Korea-Japan Workshop on the Industrial Productivity Database

Sectoral Productivity and Economic Growth in Japan, 1970-98: An Empirical Analysis Based on the JIP Database

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1. Macro Growth Accounting 1

We assume that a macro production function at time t can be expressed as the following function of capital input K_t, labor input L_t, and an index of the technology level T_t.

$$Y_{j,t} = F(K_t, L_t, T_t) \qquad (1)$$

where Y_t denotes real GDP at time t. We assume constant returns to scale. The capital input K_t is derived by an aggregation of several types of assets, structures and equipment. The labor input L_t is an aggregate of the number of workers cross-classified by sex, age, and educational attainment.

1. Macro Growth Accounting 2

By differentiating the production function (1) over time, we get

$$dlnY_t = s^{av}_{k,t}\, dlnK_t + s^{av}_{l,t}\, dlnL_t + dlnA_t$$

where $dlnY_t$, $dlnK_t$, and $dlnL_t$ denote lnY_t-lnY_{t-1}, lnK_t-lnK_{t-1}, and lnL_t-lnL_{t-1} respectively. $s^{av}_{k,t}$ ($s^{av}_{l,t}$) denote the average of cost share of capital (labor) at time t-1 and time t. $s^{av}_{k,t}$ is defined by

$$s^{av}_{k,t}=(w_{k,t}K_t/p_tY_t+ w_{k,t-1}K_{t-1}/p_{t-1}Y_{t-1})/2$$

where $w_{k,t}$ denotes service price of capital at time t.

1. Macro Growth Accounting 3

- **$dlnA_t$ denotes $(\partial lnF/\partial lnT)dlnT_t$, the contribution of technology improvement lnT_t-lnT_{t-1} to the increase in production at the macro-level.**

Factors contributing to the fall in Japan's growth rate: 1) decline in capital accumulation ratio, 2) decrease in labor input (numbers & hours), 3) decline in labor quality growth

Sources of Economic Growth: US-Japan Comparison

Panel A. The Result of Growth Accounting for the US Economy by Jorgenson et al (2002): 1973-2000

(Annual Rate, %)

	Real GDP Growth	Man-hour growth	Labor productivity (GDP/man-hour) growth	TFP growth	Contribution of labor quality growth	Contribution of capital sevices/man-hour growth		
						Sub-total	Contribution of IT capital	Contribution of non-IT capital
	a	b	c=a-b	d=c-e-f	e	f=g+h	g	h
1973-1995	2.78%	1.44%	1.33%	0.26%	0.27%	0.80%	0.37%	0.43%
1995-2000	4.07%	1.99%	2.07%	0.62%	0.21%	1.24%	0.87%	0.37%

Jorgenson et al. (2002)

Panel B. The Result of Growth Accounting for the Japanese Economy: 1973-1998

(annual rate, %)

	Real GDP Growth	Man-hour growth	Labor productivity (GDP/man-hour) growth	TFP growth	Contribution of labor quality growth	Contribution of capital services/man-hour growth		
						Sub-total	Contribution of IT capital	Contribution of non-IT capital
	a	b	c=a-b	d=c-e-f	e	f=g+h	g	h
1973-83	3.56%	1.53%	2.03%	-0.30%	0.65%	1.68%	0.16%	1.52%
1983-91	3.94%	1.79%	2.15%	0.40%	0.46%	1.29%	0.37%	0.92%
1991-98	1.25%	-0.08%	1.34%	0.03%	0.21%	1.10%	0.33%	0.76%
						1995-98	0.52%	0.63%

Calculated from JIP database.

4. TFP Growth at the 3-Digit Industry Level

For the growth accounting of 84 sectors we use the following equation.

$$d\ln A_{j,t} = d\ln Q_{j,t} - (s^{av}_{k,j,t} d\ln Z_{j,t} K_{j,t} + s^{av}_{L,j,t} d\ln L_{j,t} + s^{av}_{M,j,t} d\ln M_{j,t})$$

Where $d\ln A_{j,t}$ denotes the TFP growth rate from time *t-1* to *t* in sector *j*, while $d\ln Q_{j,t}$ denotes the growth rate of real gross output. $K_{j,t}$, $L_{j,t}$, and $M_{j,t}$ denote the capital, labor, and real intermediate input in sector *j* at time *t*. $M_{j,t}$ is a composite index of 84 commodities and services, which is based on the annual real IO tables of the JIP Database. $Z_{j,t}$ denotes the capacity utilization rate. $s^{av}_{f,j,t}$ denote the average of cost share of factor f in sector j at time t-1 and time t.

TFP growth accelerated in industries – retail, wholesale, broadcasting, communications, banking, insurance, real estate and other services to individuals – where restrictions were relaxed.

Nakanishi & Inui (2003): Significant acceleration of TFP growth observed in deregulated industries.