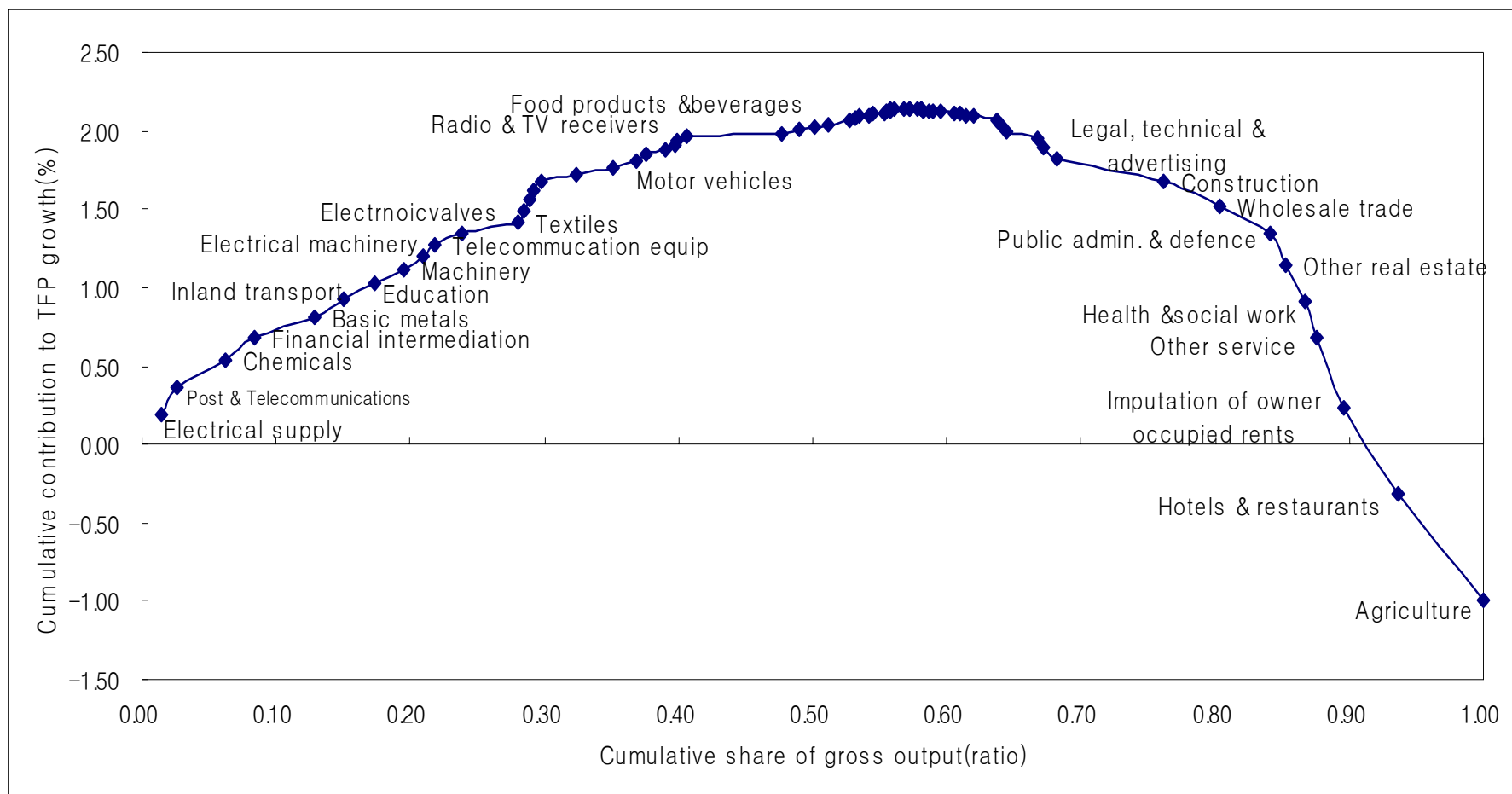
<growth rates(%)>

Period	Gross Output	Capital input	Labor input			Energy Input	Material input	Service Input	TFP
			Total labor	Quantity labor	Quality labor				
71-'79	7.98	2.39	1.89	1.48	0.41	0.73	2.65	1.55	-1.22
80-'89	7.92	3.38	1.20	1.10	0.09	0.44	2.31	1.36	-0.77
90-'99	6.66	3.18	1.46	1.17	0.29	0.17	0.84	2.34	-1.33
00-'04	5.17	1.85	1.35	1.00	0.35	0.29	0.86	1.73	-0.89
90-'98	6.74	3.29	1.60	1.27	0.33	0.14	0.82	2.36	-1.48
99-'04	5.30	1.90	1.16	0.88	0.28	0.31	0.88	1.80	-0.75
71-'04	7.16	2.83	1.48	1.21	0.27	0.42	1.75	1.75	-1.07
Contribution to output growth									
71-'79	100.0	29.9	23.7	18.5	5.1	9.1	33.2	19.4	-15.3
80-'89	100.0	42.7	15.1	13.9	1.2	5.5	29.2	17.2	-9.7
90-'99	100.0	47.7	22.0	17.6	4.3	2.6	12.6	35.1	-20.0
00-'04	100.0	35.8	26.0	19.2	6.8	5.5	16.6	33.4	-17.3
90-'98	100.0	48.8	23.8	18.9	4.9	2.1	12.2	35.0	-22.0
99-'04	100.0	35.9	21.8	16.6	5.2	5.9	16.6	33.9	-14.1
71-'04	100.0	39.5	20.7	16.9	3.8	5.8	24.5	24.5	-15.0

2. Cumulative Contribution of Sectors to TFP growth

- The weight of gross output of the sectors with positive economy-wide TFP growth is about 57%
- The weight with negative TFP growth is about 43% during the entire period of 1971-2004.

Figure 1. Cumulative contribution of sectors to TFP growth in economy-wide (1971- 2004)



3. Relations between Labor Productivity, Gross output and TFP Growth

Figure 2. Plotting between Sectoral Labor Productivity Growth and TFP Growth (1971-2004, %)

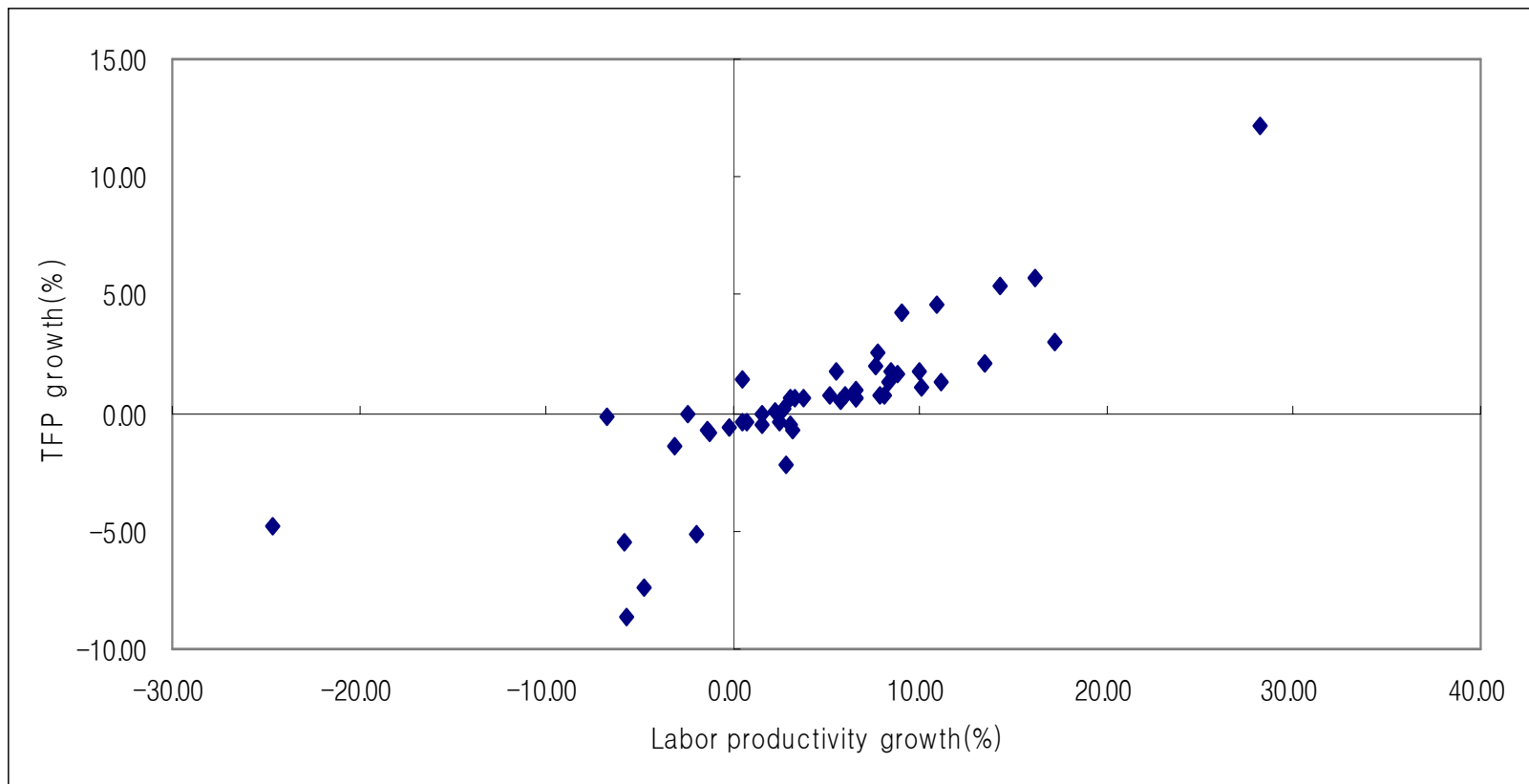
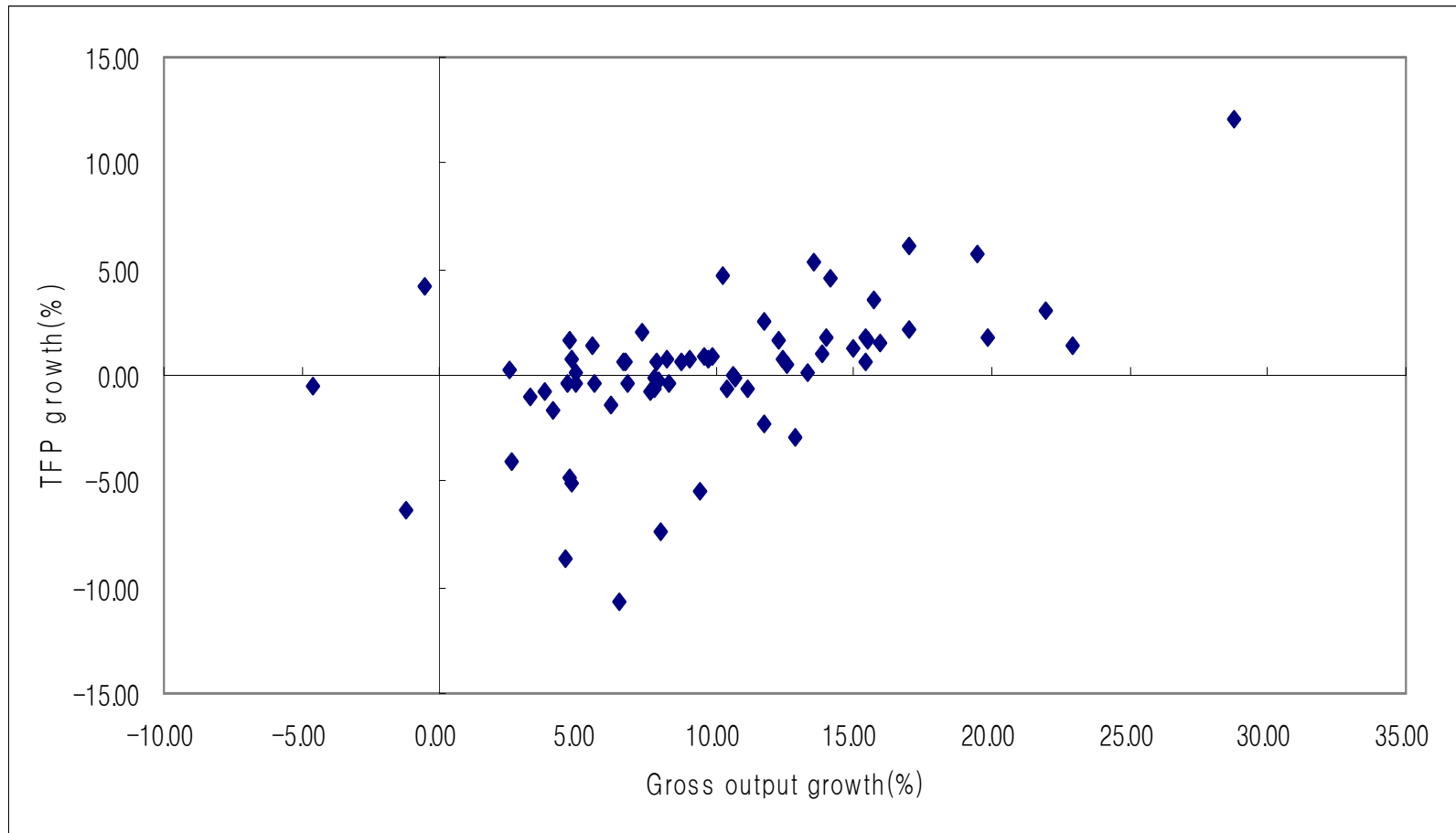


Figure 3 Plotting between Sectoral Gross output Growth and TFP Growth (1971-2004, %)



- A visual inspection
 - TFP growth is positively correlated with both labor productivity growth and output growth and TFP-LP relation is stronger than TFP–Output relation.
- Following by two simple regression results, we are adopting implicit hypotheses that higher LP and output growth induces TFP growth through enhanced human capital and economies of scale..

$$\log (\text{TFP}_t/\text{TFP}_{t-1})=\alpha + \beta \log (\text{LP}_t/\text{LP}_{t-1})+ \gamma$$

Dependent var.	β	S.E	DW	adjR ²
TFP Growth rate	0.345***	0.034	1.711	0.677

$$\log (\text{TFP}_t/\text{TFP}_{t-1})=\alpha + \beta \log (\text{GO}_t/\text{GO}_{t-1})+ \gamma$$

Dependent var.	β	S.E	DW	adjR ²
TFP Growth rate	0.326***	0.060	1.473	0.301

***: Pr>t is 1%, **:Pr>t is 5%, *:Pr>t is 10%

- The linear rank statistics reject the null hypotheses that TFP growth is stochastically independent of LP growth and that TFP growth is stochastically independent of output growth at the 1 % significance level.
- **Table 3 Test Statistics for Testing the Stochastic Independence**

$$r_s(TFP - LP) = 0.8864$$

$$r_s(TFP - GO) = 0.6150$$

$$H_0 : \rho = 0 \quad H_1 : \rho \neq 0$$

$$\Pr_{H_0}(r_s) \geq r_s(n; \alpha) = \alpha$$

$$\frac{r - E_{H_0}(r_s)}{\sqrt{\text{Var}_{H_0}(r_s)}} = r_s \sqrt{n-1} \rightarrow N(0,1)$$

$$Z(TFP - LP) = 0.8864 \times \sqrt{(49 - 1)} = 6.141$$

$$Z(TFP - GO) = 0.6150 \times \sqrt{(49 - 1)} = 4.261$$

4. Results

- TFP growth (1971-2004)
 - Economy-wide : -0.52 %,
 - Manufacturing: 0.79%
 - Service: -1.07 %
- Leading sectors
 - Manufacturing: Chemical and Basic Metals
 - Service: Financial Intermediation, Post and Telecommunications

- TFP growth is positively correlated with both LP and Output
 - TFP-LP relation is stronger than TFP-Output relation
 - An implicit hypotheses: Higher LP and output growth induces TFP growth through enhanced human capital and economies of scale.