

# Survey: Did the TFP Growth Rate in Japan Decline in the 1990s?

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# Objectives

- Analyze whether Japan's TFP growth rate (Solow's residuals) declined in the 1990s.
- Survey and compare major studies on Japanese productivity in the 1990s.
- The mark-ups and the returns to scale in each industry are estimated.
- How mark-ups and return to scale estimates affect estimates of TFP growth rates is examined.

# Macro TFP growth rate

Table 2-1 Macro TFP growth rate (annual average)

	Fukao et al.	Jorgenson & Motohashi	Hayashi & Prescott	Cabinet Office, Gov. of Japan	Nakajima et al.	Hattori & Miyazaki	Matsuoka	Miyagawa	Miyagawa & Maki	Yoshikawa & Matsumoto
1970s	-0.27%		0.52%							
1980s	0.54%	1.01%	2.36%	1.60%	-1.55%	1.20%	0.13%	1.63%	0.8-1.1%	1.20%
1990s	0.11%	0.89%	0.18%	0.20%	-0.41%	-0.60%	0.68%	0.84%	0.2-0.5%	-0.90%

# Comparison of TFP growth rate estimates

Table 4-1 Comparison of TFP growth rate estimates using the production function approach

		Fukao et al.	Hayashi & Prescott	Jorgenson & Motohashi
GNP/GDP growth rate	1975-1990	4.23%	4.17%	4.70%
	1990-1995	2.00%	1.46%	1.89%
	1995-2000	0.92%	1.09%	2.15%
Growth rate of Capital	1975-1990	6.08%	4.91%	
		(1.89%)	(1.78%)	(2.35%)
	1990-1995	3.61%	4.59%	
		(1.17%)	(1.66%)	(1.31%)
	1995-2000	2.69%	3.12%	
		(0.85%)	(1.13%)	(1.23%)
Growth rate of Labor	1975-1990	2.59%	0.89%	
		(1.79%)	(0.54%)	(1.34%)
	1990-1995	1.07%	-0.70%	
		(0.72%)	(-0.45%)	(-0.16%)
	1995-2000	0.12%	-0.58%	
		(0.08%)	(-0.37%)	(-0.20%)
TFP growth rate	1975-1990	0.55%	1.83%	1.01%
	1990-1995	0.10%	0.24%	0.74%
	1995-2000	-0.02%	0.34%	1.13%

note) Percentages in parentheses indicate the contribution rate.

# TFP growth rate in the manufacturing sector

Table 2-2 TFP growth rate in the manufacturing sector (annual average)

	Fukao et al.	Nishimura, et al.	Cabinet Office, Gov. of Japan	Nakajima, et al.	Hattori & Miyazaki	Miayagawa	Yosikawa & Matsumoto	Matsuoka
1980s	0.80%	4.02%	2.1%	-0.11%	1.61%	2.81%	2.5%	0.52%
1990s	0.25%	0.60%	1.8%	0.01%	1.54%	1.37%	0.3%	0.34%

# TFP growth rate in the non-manufacturing sector

Table 2-3 TFP growth rate in the non-manufacturing sector (annual average)

	Fukao et al.	Cabinet Office, Gov. of Japan	Nakajima et al.	Hattori & Miyazaki	Miyagawa	Yoshikawa & Matsumoto	Matsuoka
1980s	0.15%	1.3%	-1.21%	0.89%	1.18%	0.5%	-0.28%
1990s	0.09%	-0.3%	-0.23%	-1.43%	0.64%	-1.3%	0.41%

# Estimation results using Hall's method

Table 5-1 Estimation results using Hall's method

Industry	OLS			Instrumental Variable estimation		
	Mark-up ratio	Standard error		Mark-up ratio	Standard error	
Food	0.636	0.078	***	0.870	0.275	***
Textiles	0.847	0.054	***	0.915	0.113	***
Pulp and Paper	1.188	0.076	***	1.135	0.176	***
Chemicals	1.285	0.063	***	1.295	0.235	***
Petroleum and Coal	0.768	0.159	***	0.637	0.303	**
Stone and Clay	1.467	0.094	***	1.403	0.144	***
Primary Metal	1.302	0.130	***	1.201	0.576	**
Metal products	1.525	0.074	***	1.628	0.169	***
General machinery equipment	1.322	0.073	***	1.552	0.368	***
Electrical machinery	1.249	0.052	***	1.131	0.120	***
Transportation equipment	1.122	0.127	***	1.022	0.132	***
Precision machinery	1.377	0.175	***	0.985	0.676	
Other manufacturing	1.193	0.049	***	1.298	0.071	***
Agriculture, forestry and fishery	0.739	0.207	***	0.578	0.323	*
Mining	1.237	0.136	***	1.536	0.398	***
Construction	1.062	0.101	***	1.049	0.157	***
Electricity, gas, and water supply	0.947	0.228	***	1.381	0.357	***
Wholesale, Retail	1.262	0.118	***	1.136	0.203	***
Finance, insurance	1.513	0.284	***	3.475	0.707	***
Real estate	0.303	0.238		0.436	0.784	
Transport and Communication	1.051	0.048	***	1.022	0.094	***
Other services (excluding public services)	0.590	0.244	**	0.927	0.509	*

# Estimate using Roeger's method

Table 5-2 Estimation results using Roeger's method

Industry	Lerner index	S.E.		R-squared	Mark-up ratio
Food	0.058	0.013	***	0.331	1.062
Textiles	0.070	0.021	***	0.368	1.076
Pulp and Paper	0.049	0.024	**	0.320	1.051
Chemicals	0.113	0.016	***	0.589	1.128
Petroleum and Coal	-0.076	0.094		0.062	0.930
Stone and Clay	0.110	0.021	***	0.600	1.124
Primary Metal	0.121	0.011	***	0.700	1.138
Metal products	0.066	0.028	**	0.281	1.071
General machinery equipment	0.031	0.014	**	0.200	1.032
Electrical machinery	0.071	0.014	***	0.648	1.077
Transportation equipment	0.106	0.007	***	0.777	1.119
Precision machinery	0.071	0.042	*	0.368	1.076
Other manufacturing	0.049	0.009	***	0.387	1.051
Agriculture, forestry and fishery	0.341	0.050	***	0.909	1.518
Mining	0.184	0.059	***	0.449	1.225
Construction	0.086	0.031	***	0.195	1.094
Electricity, gas, and water supply	0.555	0.097	***	0.911	2.245
Wholesale, Retail	0.148	0.017	***	0.676	1.174
Finance, insurance	0.118	0.049	**	0.341	1.134
Real estate	0.593	0.068	***	0.894	2.454
Transport and Communication	0.412	0.032	***	0.944	1.700
Other services (excluding public services)	0.171	0.078	**	0.169	1.206



# Economies of Scale

Table 6-1 Result of the estimation of scale economy indexes

Industry	OLS			Instrument Variable estimation		
	Returns to scale	S.E.		Returns to scale	S.E.	
Food	0.479	0.110	***	0.543	0.119	***
Textiles	0.677	0.149	***	0.884	0.342	***
Pulp and Paper	1.194	0.084	***	1.299	0.089	***
Chemicals	1.266	0.073	***	1.275	0.097	***
Petroleum and Coal	0.609	0.148	***	0.788	0.677	
Stone and Clay	1.297	0.085	***	1.346	0.094	***
Primary Metal	1.406	0.115	***	1.633	0.113	***
Metal products	1.296	0.065	***	1.366	0.102	***
General machinery equipment	1.248	0.085	***	1.247	0.117	***
Electrical machinery	1.172	0.044	***	1.280	0.102	***
Transportation equipment	0.943	0.104	***	0.912	0.166	***
Precision machinery	1.381	0.082	***	1.498	0.121	***
Other manufacturing	1.145	0.074	***	1.265	0.087	***
Agriculture, forestry and fishery	0.704	0.174	***	1.347	1.232	
Mining	0.732	0.121	***	1.059	0.244	***
Construction	1.293	0.072	***	1.373	0.047	***
Electricity, gas, and water supply	0.442	0.170	***	1.553	0.874	*
Wholesale, Retail	0.600	0.298	**	0.540	0.447	
Finance, insurance	1.077	0.230	***	1.249	0.450	***
Real estate	0.391	0.223	*	0.776	0.253	***
Transport and Communication	0.792	0.225	***	1.811	0.719	**
Other services (excluding public services)	0.432	0.234	*	1.528	0.449	***

# Estimation of the rate of technological progress controlling for mark-ups and scale economy effects

Table 7-1 Estimation of rate of technological progress using the JIP database

	Total Industry	Manufacturing	non-Manufacturing
Ordinal growth accounting (cost share)			
1983—1991	0.47	0.85	0.15
1991—1998	0.02	0.04	0.09
Ordinal growth accounting (revenue share)			
1983—1991	0.52	1.08	0.05
1991—1998	0.04	0.04	0.04
Controlling for mark-up ratio (revenue share)			
1983—1991	0.97	1.25	0.45
1991—1998	0.57	0.25	0.32
Controlling for scale economies (cost share)			
1983—1991	-0.59	-0.11	-0.99
1991—1998	-0.18	0.09	-0.34
Controlling for labor quality and capital utilization (cost share)			
1983—1991	0.18	0.66	-0.23
1991—1998	0.02	0.11	0.07

# Summary

- The estimation results differ widely when controlling for improvements in the quality of capital and labor.
- The IT related goods deflator affects the results.
- The decline in the rate of technical progress in the 1990s decline occurred mainly in the manufacturing sector.
- The rate of technical progress may have increased during the 1990s when returns to scale are taken into account.