Assessing Industrial Competitiveness of Japan by Comparing Productivity Levels to China, Korea, Taiwan and US

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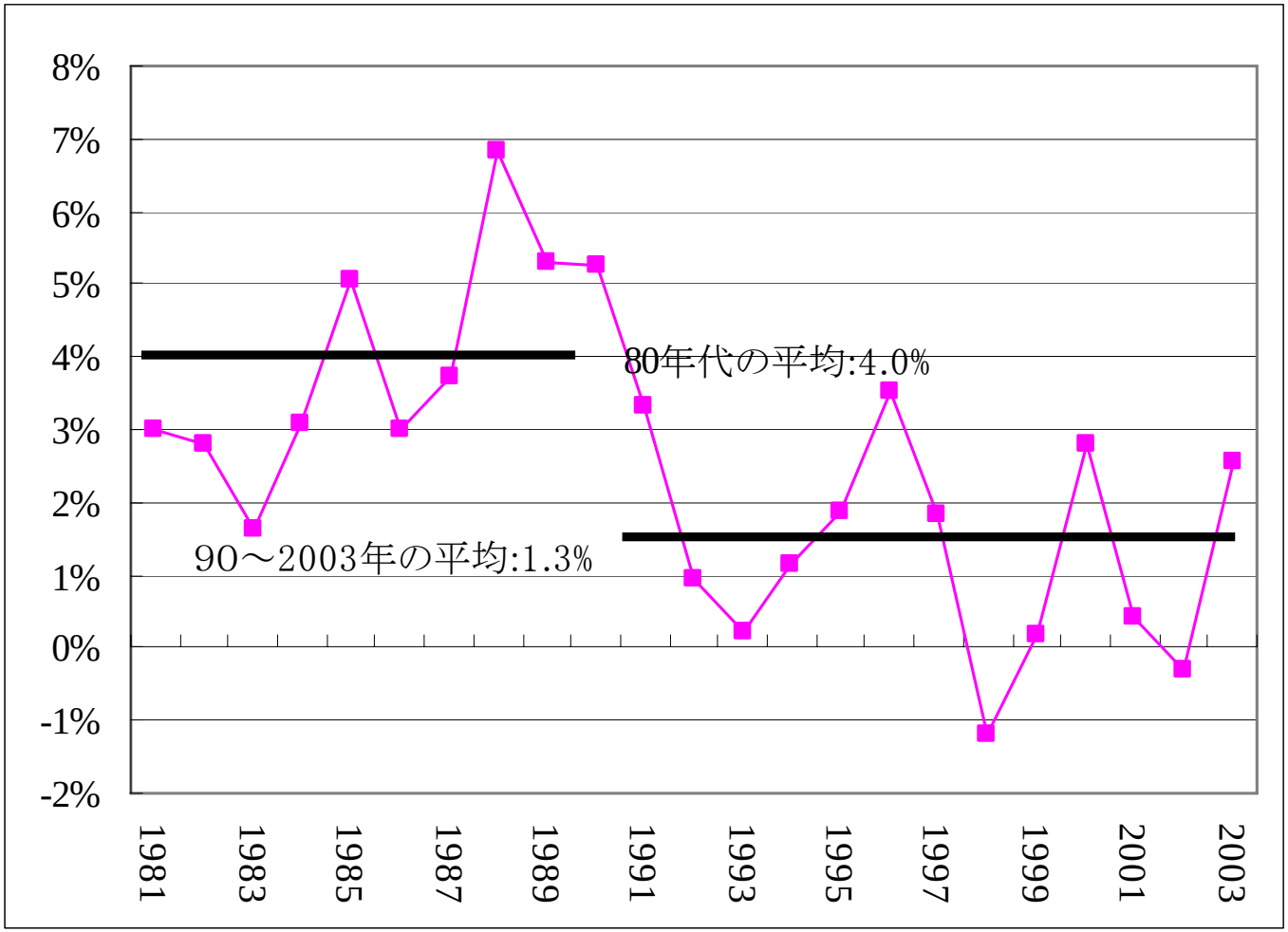
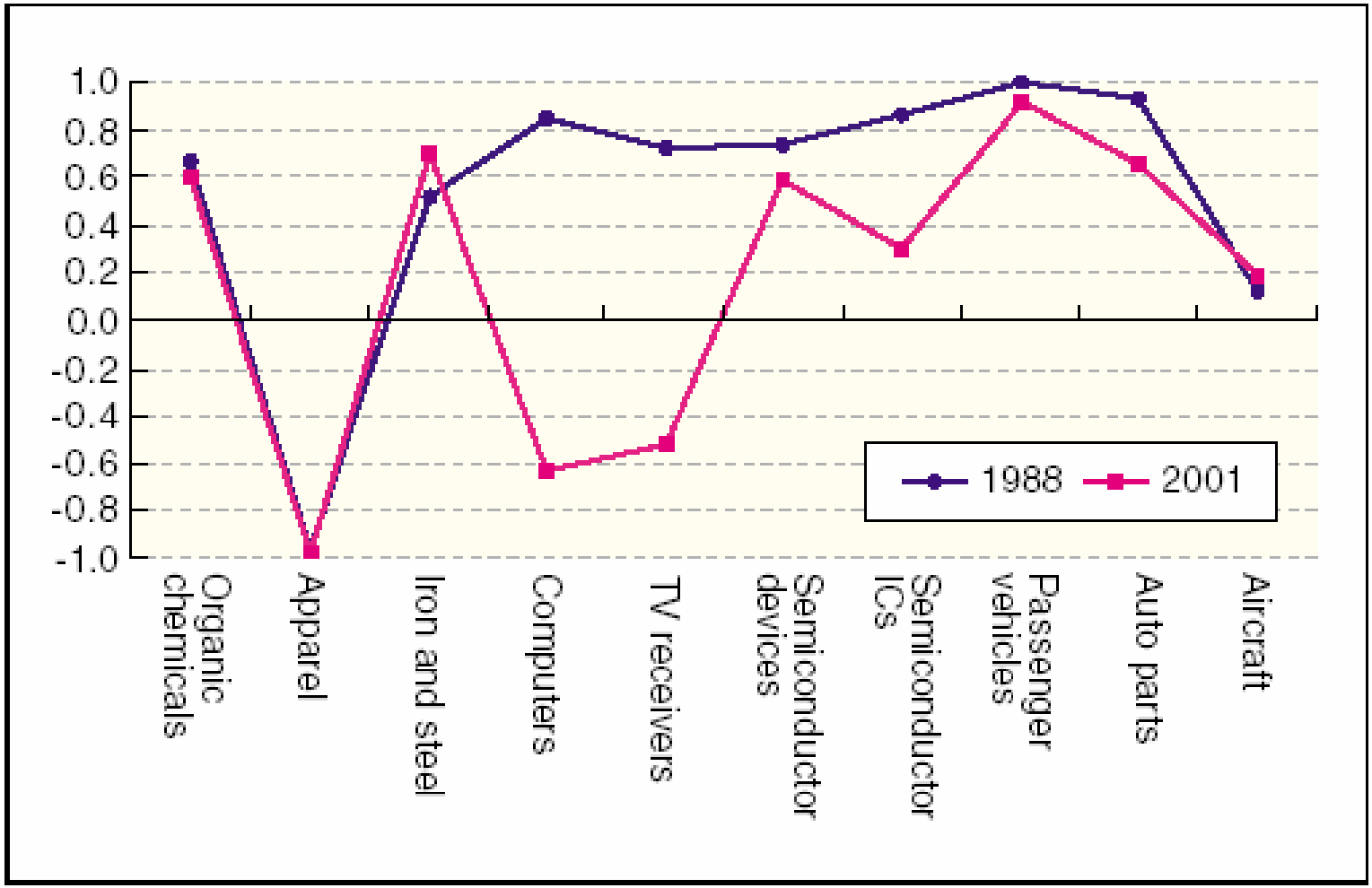
Decline of Japanese growth rate after 1990's



Trade Specialization Index
(Export-Import)/(Export+Import)



Source: Author's calculation using "Trade Statistics," Ministry of Finance

Motivation

- Slowdown of growth rate of Japan after 1990's: supply-side or demand-side factors?
- Fading international competitiveness in Japan? Particularly for electronics industries?: catching up of other East Asian economies?
- Dual economy in Japan? Lower productivity level in services sectors
- Benchmarking Japanese industries' competitiveness by productivity comparison with other East Asian countries as well as US

ICPA Project

- International comparison among Asian countries by RIETI (Research Institute of Economy, Trade and Industry)
- Productivity growth and level comparison among China, Japan, Korea, Taiwan and US by KLEM framework
- Network of researchers
  - China: Ren Ruoen (Beihang Univ.)
  - Japan: Kuroda, Shimpo and Kawai (Keio Univ.)
  - Korea: Hak Pyo (Seoul National Univ.)
  - Taiwan: Chi-Yuan Liang (Academia Sinica)
  - US: Jorgenson and Ho (Harvard Univ.)

Measuring Productivity by KLEM framework

- Industry level productivities are derived from comparable input-output tables as well as labor and capital by type (Jorgenson and his groups)
- IO table: 33 sector use matrix, and industry output and commodity input prices
- Labor data: hours worked and per hour wages by 18 types (2 sex*3 age*3 education) and 33 sectors
- Capital data: capital stock and rental service prices by 3 types (only depreciable assets) and 33 sectors

Framework for productivity level comparison

$$Y^j = f^j(K^j, L^j, E^j, M^j, TFP(c)) \tag{1}$$

$$d\log Y/dc = \sum_{X \in K,L,E,M} (\partial \log Y/\partial c)(d\log X/d c) + \partial \log TFP/\partial c \tag{2}$$

$$\partial \log TFP/\partial c = d\log Y/dc - \sum_{X \in K,L,E,M} (\partial \log Y/\partial c)(d\log X/d c) \tag{3}$$

$$\partial \log TFP/\partial c = \sum_{PX \in PK,PL,PE,PM} (\partial \log P_Y/\partial c)(d\log P_X/d c) - d\log P_Y/dc \tag{4}$$

$$\partial \log TFP/\partial c = \sum_{PX \in PK,PL,PE,PM} s_x (d\log P_X/d c) - d\log P_Y/dc \tag{5}$$

$$\log TFP_{US/JP} = \sum_{X \in K,L,E,M} \overline{Sx}(\log P_{X,US} - \log P_{X,JP}) - (\log P_{Y,US} - \log P_{Y,JP}) \tag{6}$$

where $\overline{S_X} = 1/2 * (S_{X,JP} + S_{X,US})$

Relative input and output prices

- Output prices: relative basic prices (net subsidy adjustment with producer prices by industry
- Input prices:
  - Intermediate inputs (E and M): relative purchased prices by commodity
  - Labor input (L): relative per hour wage
  - Capital input (K): relative rental service price

Issues for relative output prices

$$P_{Y(orX),US/JP} = P_{Y(orX),US} \cdot e_{JP/US} \Big/ P_{Y(orX),JP}$$

- EPPPs or UVRs
  - EPPPs (Expenditure based PPPs) : starting from official PPPs statistics by OECD, and make adjustments for distribution margins and int'l trade
  - UVRs (Unit Value Ratios): comparing per unit price (the value over the quantity) at detail commodity level and aggregated
- UVRs from GGDC, Groningen Univ. are used in this study
  - Covering non-OECD countries
  - Needs converting to industry level by make matrix, but no significant impacts of such adjustment at 33 sector level

Issues for relative input price

- Intermediate inputs
  - Purchased level relative prices, but not in this study (needs further developments)
- Labor inputs
  - Comparing per hour wage for matching categories, and Divisia aggregation to industry level
- Capital inputs
  - Same as labor inputs

$$P_k = \left(\frac{1 - zu}{1 - u} \cdot (r(1 - \pi) + \delta - \pi) + \tau\right) \bullet P_I$$

$$P^i_{K,US/JP} = \frac{annualization\_factor_{US}}{annualization\_factor_{JP}} \cdot P^i_{I,US/JP}$$

Reservations !!

- Problems with hours worked -> biases with per hour wage (for example, no hours data for China)
- Underestimation of capital stock -> overestimation of rental services and TFP levels. E.g. China's investment survey covering only SOEs and collective economies
- Ad-hoc approach to smooth out asset price movements

-> In most cases, no to much biases for factor input growth, but directly leads to miss-measurement of level comparison

Results: TFP level in 1995 (Japan=1)

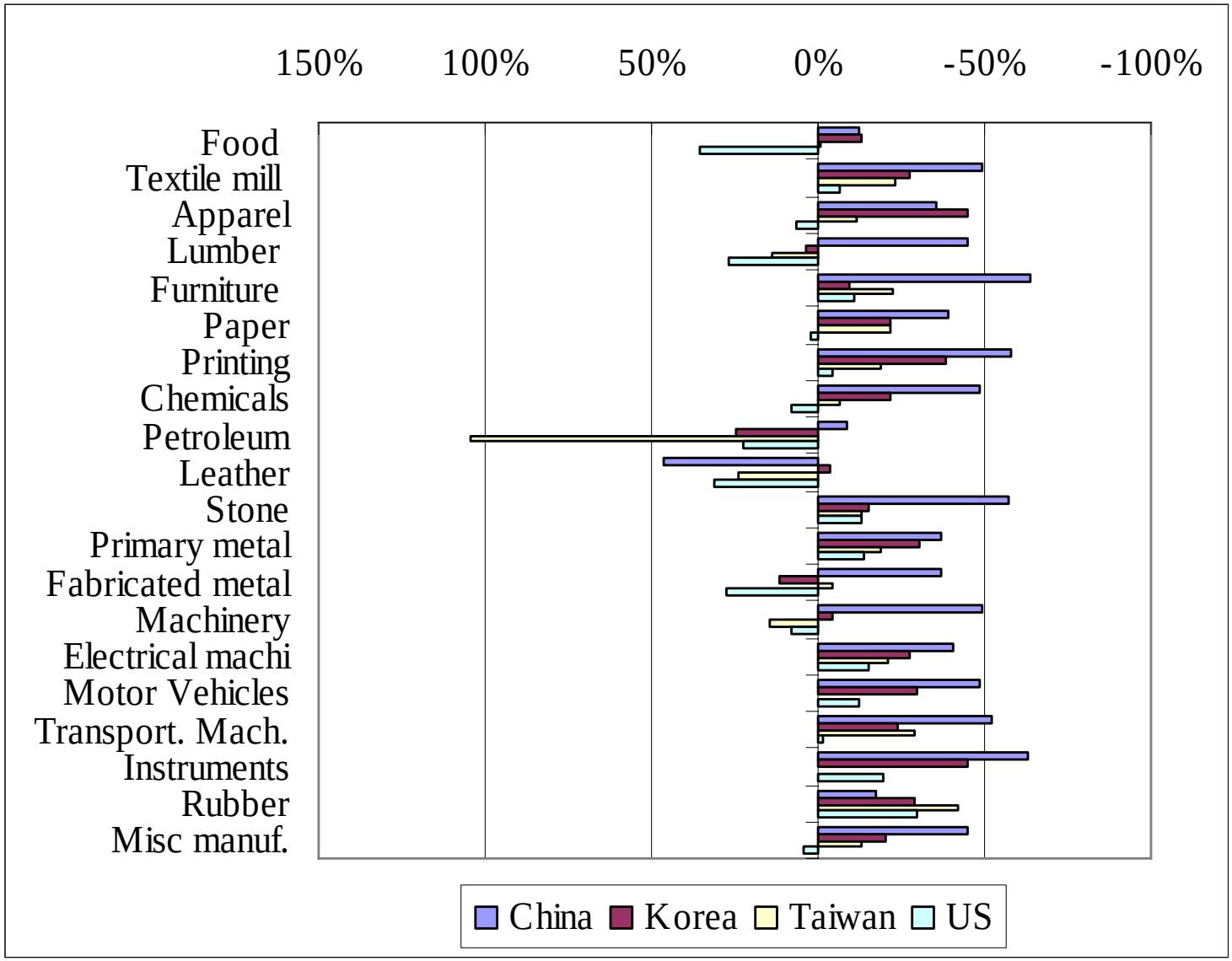
Macro Economy Level

	China	Korea	Taiwan	US
Output Price	0.29	0.68	0.47	0.68
Capital Price	0.69	1.07	0.81	1.29
Labor Price	0.02	0.21	0.30	0.68
Energy Price	0.27	0.53	0.50	0.53
Material Price	0.30	0.57	0.37	0.60
TFP	0.64	0.77	0.91	1.07

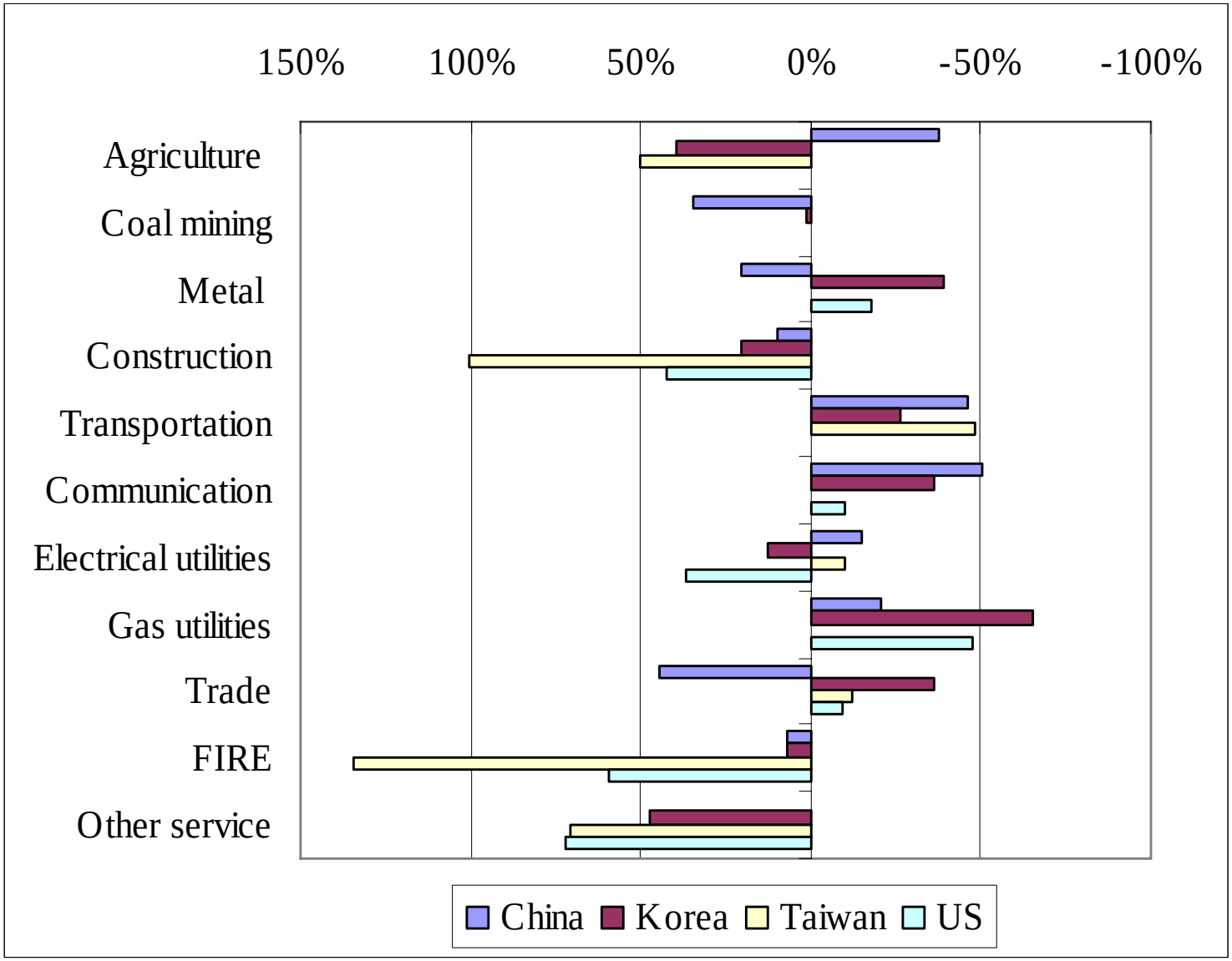
Manufacturing Sector

	China	Korea	Taiwan	US
Output Price	0.44	0.75	0.56	0.78
Capital Price	0.80	1.15	0.77	1.47
Labor Price	0.03	0.23	0.30	0.80
Energy Price	0.27	0.52	0.53	0.51
Material Price	0.36	0.72	0.54	0.70
TFP	0.59	0.81	0.90	1.00

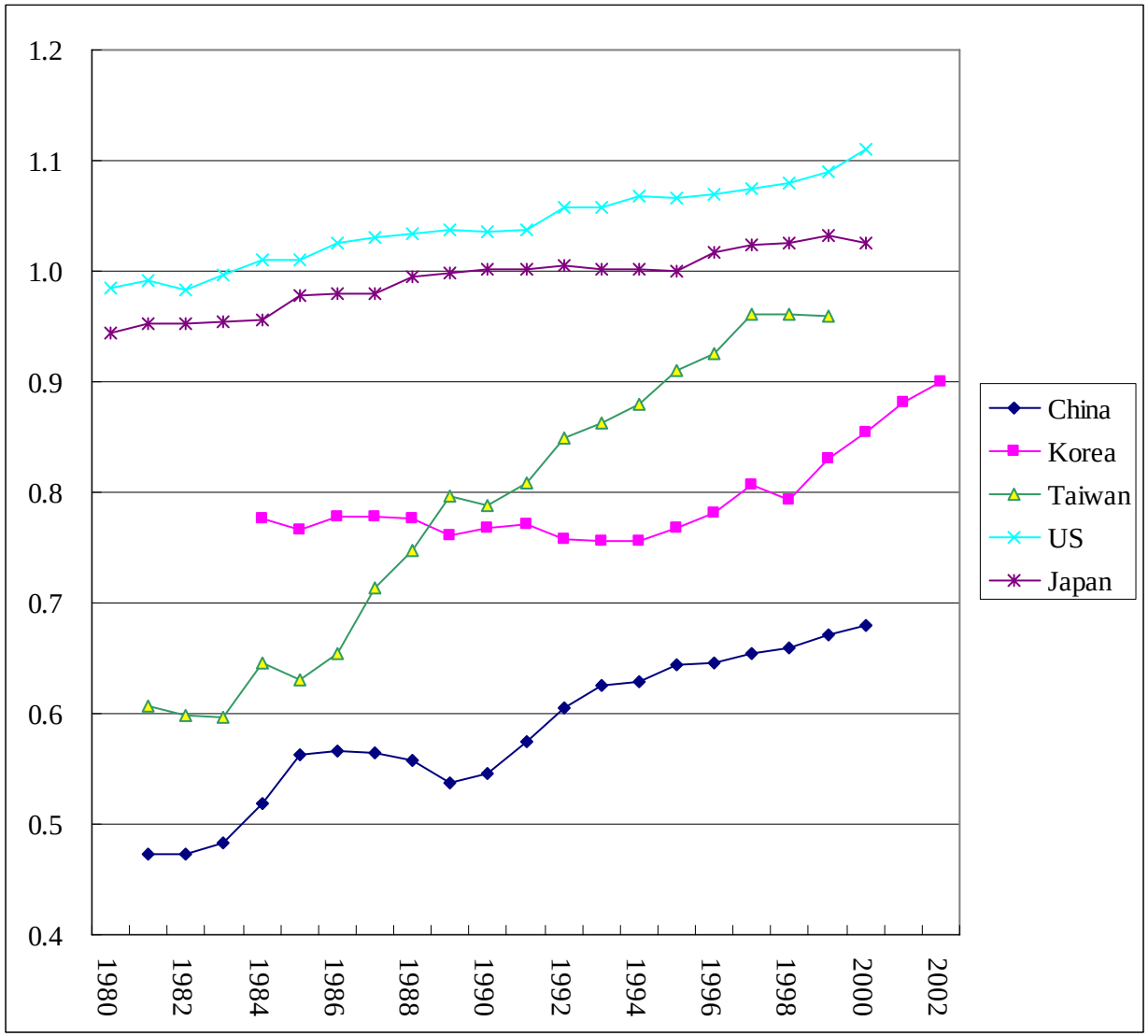
Results by industry (Manufacturing)



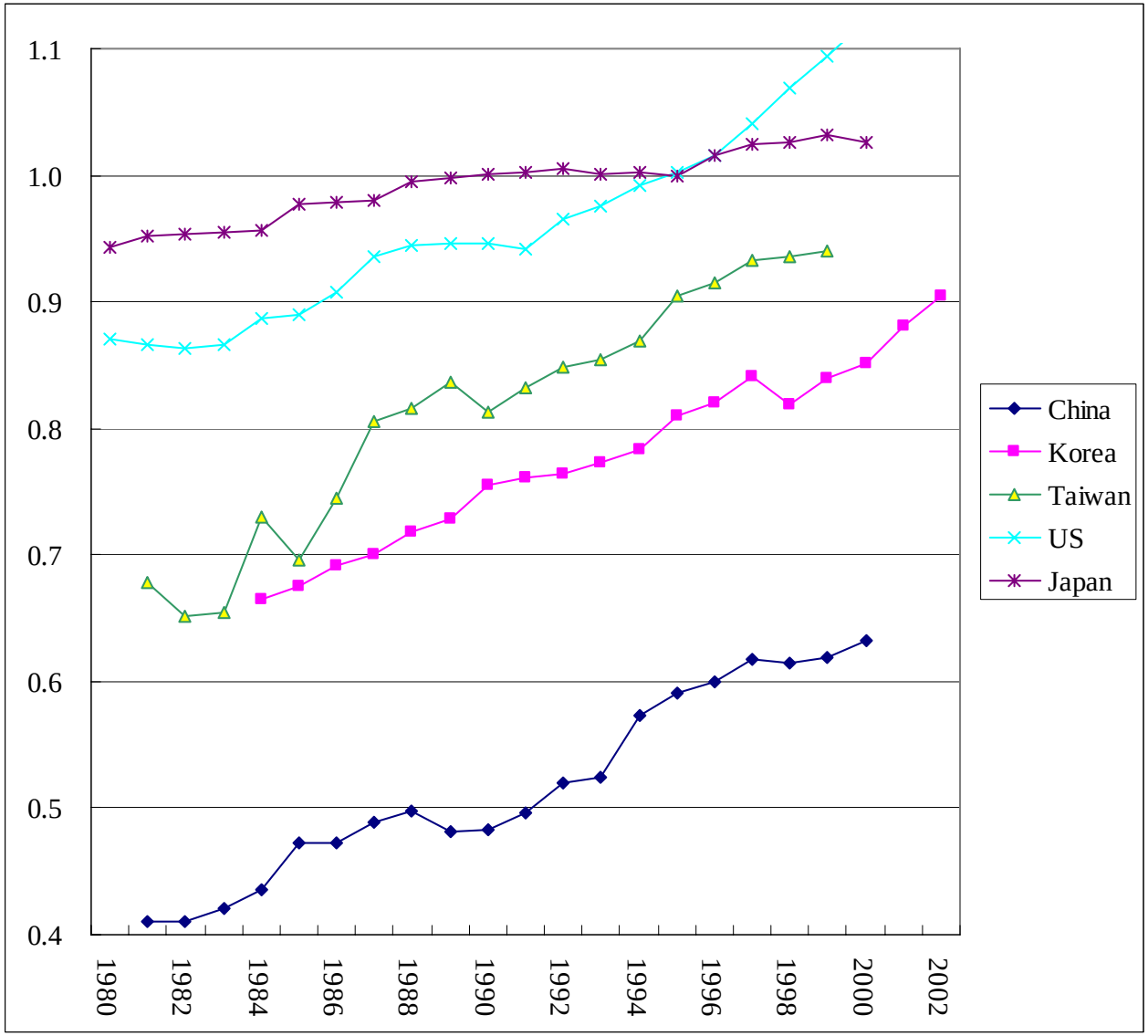
Results by industry (Non-manufacturing)



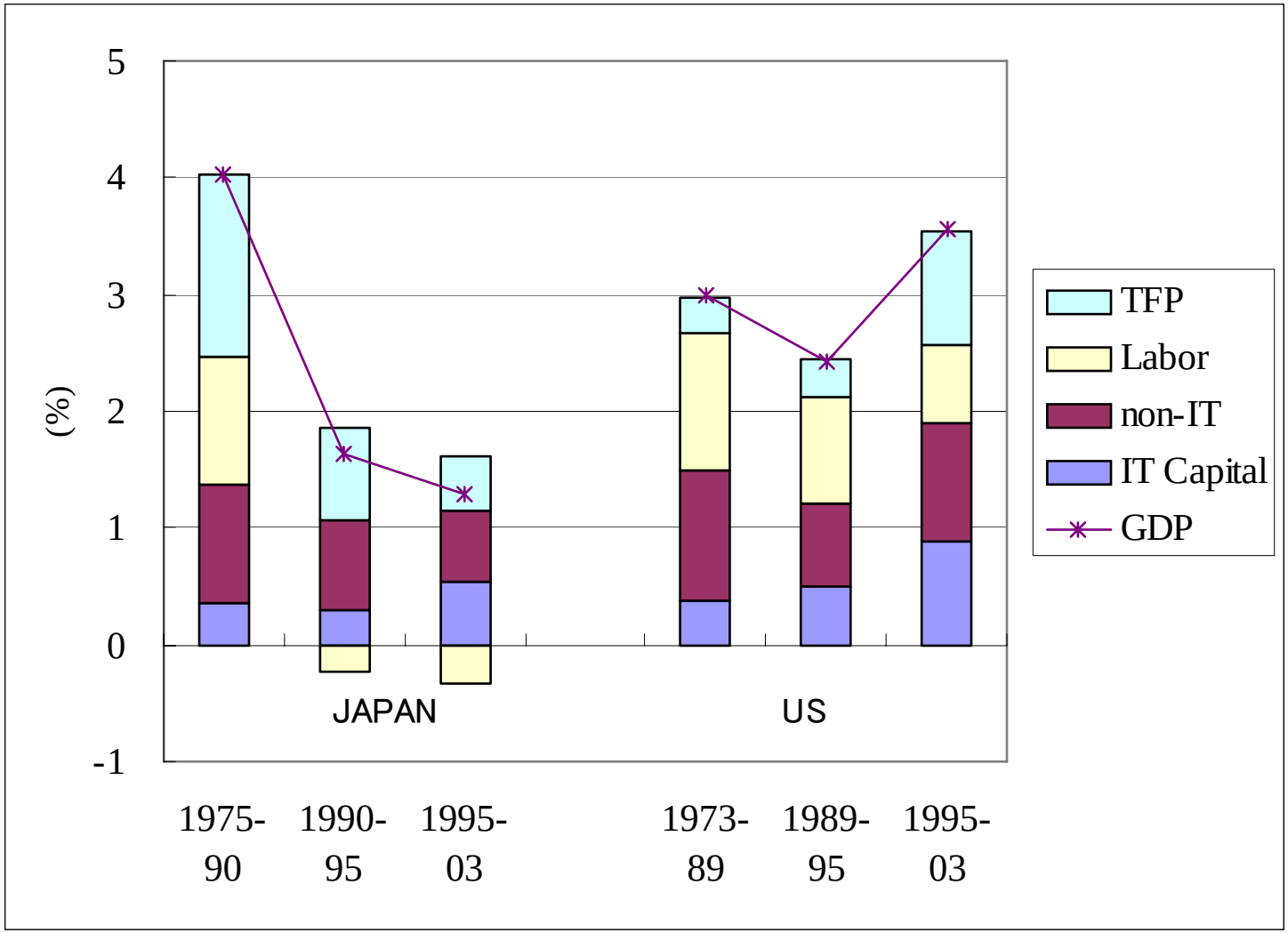
Results – levels and growth (economy-wide)



Results – levels and growth (manufacturing)

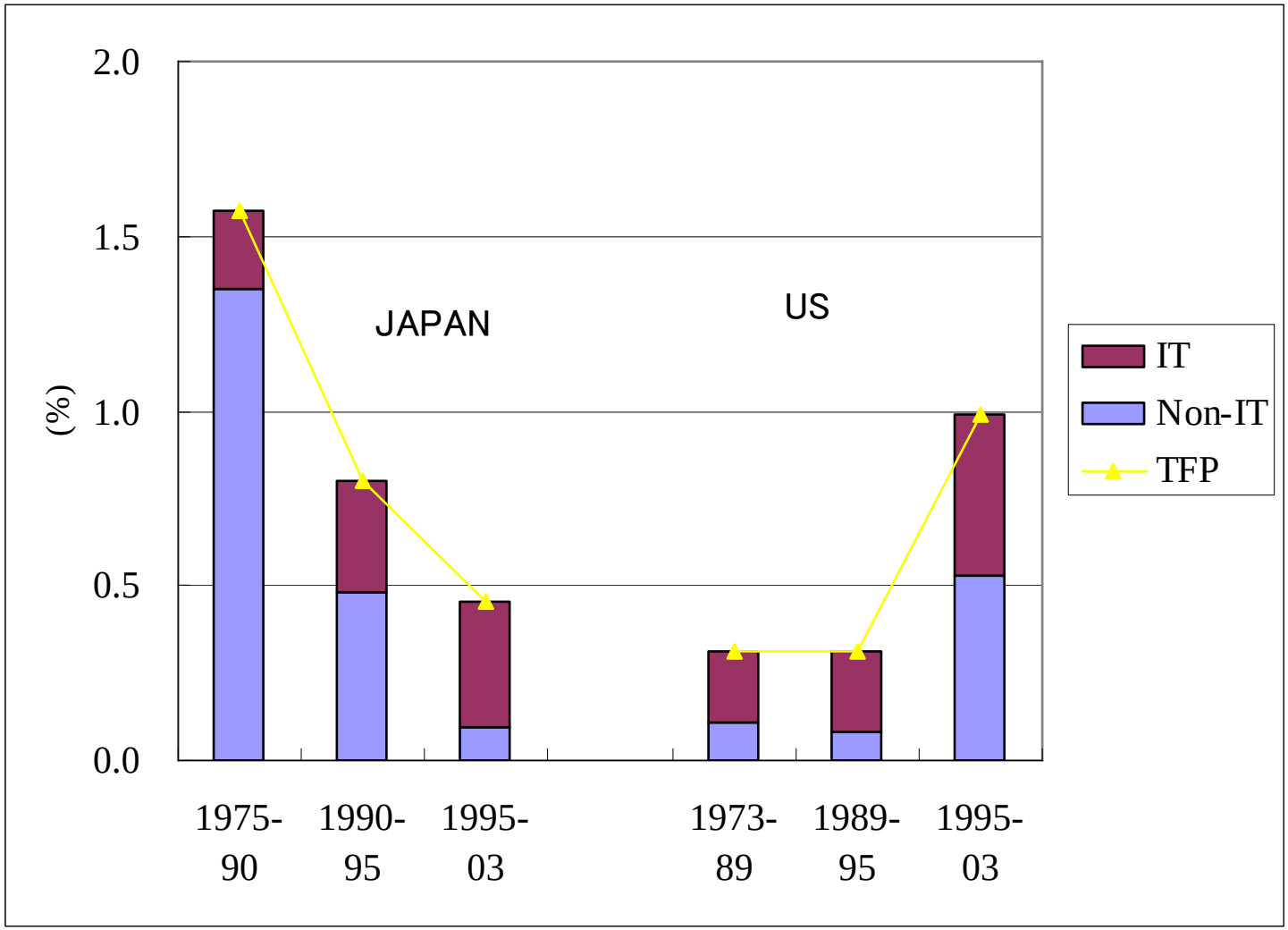


Divergence of Productivity between Japan and US? Macro-level comparison



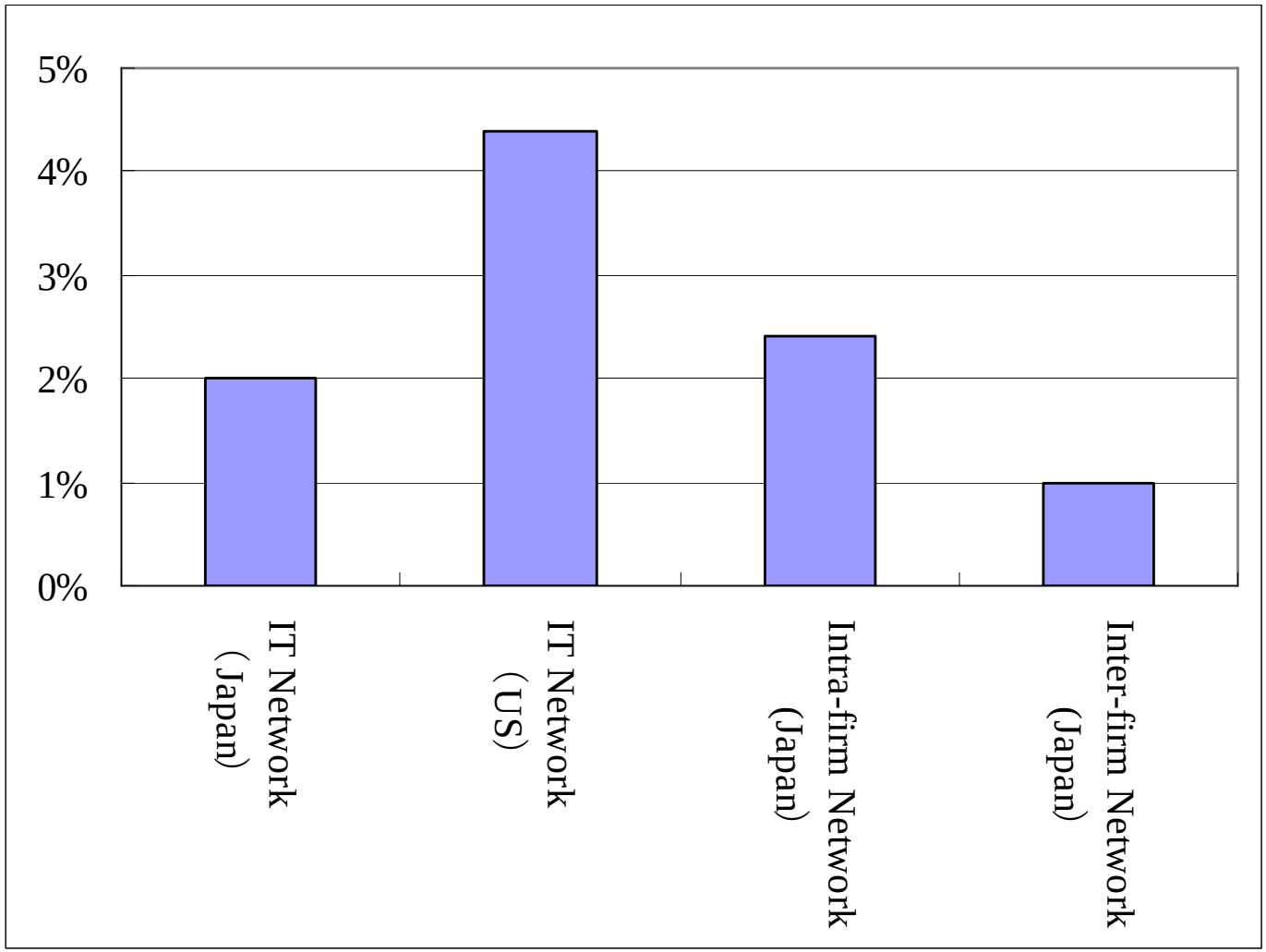
Jorgenson and Motohashi (2005)

The Role of IT in Macro-level Productivity Growth



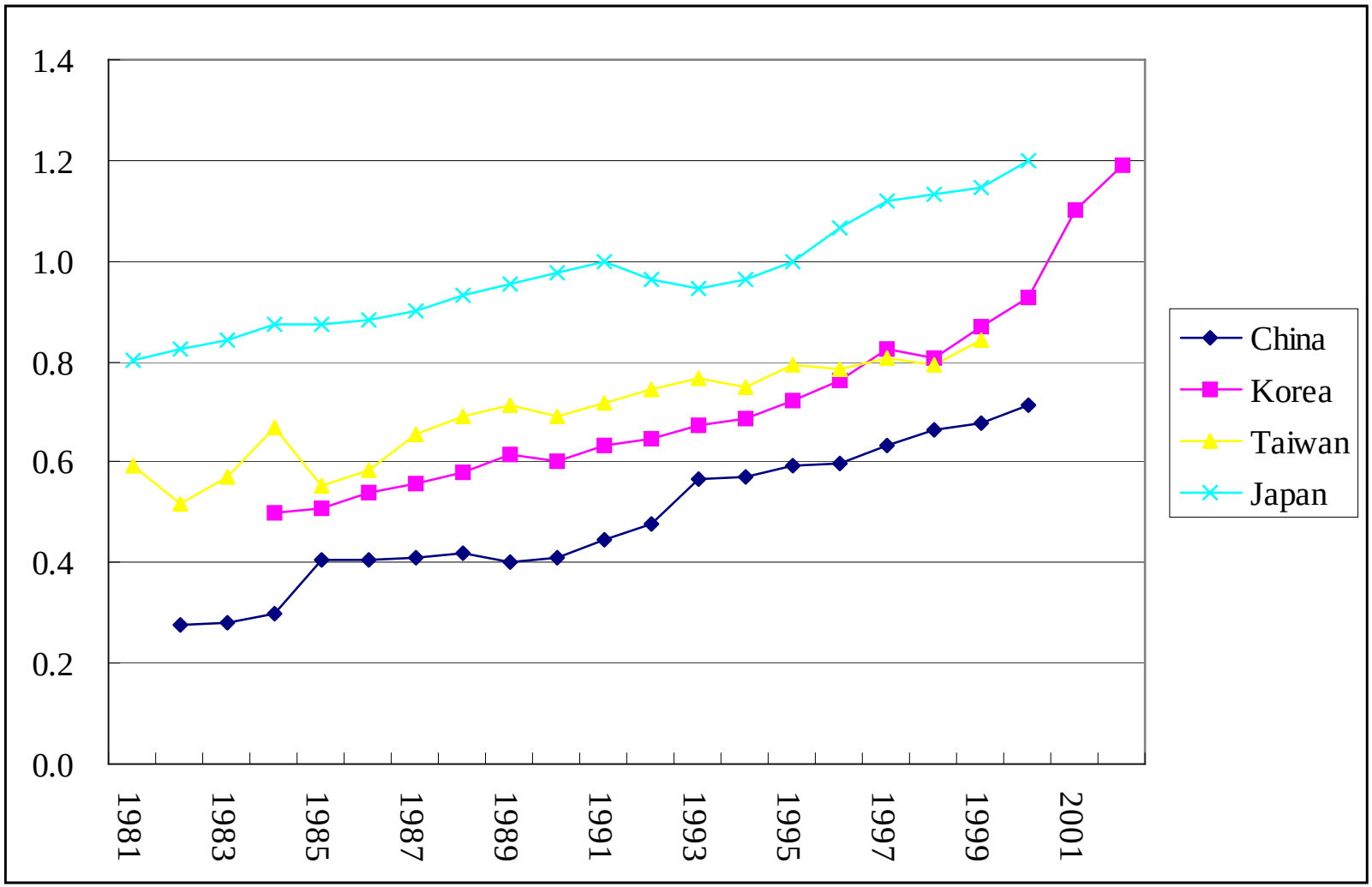
Jorgenson and Motohashi (2005)

IT network use and firm level productivity

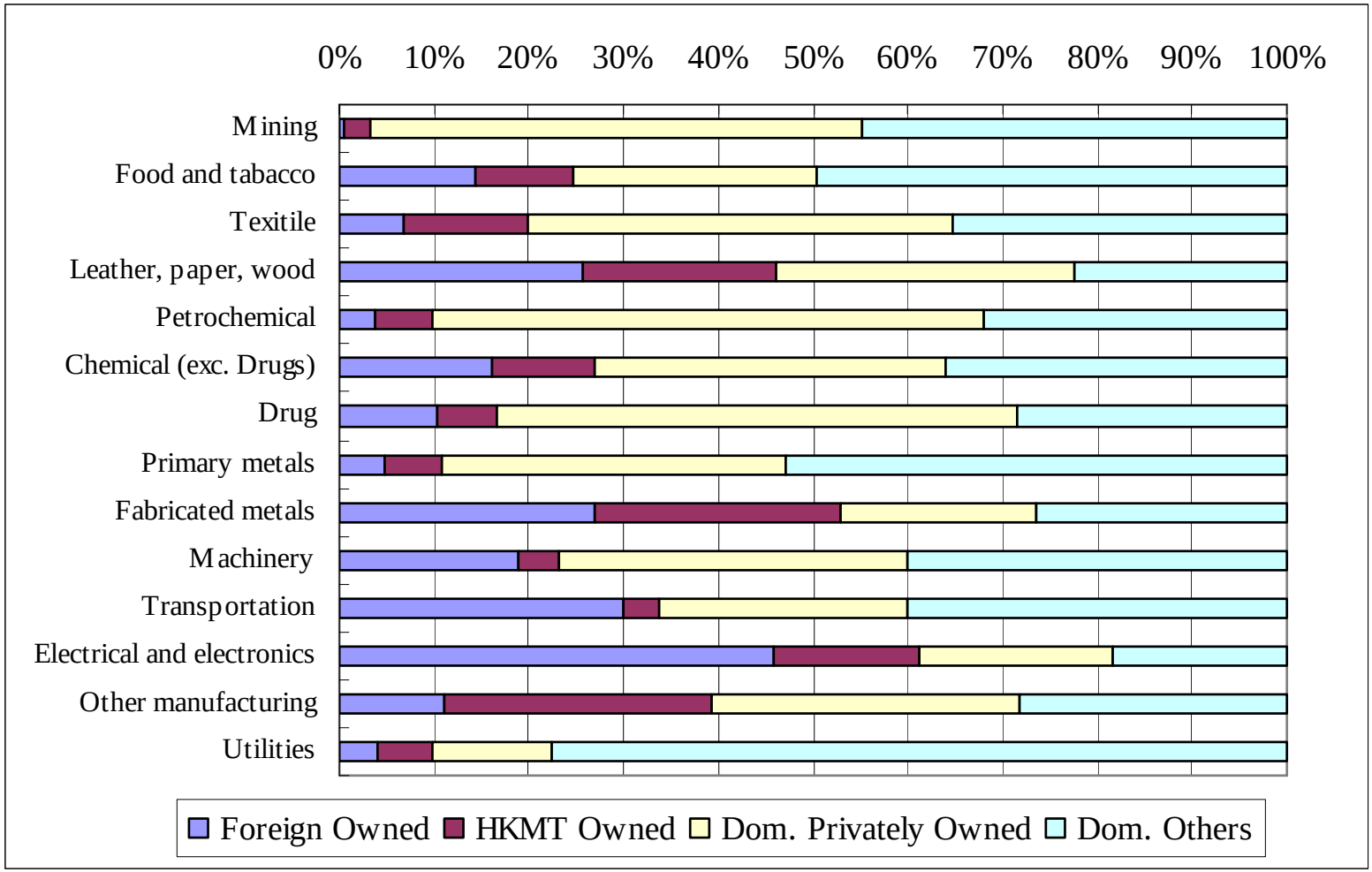


(Atrostic, Motohashi and Nguyen 2005)

Asian countries' catching up:
Electronics Industry

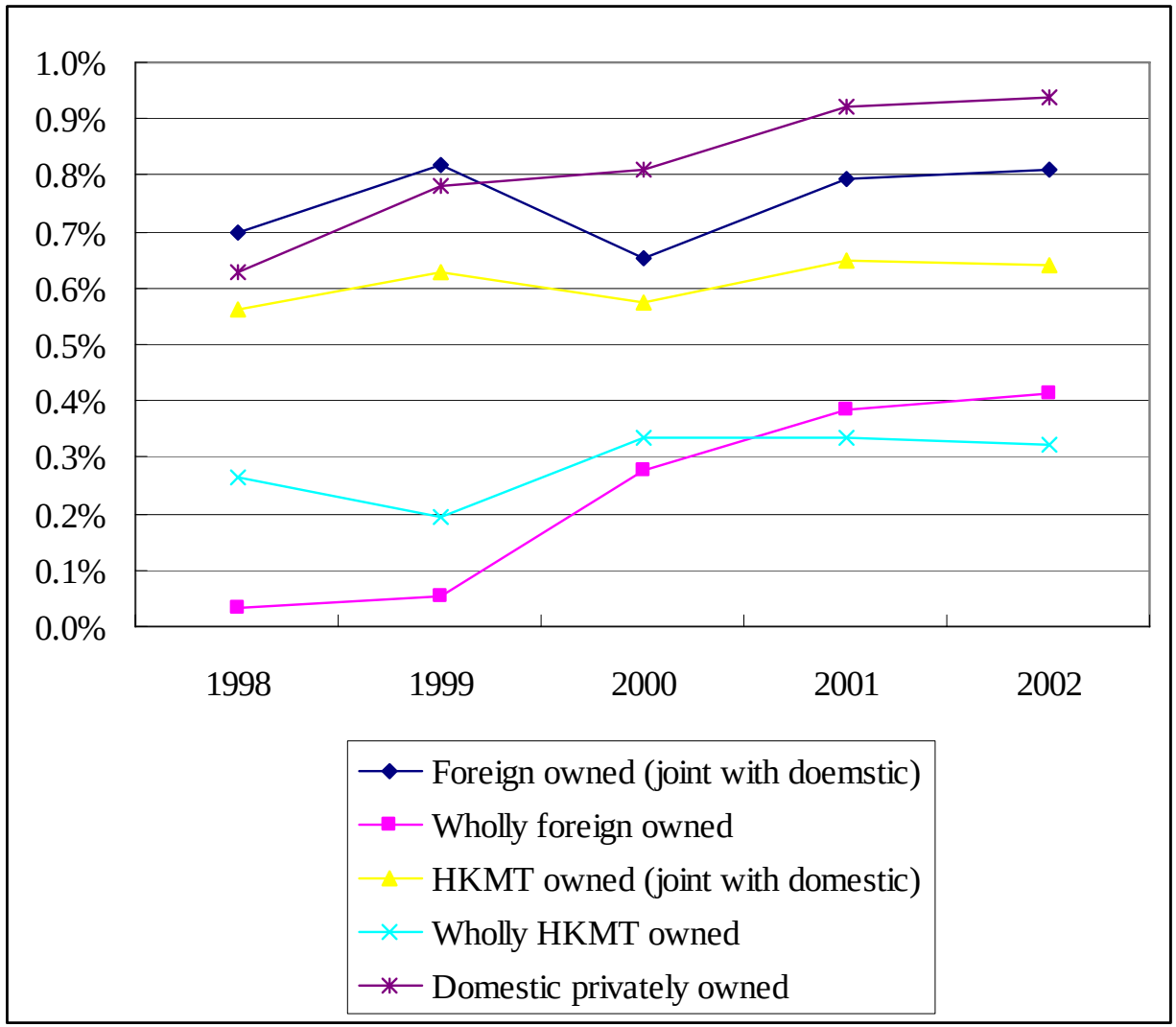


Assessment: Multinationals in China-1



("R&D of multinationals in China", RIETI-DP-06-E-005)

Assessment: Multinationals in China-2



("R&D of multinationals in China", RIETI-DP-06-E-005)

Summary and Implications

- Productivity levels in manufacturing industries are generally higher in Japan, but a great amount of heterogeneity exists
  - Strong in Electrical machinery, automobiles, instruments
  - But weak in food, lumber and fabricated metals
- East Asian countries are catching up with Japan, while there is a divergence between Japan-US
  - Difference between Japan and US comes from IT using sectors
  - Growing China: substantial contribution of multinationals, but R&D level relatively low (market driven overseas R&D)
- Implications for Japan's potential growth (TFP growth)
  - Better use of ICT in economy: growth opportunities (+)
  - Catching up from Korea, Taiwan and China: threat by loosing high productivity growing sector (-), but competitions pushes productivity growth? (+)
  - East Asian countries form a big market: demand size opportunities (+), and effects of globalization (tapping into overseas human resources) (GNP+)