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Sources of Growth and Stagnation in the Japanese Economy: An Analysis Based on Data for Listed Firms Spanning More Than Five Decades*

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Abstract

This study presents growth accounting and an analysis of productivity dynamics (as measured by labor productivity and total factor productivity, TFP) covering almost all listed firms in Japan spanning the 55-year period from 1960 to 2015 using the Development Bank of Japan's "Corporate Financial Databank" on listed firms. The results show that during much of the period, the productivity growth of listed firms diverged substantially from macroeconomic productivity trends: during the 1980s, when the Japanese economy received worldwide acclaim, listed firms' productivity growth declined substantially, while during the 1995–2010 period, when Japan's economy registered only tepid growth, listed firms enjoyed steady productivity improvements. Moreover, from 2010 to 2015, when the economy overall accelerated under "Abenomics," listed firms' productivity growth remained sluggish. This divergence in productivity trends between the economy overall and listed firms likely is due to differences in productivity growth between listed firms and other firms – primarily small and medium-sized firms – linked to their size, such as differences in terms of their speed of internationalization, investment in tangible and intangible assets, increases in part-time employment, and restructuring. This finding suggests that understanding differences in productivity linked to firm size is crucial for understanding productivity dynamics within Japan's economy, which has been characterized by a dual structure since the Meiji period. Meanwhile, our analysis of productivity dynamics shows that the contribution of the reallocation of resources from listed firms with low TFP to other listed firms to overall TFP growth among listed firms has been small, and that most of the overall TFP growth was due to TFP growth within firms (i.e., the within effect). The exception is the 2010–2015 period, when resource allocation in the nonmanufacturing sector made a substantial positive contribution to TFP growth.

Keywords: labor productivity, TFP, growth accounting, productivity dynamics
JEL classification: D24, O47

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1. Introduction

There are a substantial number of studies examining long-term productivity trends in Japan both at the industry level and for the economy overall. Examples include the studies by Jorgenson, Nomura, and Samuels (2016) and Fukao and Makino (2021), who analyzed industry-level total factor productivity (TFP) trends for the period from 1955 to the 2010s. However, a lack of adequate data means that, to the best of the authors' knowledge, there are few firm-level studies examining a similarly long time span. For instance, in the Census of Manufactures, microdata that could be used for such an analysis are available only from the 1980s onward. As a result, it has not been possible to examine productivity dynamic using firm-level data covering the high-speed growth (HSG) era from 1955–1970 and the first half of the stable growth period from 1970–1990. For this reason, how developments in factor inputs and productivity at the firm level during Japan's lost decades from the 1990s onward differed from the HSG era, when the Japanese economy achieved exceptional growth, as well as the period of stable growth is not well understood. Against this background, this study seeks to examine productivity trends among listed firms in Japan spanning the 55-year period from the 1960s to 2015 using corporate data from the Development Bank of Japan's "Corporate Financial Databank" (which we will refer to as the "DBJ Database").

The main findings of our study can be summarized as follows. First, the labor productivity and TFP growth of listed firms in the non-manufacturing sector already slowed down considerably in the 1970s, while that of listed firms in the manufacturing sector decelerated substantially during the 1980s. In fact, the slowdown in TFP growth during the 1980 was so severe that listed firms' labor productivity only continued to grow due to robust capital accumulation. Second, during 1995–2010, listed firms achieved high TFP growth. In the manufacturing sector, the TFP growth of listed firms was comparable to that of the HSG era (1960–1970) and the 1970s. In the non-manufacturing sector, TFP growth was the strongest since the HSG era. Further analysis will be necessary to determine how the structural reforms of the Koizumi government (2001–2006) contributed to the TFP growth. Third, labor productivity and TFP growth in both the manufacturing and the non-manufacturing sector decelerated in the 2010s. In terms of productivity growth, no clear impact of Abenomics can be discerned. These patterns in the performance of listed firms differ from developments in the economy overall as captured by the Japan Industrial Productivity (JIP) Database. To some extent, this can be explained by changes in productivity differences between firms of different sizes (see Fukao et al., 2014, for details): large firms performed poorly in the 1980s, small and medium-sized firms performed poorly from the 1990s to the early 2000s, and large firms performed poorly from 2007. Moreover, the factors driving both economic and labor productivity growth, i.e., increases in TFP, human capital, and the capital-labor ratio, have all decelerated at listed firms. It can therefore be said that the ability of Japan's large corporations to propel the economy forward is showing signs of decline.

On the other hand, our analysis of productivity dynamics suggests that the reallocation of resources from low-productivity to high-productivity listed firms made only a small contribution to the overall TFP growth of listed firms, and most of the overall growth in listed

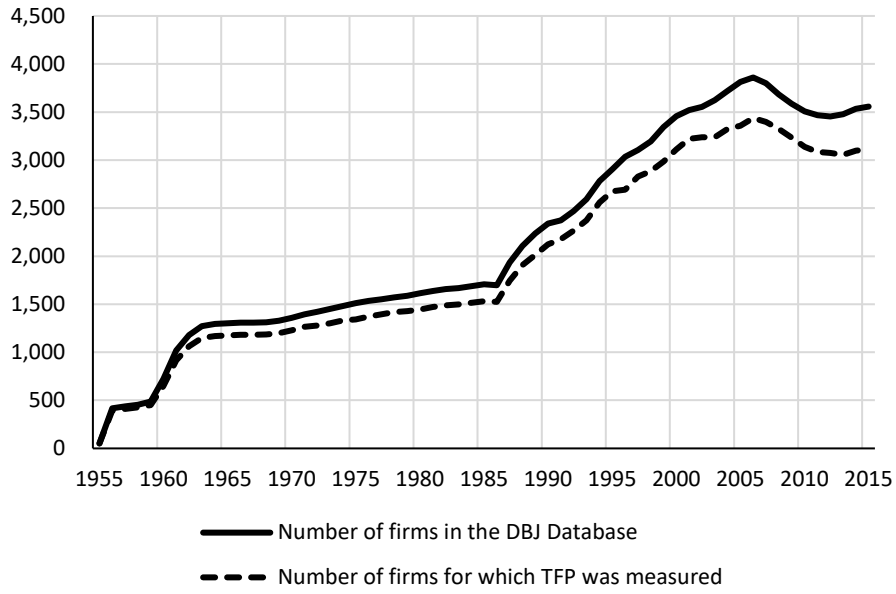
firms' TFP was generated by the TFP growth within firms (the within effect). That said, a large positive reallocation effect was observed in the non-manufacturing sector in 2010–2015.

The remainder of this study is organized as follows. The next section describes the data and variables used in our analysis. Section 3 presents growth accounting results for the labor productivity growth of listed firms. Section 4 then looks at developments in TFP growth by detailed industry and examines the extent to which the reallocation of resources across firms contributed to the TFP growth of listed firms overall. Finally, Section 5 summarizes the results and concludes.

2. Data and Variables

For our analysis, we use the DBJ Database, which contains financial data for listed firms. We construct variables such as firms' productivity using firm-level panel data spanning the period from 1955 to 2015. Figure 1 shows the number of firms included in the DBJ Database and the number of firms for which we were able to measure TFP.[1]

Figure 1. Number of firms in the DBJ Database and number of firms for which TFP was measured



The number of listed firms in the database increased from only 52 in 1955 to 1,020 in 1961, 2,106 in 1988, 3,034 in 1996, and peaked at 3,861 in 2006. The number of listed firms consistently increased from 1955 to 2006 along with the growth of the Japanese economy.

[1] When measuring firm-level TFP, we exclude firms as outliers if the log of their TFP in year t, $\ln TFP_{f,t}$, is more than three standard deviations from the average $\ln TFP_{f,t}$ (arithmetic mean of $\ln TFP_{f,t}$) for year t of the industry to which the firm belongs. Outliers likely are caused by rapid changes in major variables such as input and output due to changes at the firm such as organizational changes, or when the value of a major variable was zero. Outliers accounted for approximately 10% of all observations in the dataset.

Next, Figure 2 shows the number of firms in the manufacturing and the non-manufacturing sector in the database for which we were able to measure TFP, while Figure 3 shows the number of employees of these firms.

Figure 2. Number of firms in the manufacturing and the non-manufacturing sector (only firms for which TFP was measured)

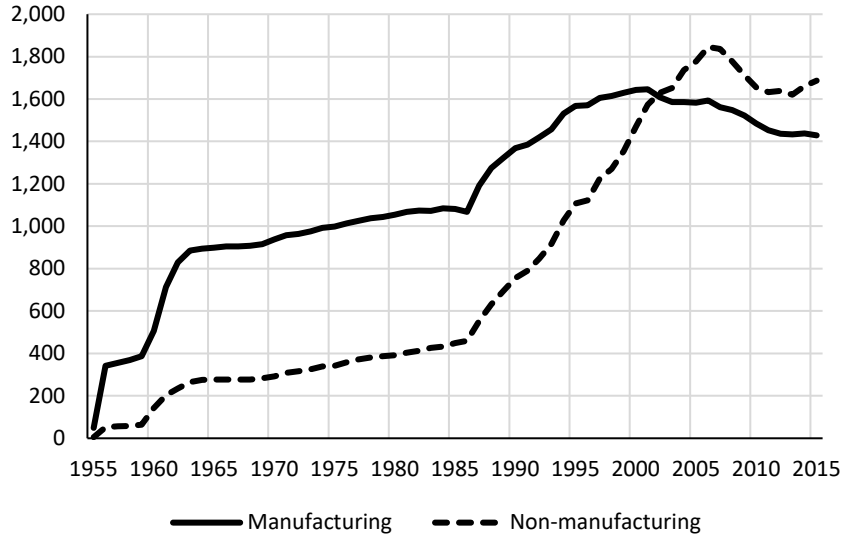
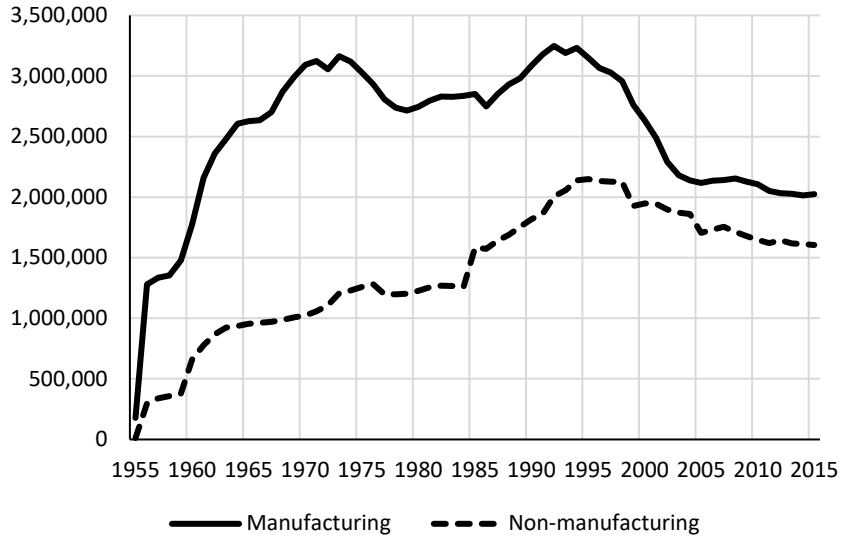


Figure 3. Number of employees in the manufacturing and the non-manufacturing sector (only firms for which TFP was measured)



Looking at the number of firms in our dataset, the number of non-manufacturing firms overtook that of manufacturing firms in the early 2000s; on the other hand, in terms of the number of employees of firms in our dataset, the non-manufacturing sector has lagged behind the manufacturing sector throughout the period, unlike in the economy as a whole. Thus, while

our dataset on listed firms generally covers production activities in Japan's manufacturing sector quite well, especially that of large firms, the coverage of the non-manufacturing sector in our dataset is low.

Next, we explain how we construct our data for the decomposition of labor productivity and TFP growth. We obtain firm-level labor productivity by dividing the real value added of a firm in a given year by the total hours worked, taking labor quality into account. Since data on firm-level total hours worked are not available, we estimated them by multiplying each firm's number of workers by the industry-level average hours worked per worker. Moreover, because information on labor quality is also not available at the firm level, we use industry-level labor quality instead. For industry-level hours worked per worker and labor quality, we use the long-term industry-level data prepared by Fukao and Makino (2021). Specifically, they constructed the "Japan Industrial Productivity (JIP) Database for the High-Speed Growth Era (1955–1970)" for 24 industries. Further, using the JIP Database 2015, which covers the period 1970–2012, for the period 1970–2000, and the JIP Database 2018, which covers the period 1994–2015, for the period 2000–2015, they aggregated the data for these 24 industries and then linked them to construct long-term industry-level data.

We obtain nominal value added by subtracting nominal intermediate inputs from gross sales. Nominal intermediate inputs are calculated by subtracting total wages and depreciation from the total of cost of goods sold and selling, general, and administrative expenses. However, for the retail and wholesale sectors, we subtract the amount of purchases from total sales and intermediate inputs, respectively. The deflator used to convert nominal into real value added is also taken from the long-term industry-level data from Fukao and Makino (2021). [2]

We obtain real capital stock by multiplying the nominal value of tangible fixed assets excluding land at the end of the period by the industry-level market-to-book ratio for tangible fixed assets excluding land taken from the Financial Statement Statistics of Corporations by Industry (market values were estimated using the perpetual inventory method).

For the analysis of productivity dynamics, we calculate each firm's TFP level relative to the industry average of the industry in which the firm operates using the index method employed by Good, Nadiri and Sickles (1997). Specifically, the logarithm of the TFP level of firm *f* at time *t*, $\ln TFP_{f,t}$, is compared with the logarithm of the TFP level of the representative firm of the industry to which the firm belonged in the initial period (*t*=0, 1955), $\ln TFP_0$, i.e.:

$$\ln TFP_{f,t} = \left(\ln VA_{f,t} - \overline{\ln VA_{f,t}}\right) - \sum_i \frac{1}{2}\left(S_{f,i,t} + \overline{S_{\iota,t}}\right)\left(\ln X_{f,i,t} - \overline{\ln X_{\iota,t}}\right), \qquad for\ t = 1955, \tag{1}$$

and

[2] By using industry-level data for a given variable in the productivity analysis of listed firms, we are implicitly assuming that the rate of change in this variable is identical for listed and unlisted firms as well as across listed firms.

$$\ln TFP_{f,t} = \left(\ln VA_{f,t} - \overline{\ln VA_t}\right) - \sum_i \frac{1}{2}\left(S_{f,i,t} + \overline{S_{i,t}}\right)\left(\ln X_{f,i,t} - \overline{\ln X_{i,t}}\right)$$
$$+ \sum_{s=1}^{t}\left(\overline{\ln VA_s} - \overline{\ln VA_{s-1}}\right) - \sum_{s=1}^{t}\sum_i \frac{1}{2}\left(\overline{S_{i,s}} + \overline{S_{i,s-1}}\right)\left(\overline{\ln X_{i,s}} - \overline{\ln X_{i,s-1}}\right), \qquad for\ t \geq 1956. \tag{2}$$

where $VA_{f,t}$ is the real value added of firm f in period t, $S_{i,f,t}$ is the cost share of production factor i at firm f, and $X_{i,f,t}$ is firm f's input of production factor i. In addition, variables with a bar are the industry average of that variable. The factors of production we consider in our analysis are capital and labor. Labor input is the total hours worked taking labor quality into account, which we obtain by multiplying the number of employees at the end of the period with the industry-level average annual hours worked per person and the industry-level average labor quality index. The cost of capital is calculated by multiplying the real capital stock of each firm by the industry-level service price of capital estimated by Fukao and Makino (2021).

We exclude firms whose TFP level as measured above falls into the top or bottom 2% of firms in each industry and year as outliers. Similarly, we exclude firms whose TFP growth rate falls into the top or bottom 2% of firms in each industry and year as outliers.

3. The Sources of Labor Productivity Growth: Growth Accounting

We start by examining the extent to which labor productivity growth and the sources of labor productivity growth for listed firms overall differed from productivity trends in the market economy overall.

We regard all listed firms as a single economy and use decomposition analysis to examine the trends in labor productivity growth and the sources underlying these trends for all listed firms. Specifically, we assume that the total value added and hours worked for all firms are the sum of the value added and hours worked of individual firms and measure the labor productivity growth of all listed firms from period $t-\tau$ to period t, $\Delta \ln LP_{t-\tau,t}$, as follows:

$$\Delta \ln LP_{t-\tau,t} = (\ln VA_t - \ln VA_{t-\tau}) - (\ln L_t - \ln L_{t-\tau}) \tag{3}$$

Moreover, for the decomposition of labor productivity growth, we use a different definition from equations (1) and (2) for TFP growth on a value added basis. Specifically, we define and measure the value-added TFP growth from period $t-\tau$ to period t for all listed firms, $\Delta \ln TFP^{VA}_{t-\tau,t}$, as follows:

$$\Delta \ln TFP^{VA}_{t-\tau,t} = (\ln VA_t - \ln VA_{t-\tau}) - \frac{1}{2}(s^K_t + s^K_{t-\tau})(\ln K_t - \ln K_{t-\tau})$$
$$- \frac{1}{2}(s^L_t + s^L_{t-\tau})(\ln L_t Q_t - \ln L_{t-\tau} Q_{t-\tau}) \tag{4}$$

Equation (4) differs from equations (1) and (2), which are equations for measuring TFP for the analysis of productivity dynamics. The reason for using equation (4) is that whereas equations (1) and (2) measure the TFP of individual firms to examine productivity dynamics, in this section we measure the TFP growth of all listed firms and compare this with the TFP growth of the economy as a whole.

Meanwhile, capital stock *K*, as mentioned, is calculated by multiplying firms' total tangible fixed assets excluding land by the market-to-book ratio of tangible fixed assets calculated from the Financial Statement Statistics of Corporations by industry. Moreover, *L* is firms' total number of employees at the end of the year, *M*, multiplied by the industry-level average annual hours worked per person in the JIP Database 2018, *H* (i.e. *L*=*MH*), and *Q* is the labor quality index (2011=1). s_t^K and s_t^L represent the cost shares of capital and labor, respectively.

Equations (3) and (4) can be combined to yield equation (5):

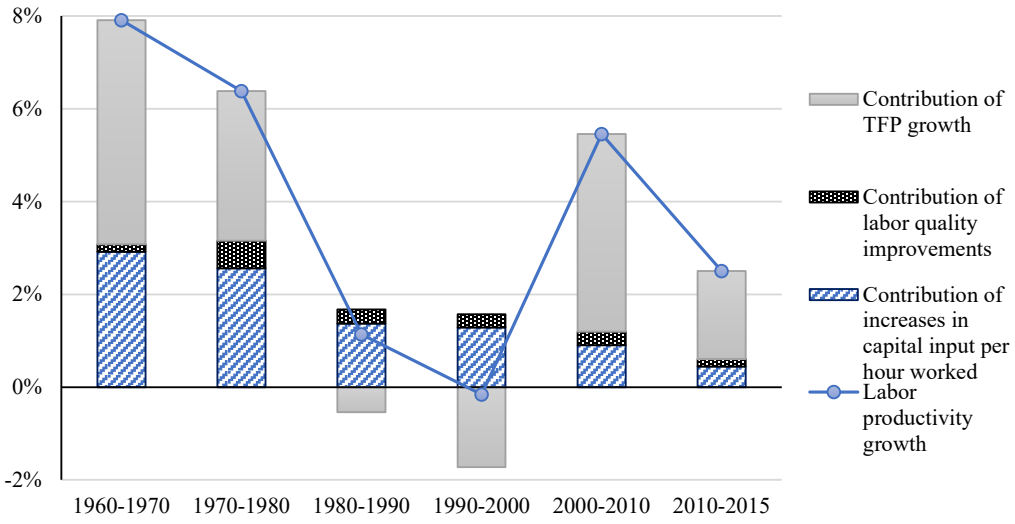
$$\Delta \ln LP = \left(1 - s^L\right)\left(\ln \frac{K_t}{MH_t} - \ln \frac{K_{t-\tau}}{MH_{t-\tau}}\right) + s^L \left(\ln Q_t - \ln Q_{t-\tau}\right) + \Delta \ln TFP_{t-\tau,t}^{VA} \tag{5}$$

Equation (5) shows that increases in labor productivity (real value added per total hours worked, *VA*/*MH*) can be decomposed into the contribution of increases in capital input per hour worked, $\left(1 - s^L\right)\left(\ln \frac{K_t}{MH_t} - \ln \frac{K_{t-\tau}}{MH_{t-\tau}}\right)$, the contribution of increases in labor quality, $s^L \left(\ln Q_t - \ln Q_{t-\tau}\right)$, and the contribution of increases in TFP, $\Delta \ln TFP_{t-\tau,t}^{VA}$.

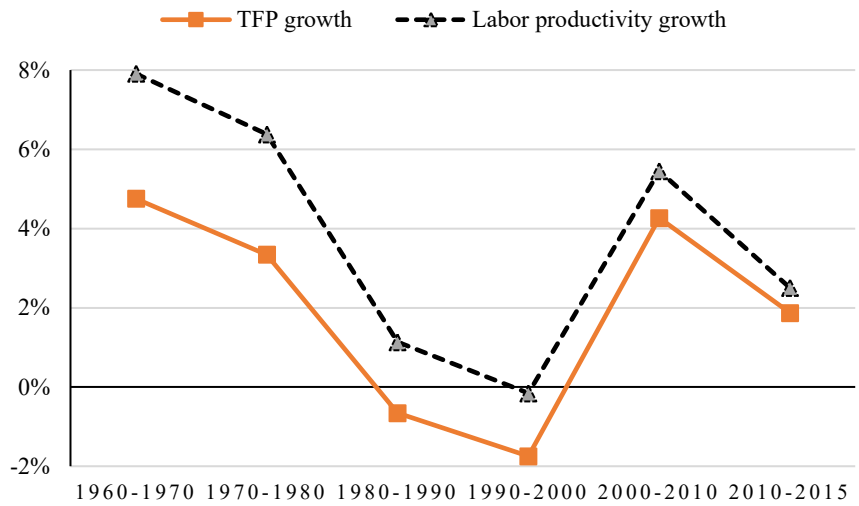
Using this decomposition approach and the DBJ Database from 1960 to 2015, we decompose the growth rate of labor productivity in each decade into the contribution of the three different factors.

The results of the decomposition of labor productivity growth of all listed firms are summarized in Figure 4. Detailed figures are presented in Appendix Table A1.

Figure 4. Sources of labor productivity growth: All listed firms (annual average rate)



Source: Authors' calculations based on the DBJ Database.



Source: Authors' calculations based on the DBJ Database.

Table 1. Sources of labor productivity growth: The whole economy (annual average rate)

		1955-1970	1970-1990	1990-2015
Labor productivity growth	a=b+c+d	8.7%	4.0%	1.4%
Contribution of increases in capital input per hour worked	b	3.1%	1.7%	0.8%
Contribution of labor quality improvements	c	0.4%	0.8%	0.4%
Contribution of TFP growth	d	5.2%	1.6%	0.3%

Source: Fukao and Makino (2021, Table 1).

Figure 5 shows that developments in listed firms' labor productivity over the 55-year period were primarily driven by changes in TFP. The correlation coefficient between labor productivity growth and TPF growth is 0.971. Meanwhile, as shown by the gap between the two, before 1990, the rate of labor productivity growth was much higher than the rate of TFP growth, reflecting the fact that during this period labor productivity growth was pushed up by increases in the capital-labor ratio and increases in the quality of labor, as will be discussed later.

Let us examine the results of the decomposition of labor productivity growth by period based on the periods used by Fukao and Makino (2021). As shown in Figure 4, the labor productivity of listed firms overall rose at a rapid annual rate of 7.9% between 1960 and 1970, the HSG era (1955–1970), meaning that the labor productivity of listed firms overall rose by a factor of 2.2 (= exp(7.9 x 10)) in just ten years. The largest source of labor productivity growth was TFP growth, which rose at an annual rate of 4.8%, explaining 60% of the increase in labor productivity. The next largest source was capital input per hour worked, which increased at an annual rate of 2.9%. Thus, while the commonly accepted notion is that Japan's "growth miracle" during this period was driven by capital accumulation, our results suggest that – at least for large firms – TFP growth was more important.[3] On the other hand, the contribution of increases in labor quality, at an annual rate of 0.2%, was marginal.

These results for the HSG era are generally consistent with Fukao and Makino's (2021) findings for the economy as a whole. Specifically, for the period 1955–1970, Fukao and Makino (2021) report that the main sources of the extremely rapid increase in labor productivity (averaging 8.7% per year over the period) were TFP growth (accounting for 5.2 percentage points per year) and increases in capital services inputs (accounting for 3.6 percentage points per year). Thus, in terms of the size of the growth rates and the relative importance of the growth contribution of the different factors, our results for listed firms are quite similar to those for the economy overall.

Tables 2 to 4 show the sources of labor productivity growth for the period 1955–2015 in five-year intervals for the macroeconomy (including housing), manufacturing, and non-

[3] Growth accounting for the macroeconomy indicates that while the main source of growth in Singapore, Taiwan, and South Korea during their respective "growth miracles" from the 1970s onward was capital accumulation, in the case of Japan's HSG era, TFP growth played a major role (Fukao, Makino, and Settsu, forthcoming). Moreover, Fukao (2020) suggests that most of the capital accumulation during the HSG era took place not at listed firms but in areas such as the building of roads, ports, and housing.

manufacturing (market economy only, excluding housing and unclassified), using data from Fukao and Makino (2021).

Table 2. Sources of labor productivity growth in the macroeconomy (including housing) (annual average rate)

		1955-60	1960-65	1965-70	1970-75	1975-80	1980-85	1985-90	1990-95	1995-2000	2000-05	2005-10	2010-15
GDP growth	a=b+c	9.9%	10.3%	11.7%	4.2%	5.2%	4.0%	4.6%	1.1%	1.0%	0.9%	-0.2%	0.9%
Growth in hours worked	b	3.0%	1.1%	1.6%	-0.4%	1.3%	0.4%	0.7%	-0.5%	-1.1%	-0.7%	-0.9%	-0.1%
Labor productivity growth	c=d+e+f+g+h	6.9%	9.2%	10.1%	4.7%	3.9%	3.5%	3.9%	1.7%	2.1%	1.6%	0.7%	1.0%
Contrib. of increases in capital-labor ratio		1.9%	4.0%	3.4%	2.0%	1.2%	1.8%	1.8%	1.6%	1.2%	0.7%	0.4%	0.1%
Contrib. of increases in capital input	d	2.8%	4.3%	3.8%	1.9%	1.5%	2.0%	2.0%	1.4%	0.8%	0.4%	0.1%	0.0%
Contrib. of increases in hours worked	e	-0.8%	-0.3%	-0.4%	0.1%	-0.3%	-0.1%	-0.2%	0.2%	0.4%	0.3%	0.3%	0.0%
Contrib. of increases in labor quality		0.7%	0.3%	0.4%	1.0%	0.8%	0.9%	0.4%	0.5%	0.6%	0.3%	0.3%	0.1%
Contrib. of increases in labor quality (excl. reallocation effect)	f	0.6%	-0.1%	0.2%	0.9%	0.6%	0.8%	0.3%	0.4%	0.5%	0.3%	0.3%	0.2%
Contrib. of increases in labor quality through reallocation effect	g	0.0%	0.3%	0.2%	0.2%	0.1%	0.1%	0.0%	0.0%	0.1%	0.0%	0.0%	-0.1%
TFP growth	h	4.3%	4.9%	6.3%	1.7%	2.0%	0.8%	1.8%	-0.4%	0.4%	0.6%	0.0%	0.8%

Note: Calculated based on the data used in Fukao and Makino (2021). Note that in our analysis social capital for which no compensation is paid at the time of use, such as general roads, mountain and flood control, coastal areas, and urban parks, is not included in the capital stock. The same applies to Tables 3 and 4.

		1955-60	1960-65	1965-70	1970-75	1975-80	1980-85	1985-90	1990-95	1995-2000	2000-05	2005-10	2010-15
GDP growth	a=b+c	14.4%	14.6%	16.3%	2.7%	7.5%	7.1%	5.1%	0.5%	0.9%	1.0%	0.8%	0.7%
Growth in hours worked	b	6.9%	3.1%	2.3%	-2.4%	0.7%	1.0%	0.6%	-2.8%	-2.3%	-2.8%	-2.1%	-1.1%
Labor productivity growth	c=d+e+f+g+h	7.5%	11.5%	14.1%	5.1%	6.8%	6.1%	4.5%	3.3%	3.2%	3.9%	3.0%	1.8%
Contrib. of increases in capital-labor ratio		2.5%	3.7%	3.1%	1.8%	0.2%	1.3%	1.7%	2.2%	1.2%	1.4%	1.2%	0.4%
Contrib. of increases in capital input	d	3.9%	4.5%	3.7%	1.2%	0.4%	1.6%	1.8%	1.3%	0.5%	0.4%	0.3%	0.0%
Contrib. of increases in hours worked	e	-1.5%	-0.8%	-0.5%	0.6%	-0.2%	-0.3%	-0.1%	0.9%	0.7%	1.1%	0.9%	0.4%
Contrib. of increases in labor quality		0.1%	0.2%	0.5%	0.9%	0.5%	0.7%	0.3%	0.5%	0.5%	0.4%	0.3%	0.2%
Contrib. of increases in labor quality (excl. reallocation effect)	f	0.0%	0.1%	0.3%	0.8%	0.5%	0.5%	0.3%	0.4%	0.4%	0.3%	0.3%	0.1%
Contrib. of increases in labor quality through reallocation effect	g	0.1%	0.1%	0.1%	0.1%	0.0%	0.2%	0.0%	0.1%	0.1%	0.1%	0.0%	0.1%
TFP growth	h	5.0%	7.6%	10.5%	2.4%	6.1%	4.1%	2.5%	0.6%	1.5%	2.1%	1.5%	1.2%

Note: See Table 2.

Table 4. Sources of labor productivity growth in the non-manufacturing sector (market economy only, excluding housing and unclassified) (annualized average)

		1955-60	1960-65	1965-70	1970-75	1975-80	1980-85	1985-90	1990-95	1995-2000	2000-05	2005-10	2010-15
GDP growth	a=b+c	8.4%	8.6%	10.3%	4.4%	4.1%	3.0%	5.7%	0.9%	0.6%	0.8%	-1.0%	0.9%
Growth in hours worked	b	1.9%	0.2%	1.4%	-0.1%	1.3%	-0.1%	0.8%	0.0%	-1.4%	-0.9%	-1.1%	-0.3%
Labor productivity growth	c=d+e+f+g+h	6.5%	8.5%	8.9%	4.5%	2.8%	3.0%	4.8%	0.9%	1.9%	1.7%	0.0%	1.1%
Contrib. of increases in capital-labor ratio		2.0%	4.2%	3.4%	1.9%	1.2%	1.9%	1.7%	1.4%	1.1%	0.7%	0.4%	0.1%
Contrib. of increases in capital input	d	2.5%	4.2%	3.8%	1.9%	1.5%	1.9%	2.0%	1.4%	0.7%	0.4%	0.1%	0.0%
Contrib. of increases in hours worked	e	-0.5%	0.0%	-0.4%	0.0%	-0.3%	0.0%	-0.2%	0.0%	0.4%	0.3%	0.3%	0.1%
Contrib. of increases in labor quality		0.8%	0.2%	0.3%	1.3%	1.0%	1.1%	0.4%	0.4%	0.6%	0.4%	0.3%	0.2%
Contrib. of increases in labor quality (excl. reallocation effect)	f	0.6%	-0.3%	0.0%	1.0%	0.7%	1.1%	0.3%	0.4%	0.6%	0.4%	0.4%	0.3%
Contrib. of increases in labor quality through reallocation effect	g	0.1%	0.5%	0.3%	0.2%	0.2%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	-0.1%
TFP growth	h	3.8%	4.1%	5.2%	1.3%	0.7%	0.1%	2.7%	-0.9%	0.2%	0.7%	-0.7%	0.8%

Note: See Table 2.

Table 2 for the macroeconomy overall shows that annual labor productivity growth accelerated from 6.9% in 1955–1960 to 9.2% in 1960–1965 and 10.1% in 1965–1970. While increases in capital input made a substantial contribution, the main source of growth was TFP growth, which accelerated from 4.3% to 4.9% and 6.3%. Table 3 shows that this impressive growth performance was mainly driven by the manufacturing sector, where TFP growth accelerated from 5.0% to 7.6% and 10.5%. During this period, the steel, shipbuilding, industrial machinery, automobile, and electrical machinery industries not only made large capital investments to pursue economies of scale that rapidly lowered average costs but also successfully introduced more efficient production methods and technologies. Examples of the development of proprietary technologies include the introduction of integrated complexes in the petrochemical and steel industries, block construction methods in the shipbuilding industry, and the Toyota Production System (Shimotani, 2009) and of efficient and flexible mass production systems that combine quality control measures with a Japanese-style personnel system consisting of vague job classifications and flexible job assignments, extensive in-house training, an internal promotion system with appraisals, and job security (Moriguchi, 2017), as well as human capital accumulation and the formation of close supply chains, all of which are thought to have contributed to the rise in TFP. Jorgenson, Nomura, and Samuels (2016) find that TFP in manufacturing industries such as motor vehicles, computer and electronic products, and primary metals had reached U.S. levels by the mid-1970s. Moreover, new products such as black-and-white televisions, electric washing machines, electric refrigerators, passenger cars, and air conditioners were introduced in rapid succession, requiring constant large-scale capital investment to ensure that production capacity could keep up with the rapid increase in consumer spending. Thus, the HSG era was a period of economic growth supported by rapid productivity growth and vigorous private investment.

Following the "Golden 60s," the Japanese economy faced a number of challenges in the 1970s, including the collapse of the fixed exchange rate system (adjustable peg system) and the appreciation of the yen in the wake of the Nixon Shock (1971), two oil crises (1973 and 1979–1980), and a surge in inflation in 1973–74. Although labor productivity and TFP growth decelerated from the heady pace of the 1960s, Japan's economy overall still registered respectable productivity growth in the 1970s, with labor productivity growing at an average annual rate of 4.7% in the first half of the decade and 3.9% in the second, while TFP grew by 1.7% and 2.0%, respectively. In fact, our results for listed firms in Figure 4 indicate that the productivity of listed firms continued to grow quite a rapid pace. However, listed firms' productivity growth then plummeted in the 1980s, indicating that they experienced "a lost decade" before the economy overall entered the "two lost decades" of the 1990s and 2000s.[4] Thus, we find that the pattern for listed firms differs substantially from the results for the macroeconomy in Table 1, where productivity growth fell sharply in the 1990s after the collapse of the bubble economy and continued to remain sluggish until the end of our observation period in 2010–2015.

[4] Our result for listed firms is in line with findings by Inui et al. (2015), who focused on large firms with paid-in capital of at least 600 million yen and showed that the TFP of such firms stagnated in the 1980s.

Looking at the results in Figure 4 for listed firms in more detail, we find that their TFP growth was negative in the period 1980–1990 (−0.5% per year) and in the period of economic stagnation from 1990–2000 (−1.7% per year) following the collapse of the bubble economy. Despite the negative TFP growth, the labor productivity of listed firms continued to grow at about 1.1% a year in the 1980–1990 period and declined relatively little (by 0.2% per year) in the 1990–2000 because of active capital accumulation throughout the two decades. As a result, the factor that contributed most to maintaining listed firms' labor productivity growth during this period was the increase in capital input per hour worked.

Let us consider why the TFP of listed firms fell in the 1980s and 1990s. First of all, the escalation of trade frictions between Japan and the United States, which led to increased pressure from the United States on Japan's major exports, dealt a heavy blow to Japan's major automobile and electronics companies. For example, the voluntary export restraints on automobile exports to the United States that began in 1981 and lasted until 1993 and the U.S.-Japan Semiconductor Agreement signed in 1986 put pressure on major exporters that had been the drivers of the Japanese economy.[5] Second, Japan's huge current account surplus and the adjustment of Reaganomics in the United States (aimed at a soft landing for the dollar) created pressure for a stronger yen, which eventually led to the ultra-strong yen after the Plaza Accord in 1985. The strong yen further hurt Japanese exporters. Third, Japan had finished the technological catch-up with the United States in the mid-1970s in areas such as motor vehicles, computer and electronic products, and primary metals (Jorgenson, Nomura, and Samuels, 2016) and started to have to push the technological frontier itself. Further reasons for the fall in TFP growth in the 1980s and 1990s are, fourth, the fact that basic research and software became more important than *monozukuri* (manufacturing), which is Japan's forte in information technology industry, and fifth, large-scale national projects such as the Fifth Generation Computer Systems project from 1982, the Software Industrialized Generator and Maintenance Aids (SIGMA) project from 1985, and the Real World Computing project from 1992 failed and innovation stagnated. Sixth, East Asian countries such as Taiwan, South Korea, and China, which, like Japan during its period of high economic growth, had large numbers of cheap and skilled workers, caught up with Japan and reduced the relative competitiveness of Japan's manufacturing industry.

As shown in Figure 3, the manufacturing sector accounts for the majority of employees in our data on listed firms and the employment share of the manufacturing sector is much higher than in the economy overall. In the economy overall, the share of the manufacturing sector in total hours worked ranged from 27% in 1970 to 24% in 1980, 24% in 1990, 20% in 2000, and 18% in 2012, which is much lower than the share among listed firms. Moreover, among manufacturers, listed firms have tended to be more strongly affected by trade frictions and the appreciation of the yen, because they export a much higher percentage of their sales than

[5] That said, examining the impact of voluntary export restraints (VERs), Berry, Levinsohn, and Pakes (1999) found that, different from what one might expect, while the VERs substantially increased the profits of U.S. firms, the decrease in profits of Japanese firms was relatively small.

unlisted firms (see, e.g., Miyagawa and Tokui, 1994).[6] Our finding that, unlike in Fukao and Makino's (2021) results for the macroeconomy and the manufacturing sector as a whole, the TFP of listed firms declined in the 1980s partly reflects these differences in the data. How the productivity trends of listed firms in the manufacturing and non-manufacturing sectors differed, and how the productivity performance of firms of different sizes within the same industry differed will be examined in more detail later.

Meanwhile, the negative TFP growth of listed firms in the early 1990s, in addition to the damage to balance sheets caused by the collapse of the bubble economy and the slump in demand, particularly domestic demand, possibly also reflects the so-called "zombie problem." According to Hoshi (2006), while zombie firms – i.e., firms whose actual interest payments were below the minimum interest payment – made up only about 5–10% of all listed firms in the 1980s, the share of such firms began to increase after the collapse of the bubble economy and reached a high of 30% in 1996. Ahearne and Shinada (2005), using the same data and method to examine productivity dynamics as this study, found that the increase in the output share of firms with low TFP in the wholesale and retail, construction and civil engineering, and cargo road transport industries in the 1990s slowed down overall productivity growth.

Although economic growth overall remained sluggish throughout the 1990s and 2000s, the TFP growth of listed firms recovered substantially in the second half of the 1990s (see Figure 4 above and Figures 6 and 7 below, which show the results for five-year intervals). Especially during the 2000–2005 period, the labor productivity and TFP growth of listed firms was extremely strong. However, in 2005–2010, labor productivity growth decelerated again, likely reflecting the global financial crisis and the Tohoku earthquake. Interestingly, listed firms' labor productivity growth continued to deteriorate in the 2010–2015 period, which coincided with the start of Abenomics, while labor productivity growth in the macroeconomy accelerated somewhat, reflecting the economic recovery due to the weakening of the yen and other factors.

It is worth highlighting how remarkable the recovery in both TFP and labor productivity growth was during 2000–2005, the period when the Koizumi government (2001-2006) implemented "structural reforms without sanctuaries." As can be seen in Figures 6 and 7, the labor productivity growth of listed firms in the manufacturing sector during this period was comparable to that during the HSG era, and TFP growth even surpassed that during the HSG era. Listed firms in the non-manufacturing sector also recorded the highest labor productivity and TFP growth since the HSG era, although growth rates did not quite reach the levels of the HSG era.

Let us consider possible reasons why Japan's listed firms emerged in the mid-1990s from the stagnation that followed the bubble economy. First, structural reforms likely had had an impact. The government promoted corporate restructuring and corporate governance reforms by weakening the rights of minority shareholders through amendments to the Companies Act,

[6] However, large firms started moving production overseas in the 2000s and since then likely have been more resistant to trade frictions and a strong yen than small and medium-sized firms.

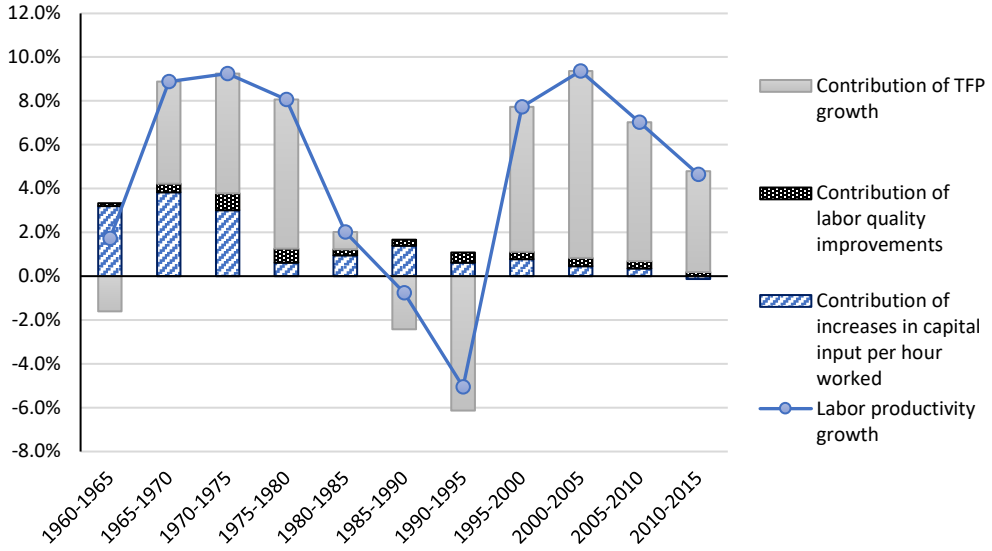
introducing mechanisms for share exchanges and transfers and for corporate splits, and offering preferential tax treatment for corporate restructuring. In addition, it introduced legislation allowing the establishment of limited liability companies and holding companies. Further, the "Large-Scale Retail Store Location Law" came into effect on June 1, 2000, facilitating the opening of large-scale stores of 1,000 square meters or more. In construction, the open competitive bidding system was greatly expanded to prevent collusion among firms and to promote competition. Meanwhile, the Worker Dispatching Act was revised to make it easier to hire non-regular workers.

Second, a lot of voluntary restructuring by firms took place. In their analysis of listed firms in the manufacturing sector, Asaba and Ushijima (2008) showed that more than 20% of firms downsized in the late 1990s, reducing the number of employees and assets by 5% or more compared to the previous year. Meanwhile, also focusing on large firms, Kwon, Kim, and Fukao (2008) found that firms engaged in exports, overseas investment, and research and development succeeded in accelerating TFP growth by implementing restructuring measures that reduced employment and capital. Meanwhile, Ito, Genda, and Takahashi (2008) found that Japanese firms reduced employment through voluntary retirement, and that the implementation of voluntary retirement raised labor productivity by 3%.

Third, large firms in the electronics and automobile industries streamlined their operations by closing inefficient domestic factories and moving production overseas, as well as by curtailing relationships with suppliers that did not possess key technologies, as exemplified by the Nissan Revival Plan (Fukao, 2020). Meanwhile, in addition to these reasons for the acceleration in listed firms' productivity growth in 2000–2005, the recovery process from the 1997 financial crisis in Japan and the 1997–1998 Asian currency crisis likely also played a role.

To examine listed firms' productivity growth in more detail, we also conducted growth decompositions for the manufacturing and the non-manufacturing sector separately. Figure 6 shows the results for the manufacturing sector. Labor productivity in the manufacturing sector was not much affected by the business cycle, growing rapidly from 1960 to 1980, stagnating or falling from 1980 to 1995, and growing rapidly again after 1995, with growth rates reaching levels comparable to the HSG era.

Figure 6. Sources of labor productivity growth: Manufacturing sector (annual average rate)[7]



Source: Authors' calculations based on the DBJ Database.

As shown in Figure 6, the TFP growth of listed manufacturing sector firms recovered rapidly from 1995 onward. Nevertheless, the TFP growth of Japan's manufacturing sector overall remained relatively sluggish after 1995. The reason likely is that, as shown by Fukao (2012), while the productivity growth of large establishment increased in the 1990s, the TFP growth of medium-sized and smaller establishments (SMEs) fell substantially.

Ikeuchi et al. (2013) argue that the relocation of production abroad by large R&D-intensive firms has weakened long-term transaction relationships, which used to be one of the key characteristics of Japan's production system, and reduced R&D spillover effects propagated through interfirm transaction relationships. This likely reduced the productivity growth of small and medium-sized firm, which, unlike those in the United States, do not invest much in R&D. The closure of plants with relatively high productivity due to the transfer of production overseas by large firms (Fukao, 2020, chapter 5) and the decline in the R&D spillover effects likely reduced TFP growth in the manufacturing sector after 1995. As shown by Yamaguchi et

[7] The figures for the chart are provided in Appendix Table A2.

al. (2019), in Japan, R&D by suppliers and capital tie-up partners tended to act as a substitute for small firm's own R&D investment. Therefore, as R&D spillover from large firms declined, SMEs acting as subcontractor would have had to increase their own R&D to maintain TFP growth, but most did not do so.

Meanwhile, unlike labor productivity in the manufacturing sector overall, the labor productivity of listed firms in the manufacturing sector continued to grow relatively steadily during the 2000s and early 2010s. The driving force behind this recovery was the steady increase in TFP. On the other hand, the contribution of increases in capital services input per hour worked has been declining. Moreover, the contribution of increases in labor quality also gradually declined. This contrasts with the important role played by capital accumulation and increases in labor quality in the labor productivity growth of listed firms in the manufacturing sector during the HSG era and the period of stable growth. The sluggish contribution of capital accumulation in the manufacturing sector since the 1990s may be attributable to corporate restructuring and the transfer of production overseas. Meanwhile, in addition to restructuring and the transfer of production overseas, tax breaks for information technology (IT) investment, tax reductions for experimental research expenses, and reform of the system of special depreciation rates for R&D equipment may have contributed to the increase in TFP in the manufacturing sector since 2000.

Figure 7. Sources of labor productivity growth: Non-manufacturing sector (annual average rate)[8]

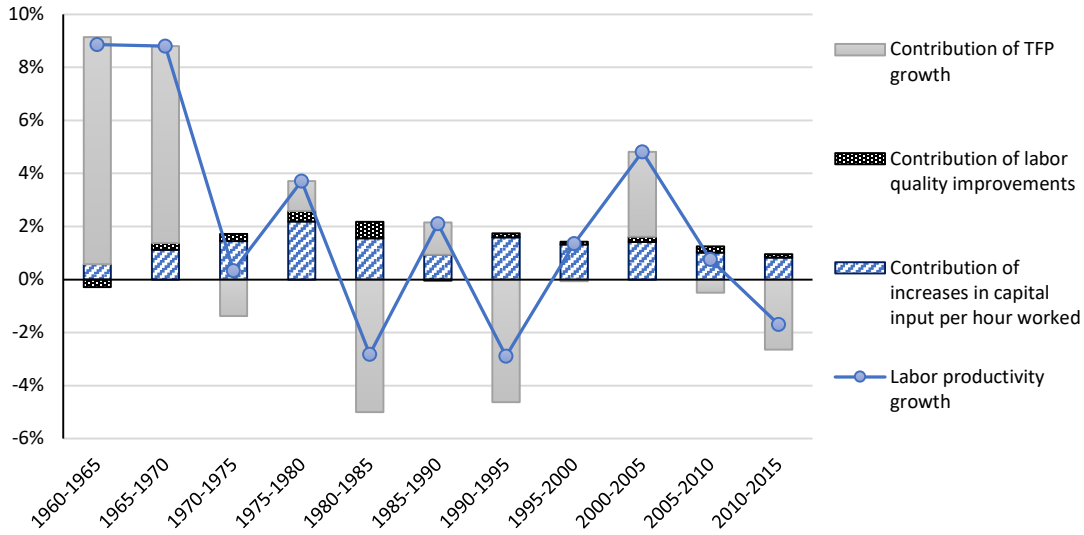


Figure 7 shows the results of the decomposition of the labor productivity growth of firms in the non-manufacturing sector. The figure indicates that labor productivity in the non-manufacturing sector is closely linked to the business cycle.[9] This is consistent with the result

[8] The figures for the chart are provided in Appendix Table A3.
[9] The reason why developments in the labor productivity of non-manufacturing firms differ considerably from

obtained by Miyagawa, Sakuragawa, and Takizawa (2006), who found that the correlation between productivity and the business cycle is stronger in the non-manufacturing sector than the manufacturing sector.

Looking at the sources of labor productivity growth of listed firms in the non-manufacturing sector shows that increases in capital services input per hour worked consistently made a positive contribution throughout the 55-year period. It is interesting to note that whereas in the manufacturing sector, the contribution of capital accumulation to labor productivity growth declined substantially from 1990 onward, in the non-manufacturing sector, capital accumulation continued to make a relatively solid contribution to labor productivity growth after 1990.

Given the steady contribution of capital accumulation, it is mainly developments in TFP growth that, like in the manufacturing sector, have determined developments in labor productivity growth overall. TFP growth of listed firms in the non-manufacturing sector was highest during the HSG era (1960–1970). During this period, self-service supermarkets such as Toko Store (1956), Seiyu Store (1956), and Daiei (1957) made their appearance and started to grow, and by 1972 supermarket sales had surpassed department store sales (Morikawa, 2017). Moreover, as highlighted by Morikawa (2017), not only the retail industry but also the wholesale industry, including general trading companies, saw a significant expansion in size during this period. The growth in TFP during this period thus likely reflects the emergence of new types of business, their growth in size, and increases in aggregate demand due to the rise in personal consumption and private investment.

After the HGS era, TFP growth was negative in many of the subperiods, and labor productivity growth overall became weak. Specifically, labor productivity growth turned negative during the recession in the first half of the 1980s, in 1990–1995 following the collapse of the bubble economy, and in 2010–2015 following the Tohoku earthquake. Examining productivity growth in Japan's wholesale and retail trade industry, Kwon and Kim (2008) found that this was driven more by the entry and exit of firms than by productivity improvements within firms through, for example, R&D, IT investment, human capital accumulation, and the formation of organizational capital. Meanwhile, comparing labor productivity in the retail industry in the United States and Japan as of 1997, McKinsey Global Institute (2000) reports that productivity in the United States was twice as high in Japan. The report therefore argues that it would be no exaggeration to say that Japan's wholesale and retail trade industry had not seen any major technological innovation since the introduction of supermarkets during the HSG era and the introduction of convenience stores in 1974 by 7-Eleven.

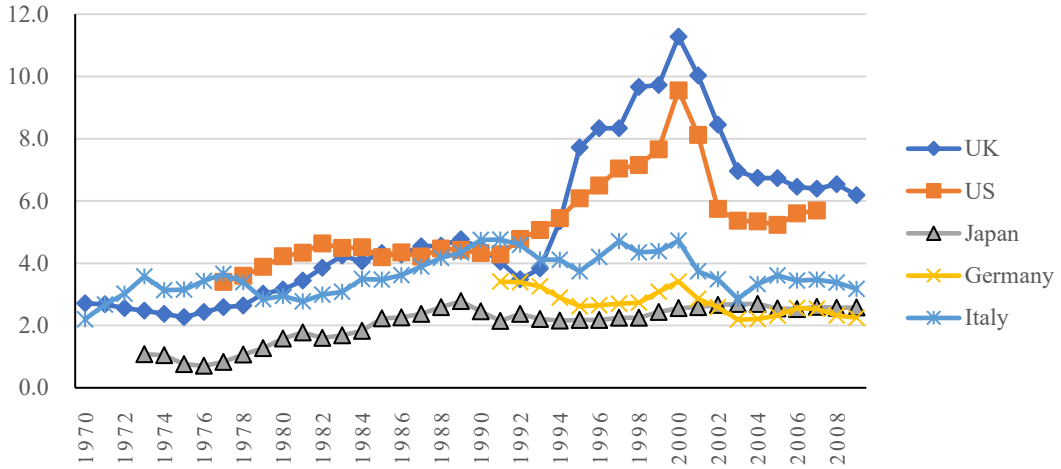
Another possible reason why labor productivity growth in the non-manufacturing sector has been very weak since 2005 is insufficient investment in information and communication

those of all listed firms is that, as mentioned earlier, non-manufacturing firms account for a small proportion of listed firms.

technology (ICT) in ICT-using sectors such as wholesale and retail trade. As shown in Figure 8, the ICT investment to GVA ratio in distribution services in Japan is extremely low compared to other developed countries (see Fukao et al. 2016 for details).

Meanwhile, as shown by Kim, Kwon, and Fukao (2020), there is no evidence that ICT inputs in Japan are clearly lower than in other countries in terms of ICT capital services or intermediate ICT services, although it is necessary to pay careful attention to price differences between Japan and the United States.[10] However, Japan lags behind other major economies in terms of capital accumulation, the accumulation of R&D and ICT assets has been extremely sluggish. Thus, when considering labor productivity growth in Japan, what seems worrying is not that the technologies employed by firms are not ICT-intensive or R&D-intensive, but that firms do not invest very much to begin with.

Figure 8. ICT investment-gross value added ratio in distribution services: International comparison



Source: Fukao et al. (2016).

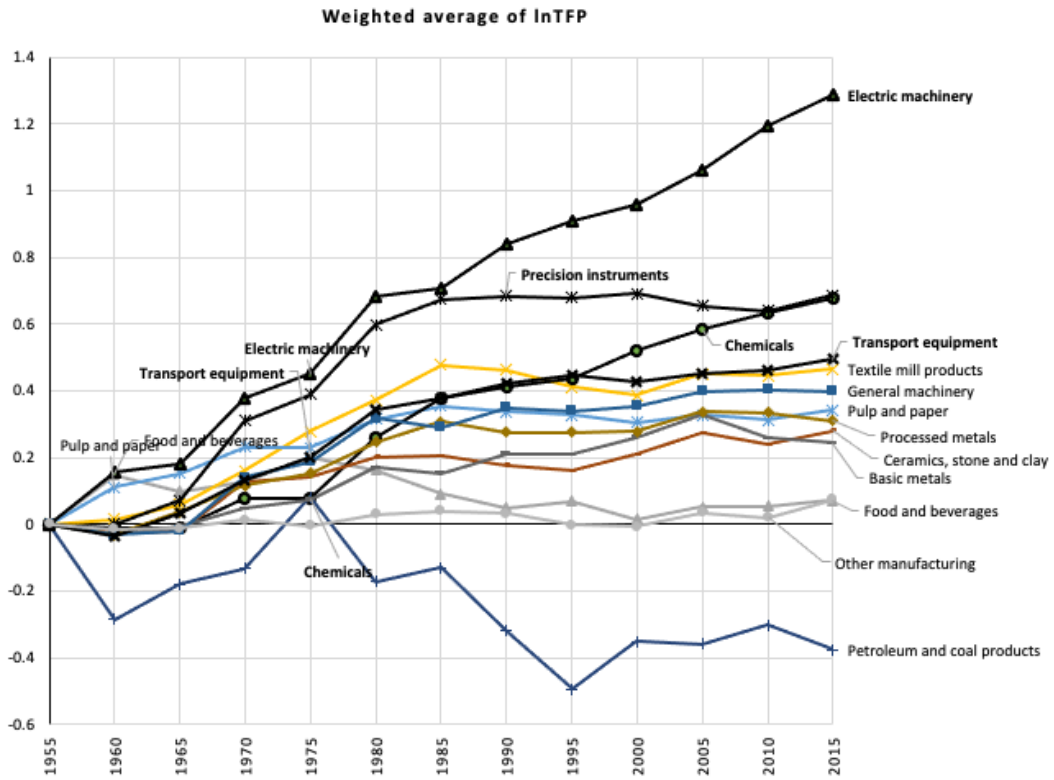
4. TFP Growth by Industry and Analysis of TFP Dynamics

The results in the previous section suggest that the main factor determining developments in the labor productivity growth of listed firms in Japan is TFP growth. Although the pace of capital accumulation also plays an important role, to a considerable extent this also depends on the rate of TFP growth, since slower TFP growth tends to reduce the rate of return on capital and hence hinder capital accumulation. Therefore, given the central role played by TFP growth, in this section we examine which industries have been at the forefront of driving TFP growth in Japan. To do so, we examine developments in the weighted average of TFP for listed firms in 23 industries. Further, in the latter part of this section, we examine productivity dynamics to

[10] The authors highlight that since the prices of certain ICT inputs in Japan are substantially higher than in the United States, it is possible that in real terms ICT inputs in Japan may be lower once price differences are adjusted for.

determine how the reallocation of resources across listed firms affected the TFP growth of listed firms overall.

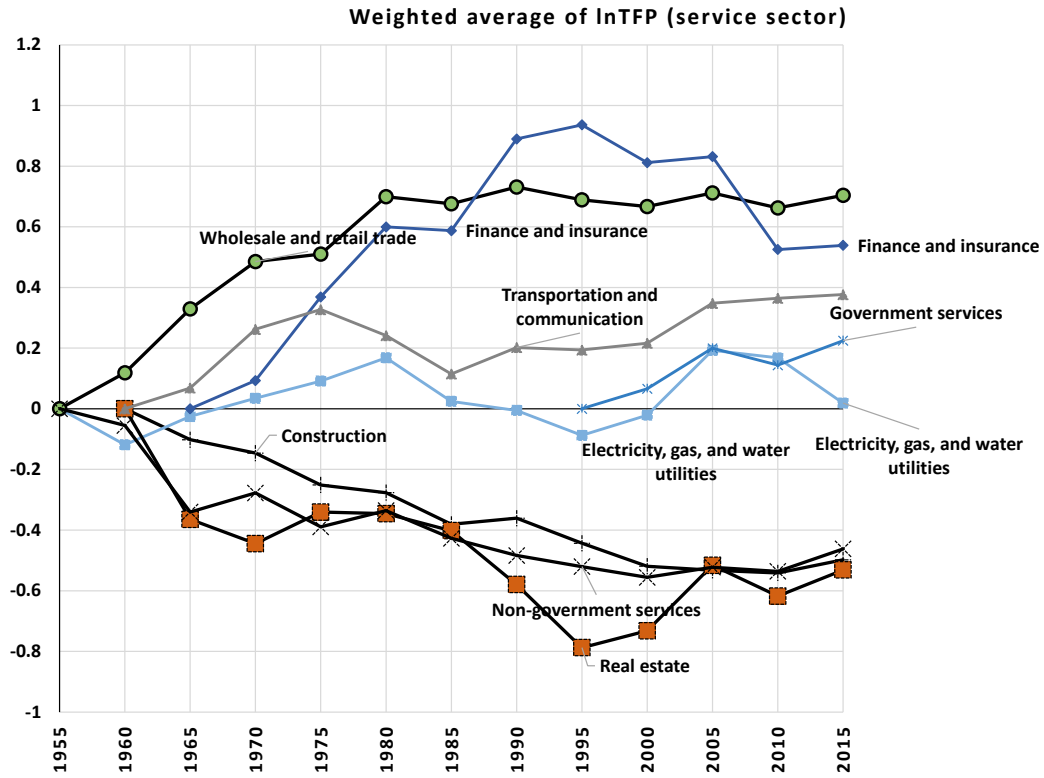
Figure 9. Average TFP levels of listed firms in the manufacturing sector (Natural logarithm, 1995 = 0, gross output basis)



Source: Authors' calculations based on the DBJ Database. The industry classification follows Fukao and Makino (2021).

Figure 9 presents the TFP levels of listed firms by industry. The vertical axis shows the change in the natural logarithm of the TFP level of listed firms in a particular industry on a gross output basis, setting the value for 1955 as the base value. Industry average TFP levels are calculated by aggregating individual firms' TFP level using firms' gross output shares in their industry as weights. As can be seen from this figure, electrical machinery, precision machinery, chemicals, and transportation machinery were the main drivers of TFP growth in the manufacturing sector. With the exception of electrical machinery and chemicals, TFP growth has slowed down substantially in most industries since 1980. Meanwhile, it should be noted that while TFP in the petroleum and coal products industry appears to have fallen sharply, the measurement of TFP for this industry is not very reliable since it is difficult to adjust for indirect taxes and because the value added ratio is low, which means that measured TFP is affected by changes in the price of raw materials.

Figure 10. Average TFP levels of listed firms in the non-manufacturing sector (natural logarithm, 1995 = 0, gross output basis)



Source: Authors' calculations based on the DBJ Database. The industry classification follows Fukao and Makino (2021).

Next, Figure 10 shows developments in the average TFP level of listed firms in the non-manufacturing sector. TFP in the real estate, construction, and non-government services (private, including activities not for profit) industries has steadily fallen. Meanwhile, while wholesale and retail trade showed the largest increases in TFP from 1955 until 1980, since then, TFP in this industry has stagnated.[11] TFP in the finance and insurance industry rose until 1995 but has been declining since then.

Fueki and Kawamoto (2008), using industry-level data, argue that productivity increased during the early 2000s in IT-using industries such as transportation, telecommunications, and electricity and gas. Consistent with their results, our analysis of listed firms shows that TFP rose steadily in the transport and communications industry in 2000–2005 and in the electricity, gas, and water supply industry in 1995–2005. On the other hand, the decline in TFP in 2010–2015 in the electricity, gas, and water supply industry can be attributed to a considerable extent to the shutdown of many nuclear power plants following the Tohoku earthquake in 2011.

Taken together, Figures 9 and 10 show that the industries that have led the TFP growth of listed firms overall are the electrical machinery, chemicals, precision instruments, wholesale

[11] The information services industry, which is the main industry producing ICT services, is included in non-government other services in the classification in this study (which is based on Fukao and Makino, 2021).

and retail trade, and finance and insurance industries. These results are consistent with the growth accounting results obtained by Fukao and Makino (2021) using long-term industry-level data.

Next, we analyze productivity dynamics to examine how the reallocation of resources across firms affected the TFP growth of listed firms overall. We define the industry-level TFP (on a value added basis) as the industry average of listed firms' TFP (on a gross output basis) using the following equation:

$$lnTFP_{i,t} = \sum_{f=1}^{n} D_{f,t}\, lnTFP_{f,t} \qquad (6)$$

where $lnTFP_{i,t}$ is the logarithm of the industry average of listed firms' TFP (on a value added basis) in industry *i* in year *t*, $lnTFP_{f,t}$ is the logarithm of the TFP (on a gross output basis) of firm *f* in industry *i* in year *t*, and weight $D_{f,}$ is the Domar weight of firm *f* in year *t* in the industry *i* to which it belongs (where the weight is calculated as firm *f*'s sales divided by the nominal value added of the industry to which it belongs).[12]

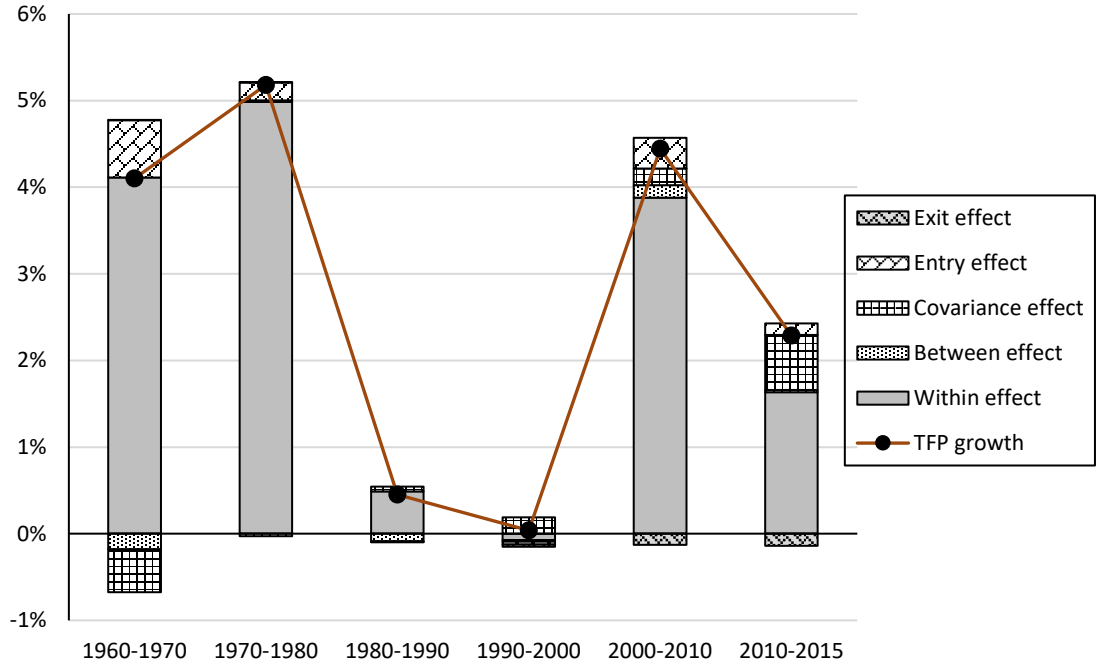
We then decompose the industry-level TFP growth rate using the decomposition method of Forster, Haltiwanger and Krizan (2001):

$$\sum_{f\in s} D_{f,t-\tau}\,\Delta lnTFP_{f,t} + \sum_{f\in s} \Delta \mathrm{D}_{f,t}\left[lnTFP_{f,t-\tau} - \overline{lnTFP_{t-\tau}}\right] + \sum_{f\in s} \Delta \mathrm{D}_{f,t}\,\Delta lnTFP_{f,t} + \sum_{f\in E} \Delta \mathrm{D}_{f,t}\left[lnTFP_{f,t} - \overline{lnTFP_{t-\tau}}\right] + \sum_{f\in X} D_{f,t-\tau}\left[\overline{lnTFP_{t-\tau}} - lnTFP_{f,t-\tau}\right] \qquad (7)$$

where *S* represents the set of surviving firms, *E* represents the set of entering (=newly listed) firms, and *X* represents the set of exiting (=delisted) firms. Variables with a bar represent the average of all firms in the industry, while Δ represents the difference from period t-τ to period t. The first term on the right-hand side of the equation is the change in the weighted average of the TFP of surviving firms and thus represents the within effect. The second term is the change in TFP due to changes in the industry weight of surviving firms with high TFP, i.e., the between effect. Next, the third term is the covariance effect, which is the effect of an increase in the weight of firms whose TFP has increased. Further, the fourth term captures the entry effect of firms that newly listed in year *t*, while the fifth term captures the exit effect of firms that delisted in year *t*.

[12] See Domar (1961) for a discussion of Domar weights. Domar does not consider in detail changes in weights over time.

Figure 11. Decomposition of TFP growth of listed firms: All firms (value added basis, average annual rate)



Source: Authors' calculations based on the DBJ Database.

Figure 11 shows the contribution of each of these effects to the TFP growth rate of listed firms overall by decade. Like the previous section, the figure shows that listed firms' TFP growth in the 1980s was substantially lower than in the preceding decades and remained sluggish in the 1990s. However, TFP growth recovered considerably during the 2000s and remained comparatively strong during 2010–2015. Therefore, when we look at the TFP of listed firms, the "two lost decades" started in the 1980s and ended around 2000.

The main cause of changes in listed firms' TFP growth was the within effect. The within effect was extremely small between 1980 and 1990 and even negative between 1990 and 2000. As outlined in Section 3, likely reasons for the decline in the within effect in the 1980s and 1990s include the end of the catch-up with the United States in the automobile, electronics, chemicals, and other industries, the increased competition from other East Asian countries, the appreciation of the yen and trade friction, and the lack of innovation in non-manufacturing industries. However, further analysis will be necessary to explain why TFP growth fell so sharply during this period.

It is also interesting to note that even though 1,738 new firms were newly listed between 1980 and 2000, no entry effect is observed at all for this period. Furthermore, from 2000, a negative exit effect is observed for the listed firms in our database, which is in line with previous studies using microdata underlying government statistics on Japanese firms and establishments. Likely reasons why high-productivity firms delisted include the introduction of the holding company system and the impact of mergers and acquisitions.

Figure 12. Decomposition of TFP growth of listed firms: Manufacturing (value added basis, average annual rate)

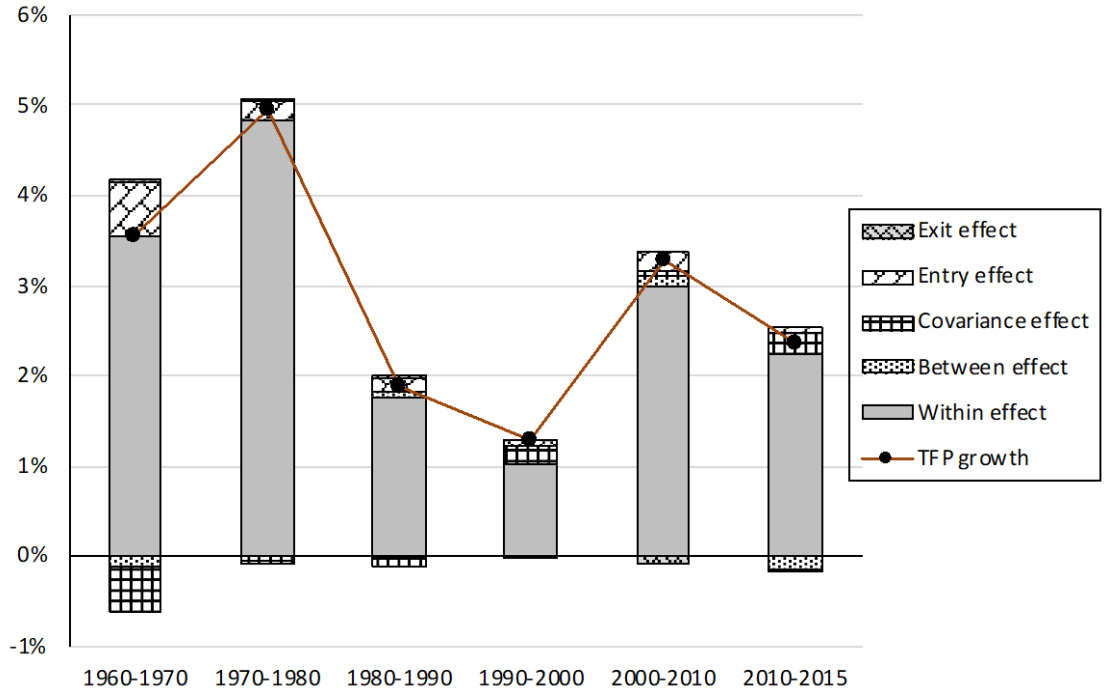
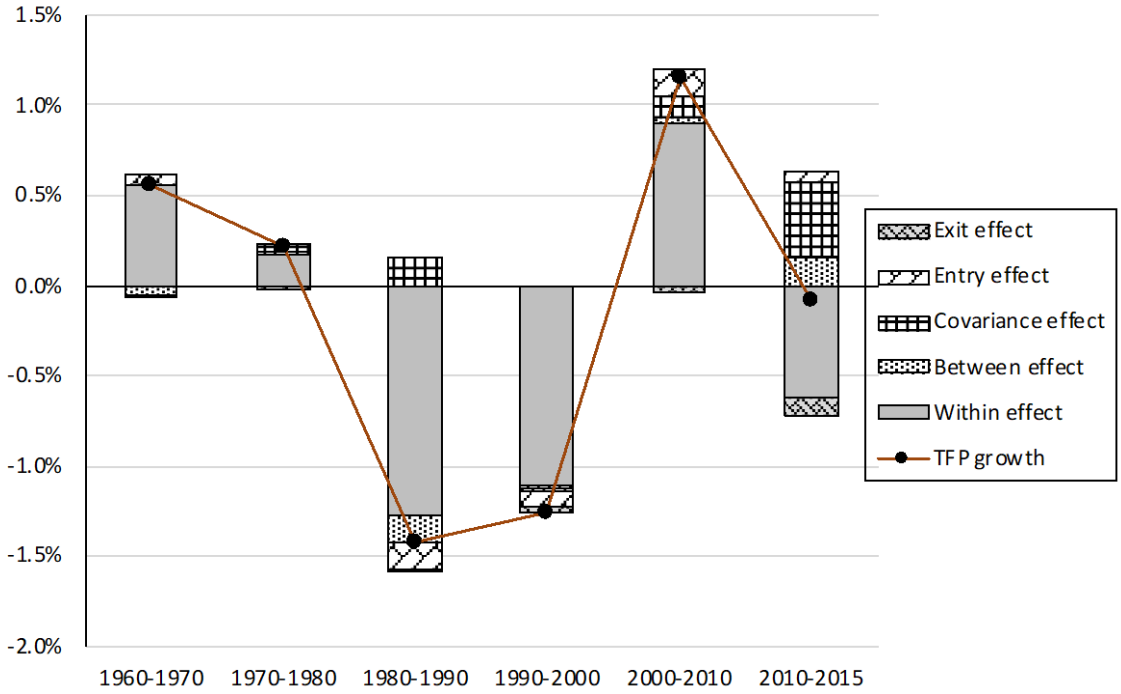


Figure 12 shows the decomposition of TFP growth focusing on listed firms in the manufacturing sector only. The results are generally the same as those for all listed firms. Next, Figure 13 shows the results focusing on non-manufacturing firms only. As discussed in Section 3, productivity developments in the non-manufacturing sector are closely linked to the business cycle, and TFP growth in the non-manufacturing sector decelerated in the 1970s and turned negative in the 1980s and 1990s. In the 2000s, TFP growth was more vigorous than during the high-speed growth era, mainly due to the increase in the within effect, but then fell back to around zero again in the 2010–2015 period. It is interesting to note that, unlike in the manufacturing sector, the reallocation effect (the sum of the between effect and the covariance effect) has made a substantial positive contribution since 2010.

Figure 13. Decomposition of TFP growth of listed firms: Non-manufacturing (value added basis, average annual rate)



In summary, the TFP growth of listed firms in Japan fell in the 1980s and experienced a two-decade-long slump until 2000. However, the TFP growth of listed firms recovered in the 2000s, when the Japanese economy overall was still in the doldrums. The main reason for this turnaround was the change in the within effect. Meanwhile, the allocation of resources across firms – i.e., the sum of the covariance and the between effect – has generally only made a minor contribution to the TFP growth of listed firms throughout the entire period. The exception is the notable contribution of the reallocation effect in the non-manufacturing sector since the 2000s, especially in the 2010–2015 period.

5. Conclusion

This study examined the sources of growth and stagnation of the Japanese economy since the high-speed growth (HSG) era using a long-term database of listed firms covering the period 1960–2015. The decomposition of labor productivity growth and analysis of TFP dynamics produced a number of unexpected findings. Specifically, while Japan's economy suffered from "two lost decades" following the collapse of the bubble economy around 1990, listed firms entered their own "two lost decades" a full decade earlier, during the 1980s, experiencing a sharp fall in TFP and labor productivity growth at a time when Japan's economy was still receiving worldwide acclaim. On the other hand, listed firms also exited their "two lost decades" a decade before the rest of the economy (i.e., around 2000 versus around 2010). Furthermore, we found that labor productivity and TFP growth in the non-manufacturing sector plummeted in the 1970s, as soon as the HSG era ended, and failed to recover for a long time. Another finding is that the TFP growth of listed firms decelerated in 2010–2015, when the economy

was recovering due to the depreciation of the yen under Abenomics and TFP growth in the economy overall was relatively strong.

Comparing our results here with studies examining industry-level TFP developments covering all economic activities based on the JIP Database and other sources, we find that the TFP growth of listed firms was lower than in the economy overall in the 1980s, higher in the mid-1990s to 2000s, and lower in 2010–2015. The difference between listed firms and the economy overall can be regarded as reflecting differences in the performance of listed firms on the one hand and unlisted firms, many of which are small and medium-sized firms, on the other (Fukao et al., 2014). It seems likely that the TFP gap between large firms and small and medium-sized ones narrowed in the 1980s due to the appreciation of the yen, trade frictions, and the end of the catch-up by large manufacturing firms with U.S. firms. On the other hand, from the mid-1990s, large firms increased their productivity through restructuring and by transferring production overseas, while the productivity of small and medium-sized firms stagnated as they were slow to internationalize and invest in R&D. In particular, the structural reforms of the Koizumi government are likely to have supported the restructuring of large firms and raised the productivity of listed firms. This period also saw the weakening of Japan's characteristic interfirm relationships due to restructuring and the transfer of production overseas, particularly by large firms. This may have reduced technological spillovers from large firms and slowed down the productivity growth of small and medium-sized firms. This widening of interfirm differences likely is one of the factors that contributed to Japan's prolonged stagnation from around 1995.

Meanwhile, following the slogan of the structural reforms introduced by the Koizumi government (2001–2006), large firms increased the hiring of non-regular employees and focused on restructuring measures that yielded "easy" productivity gains. This hindered the accumulation of human capital and led to insufficient investment in intangible and tangible assets (Fukao et al., 2014; Fukao, 2021), and may have contributed to the slowdown in the labor productivity and TFP growth of listed firms after 2010. It is disappointing that listed firms have not been able to translate the structural reforms into an increase in their growth potential.

This study outlined the productivity trends of listed firms over a 55-year period. It raises a number of questions, including why productivity fell in the manufacturing sector in the 1980s and in the non-manufacturing sector from the 1970s, and what exactly led to the recovery in productivity after 2000. We hope to address these questions in future research.

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Appendix

A1. Sources of labor productivity growth: All listed firms (Annual average)

	TFP growth	Labor productivity growth	Contribution of increases in capital input per hour worked	Contribution of labor quality improvements	Contribution of TFP growth
1950-1960	8.1%	16.3%	6.2%	1.0%	9.1%
1960-1970	4.8%	7.9%	2.9%	0.2%	4.8%
1970-1980	3.3%	6.4%	2.6%	0.6%	3.2%
1980-1990	-0.7%	1.1%	1.4%	0.3%	-0.5%
1990-2000	-1.7%	-0.2%	1.3%	0.3%	-1.7%
2000-2010	4.3%	5.5%	0.9%	0.3%	4.3%
2010-2015	1.9%	2.5%	0.4%	0.2%	1.9%

A2. Sources of labor productivity growth: Manufacturing (Annual average)

	TFP growth	Labor productivity growth	Contribution of increases in capital input per hour worked	Contribution of labor quality improvements	Contribution of TFP growth
1955-1960	1.7%	6.4%	3.4%	0.5%	2.4%
1960-1965	-1.9%	1.7%	3.2%	0.1%	-1.6%
1965-1970	4.9%	8.9%	3.8%	0.4%	4.7%
1970-1975	5.5%	9.3%	3.0%	0.8%	5.5%
1975-1980	6.8%	8.1%	0.6%	0.6%	6.8%
1980-1985	0.7%	2.0%	0.9%	0.3%	0.8%
1985-1990	-2.3%	-0.8%	1.4%	0.3%	-2.4%
1990-1995	-6.2%	-5.1%	0.6%	0.5%	-6.1%
1995-2000	6.7%	7.7%	0.8%	0.3%	6.6%
2000-2005	8.5%	9.4%	0.4%	0.4%	8.5%
2005-2010	6.3%	7.0%	0.3%	0.3%	6.3%
2010-2015	4.6%	4.7%	-0.1%	0.2%	4.6%

A3. Sources of labor productivity growth: Nonmanufacturing (Annual average)

	TFP growth	Labor productivity growth	Contribution of increases in capital input per hour worked	Contribution of labor quality improvements	Contribution of TFP growth
1955-1960	18.7%	29.9%	7.2%	3.9%	18.8%
1960-1965	8.6%	8.9%	0.6%	-0.3%	8.6%
1965-1970	7.3%	8.8%	1.1%	0.3%	7.4%
1970-1975	-1.7%	0.3%	1.5%	0.3%	-1.4%
1975-1980	1.0%	3.7%	2.2%	0.4%	1.1%
1980-1985	-5.2%	-2.8%	1.6%	0.6%	-5.0%
1985-1990	1.3%	2.1%	0.9%	0.0%	1.2%
1990-1995	-4.8%	-2.9%	1.6%	0.2%	-4.6%
1995-2000	0.0%	1.4%	1.3%	0.1%	-0.1%
2000-2005	3.3%	4.8%	1.4%	0.2%	3.2%
2005-2010	-0.6%	0.8%	1.0%	0.2%	-0.5%
2010-2015	-2.7%	-1.7%	0.8%	0.1%	-2.6%