

# The Industry Origins of the US-Japan Productivity Gap

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Dale W. Jorgenson (Harvard University)

Koji Nomura (Keio University)

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# Contents

- Relative Prices
  - Industry PPPs for output and KLEM inputs
  - Bilateral I-O Framework
  - Hybrid Approach based on production-side data and demand-side data
- Economic Growth in the U.S. and Japan
- Level Comparison of ALP and TFP
- Industry Origins of TFP-gap
  - Manufacturing vs Services

# Relative Prices Required for Productivity Comparison

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- Industry-Level PPPs for
  - 42 US-Japan Common Industry Classification
  - Gross Output: X
  - Capital Service: K and Capital Acquisition: A
  - Labor Service: L
  - Energy: E
  - Materials: M
- Bilateral I-O Framework used for defining PPPs for X, E, M, and A

# US-Japan 42 Common Industry Classification

1. Agriculture, Forestry, Fishery
2. Coal Mining
3. Other Mining
4. Construction
5. Foods
6. Textile
7. Apparel
8. Woods and Related Products
9. Furniture and Fixture
10. Paper and Pulp
11. Printing and Publishing
12. Chemical Products
13. Petroleum Refining
14. Leather Products
15. Stone, Clay, Glass
16. Primary Metal
17. Metal Products
18. Machinery
19. Computers
20. Communications Equipment
21. Electronic Components
22. Other Electrical Machinery
23. Motor Vehicles
24. Other Transportation Equipment
25. Precision Instruments
26. Misc Manufacturing
27. Railroad Transportation
28. Water Transportation
29. Air Transportation
30. Other Trans and Storage
31. Communications
32. Electricity
33. Gas Supply
34. Wholesale and Retail
35. Finance and Insurance
36. Real Estate
37. Education
38. Research
39. Medical Care
40. Other Services
41. Public Administration
42. Household

# Various Concepts of Relative Prices on Commodity

## ■ Producer's Prices

- Domestic Output Price:  $P_{di}$
- Demand Price of Domestic Goods:  $P_{d(H)i}$  and  $P_{d(I)i}$ , where (H) and (I) represent Purchases by Household and Industry, respectively
- Demand Price of Composite Goods (inc. imports):  $P_{c(H)i}$ ,  $P_{c(I)i}$

## ■ Purchaser's Prices

- Demand Price of Domestic Goods:  $P_{pd(H)i}$  and  $P_{pd(I)i}$
  - Demand Price of Composite Goods (inc. imports):  $P_{pc(H)i}$ ,  $P_{pc(I)i}$
- ## ■ PPPs for X, E, M, and A
- $P_{di}$  used for X,  $P_{c(I)i}$  for E and M, and  $P_{pc(I)i}$  for A

# Bilateral I-O Framework in Measuring Relative Prices

- I . Construction of Price Model  
based on Bilateral Input-Output Framework
- II . Describe the Linkages among Relative Prices  
based on the Price Model
- III . One Data Sources  $\Rightarrow$  All Relative Prices  
(e.g.  $\mathbf{P}^{pc(H)}_i \Rightarrow \mathbf{P}^{c(H)}_i \Rightarrow \mathbf{P}^{d(H)}_i = \mathbf{P}^{d(l)}_i \Rightarrow \mathbf{P}^d_i \Rightarrow \mathbf{P}^{c(l)}_i$  )
- IV . Comparison and Check in the case that multiple estimates will be available for one commodity

# Bilateral Input-Output Table between Japan and US

	Intermediate Demand		Final Demand		Export to	
	JP	US	JP	US	RoW	output
JP	$\frac{1}{e} p_{J_i}^d x_{JJ_{ij}}$	$\frac{1}{e} p_{J_i}^d x_{JU_{ij}}$	$\frac{1}{e} p_{J_i}^d F_{JJ_i}$	$\frac{1}{e} p_{J_i}^d F_{JU_i}$	$\frac{1}{e} p_{J_i}^d E_{JR_i}$	$\frac{1}{e} p_{J_i}^d X_{J_i}$
US	$p_{U_i}^d x_{UJ_{ij}}$	$p_{U_i}^d x_{UU_{ij}}$	$p_{U_i}^d F_{UJ_i}$	$p_{U_i}^d F_{UU_i}$	$p_{U_i}^d E_{UR_i}$	$p_{U_i}^d X_{U_i}$
Freight & Insurance	$IF_{UJ_j}$	$IF_{JU_j}$	$IF_{JU_j}^F$	$IF_{UJ_j}^F$		
Duty	$CD_{UJ_j}$	$CD_{JU_j}$	$CD_{JU_j}^F$	$CD_{UJ_j}^F$		
RoW	$p_{RJ_i}^m x_{RJ_{ij}}$	$p_{RU_i}^m x_{RU_{ij}}$	$p_{RJ_i}^m F_{RJ_i}$	$p_{RU_i}^m F_{RU_i}$		
Duty	$CD_{UJ_j}$	$CD_{JU_j}$	$CD_{JU_j}^F$	$CD_{UJ_j}^F$		
Value added	$VA_{J_j}$	$VA_{U_j}$				
output	$\frac{1}{e} p_{J_j}^d X_{J_j}$	$p_{U_j}^d X_{U_j}$				

# Linkage of Relative Prices

- Domestic Price Linkages between Output and Input
  - $P_i^d = f^d(P_i^{d(H)}, P_i^{d(L)})$   
← consumption demand share of domestic goods
- Linkages between Domestic Price and Composite Price
  - $P_i^{d(H)} = f^H(P_i^{c(H)}), P_i^{d(L)} = f^L(P_i^{c(L)})$   
← imports share, freight and insurance, duties
- Linkages between Producers Price and Purchasers Price
  - $P_i^{pd(H)} = f^{dH}(P_i^{d(H)}), P_i^{pd(L)} = f^{dL}(P_i^{d(L)})$
  - $P_i^{pc(H)} = f^{cH}(P_i^{c(H)}), P_i^{pc(L)} = f^{cL}(P_i^{c(L)})$   
← wholesale and retail margin, transportation cost



# Data Sources

- Japan-US Bilateral I-O Table in 1990 (METI)
  - 164 commodities
  - Import share & consumption share by commodity
  - Freight & insurance rate **by commodity**(←supplementary table)
  - Duties tax rate **by commodity** (←supplementary table)
- US Use-Table in 1987 and Japan X-Table in 1990
  - Wholesale and retail margin rate by 164 commodity
  - Transportation margin rate(rail,road,water,air,other) by 164 commodity
- A Multitude of Data Source for Relative Prices
  - next page

# Data for Relative Prices

Sources	Target and Classification	Price Evaluation	Domestic / Imports	
ICP (UN)	FD, ICP basic heading	Purchaser	inc.Import	$P_{pc(H)_i}$
Eurostat-OECD	FD, ICP basic heading	Purchaser	inc.Import	$P_{pc(H)_i}$
Energy Prices & Taxes (IEA)	Coal,raw oil,LNG, electricity,town-gas	Purchaser	Domestic /Import	$P_{pd}_i$
Consumer Price Comparison Survey (METI)	94 consumer goods & services	Purchaser	inc.Import	$P_{pc(H)_i}$
Intermediate goods Price Comparison Survey (METI)	152Goods & 35service as intermediate inputs	Purchaser (Producer, partly)	inc.Import	$P_{pc(I)_i}$
PPP Survey Committee (METI)	About 100 Products	Producer	Domestic	$P_{d}_i$
Transportation Service Price (MLIT)	Transportation	Producer	Domestic	$P_{d}_i$
Housing,Construction Price (MLIT)	Building&Const.	Producer(Cost)	Domestic	$P_{d}_i$
Foods and Restaurant Price(MAFF)	Foods and Restaurant	Purchase	inc.Import	$P_{pc}_i$
Mobile Phone Price ( MPT )	Communication	Purchaser	Domestic	$P_{pd}_i$
Woods Products Price (MAFF)	Woods Products	Purchaser	inc.Import	$P_{pc(I)_i}$

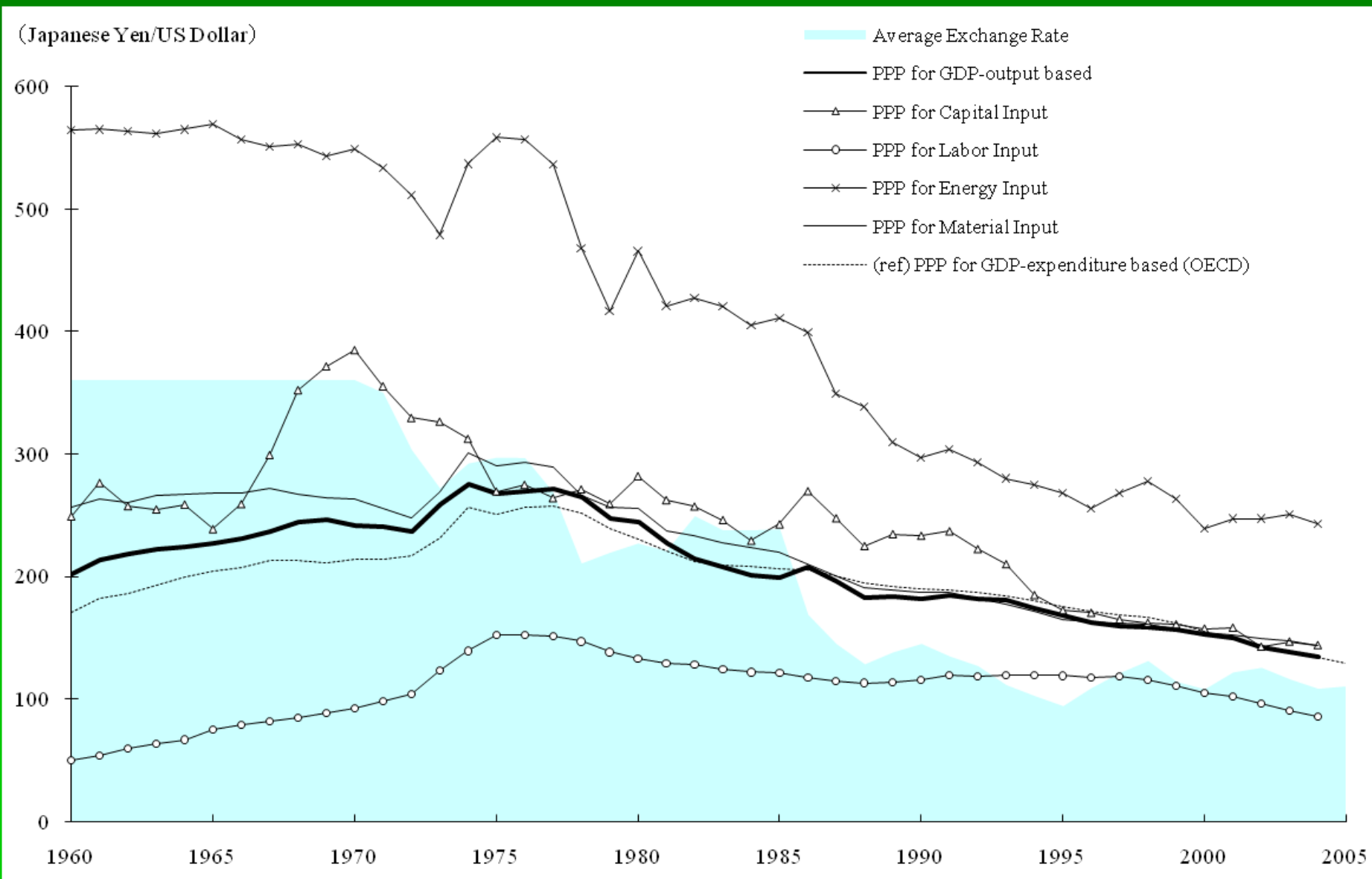
# PPP for Capital Inputs

- Common Classification for Asset Category
  - 29 tangible assets
  - 2 intangible assets: mineral exploration and software
  - Inventories
  - Land
- Measurement of PPPs for capital acquisition
  - Based on purchaser's price PPP for composite goods sold to industry
- Measurement of annualization factor
  - Detailed tax system is considered in each country
  - 59 assets in 36 industries in the U.S.
  - 103 assets in 47 industries in Japan

# PPP for Labor Inputs

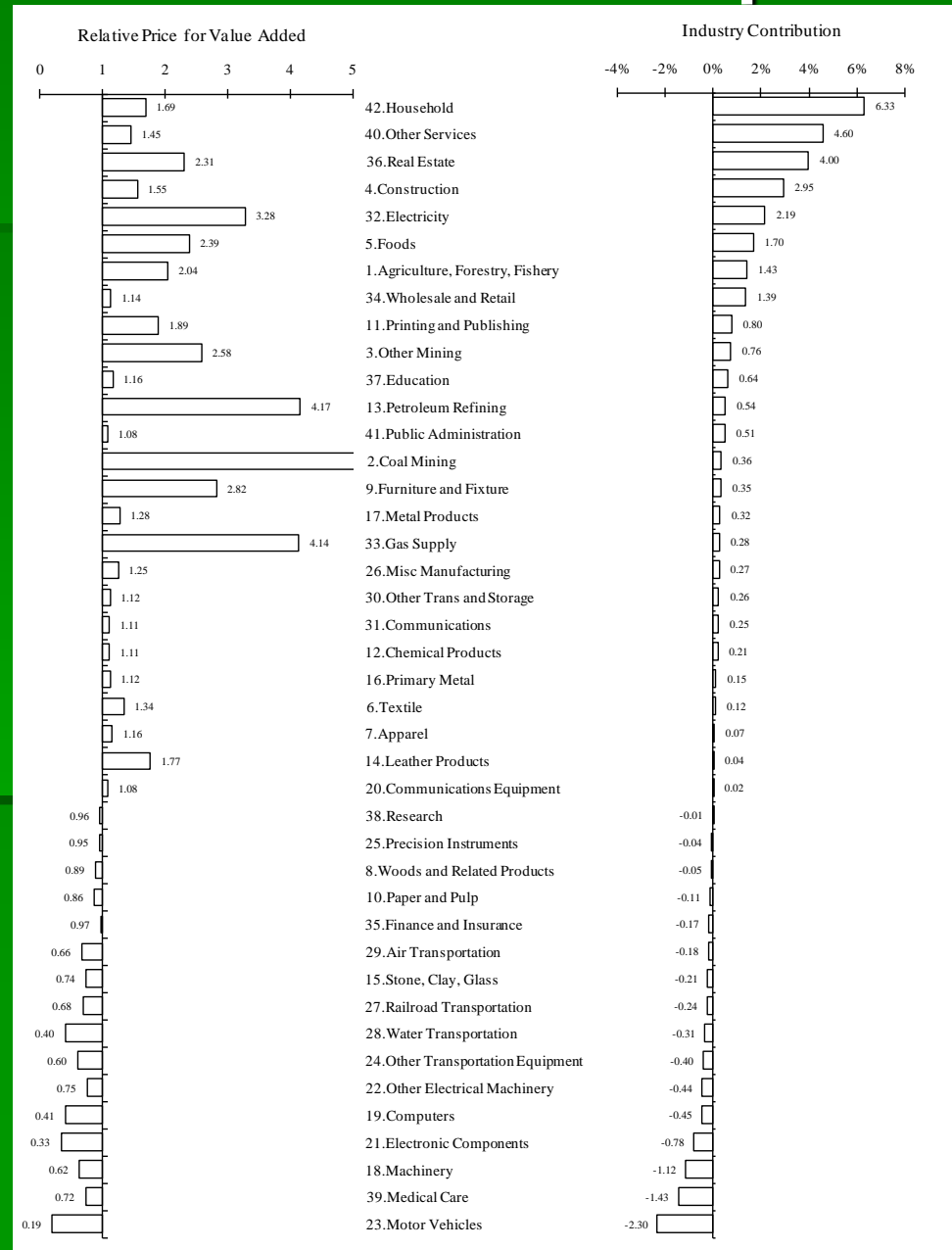
- Common Classification for Labour Category
  - industry: common 38 industries
  - gender: male and female
  - age: 6 groups (-24, 25-34, 35-44, 45-54, 55-64, 65-)
  - class of worker: employee
  - education: four groups(male), three groups(female)
  - Totally, 1596 categories
- See Nomura and Samuels (2003)

# Aggregate PPPs for KLEM: 1960-2004



# Industry Origins of PPP-for-GDP Gap in 1990

- PPP for GDP-output based=181.0
- PPP for GDP-expenditure based=189.2 (OECD)
- Exchanger rate=144.8

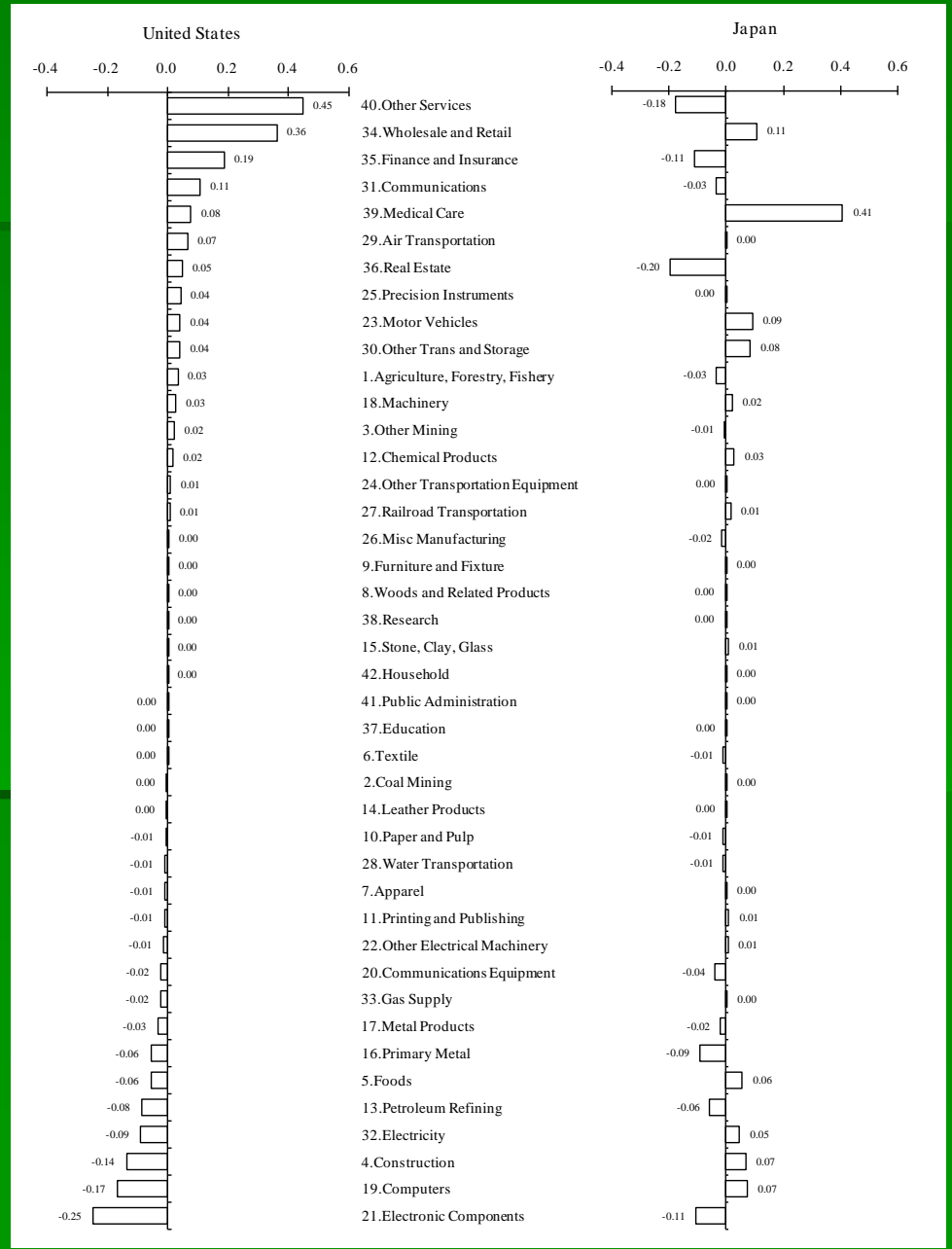


# Economic Growth in the U.S. and Japan

	1960-73	1973-90	1990-95	95-2000	2000-04	1960-2004
United States						
Value Added	3.90	2.83	2.35	4.12	2.56	3.21
Capital Input	1.81	1.59	1.19	2.14	1.46	1.66
IT Capital	0.21	0.41	0.49	0.97	0.63	0.44
Non-IT Capital	1.60	1.18	0.70	1.16	0.83	1.22
Labor Input	1.29	1.08	0.81	1.29	-0.17	1.02
Total Factor Productivity	0.81	0.17	0.35	0.69	1.27	0.54
Agriculture	0.00	0.13	0.03	0.07	0.10	0.07
IT-manufacturing	0.09	0.20	0.27	0.48	0.04	0.19
Motor Vehicle	0.02	0.00	-0.01	0.02	0.06	0.01
Other manufacturing	0.52	-0.02	0.11	0.21	0.04	0.19
Communications	0.01	0.06	-0.01	-0.04	0.07	0.03
Trade	0.17	0.15	0.07	0.15	0.51	0.18
Finance & Insurance	-0.05	0.01	0.04	0.11	0.30	0.03
Other services	0.04	-0.37	-0.14	-0.30	0.15	-0.17
Japan						
Value Added	10.00	4.50	1.31	1.31	1.14	5.10
Capital Input	4.95	2.19	1.93	1.02	0.72	2.71
IT Capital	0.22	0.26	0.27	0.32	0.37	0.27
Non-IT Capital	4.72	1.93	1.66	0.70	0.35	2.44
Labor Input	1.75	1.12	-0.16	-0.19	-0.15	0.90
Total Factor Productivity	3.30	1.18	-0.46	0.48	0.57	1.48
Agriculture	0.20	0.00	0.06	-0.01	-0.04	0.06
IT-manufacturing	0.17	0.21	0.09	0.42	0.35	0.22
Motor Vehicle	0.28	0.13	0.00	0.02	0.11	0.14
Other manufacturing	1.78	0.41	-0.33	0.17	0.08	0.68
Communications	0.07	0.05	0.07	0.12	0.08	0.07
Trade	0.94	0.28	0.01	-0.13	-0.03	0.37
Finance & Insurance	0.23	0.10	-0.22	0.15	0.04	0.10
Other services	-0.36	0.01	-0.14	-0.26	-0.03	-0.15

Note: All figures are average annual growth rates. Value added is aggregated from industry GDPs evaluated at the factor cost.

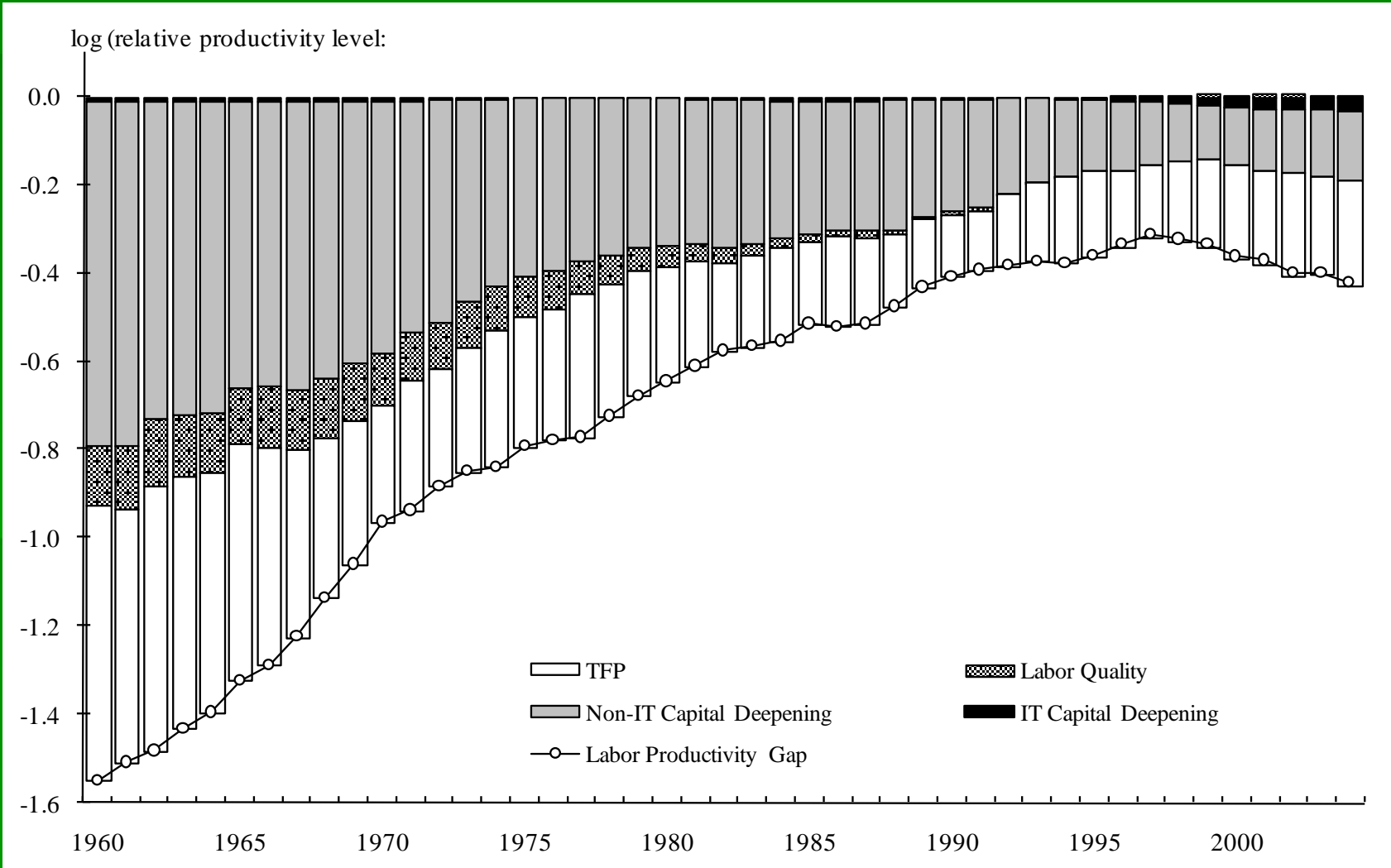
# Changes in Contribution of Industry TFP to Economic Growth: 2000-2004 less 1995-2000





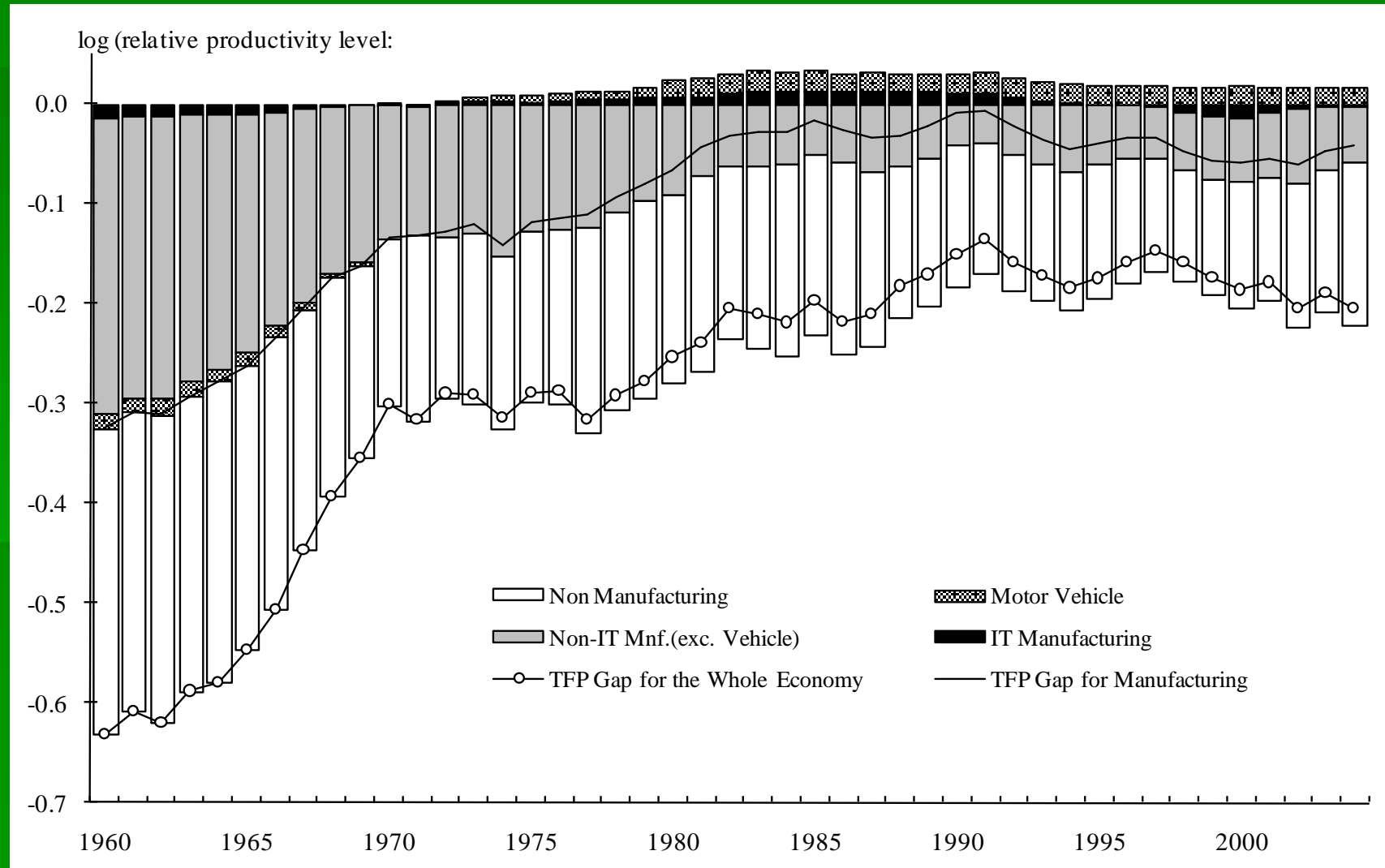
# U.S.-Japan Labor Productivity Gap

	1960	1973	1980	1990	1995	2000	2004
Labor Productivity	21.2	42.8	52.5	66.6	69.9	69.7	65.7

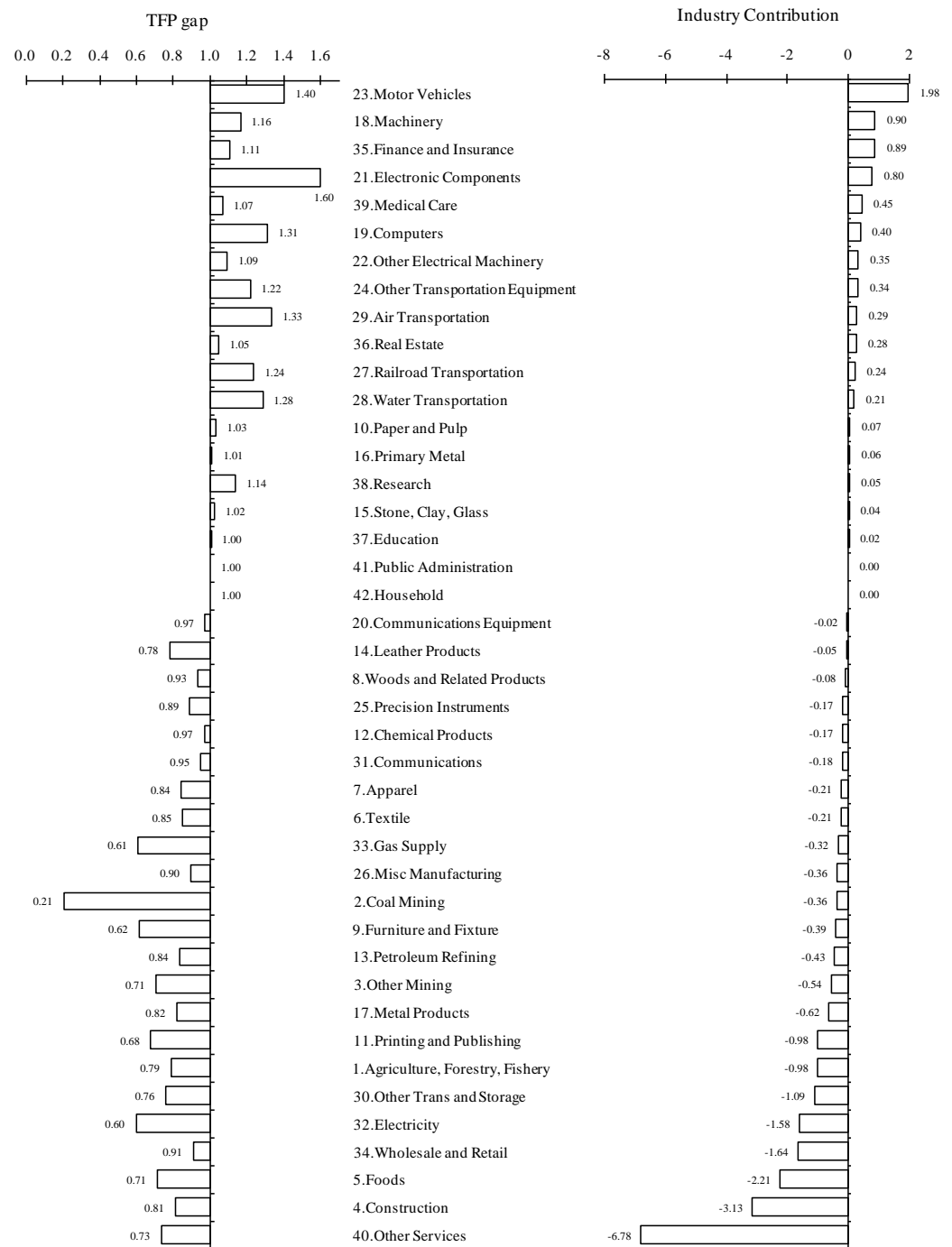


# U.S.-Japan TFP Gap

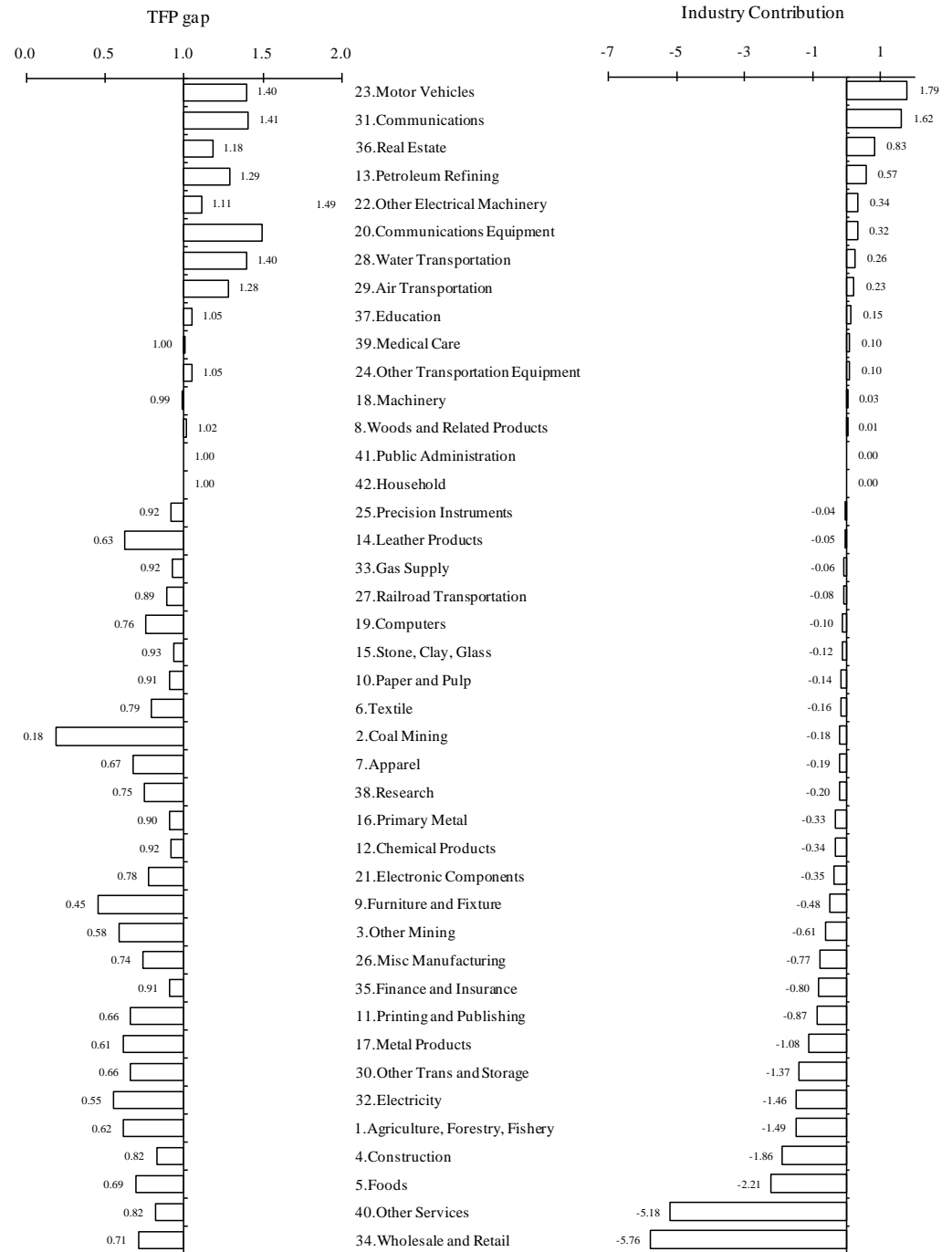
	1960	1973	1980	1990	1995	2000	2004
Total Factor Productivity	52.4	72.5	75.4	86.1	82.6	81.7	79.5



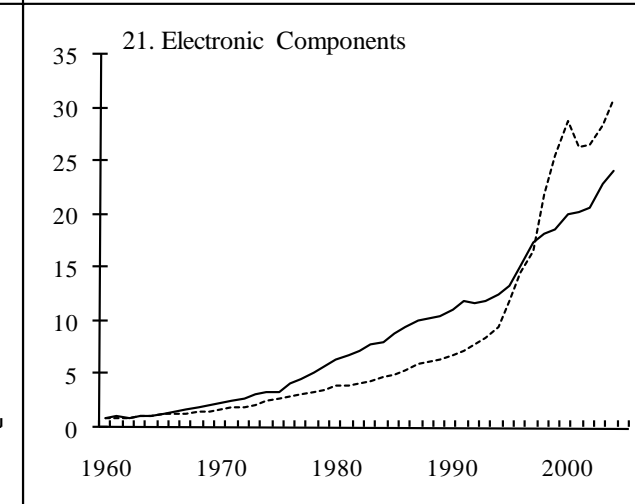
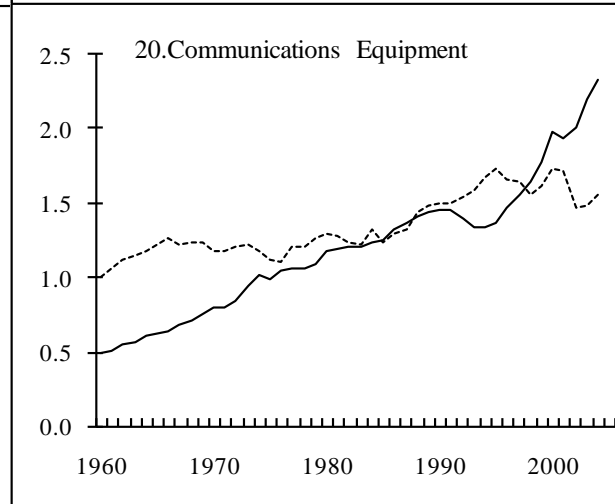
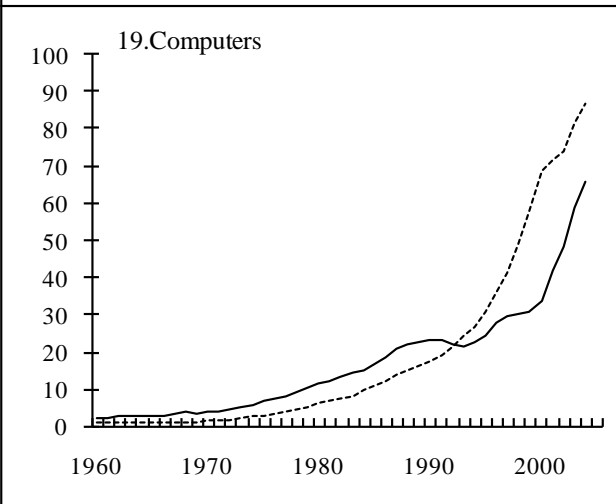
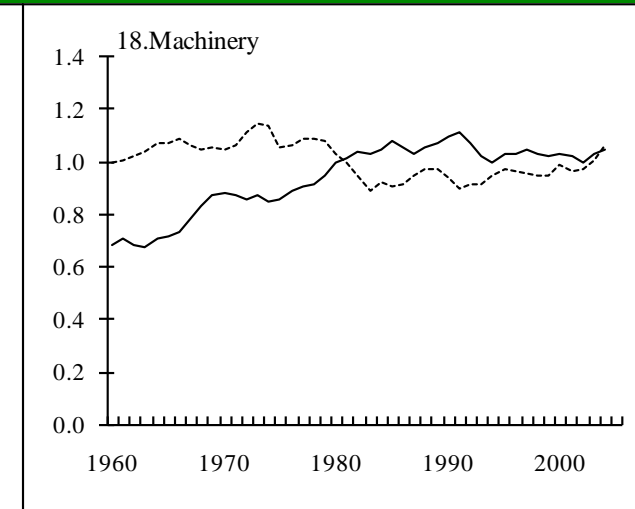
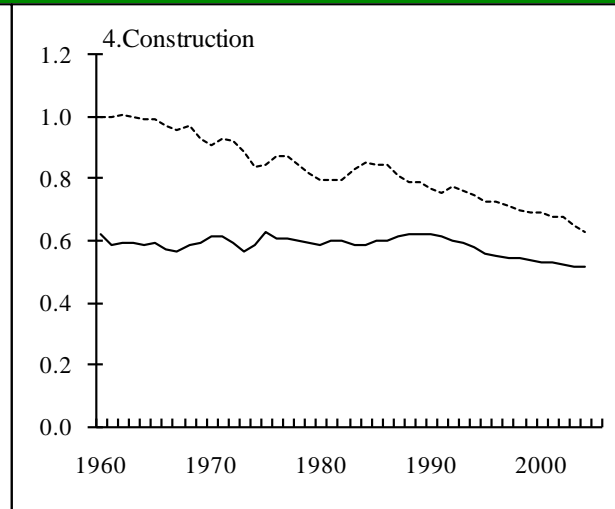
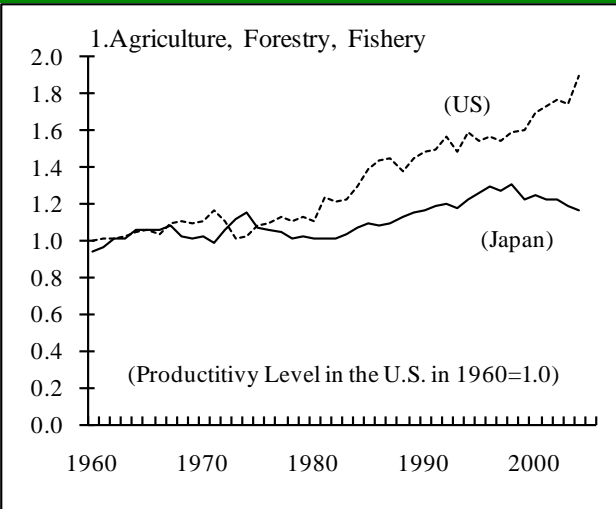
# Industry Origins of TFP Gap in 1990



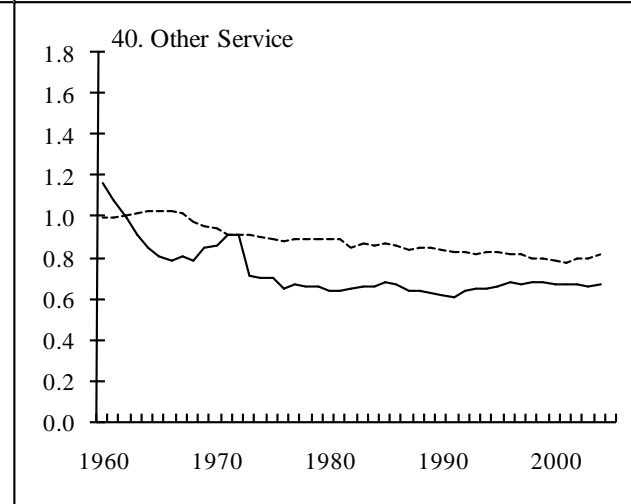
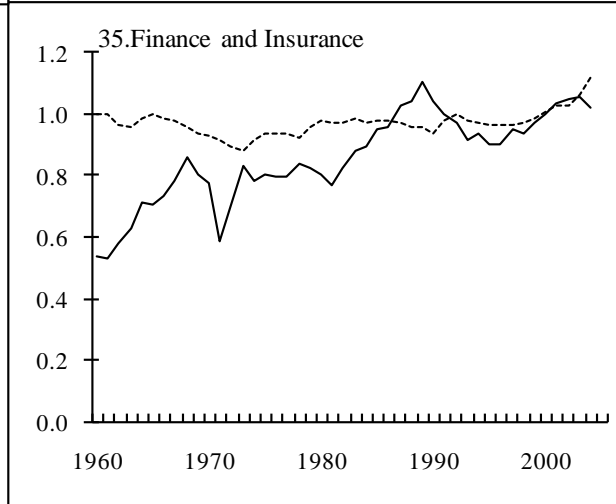
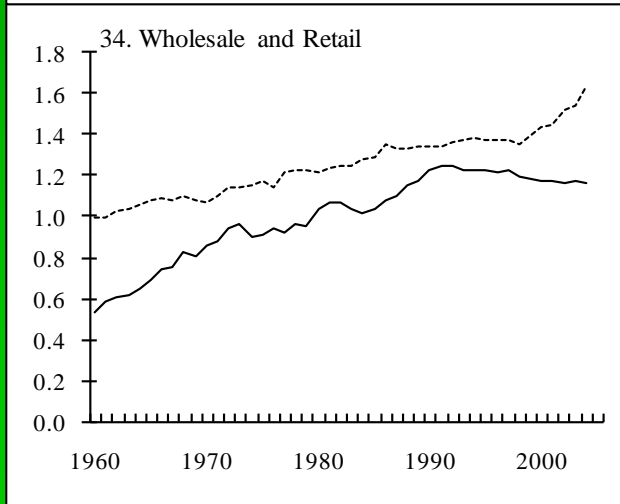
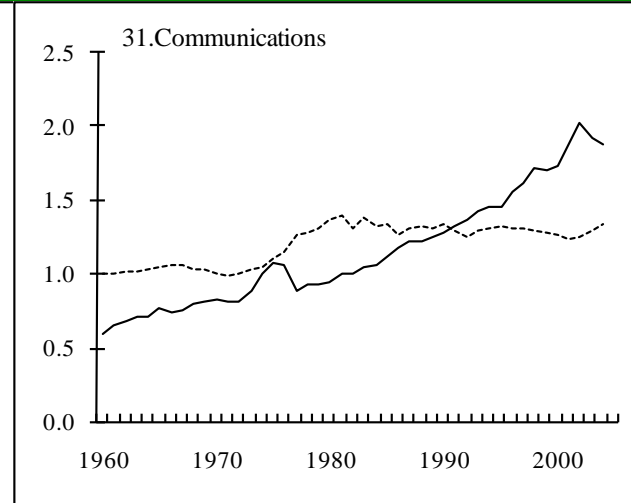
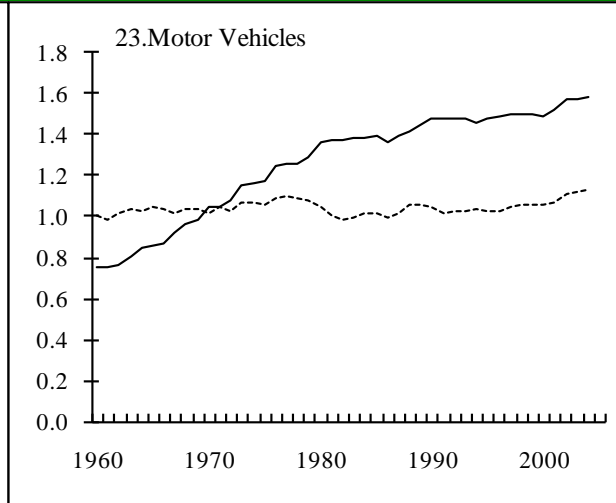
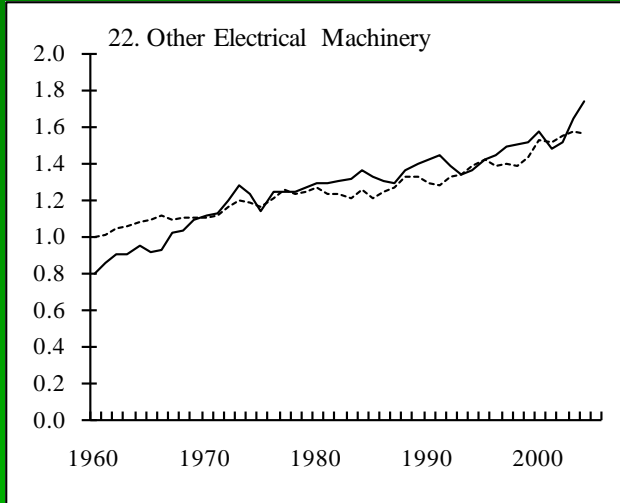
# Industry Origins of TFP Gap in 2004



# TFP Level Comparison during 1960-2004 (1)



# TFP Level Comparison during 1960-2004 (2)



# Conclusion

- Labor Productivity Gap
  - 65.7 in 2004
  - Lower TFP accounts for 57%
  - Lower Non-IT-capital deepening accounts for 37%
- TFP Gap
  - Period of Convergence: 1960-1990
  - Period of Divergence: 1990-2004
    - IT producing Industries during the late 1990s
    - IT using industries after 2000
  - 79.5 in 2004
  - Wholesale and Retail Trade emerged as the largest contributor to this gap, accounting for 25% of the lower TFP of the Japanese economy