TFP and Production Factors over the Post-War Period in Japan's Macro Economy*

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Abstract

This paper analyzes factors in the transition of production and the situation of productivity including (Total Factor Productivity) TFP using Japanese macro time series economic data from 1955 to 2000. Labor productivity in the overall Japanese economy slowly declined during the 1990s, yet TFP did not decline during the same period. These changes were measured using both the Total Cost approach and Solow's residuals, adjusted by the operating ratio of equipment. We found that the real reasons for Japan's slower growth rate during the 1990s were negative growth of capital and labor. The primary cause was a decline in the distribution of capital, which negatively affected the operating ratio and the growth rate of capital stock on the capital side, while also decreasing both labor hours and employees on the labor side. This corresponds with declining investment on the demand side as a factor in recession.

Keywords : Macro economy, capital stock, productivity, TFP, Solow's residuals

1 Introduction

This paper analyzes factors in the transition of production and overall productivity including TFP using Japanese time series macroeconomic data from 1955 to 2000. There are several perspectives regarding Japan's long recession. The first states that supply side changes caused the long recession. Continued low productivity during the 1990s could not support Japanese economic growth. Representative of this view is Hayashi and Prescott (2002). Another perspective is that a shortage of demand within the business cycle actually caused the recession, as cited by Iwata and Miyakawa (2003). Other perspectives on the long Japanese recession are available from Hamada and Horiuchi (2004), Kobayashi and Kato (2001), and Noguchi and Tanaka (2001).

In Japan, collusion in the construction industry, large bankruptcies in the field of distribution, and bad-debt disposal in monetary institutions had the most adverse effect on investment. It is logical to focus next on the problem of productivity and effectiveness in those sectors because declining investment there may be

^{*} I'd like to appreciate anonymous comments of this journal. Mistakes still remained are all owed to me, of course.

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structural and therefore, not suitable to updated change. Consequently, we would also like to analyze the supply side situation in Japan through the analysis of productivity.

TFP (Total Factor Productivity) is crucial in this analysis. Previous research on Japanese TFP noted declines during the 1990s (Kawai and Inui (2003)), Hayashi and Prescott (2002), and Iwata and Miyakawa (2003). Recently, Morana (2004) supported supply side reform by using VECM, noting common trends in productivity and labor supply. Also, Miyao (2004), along with Hamada and Horiuchi (2004), pointed out the tendency for decline in productivity by TFP when excluding linear trends on the monetary side.

Shinozaki (2003) indicated TFP was in a slight decline during the 1990s in an analysis on information-related industries in Japan.

In contrast, Kamada and Masuda (2001) and Kawai and Inui (2003) have found different TFP results. This can be explained by a kind of *residuals of measurement* due to the quality of the economic data. Results depend on the quality and type of statistics, the adjustment of the operating ratio of production equipment, and the changing quality of labor.

Kawamoto (2004) and others reported that *the true* TFP or progress rate of technology was not declining during the 1990s after adjustment of the operating ratio and the quality of labor. Going even further, Inui and Kwon (2004) said TFP in services was rising rather than declining.

The following problems still exist though the different result of TFP variation is reported in the previous research above.

First, the measurement period is not consistent. Some measurements are used ones from middle in 1970s as 70s TFP and other is used one from middle in 80s as 80s TFP. It can be said that it is a rough estimate that assumes the mean value of a decade except some specific years. Secondarily, some measurements are not modified capital contribution with operating ratio. However, capital contribution must be overestimate without modification by business cycle index during recession period. Thirdly, there is not much research of examining how influent the change of the distribution rate gives TFP.

This paper is going to contribute to some points as follows;

First, we analyzed the productivity change during 46 years in postwar period constantly by unified data from 1946 to 2000.

Secondarily, we examined to include the change in the capital operating and the distribution rate for estimation of the change of TFP.

Thirdly, we tried to use and examine net fixed assets as capital in macro not so used by the previous research.

The second section discusses the transition of labor productivity and capital stock. This includes a discussion of problems in capital stock data. In the third section we will see the measurement result of TFP and the components and tendencies of individual TFP. We will follow these discussions with brief concluding remarks.

2 Changes in Labor Productivity and Capital stock

First, let us examine the characteristics of real production per capita, that is labor productivity,

$$y_i = \frac{Y_i}{L_i}$$
, $i = 1, 2, \dots, 46$ during the past 46 years in postwar Japan¹. References are Table1 and Table2.

Briefly, these tables indicate the following: Real estate, petroleum, coal products, electricity, and private gas and water supply maintained high labor productivity through the 46 postwar years. Electrical machinery, equipment, and supplies rapidly rose in labor productivity since the middle 1980s.

Real GDP per capita appeared to decline slowly. In contrast, labor productivity in manufacturing tended to rise slowly. Textiles, however, declined since the 1980s. Agriculture, forestry and fishing have had lower labor productivity throughout the postwar period². Labor productivity in government services is declining slowly³. It is obvious that the productivity of service activities and construction has tended to decline. In addition, wholesale and retail trade remains at lower labor productivity.

In the end, labor productivity in manufacturing remains high except for a few sectors, and service-related sectors are generally low in productivity in Japan. Specifically, wholesale and retail trade, service activities, and construction employ large numbers of workers, but have lower productivity. Achieving greater productivity in those sectors may be an ongoing problem in Japan since they usually have lower productivity due to large numbers of workers.

Table 1: Labor Productivity (real production per capita at price of 1990) 1: Billion Yen	

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Next we will consider capital with fixed assets on balance sheets since we can view assets and liabilities by using stock tables in SNA.

Please note that market price data is based directly on B/S due to the lack of an adequate deflator for

each asset⁴.

Theoretically, an increase in capital stock must correspond with investment in that period $I_t = \Delta K_t = K_t - K_{t-1}$, so the amounts of net fixed capital formation (gross fixed capital formation - consumption) in the *Integrated account* (Flow table) equals the net fixed capital formation in the *Capital Finance Account* (Stock table)⁵.

Also, changes in financial assets in the Capital Finance Account in the Stock table are consistent with Financial transactions in Capital Finance Accounts by institutional sector in the Flow tables⁶.

We used five asset items here: net fixed assets, inventories, tangible non-produced assets⁷, financial assets, and corporate shares⁸ and three types of liabilities--liabilities, corporate shares, and net worth (national wealth)⁹.

Calculating a correlation coefficient matrix between assets and liabilities with the data above, significant relationships were shown in net worth and tangible non-producible assets, financial assets and liabilities except shares, and corporate shares and shares in liabilities. The result is shown in Table 3.

All coefficients were recorded at over 0.99. This result means that net worth or national wealth mainly

Real estate 1185.620 Real estate 1000.000 Real estate 608.071 Electricity, gas and water supply(Public) 82.919 Petroleum and coal products 14.919 Petroleum and coal products 33.567 Public administration 58.413 Electricity, gas and water supply(Public) 66.890 Education, medical services and research 55.201 Producers of government services 53.181 Public administration 53.937 Public administration 52.161 Public administration 53.937 Public administration 52.161 Public administration 53.937 Public administration 52.161 Public admini	Labor Productivity(Billion Yen/person)							
Electricity, gas and water supply(Public)82.219Petroleum and coal products141.919Petroleum and coal products333.59Petroleum and coal products59.974Electricity, gas and water supply(Private)67.997Electricity, gas and water supply(Private)96.45Public administration58.413Electricity, gas and water supply(Public)68.90Education, medical services and research55.200Producers of government services53.111Public administration53.977Producers of government services53.417Education, medical services and research48.022Froducers of government services44.912Electricity, gas and water supply(Public)64.84Frivate non-profit services42.315Forviate non-profit services49.902Electricity, gas and water supply(Public)51.41Food products and beverages24.759Service activities29.537Construction32.162Service activities23.224Construction20.694Food products and beverages31.361Ion and steel15.401Tranport and communications20.580Fron and steel27.102Tranport and communications13.578Iron and steel13.297Public administration26.897Finance and insurance12.937Whole country15.913Finance and insurance25.501Whole country11.715Finance and insurance14.280Whole country25.00Others10.120Others13.948Pulp, paper and paper products19.654Manuf	1955		1960					
Petroleum and coal products59,974Electricity, gas and water supply(Private)67,997Electricity, gas and water supply(Private)66,800Electricity, gas and water supply(Private)53,071Problic administration53,071Producers of government services53,101Public administration53,071Producers of government services53,101Producers of government services44,023Education, medical services and research49,902Electricity, gas and water supply(Private)51,141Private non-profit services42,303Education, medical services43,975Private non-profit services42,903Private non-profit services24,756Service activities23,571Construction21,122Service activities23,224Construction26,084Food products and beverages31,904Construction20,709Fron and steel12,526Tranport and communications25,801Ironand steel13,571Fron and steel12,526Tranport and communications25,801Finance and insurance12,337Whole country15,913Finance and insurance22,500Others11,125Others13,986Mining21,030Moning7,065Mining11,403Pulp, paper and paper products19,457Moning7,065Mining11,403Pulp, paper and paper products19,457Agriculture,forestry and fishing6,271Non-metallic mineral products14,527Fabricated metal products4,307Agriculture,fo	Real estate	1185.620	Real estate			608.976		
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Producers of government services53.181 Fuducers of government services53.171 Fuducers of government services	Petroleum and coal products	59.974	Electricity, gas and water supply(Private)	67.997	Electricity, gas and water supply(Private)	96.459		
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Food products and beverages24,75Service activities29,537Construction32,12Service activities23,224Construction26,684Food products and beverages31,96Construction20,709Food products and beverages24,981Service activities30,233Iran and steel15,491Tranport and communications20,500Iron and steel27,101Tranport and communications13,376Iron and steel12,626Tranport and communications26,892Finance and insurance12,337Whole country15,913Finance and insurance22,510Whole country11,715Finance and insurance13,988Mining21,333Munifacturing0.903Manufacturing11,403Pulp, paper and paper products19,464Mon-metallic mineral products6,069Pulp, paper and paper products19,46519,406Apriculture, forestry and fishing5,219Non-metallic mineral products10,314Manufacturing18,202Fabricated metal products4,337Agriculture, forestry and fishing6,827Transport equipment13,218Pub, paper and paper products10,314Manufacturing18,20211,21514,252Fabricated metal products4,337Agriculture, forestry and fishing6,827Transport equipment14,252Fabricated metal products4,337Agriculture, forestry and fishing6,827Transport equipment13,218Pub, paper and paper products4,321Habricu	Private non-profit services	44.238	Education, medical services and research	49.902	Electricity, gas and water supply(Public)	51.411		
Service activities23.224Construction26.694Food products and beverages31.86Construction20.709Food products and beverages24.981Service activities30.23Iron and steel15.491Tranport and communications20.580Iron and steel27.101Tranport and communications18.256Tranport and communications20.581Iron and steel27.101Tranport and communications18.378Iron and steel18.256Tranport and communications26.894Whole country11.715Finance and insurance14.236Whole country22.501Others10.123Others20.398Mining21.933Manufacturing9.093Manufacturing11.403Pulp, paper and paper products10.615Non-metallic mineral products19.065Apriculture.forestry and fishing5.219Non-metallic mineral products10.374Manufacturing18.202Table, paper and paper products10.374Manufacturing18.20218.202Lip, paper and paper products4.397Agriculture.forestry and fishing5.219Non-metallic mineral products10.374Lip, paper and paper products4.337Agriculture.forestry and fishing6.827Transport equipment13.412Lip, paper and paper products4.317Machinery6.823Machinery11.212Wholesale and retail trade3.841Fabricated metal products6.728Wholesale and retail trade10.944Transport equipment <t< td=""><td>Electricity, gas and water supply(Private)</td><td>42.918</td><td>Private non-profit services</td><td>43.975</td><td>Private non-profit services</td><td>46.847</td></t<>	Electricity, gas and water supply(Private)	42.918	Private non-profit services	43.975	Private non-profit services	46.847		
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Agriculture,forestry and fishing 5.219 Non-metallic mineral products 10.374 Manufacturing 18.02 Textiles 4.795 Transport equipment 7.847 Fabricated metal products 14.52 Fabricated metal products 4.337 Agriculture,forestry and fishing 6.827 Transport equipment 13.81 Pub, paper and paper products 4.121 Machinery 6.823 Machinery 11.21 Wholesale and retail trade 3.841 Fabricated metal products 6.72 Wholesale and retail trade 10.944 Transport equipment 3.492 Textiles 6.428 Textiles 9.61 Machinery 2.994 Wholesale and retail trade 6.01 Chemicals 8.73 Chemicals 1.972 Chemicals 4.012 Agriculture,forestry and fishing 8.28 Precision instruments 1.973 Chemicals 4.012 Agriculture,forestry and fishing 8.28	Mining	7.065	Mining	11.403	Pulp, paper and paper products	19.458		
Textile 4,795 Transport equipment 7.847 Fabricated metal products 14.52 Fabricated metal products 4.337 Agriculture,forestry and fishing 6.827 Transport equipment 13.81 Pulp, paper and paper products 4.121 Machinery 6.823 Machinery 11.21 Wholesale and retail trade 3.841 Fabricated metal products 6.772 Wholesale and retail trade 10.94 Transport equipment 3.492 Textiles 6.421 Chemicals 9.91 Machinery 2.994 Wholesale and retail trade 6.041 Chemicals 8.73 Chemicals 1.972 Chemicals 4.012 Agriculture,forestry and fishing 8.26 Precision instruments 1.913 Precision instruments 6.285 Precision instruments 6.285	Non-metallic mineral products	6.069	Pulp, paper and paper products	10.615	Non-metallic mineral products	19.067		
Fabricated metal products 4.37 Agriculture,forestry and fishing 6.827 Transport equipment 1.381 Pulp, paper and paper products 4.121 Machinery 6.823 Machinery 1.121 Wholesale and retail trade 3.841 Fabricated metal products 6.72 Wholesale and retail trade 10.94 Transport equipment 3.492 Textiles 6.421 Textiles 9.61 Machinery 2.944 Wholesale and retail trade 6.041 Chemicals 8.73 Chemicals 1.972 Chemicals 4.012 Agriculture,forestry and fishing 8.628 Precision instruments 1.913 Precision instruments 6.281 Machinery 8.284	Agriculture, forestry and fishing	5.219	Non-metallic mineral products	10.374	Manufacturing	18.024		
Pulp, paper and paper products 4.121 Machinery 6.823 Machinery 11.21 Wholesale and retail trade 3.841 Fabricated metal products 6.722 Wholesale and retail trade 10.94 Transport equipment 3.492 Fextles 6.823 Machinery 19.81 Machinery 2.994 Wholesale and retail trade 6.041 Chemicals 8.73 Chemicals 1.912 Chemicals 4.012 Agriculture, forestry and fishing 8.36 Precision instruments 1.913 Precision instruments 3.085 Precision instruments 6.288	Textiles	4.795	Transport equipment	7.847	Fabricated metal products	14.522		
Wholesale and retail trade 3.841 Fabricated metal products 6.712 Wholesale and retail trade 10.94 Transport equipment 3.492 Textiles 9.61 Machinery 2.994 Wholesale and retail trade 6.042 Textiles 9.61 Machinery 2.994 Wholesale and retail trade 6.041 Chemicals 8.73 Chemicals 1.972 Chemicals 4.012 Agriculture/forestry and fishing 8.36 Precision instruments 1.913 Precision instruments 6.285 6.282	Fabricated metal products	4.337	Agriculture,forestry and fishing			13.819		
Transport equipment 3.492 Textiles 6.428 Textiles 9.61 Machinery 2.94 Wholesale and retail trade 6.041 Chemicals 8.73 Chemicals 1.972 Chemicals 4.012 Agriculture,forestry and fishing 8.36 Precision instruments 1.913 Precision instruments 3.085 Precision instruments 6.28	Pulp, paper and paper products	4.121	Machinery	6.823	Machinery	11.214		
Machinery 2.994 Wholesale and retail trade 6.041 Ohemicals 8.73 Chemicals 1.912 Chemicals 4.012 Agriculture,forestry and fishing 8.36 Precision instruments 1.913 Precision instruments 3.085 Precision instruments 6.28	Wholesale and retail trade	3.841	Fabricated metal products	6.772	Wholesale and retail trade	10.946		
Chemicals 1.972 Chemicals 4.012 Agriculture,forestry and fishing 8.36i Precision instruments 1.913 Precision instruments 3.085 Precision instruments 6.28i	Transport equipment	3.492	Textiles	6.428	Textiles	9.614		
Precision instruments 1.913 Precision instruments 3.085 Precision instruments 6.28	Machinery			6.041	Chemicals	8.731		
	Chemicals	1.972	Chemicals	4.012	Agriculture, forestry and fishing	8.360		
Electrical machinery, equipment and supplies 0.635 Electrical machinery, equipment and supplies 1.274 Electrical machinery, equipment and supplies 2.479	Precision instruments	1.913	Precision instruments	3.085	Precision instruments	6.285		
	Electrical machinery, equipment and supplies	0.635	Electrical machinery, equipment and supplies	1.274	Electrical machinery, equipment and supplies	2.479		

Table 2: Labor Productivity ((real production per capita	at price of 1990) 2: Billion Yen

1970	1975							
Petroleum and coal products	612.668	Petroleum and coal products	765.248					
Real estate	497.177	Real estate	532.081					
Electricity, gas and water supply(Private)	170.600	Electricity, gas and water supply(Private)	187.091					
Iron and steel	71.105	Iron and steel	82.635					
Education, medical services and research	63.312	Food products and beverages	76.591					
Producers of government services	60.206	Mining	66.906					
Public administration	58.412	Education, medical services and research	66.290					
Food products and beverages	56.974	Producers of government services	63.841					
Construction	53.376	Public administration	62.545					
Electricity, gas and water supply(Public)	53.302	Electricity, gas and water supply(Public)	55.474					
Tranport and communications	48.896	Tranport and communications	55.301					
Mining	48.790	Construction	55.284					
Private non-profit services	45.003	Finance and insurance	50.933					
Service activities	40.464	Pulp, paper and paper products	49.392					
Non-metallic mineral products	39.036	Private non-profit services	49.294					
Pulp, paper and paper products	35.529	Whole country	41.972					
Whole country	34.677	Service activities	40.786					
Finance and insurance	34.026	Manufacturing	39.046					
Manufacturing	31.907	Transport equipment	38.881					
Transport equipment	31.708	Non-metallic mineral products	36.972					
Others		Others	31.779					
Fabricated metal products	24.989	Chemicals	29.297					
Machinery	24.830	Machinery	27.537					
Chemicals		Wholesale and retail trade	25.210					
Wholesale and retail trade	18.915	Fabricated metal products	24.781					
Textiles	14.839	Textiles	21.984					
Precision instruments	11.593	Precision instruments	17.630					
Agriculture, forestry and fishing		Agriculture, forestry and fishing	12.711					
Electrical machinery, equipment and supplies	2.507	Electrical machinery, equipment and supplies	9.567					
Note: Data source is NEEDS Database in 2002.								

affects tangible non-producible fixed assets such as land, forests and fisheries. In other words, non-reproducible tangible assets have a greater effect on net worth than on net fixed assets and inventories. We can see that not only financial assets affect liabilities except corporate shares, and also corporate shares affect equity financing. These results are reasonable because credit and debt in the entire country correspond with one another.

	Net fixed assets	Inventories	Tangible non-produced assets	Financial assets	Shares				
Liabilities	0.9764	0.9275	0.9139	0.9999	0.8187				
Shares	0.8748	0.8172	0.9421	0.8435	0.9978				
Net worth(national wealth)	0.9802	0.9634	0.9903	0.9521	0.9154				
late Data anna is NEEDO Database in 0000. Nat final annata in Olasian balance abaat annamt									

Table 3: correlation between Assets and Liabilities

Note:Data souce is NEEDS Database in 2002. Net fixed assets in Closing balance sheet account.

Next, we would like to break down the growth rate of the stock data above by the degree of contribution. The growth rate of aggregation of Y_t , closing assets, can be expressed as a weighted summation of the growth rate of the components X_{it} . The result of the breakdown of the growth rate of stock (1) is seen on Table 4.

$$\hat{Y}_{t} = \sum_{i=1}^{n} w_{it-1} \hat{X}_{it}, \qquad t = 1, 2, \cdots, T$$
(1)

Table 4: Decomposition of growth rate of capital stock by Contribution degree

-	Net fixed assets	Inventories	Tangible non-produced assets	Financial assets	Shares	Closing assets	Liabilities	Shares	Net worth(national wealth)	Closing liabilities plus net worth
1956	3.298%	1.388%	4.327%	7.592%	0.700%	17.305%	8.088%	0.669%	8.553%	17.309%
1957	0.917%	1.051%	3.987%	6.543%	0.637%	13,135%	6.891%	0.640%	5.600%	13.131%
1958	0.169%	0.205%	4.249%	6.515%	0.510%	11.648%	6.399%	0.456%	4.793%	11.648%
1959	1.801%	0.925%	4.741%	8.993%	0.522%	16.982%	8.859%	0.467%	7.655%	16.982%
1960	2.331%	0.844%	8.203%	8.814%	0.795%	20,988%	8.806%	0.700%	11.483%	20.989%
1961	4,148%	1.200%	6.546%	10.639%	1.062%	23.594%	11.123%	0.901%	11.570%	23.594%
1962	2.222%	0.482%	5.782%	8,145%	0.681%	17.312%	8.321%	0.615%	8.376%	17.312%
1963	2.586%	0.641%	3.032%	10.466%	0.487%	17.212%	10.723%	0.437%	6.052%	17.212%
1964	2.699%	0.640%	4.612%	8.215%	0.530%	16.696%	8.325%	0.531%	7.840%	16.697%
1965	1.956%	0.506%	2.451%	7.952%	0.087%	12.952%	7.785%	0.147%	5.019%	12.952%
1966	2.783%	0.588%	4.416%	8.225%	0.165%	16.177%	8.046%	0.190%	7.941%	16.177%
1967	3.064%	0.764%	5.666%	9.282%	0.125%	18.901%	9.271%	0.142%	9.489%	18.901%
1968	2.666%	0.717%	6.626%	8.025%	0.207%	18.242%	7.945%	0.159%	10.138%	18.242%
1969	3.437%	0.746%	6.834%	9.745%	5.809%	26.571%	9.289%	6.128%	11.155%	26.572%
1970	4.034%	0.553%	6.173%	8.329%	-0.835%	18.255%	8.156%	-0.871%	10.970%	18.254%
1971	3.139%	0.142%	6.043%	8.546%	1.073%	18.943%	8.261%	1.133%	9.549%	18.943%
1972	4.626%	0.367%	11.985%	10.765%	5.052%	32.795%	10.444%	5.193%	17.157%	32.795%
1973	6.356%	0.928%	8.899%	9.709%	0.420%	26.312%	9.804%	0.354%	16.155%	26.312%
1974	4.492%	0.736%	0.111%	5.956%	-0.886%	10.409%		-0.932%	5.232%	10.410%
1975	2.009%	0.110%	2.067%		-0.126%	10.600%		-0.093%	4.140%	10.600%
1976	3.035%	0.248%	1.897%	6.719%	1.246%	13.145%	6.634%	1.276%	5.235%	13.145%
1977	2.037%	0.049%	1.894%	5.517%	-0.038%	9.459%	5.318%	-0.073%	4.214%	9.459%
1978	2.249%	0.022%	3.571%	6.522%	1.666%	14.029%	6.412%	1.680%	5.937%	14.029%
1979	3.251%	0.444%	5.129%	5.538%	0.577%	14.940%	5.658%	0.583%	8.699%	14.940%
1980	2.409%	0.288%	4.869%	5.475%	0.092%	13.134%	5.522%	0.179%	7.432%	13.134%
1981	1.433%	0.069%	3.674%	4.843%	0.434%	10.453%	4.766%	0.529%	5.157%	10.452%
1982	1.117%	0.052%	1.982%	4.286%	-0.155%	7.282%		-0.120%	3.269%	7.282%
1983	0.778%	-0.037%	1.106%	4.350%	1.020%	7.217%	4.114%	1.157%	1.946%	7.217%
1984	1.047%	0.036%	1.121%	4.282%	1.264%	7.751%	4.041%	1.256%	2.453%	7.751%
1985	0.855%	-0.019%	2.128%	4.792%	1.067%	8.822%	4.344%	1.077%	3.401%	8.822%
1986	0.639%	-0.103%	6.489%	4.786%	3.375%	15.186%	4.695%	3.456%	7.035%	15.186%
1987 1988	0.966% 0.952%	-0.005% 0.037%	9.164% 3.188%	5.472% 4.418%	2.165% 3.673%	17.762% 12.268%	5.486% 4.429%	2.085% 3.648%	10.191% 4.190%	17.762% 12.268%
1989	1.408%	0.037%	4.991%	4.410%	3.685%	14.414%	4.429%	3.865%	4.190%	14.414%
1989	0.652%	0.069%	4.991%	4.240%	-5.371%	16.058%	4.043%	-5.391%	5.280%	14.414%
1990	0.896%	0.012%	-2.258%	2,509%	-0.170%	0.990%	2.406%	-0.117%	-1.299%	0.990%
1992	0.537%	-0.011%	-2.634%		-1.725%	-2.355%		-1.772%	-1.880%	-2.355%
1993	0.363%	-0.068%	-1.154%	1.735%	0.355%	1.231%	1.590%	0.437%	-0.796%	1.231%
1994	0.293%	-0.039%	-0.735%	1.587%	0.954%	2.060%	1.516%	1.019%	-0.475%	2.060%
1995	0.129%	-0.004%	-1.027%	2.136%	-0.067%	1,166%	1.961%	0.036%	-0.831%	1.166%
1996	0.437%	0.029%	-0.419%	1.472%	-0.501%	1.018%		-0.459%	0.282%	1.018%
1997	0.443%	0.015%	-0.474%		-0.728%	1.699%		-0.791%	0.241%	1,699%
1998	-0.046%	-0.064%	-0.859%		-0.713%	-0.800%		-0.734%	-0.866%	-0.800%
1999	-0.025%	-0.046%	-0.890%	0.955%	2.495%	2.488%		3.204%	-1.542%	2.488%
2000	0.145%	-0.021%	-0.787%		-1.073%	-1.113%		-1.388%	-0.099%	-1.113%
2001	-0.110%	-0.057%	-1.043%	-0.053%		-2.331%	-0.441%		-0.664%	-2.331%
			2002. Net fixed assets in Closing I							

Here, $\hat{Y}_{t}, \hat{X}_{it}$ are growth rate individually. $\hat{Y}_{t} := \Delta Y_{t} / Y_{t-1}, \hat{X}_{it} := \Delta X_{it} / X_{it-1}$. w_{it-1} is weight of X_{it-1} on Y_{t-1} and then $w_{it-1} := X_{it-1} / Y_{t-1}$.

This table has the following features: First, the growth rate of closing assets was very high during the rapid growth period prior to the oil crisis in 1973. Second, net fixed assets did not contribute significantly. Third,

corporate shares as assets and inventories have consistently made small contributions. Fourth, the growth rate of closing assets in the 1990s enters into a low growth rate period due to falling tangible non-producible assets. In contrast, financial assets except shares were up in the 1990s, with total corporate shares rising in late 1990s. Fifth, net fixed assets, inventories, and shares as assets did not significantly contribute to the growth rate of closing assets in the 1990s. Sixth, net worth and liabilities in closing liabilities plus net worth were high until the 1990s. Seventh, the low growth rate of closing liabilities in the 1990s was affected by the contribution of liabilities but the negative contribution of net worth in the early 1990s. Also, the contribution of corporate shares as equity finance affected the growth rate negatively in the late 1990s.

Traditionally, the role of assets in the Japanese economy has been mainly affected by tangible non-producible assets and financial assets, but lately the role of corporate shares has become more important. This tendency began with the boom period of the late 1980s, called *Bubble economy* but it later became a permanent feature of Japanese assets. As a result, the weight of indirect financing such as loans from banks backed by land mortgages will decline. Direct financing by holding shares and their operations will increase in Japan. We can see similarities in some institutional financial reforms from the late 1990s, particularly the easing of restrictions on securities transactions on the Internet, a liberalization of financing that increased the total number of investors.

Now we will examine the change in the capital coefficient K_1/Y_1 by using net fixed assets and nominal

GDP. That is Figure 1. The capital coefficient tended to decline until the late 1960s, but then grew rapidly from 1969 onward. It stabilized in the 1980s and since the 1990s, increased slowly. This means that although productivity of capital fell in the 1990s, the magnitude of the decline was not serious. This also parallels the slow decline of labor productivity across the country and mirrors the low growth rate of GDP above.

Comparison of the ratio of gross fixed capital¹⁰ over GDP by flow data is visible in Figure 2. This figure shows how the fluctuating ratio had increased until 1975 but then turned down slowly from then. The ratio increased again in the bubble economy, but finally declined in the 1990s.

Here, the tendency of the ratio of gross fixed capital to decline during the 1990s indicated that a decrease in demand of investment does not necessarily fit with an increasing of capital coefficient on Figure 1. However, this result could be theoretically true if marginal investment were diminishing.

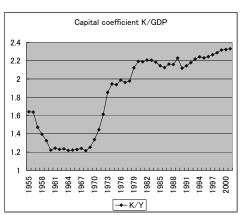
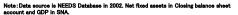
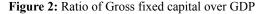
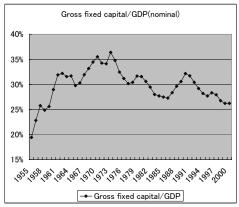


Figure 1: Transition of Capital coefficient





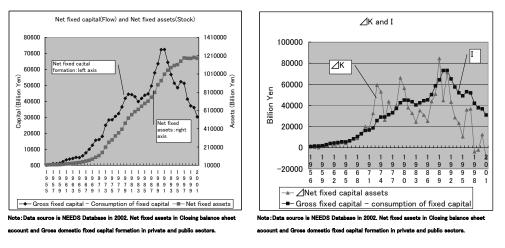


Note: Data source is NEEDS Database in 2002. Gross domestic fixed capital formation in private and public sectors and GDP in SNA. However, there is a more serious problem with the data we used than with the theory. K (fixed assets) from stock data and I (fixed capital formation) from flow data must correspond as $\Delta K = I$, but the actual statistics differ. Figure 3 indicates net fixed capital formation (gross fixed capital formation - its consumption) by flow data, and net fixed assets (so called capital stock) by stock data. The increase of the latter (ΔK) and the former are apparent in Figure 4. This tendency is especially obvious after the 1970s, when the largest difference between ΔK and I occurs. The changes discussed are both caused by the Reconciliation Accounts for capital stock in Japanese SNA.

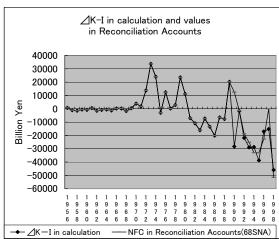
Figure 4: Net fixed capital formation

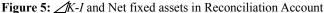
and Increases of capital stock

Figure 3: Transition of Net fixed capital formation and Capital stock



To further clarify, we plot the difference of I and ΔK on Figure 4 and the amount of net fixed assets from the Reconciliation Account in 68SNA, as seen in Figure 5. The values of the Reconciliation Account in





Note: Data source is NEEDS Database in 2002. Reconciliation Accounts

68SNA exist only until 1998, but these very nearly correspond to $\Delta K - I$ that we measured.

We have covered both flow data for investment and capital stock data as published *right*. However, stock data is adjusted largely by Reconciliation Accounts, creating the most serious problem in Japanese SNA when using capital stock data. Seen from this perspective, we can see that capital stock during the 1990s era Japan simultaneously faced both a shortage of demand by declining investment and a decrease in capital productivity.

3 Measurement of TFP

Now, we will outline technical progress in the recession of the 1990s by measuring TFP¹¹. Extensive research exists on the measurement of TFP in Japan¹². Studies range from the construction of databases to measurement methods. Taken together, these studies offer certain conclusions. Most obvious is that Japanese TFP in the 1990s has been declining. In addition, the magnitude of the TFP drop is not significant when considering operating ratio from the demand side and the quality of labor¹³.

We believe that our research leads to an easier and more accurate method of calculation. We first connected annual data between 68SNA and 93SNA at 1990, creating a long time series of over 40 years of data¹⁴. Next, we used Net Fixed Assets from the National Balance Sheet in SNA as capital stock and then deflated it by the Private Capital Formation Deflator. Lastly, we transformed quarterly and monthly data into annual data for annual comparison with other annual indexes.

Contrary to previously published research, we did not use *Gross Capital Stock of Private Enterprises*. The reason we employed net fixed assets as capital stock was to include and cover all fixed assets of all institutional sectors in the macro economy. Keep in mind, however, that gross capital stock of private enterprise does not include the stock of public sectors such as social stock. Our estimation of TFP in the macro economy is by an aggregate production function, so our production function should cover the stock of public, private, and nonprofit organizations. A price adjustment is required to employ net fixed assets of SNA. We deflated it with the Private Capital Formation Deflator of 1990.

The method of depreciation is also different between gross capital stock of private enterprise and net fixed assets of SNA. Gross capital stock of private enterprise includes the estimated gross assets value before depreciation. This method is best for evaluating the real ability to produce. The method of estimation is the two points benchmark year method based on national wealth statistics in 1955 and 1970. Investment and deduction of assets of each year are added and subtracted from the bench mark¹⁵.

In contrast, tangible fixed assets (net fixed assets) from the National Balance Sheet in SNA are evaluated by the replacement cost after depreciation. Depreciation is based on the fixed rate method as the 10% redemption rate to the residual value. *Depreciation of social capital* is estimated by the fixed amount method. Here, the method of estimation is the Bench Mark Year method based on National Wealth Statistics in 1970.

Evaluating the ability to produce, which will also depreciate, depends on whether we focus on economic depreciation or the real abilities of the materials. In this case, we assume that economic depreciation is more important¹⁶.

Total number of workers of SNA is used for the number of labor and the average total hours are used for labor hours, which those are worked per regular employee in manufacturing operations of 30 or more employees in *Final report of monthly Labor Survey* of Ministry of Health, Labor and Welfare.

The operating ratio we use is derived from the operating ratio of the original index in manufacturing *Indices of operating ratio and production Capacity* from the Ministry of Economy, Trade and Industry. The rest of our data is supplemented from the Connected Indices of Industrial Production (Jan. 1978 to Dec. 2002) on HP¹⁷ of METI, because time series data of operating ratio with MT code exists only from 1968 to 1998. We transformed

monthly data into annual data using the averaging method of calculation.

Total input originates from the annual series of intermediate inputs (nominal) by economic activities in SNA. We made real intermediate inputs by adjusting for deflation with the subtotal of economic activity. In the calculation, since we could not find a significant difference between the nominal and real result, we show the result with real values.

We used two models, one being TFP for total outputs divided by total inputs, and the other TFP by Solow's residuals with Cobb-Douglas production function adjusted by operating ratio of capital.

The definitions of both are as follows;

$$TFP = \frac{Y}{X} \tag{2}$$

$$Y = A(\rho K)^{\alpha} (LH)^{\beta}$$
(3)

Here, X is total inputs in the equation (2). A in equation (3) is seen as Solow's residuals, the technical progress term and another definition of TFP. However, it is accepted knowledge that the two types of TFP are equivalent from an accounting balance if total inputs is defined as costs and the production function is transformed to include three factors of production: capital, labor and intermediate inputs¹⁸. K is fixed capital stock (Net fixed capital), ρ is operating ratio. LH is labor hours (total number of workers × hours).

It is commonly understood that Solow's residual as a term of technical progress differs from real technical progress if imperfect competition (or mark-up ratio) and economies of scale exist¹⁹. However, for simplicity's sake we assume the existence of neither.

Model (2) is very easy to measure. Especially, when TFP according to industry is measured, the acquisition of data is easy. On the other hand, model (3) is a typical expression of Solow's residual and it is convenient that the contribution of the capital and labor can be specified. However, it has the difficulty obtaining data by each industry. We used both models together here because there are both merit and demerit in those.

If we assume the proposition of marginal productivity in equation (3), α and β (indices of elasticity) correspond to the distribution rate of capital and labor, respectively, we can use the value of each parameter when calculated in advance. However, we do not assume unrealistic constant returns to scale, $\alpha + \beta = 1$ or $\alpha + \beta = const$. have been constant for 46 years, rather, we use each annual distribution ratio²⁰.

A share of operating surplus to value-added is used as the distribution ratio of capital²¹ and a share of employee compensation is used as the distribution ratio of labor. Adding both is still less than the total because it does not include consumption of fixed capital and taxes less subsidies.

We calculated individual distribution ratio with real value added, which was derived from *value-added economic activities* we calculated. Individual value added is adjusted for deflation and summarized by real value added and the individual distribution ratio²². Of course, it is possible to calculate distribution ratios of capital and labor with nominal value added, but this tends to be lower than ratios with real value due to variation of price²³. If we were to use the nominal distribution ratio, the result regarding TFP could have an upward bias.

Moreover, aggregation of nominal operating surplus does not usually include imputed interests according to the definition in SNA. Nevertheless, imputed interests should be included in the distribution of capital of industries such as finance and insurance. Therefore, we included real imputed interests in each real operating surplus. We calculated with logarithm conversion of equation (3).

$$\ln Y_{t} = \ln A_{t} + \alpha_{t} \ln(\rho K)_{t} + \beta_{t} \ln(LH)_{t}, \qquad t = 1, 2, \cdots, 46$$
(4)

Figure 6 and Figure 7 show results of the macro economy with equation (2) and $(4)^{24}$. According to our results, TFP level in 1990s Japan does not decline. This is similar to the result of Kawamoto (2004).

Both figures show that TFP tended to increase in the 1990s despite variations in TFP within these figures until the late 1980s. The variance is due to different methods of measuring TFP. As mentioned above, TFP with equation (2) uses total costs while TFP with equation (3) uses stock data. The latter has the tendency to lower TFP when distribution rate (α , β) and operating ratio (ρ) are relatively larger.

operating ratio

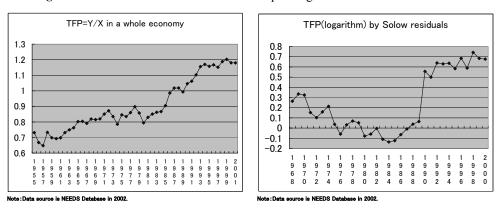


Figure 6: Transition of TFP=Y/X

Actually, the capital distribution rate has been changing about 0.31 since the late 1980s and the operating ratio has been about 96, as we will see later. Since those percentages are significant, we can surmise that they raised the distribution of capital and then lowered TFP.

The calculation of average growth rates of Solow's residual and TFP by total inputs is seen in Table 5. Both growth rates have similar tendencies, but some characteristics compare with prior studies (Table 7). The average growth rate of TFP in the 1990s dropped since the 1980s as verified in previous research, declining around $1.0\% \sim 1.3\%$. Contrary to previous research, we found a smaller drop of TFP in the 1990s.

	Average growt			Table 6: Modified Solow's residual		
	Solow	Y/X			(1)M. C. S	(2)M. D. R
60s	-	2.410%		70s	1.317%	-0.386%
70s	1.190%	-0.492%		80s	2.131%	1.480%
80s	2.285%	2.476%		90s	1.284%	0.216%
90s	1.248%	1.207%		90s-80s	-0.847%	-1.265%
90s-80s	-1.038%	-1.269%				
			-			

Note:(1) M.C.S means Modified capital stock. (2) M.D.R means Modified distribution ratio.

Figure 7: Solow's residuals adjusted by

One reason for the differing results is the source of capital stock data. The value of the reconciliation account in 93SNA had been increasing each year, resulting in less consideration for the impact of capital. As a test,

let us calculate Solow's residual again with other capital stock data. We totaled new net fixed assets again by adding *net capital formation* in the integrated account in each year to the net fixed asset on the 1955 Closing Balance Sheet. This asset is capital stock for a modified Solow's residual. Here, the net fixed formation results from the consumption of capital (depreciation costs) in Value Added subtracted from gross capital formation. This modified Solow's residual is shown on the left side column (1) of Table 6. In this table, Solow's residual dropped in the 1980s as compared with Table 5, and by contrast, it rose somewhat in the 1970s. Also, it rose in the 1990s because of new capital stock affecting TFP. As a result, the difference in TFP growth between the 1980s and 1990s is less.

Another reason that we believe TFP has not dropped as much as previously thought is inaccurate calculation of the distribution ratio. We did not include depreciation costs in the ratio of capital, but had they been included, Solow's residual would have decreased due to extra impact of capital. The column on the right (2) in Table 6 indicates TFP changes due to capital stock when including depreciation costs. Clearly, residuals in all periods decreased more quickly when compared with Table 5. These results are caused by substantial depreciation in each period, which we interpret as the result of solid renewal or accumulation of capital during those decades²⁵.

If you would consider that productive ability was a key in manufacturing sectors and depreciation costs should've been included in capital factor like *Gross Capital Stock of Private Enterprises*, TFP would be decreased because of the greater evaluation of capital contribution. In contrast, if you would use the concept of net fixed capital excluded depreciation costs and then TFP would be increased because the contribution of capital would be small. That is the second point that our result is different from the results of previous studies.

Another difference resulting in falling TFP involves consideration of the adjustment of capital by the operating ratio. If the ratio were not considered when calculating TFP growth, Solow's residual in a recession period would be smaller because total operating capital is assumed. Although the majority of previous research reported declining TFP, those studies did not consider adjustment by operating ratio (See Table 7). Kawamoto (2004), however, found that when considering operating ratio, TFP in the 1990s did not decline.

	Fukao et al.(a)	Jorgenson & Motohashi(b)	Hayashi & Nomura(c)	Hayashi & Prescott(d)	Cabinet Office(e)	Yoshikawa & Matsumoto(f)	Nakajima et al.(g)	Kawamoto(h)
1970s	1.55%	1.57%	0.00%	0.52%				
1980s	1.29%	1.25%	0.70%	2.36%	1.60%	1.20%	-1.55%	1.90%
1990s	0.58%	0.58%	-0.20%	0.18%	0.20%	-0.90%	-0.41%	1.90%
90s-80s	-0.71%	-0.67%	-0.90%	-2.18%	-1.40%	-2.10%	1.14%	0.00%
(a)70s' avera	age=1970-1980,	80s'=1980-1990, 90s'=1990	-2002. Operating ration	is not adjusted.				
(b)70s' avera	age=1975-1980,	80s'=1980-1990, 90s'=1990	-2003. Operating ration	is not adjusted.				
(c)70s' avera	age=1973-1984,	80s'=1984-1990, 90s'=1990	-2000. Operating ration	is not adjusted.				
(d)70s' avera	age=1973-1983,	80s'=1983-1991, 90s'=1991	-1998. Operating ration	is not adjusted.				
(e)80s' avera	age=1981-1990,	90s'=1991-2000.						
(f)80s' avera	ge=1987-1993,	90s'=1994-1997.						
(g)80s'avera	age=1985-1989,	90s'=1990-1999.						
(h)80s' avera	age=1980-1990,	90s'=1990-1998.						
This table is	retouched base	d on Miyakawa (2006) and Ir	nui and Keng(2005).					

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a hie	/• (omparison	i fable of	тнр	growth rates	1n	previous research
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TEP growth rate comparison table in other research

As a caveat, our results are based on a single industry — manufacturing. We calculated Solow's residual using the operating ratio of manufacturing for the purpose of TFP for the entire macro economy. Needless to say, individual operating ratios are different in each industry. We could have found different results using other operating ratios related to individual capital by industry. This is an area open to future study.

Naturally, it is quite possible to arrive at different results when measuring Solow's residuals as TFP using different data and various methods of calculation. This underlies the differing results of previous studies. In any case, our result indicates that TFP in the 1990s did not decline seriously despite being somewhat lower than it was in the 1980s. Therefore, we believe that Japan's long recession was not caused by the decline of TFP in the

1990s.

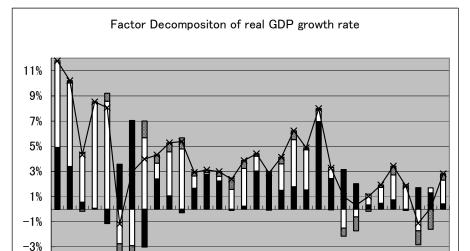
The question is what did cause the long recession of the 1990s if TFP was not falling? Let us begin by breaking down the growth rate of the macro economy into the TFP components of capital, labor and technology. We can view the growth rate of real GDP to growth rate of each factor in the next equation.

$$\Delta \ln Y_{t} = \Delta \ln A_{t} + \Delta \alpha_{t} \ln(\rho K)_{t} + \Delta \beta_{t} \ln(LH)_{t}$$

= $\Delta \ln A_{t} + [\Delta \alpha_{t} \{\ln \rho_{t} + \ln K_{t}\} + \alpha_{t} \Delta \ln \rho_{t} + \alpha_{t} \Delta \ln K_{t}]$
+ $[\Delta \beta_{t} \{\ln L_{t} + \ln H_{t}\} + \beta_{t} \Delta \ln L_{t} + \beta_{t} \Delta \ln H_{t}]$
 $t = 2,3, \dots, 46$ (5)

We can see the result on Figure 8.

This figure shows that the main causes for slowed economic growth in the 1990s were related capital and labor. The growth rates of capital were negative in the three years of 1992, 1993 and 1998. The growth rates of labor were negative in six different years ranging from 1991 to 1994 and 1998 to 1999. Growth rates less than -1.0 % occurred for capital in 1992 and 1998, and the same held true for labor in 1993, 1998 and 1999. Taken together, these years had a significant effect on the decade's economic growth. In contrast, the growth rates of TFP were positive during the 1990s with the exception of 1997. That means declining capital and labor growth at that time weakened the entire economy. Therefore, it does not appear that the TFP factor on the supply side seriously damaged the economy.



9

3

9

8

5

9

1 1

9 1

□ Capital **EXAMPL** Labor*time × GDP growth rate

9 9 9 9 9 9 9

8 8 9 9 9 9 9

7

1 1 1 1

3 5 7

9

Figure 8: Factor Decomposition of growth rate of real GDP with TFP components

Note: Data source is NEEDS Database in 2002.

■Technology □

-5%

1

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1 1 1 1 1 1 1 1

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3 5

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1

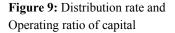
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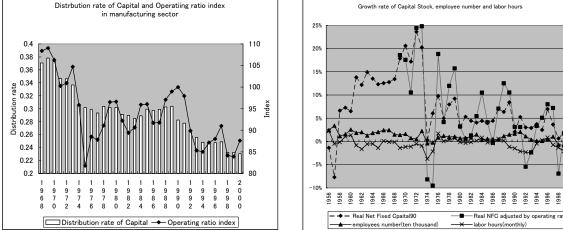
6 7 7 7 7 7 8 8

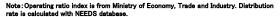
What then caused negative growth of capital and labor? Figure 9 shows the distribution rate and operating ratio of capital. As you can see, both fall sharply in the 1990s. One reason that capital declined was a decrease in both the distribution rate of capital and the operating ratio.

Another reason relates to labor. Figure 10 shows the growth rate of capital stock, total employees, and hours worked. Capital stock recorded serious negative growth in 1992, 1993 and 1998, the worst decline since the 1974 and 1975 oil shock. Moreover, on the labor side, continuous shortening of labor hours in the 1990s surpassed the growth of employees. The growth rate of employees was also negative in the late 1990's. Taken together, these factors led to negative overall labor growth in the six years in Figure 8 above.

Three indices of the economy declined in the 1990s-distribution rate, operating ratio and growth rate of capital stock, together leading to negative growth of capital. In addition, shortened labor hours and fewer employees caused negative growth of labor. Therefore, we can infer that the combination of these caused a slowdown in macroeconomic growth in the 1990s. This result is also compatible with the theory that declining investment (lack of effective demand) was the main factor in Japan's long recession.







Note: Number of employees and labor hours are from Health, Labor and Welfare. Others are

Figure 10: Growth rate of capital stock,

employee number and working hours

Finally, we look at the transition of TFP with regard to individual industries. Due to the difficulty of collecting capital stock data for individual industries, we calculated individual TFP by means of the total cost approach for 26 industries (equation (2)) and created an individual index based on the year 1990. Those results are displayed in Table 8.

calculated with NEEDS datab

Let's call *TFP increasing industries* if the index exceeds 100 in the year 2000. Eleven industries showed a rising TFP: petroleum and coal products, and manufacturing-related industries such as textiles and food products and beverages. Also, the three non-manufacturing-related industries, including service activities and wholesale and retail trade tended to increase TFP²⁶. Textiles, wholesale and retail trade, and service activities declined in labor productivity as mentioned above, while increasing in TFP. This could indicate either technical progress or efficiency of production in these industries.

In contrast, TFP decreasing industries, even more industries did not exceed 100 in the 2000 TFP index. These include three manufacturing industries, such as the electrical machinery, equipment and supplies industry, and nine non-manufacturing related industries, including transport and communications, agriculture, forestry and fishing, finance and insurance, construction, education, medical services and research, real estate, and public administration. Although electrical machinery, equipment and supplies, real estate, electricity, and gas and water supply all had high labor productivity as mentioned above, their TFPs tended to decrease. This could indicate an inefficiency of capital in these industries.

	1	2	3	4	5	6	7		19	20	21	22	23	24	25	26
	PET	TEX	SER	F00	IRN	TRD	PUL	Whole economy	EST	EMR	CON	MAC	MIN	FIN	AGR	TRC
1955	100.50	60.48	100.23	104.45	55.73	44.71	66.25	68.23	46.11	73.99	47.59	66.39	147.76	74.41	94.43	83.14
1956	83.75	58.53	86.97	107.08	71.13	48.02	69.56	62.87	52.72	74.15	39.02	51.66	154.20	71.91	87.55	83.46
1957	100.01	57.82	77.22	100.06	79.60	48.51	65.48	60.84	61.97	71.53	37.18	54.90	168.06	71.78	86.31	83.50
1958	127.40	56.53	75.58	108.17	55.35	52.07	67.90	68.59	65.08	67.50	49.29	78.57	189.53	68.13	93.33	96.46
1959	161.57	58.40	63.97	107.30	58.68	52.14	68.82	65.46	65.25	66.75	42.32	76.48	165.06	57.33	98.24	99.52
1960	168.09	63.33	54.91	99.18	63.41	63.04	67.04	66.16	91.54	68.53	45.00	76.31	170.97	48.44	99.89	97.76
1961	157.42	62.52	56.55	98.54	65.49	70.08	69.33	67.70	99.08	66.97	42.49	78.15	143.88	48.26	100.22	104.29
1962	174.74	62.13	57.58	97.42	55.66	71.51	66.35	71.70	87.88	59.27	47.96	89.94	150.92	52.15	103.60	103.68
1963	178.51	66.34	59.48	97.53	53.43	69.66	70.04	74.73	82.22	63.24	50.21	89.79	145.31	56.41	110.59	111.83
1964	193.67	70.26	62.71	91.24	65.42	73.46	72.13	76.41	65.40	65.31	48.39	91.20	166.31	62.12	101.97	105.71
1965	183.75	70.41	66.60	97.55	60.27	76.64	74.77	80.68	72.62	66.46	54.16	96.51	177.16	66.40	110.05	107.47
1966	183.46	74.36	68.32	93.80	59.88	82.38	70.13	81.22	74.55	64.85	50.25	86.65	202.28	66.18	112.06	108.86
1967	186.85	74.75	74.11	93.61	57.51	82.96	66.52	80.76	72.16	60.33	45.37	88.97	169.73	71.85	115.46	110.03
1968	181.28	83.64	81.21	101.29	59.98	92.70	70.85	84.00	57.75	59.15	47.90	87.29	159.27	81.46	111.08	112.51
1969	155.51	84.34	86.06	103.98	64.63	90.14	68.67	83.63	66.81	61.29	51.77	85.73	173.63	80.58	107.83	118.14
1970	156.41	90.17	86.30	104.47	74.49	95.47	73.79	83.74	65.52	64.09	59.68	82.70	165.92	78.23	103.32	115.95
1971	142.48	91.89	84.50	105.00	79.80	97.94	78.58	86.12	68.66	66.46	65.93	90.05	158.72	76.69	95.30	105.51
1972	142.94	86.11	90.60	97.12	89.00	97.48	80.44	88.07	68.94	67.92	66.37	89.00	151.34	80.92	111.88	103.25
1973	132.50	93.18	85.92	90.03	86.37	106.36	78.25	85.33	69.85	70.41	61.38	74.19	145.82	78.05	128.07	105.20
1974	16.02	101.90	86.35	80.84	75.68	104.99	85.84	79.81	70.58 65.35	75.62	63.63	73.78	118.86	80.40 76.87	111.49	87.92 90.38
1975	34.63	90.27	86.56	77.38	70.58	105.36	81.47	85.70		79.56	76.93	86.96	110.67		113.03	
1976 1977	41.64 50.18	78.65 80.36	86.17 90.08	83.49 94.58	68.84 63.76	105.28 101.15	77.17 75.38	84.67 86.92	71.69 74.29	76.30 73.83	72.71 69.99	75.92 74.30	112.32 108.52	71.94 69.95	111.09 108.82	90.23 102.09
1977	80.90	88.12	90.08	94.58	80.37	101.15	79.17	91.03	73.80	70.48	74.88	69.69	111.03	74.47	108.82	97.56
1978	35.35	87.47	90.43 93.48	97.29	86.04	100.38	70.84	86.11	73.80	66.39	74.80	69.09	104.98	77.00	107.23	97.56 87.45
1979	29.43	88.22	93.46 94.21	97.29	75.34	96.73	66.20	78.70	72.33	62.67	72.88	70.70	104.98	79.66	81.09	87.45 71.81
1981	33.33	90.45	97.94	95.85	71.25	97.54	75.43	81.40	72.93	60.66	81.18	75.59	94.77	67.21	81.57	75.22
1982	38.34	92.72	96.82	100.91	69.32	98.37	73.46	83.93	63.83	59.04	82.04	81.67	95.71	71.16	82.23	76.59
1983	45.56	97.44	97.87	104.51	58.72	94.78	75.78	84.57	64.39	58.71	77.37	82.71	95.18	70.77	83.54	78.77
1984	47.74	97.42	98.80	99.72	75.26	90.36	75.94	84.17	72.90	57.80	78.92	83.10	92.49	64.15	83.60	82.63
1985	53.98	100.62	109.10	100.97	78.70	90.85	78.89	87.19	78.80	57.41	83.16	92.03	91.32	61.24	86.49	84.70
1986	92.83	107.86	108.22	108.15	86.72	93.21	92.49	95.69	92.07	57.92	85.78	92.56	96.86	60.01	88.77	98.12
1987	116.93	117.55	103.71	111.14	96.70	95.95	98.10	98.22	98.46	56.20	90.12	93.84	92.32	59.83	97.57	104.62
1988	121.27	118.42	100.87	107.03	105.61	96.47	100.87	97.97	111.26	55.61	94.27	94.64	92.56	66.36	98.26	106.50
1989	120.24	100.90	101.22	104.26	106.64	97.12	105.56	95.34	102.96	55.27	96.40	93.75	79.00	59.16	98.95	108.64
1990	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
1991	119.01	101.69	102.62	101.53	103.04	103.76	101.38	101.54	91.63	98.99	96.46	101.82	100.72	119.72	98.22	100.40
1992	142.98	124.88	108.62	109.81	114.24	108.05	104.11	105.52	94.31	97.80	97.29	107.65	99.66	82.37	100.72	101.90
1993	155.65	155.20	117.02	113.21	111.29	114.89	113.23	110.67	104.97	99.17	99.56	106.80	98.36	88.39	97.89	100.85
1994	181.17	148.39	115.44	113.84	113.71	118.74	111.42	112.05	104.66	99.21	94.57	98.46	95.44	83.42	99.77	97.72
1995	172.62	140.48	117.73	116.12	117.06	118.10	111.17	110.82	102.99	99.45	90.80	96.80	100.61	74.38	92.76	97.77
1996	162.51	138.89	119.71	113.10	120.24	116.23	113.80	111.79	103.57	97.24	88.47	97.17	98.11	73.67	98.75	97.65
1997	158.97	140.16	122.60	112.73	114.27	118.81	109.28	110.21	101.70	96.66	88.32	96.51	96.84	74.35	84.16	93.35
1998	174.14	137.40	125.98	112.21	108.36	118.13	112.07	113.59	91.83	99.53	91.33	94.30	100.72	71.19	87.67	89.36
1999	180.55	133.89	125.63	118.17	115.35	117.91	111.88	114.87	90.84	95.59	91.75	93.10	88.28	75.91	82.39	79.85
2000	144.07	143.64	123.28	119.81	117.13	116.56	116.13	112.49	94.65	92.97	90.82	88.05	86.47	78.89	77.91	73.31
Note	eta enuro	a is NEED	S Detebe	se in 200	2 Interne	diate Con	sumption	and GDP in SNA								

Table 8: Individual TFP index by Industries (based on '90)

PET Petroleum and coal products TEX Textiles SER Service activities

FOO Food products and beverages IRN

Iron and steel

TRD Wholesale and retail trade PUL Pulp, paper and paper products

EST Real estate

EMR Education, medical services and research Construction

CON

MAC Machinery MIN Mining

FIN Finance and insurance

AGR Agriculture, forestry and fishing

TRC Tranport and communications

Sector

Note that both labor productivity and TFP in construction, agriculture, and forestry and fishing are low. This is indicative of structurally low productivity sectors, calling for reforms in efficiency.

Declines in TFP for numerous non-manufacturing industries concur with previous studies such as Kawai and Inui (2003). It is particularly interesting that declines in TFP during the 1990s occurred in several industries for different problems. For example, finance, insurance and real estate had been holding bad debts. Agriculture, public administration and education had low productivity. Communication, electricity, and gas and water supply had been criticized as monopolies or oligopolies. These non-manufacturing industries should make efficiency in production a priority. In the final analysis, improving productivity in the non-manufacturing sectors of Japan's economy is the key to overcoming a long recession.

4 Concluding Remarks

This paper analyzed production factors using annual macroeconomic data over the 46 post-war years in determining the causes behind Japan's long recession of the 1990s. In conclusion, TFP of the entire Japanese economy did not have a tendency to decrease despite slowly decreasing labor productivity in the 1990s. Factors relating to capital caused negative macroeconomic growth in the 1990s. The distribution rate, operating ratio and growth rate of capital stock all tended to decline in the 1990s, leading to negative overall growth. Worsening the situation, shortened labor hours and a decrease in employees caused negative growth in labor. The combination of these slowed economic growth in the 1990s, despite the apparently positive growth rates of TFP through most of the 1990s.

We have considered the serious problem of capital stock data. When compared with flow data, a substantial discrepancy results, making reconciliation difficult. This point must be kept in mind throughout all studies on this topic.

We analyzed TFP by individual industry, and found interesting results. Eleven manufacturing-related industries and three non-manufacturing industries showed a tendency to increase TFP. However, nine non-manufacturing related industries actually indicated decreasing TFP. On the whole, we can say that Japanese industries have problems in efficiency, mainly in the non-manufacturing sectors.

References

- Economic and Social Research Institute, Cabinet Office (2004), <u>Annual Report on National Account 2004</u> (in Japanese), Economic and Social Research Institute, Cabinet Office.
- Hamada, K. and Horiuchi, A. ed. (2004), <u>The controversy: Japanese economic crisis</u> (in Japanese), Nihon Keizai Shinbunsya.
- Hayashi, F. and Prescott, E. C. (2002), 'The 1990s in Japan: A Lost Decade', <u>Review of Economic Dynamics</u>, 5, no.1, pp. 206-35.
- Ichihashi, M.(2006), 'Analysis for causes of Japanese long recession in 90's on Principle of Equivalent of three aspects' (in Japanese), Journal of Economic Policy Studies, vol. 57, pp. 67-84
- (2005), 'Structural change test of processed macro economic data' (in Japanese), <u>Studies in Social Sciences</u>, vol.31, pp.97-132.
- Inui, T. and Kwon, S. (2004), 'Survey: Did the TFP Growth Rate in Japan Decline in the 1990s? ' (in Japanese), <u>ESRI Discussion paper series</u> (Economic and Social Research Institute, Cabinet Office), No. 115, pp.1-42.
- Iwata, K. and Miyakawa, T. ed. (2003), <u>What is the true cause of lost decade</u>? (in Japanese), Toyo Keizai Shinpousya.

Kamada, K. and Masuda, S.(2001), 'An effect to Japanese GDP gap by measurement error of statistics' (in Japanese), <u>Monetary and Economic Studies</u> (Bank of Japan), vol.20, No.2, pp.123-170.

Kawai, K. and Inui, T.(2003),'A measurement of TFP and the factor analysis' (in Japanese), <u>The Economic Analysis</u> (Economic and Social Research Institute, Cabinet Office), No.170, pp.327-406.

Kawamoto (2004), 'What Do the Purified Solow Residuals Tell Us about Japan's Lost Decade?' (in Japanese), <u>Monetary and Economic Studies</u> (Bank of Japan), vol.23, No.4, pp.147-186.

Kobayashi, K. and Kato, S.(2001), The trap in Japanese Economy (in Japanese), Nihon Keizai Shinbunsya.

- Miyao, R.(2004), 'Declining of bank function and deflation in 1990s'(in Japanese), Hamada, K. and Horiuchi, A. ed., <u>The controversy: Japanese economic crisis</u>, Nihon Keizai Shinbunsya, Chap.7, pp.217-243.
- Morana, C. (2004), 'The Japanese stagnation: an assessment of the productivity slowdown hypothesis', Japan and the World Economy, 16, pp. 193-211.

Nakajima, T. (2001), Analysis of Productivity in Japanese Economy (in Japanese), Nihon Keizai Shinbunsya.

Noguchi, A. and Tanaka, H.(2001), <u>A misunderstanding for the theory of the structural reform</u> (in Japanese), Toyo Keizai Shinposya.

Shinozaki, A.(2003), Economic effect of Information Technology Innovation (in Japanese), Nihon Hyoronsya. (2007.2.23 受理)

Notes

¹ The data used in this paper is basically all the NEEDS database that the Nikkei Media Marketing is editing and publishing.

However, because the publishing period of data is different in each data, 68 SNA is connected directly with 93 SNA at the time of 1990 in this paper. When other data is used, we'll describe about data source clearly in every case.

Twenty-six industrial sectors are accepted and those sectors are agriculture, forestry and fishing, and mining, thirteen sectors related to manufacturing, construction, electricity, gas and water supply (all private), and other sectors including wholesale and retail trade, finance and insurance, real estate, transport and communications, service activities electricity, gas and water supply (public), education, medical services and research, public administration, and private nonprofit services. In addition, we treated the economy as the entire country and all manufacturing industries as total manufacturing.

² Agriculture, forestry and fishing, and textiles are also simultaneously cutting the number of workers. Hence, those sectors are considered to be declining in Japan.

³ In these tables, although the productivity of public electricity, gas and water supply tends to rise, education, medical services and research, and public administration decrease overall productivity.

⁴ It is possible to deflate only net fixed assets by the deflator of private capital formation, as we shall see later.

⁵ However, there are some differences in definitions between 68SNA and 93SNA. For example, liabilities in 93SNA include shares in both closing liabilities and financial assets, but liabilities in 68SNA exclude shares in both.

Other incongruities between 68SNA and 93SNA are notable. *Tangible fixed assets* and *intangible fixed assets* in 93SNA, which are net-based concepts, correspond with *net fixed assets* in 68SNA. Also, (*financial assets - of which shares*) and *of which shares* corresponds with *financial assets except corporate shares* and *corporate shares* in 68SNA. *Net worth* in 93SNA is equivalent with *Net worth (national wealth)* of *Corporate shares and net worth* in 68SNA. We maintained the corresponding relations of the above-mentioned concepts and decided the items.

⁶ As for the debt items, it is similar. Changes of debt in the Capital Finance Account in the Stock table are consistent with the debt totals less financial surplus or deficit in Capital Finance Accounts classified by institutional sector in the Flow tables. Moreover, saving, capital transfers and statistical discrepancy are also consistent with the corresponding items in Integrated Accounts.

⁷ Tangible non-produced assets mean tangible assets that are not a direct outcome of production such as land, forest, fishery and subsoil

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resources. These were called non-reproducible tangible assets in 68SNA. Tangible non-produced assets include accumulation and improvement of land, and developing fisheries for an increase of value.

⁸ Corporate shares in liabilities are the same as equity financing in the balance sheet.

⁹ Net worth is a peculiar stock concept in SNA and means net worth of a whole country = real assets + external assets.

¹⁰ This data corresponds with domestic gross fixed capital in the formation of the Capital Finance Account in the Integrated Account, which includes depreciation of capital.

¹¹ Refer to Nakajima (2001) for comprehensive Japanese TFP explanation.

¹² See Miyagawa (2006) and Inui and Kwon (2005) for a detailed survey concerning the comparison of Japanese TFP in the 1990s.

¹³ Besides, a bias upward in TFP could be caused by economies of scale and by mark-up ratio. Refer to Inui and Kwon (2005).

¹⁴ The unit root test and the structural change test for these dates were done in Ichihashi (2006). The result showed that real GDP was I(1) and there was no significant structural change except during the 1974 oil shock.

¹⁵ This deduction is estimated by the ratio of deduction from *Financial statements statistics of corporations by industry, quarterly.*

¹⁶ We found a similar result for TFP by gross capital stock of private enterprise data, though we report the result of TFP by real net fixed assets.

¹⁷ See http://www.meti.go.jp/statistics/index.html.

¹⁸ See Kawai and Inui (2003). Of course, actual measurement of TFP depends on how capital and labor are evaluated and on how operating ratio is considered.

¹⁹ See Inui and Kwon (2004).

 20 In the point to loosen assumption that the total of elasticity is one, our model (3) is not Cobb-Douglas type in a strict meaning. The theory of trans-log function and Divisia index also supports the idea that distribution ratio can be changeable. See Nakajima (2001).

²¹ Here, distribution ratio of *gross* capital must include depreciation costs of fixed capital but one of *net* capital does not include depreciation costs.

²² See Ichihashi (2006) about the method of deriving real value added according to the characteristics of the data.

²³ The reasons are as follows: Nominal share of taxes less subsidies tends to be higher, and secondly, nominal imputed interests, which are deducted from operating surplus, similarly tend to be evaluated higher.

²⁴ There is a peak at 1990 in Solow's residuals on Figure 7, but this is due to a difference in level when combining data.

 25 Average growth rates of real depreciation and investment in 70's were 4.3% and 2.9%, and those in 80's were 6.7% and 7.4%. Those in the 1990's were 3.7% and -0.1%.

²⁶ This table shows only a part of 26 industries.