Working Paper Series
Congressional Budget Office
Washington, D.C.

REALLOCATION AND PRODUCTIVITY GROWTH IN JAPAN: REVISITING THE LOST DECADE OF THE 1990s

Naomi N. Griffin
Congressional Budget Office
Washington, D.C.
E-mail: naomi.griffin@cbo.gov

Kazuhiko Odaki
Financial Services Agency
Tokyo, Japan
E-mail: k-odaki@fsa.go.jp

January 2006
2006-02

Abstract

Hayashi and Prescott (2002) argue that the so-called lost decade of the 1990s in Japan is explained by the slowdown in exogenous total factor productivity (TFP) growth rates. At the same time, some have suggested that Japanese banks' support for inefficient firms prolonged recession, by reducing productivity through misallocation of resources and interference with entry and exit mechanisms. Using firm-level data between 1969 and 1996, this paper investigates the micro-reallocation mechanisms to disentangle the factors behind the slowdown in productivity growth during the 1990s. The main results show that the lack of exits by the least productive firms and lack of entries by small productive firms reduced TFP growth during the 1990s. However, the paper does not find strong evidence of misallocation of resources across incumbent firms; hence, misallocation seems mostly to have taken place at the entry and exit margin. Most important, during the 1990s there was a large drop in productivity growth within firms, the component not affected by reallocation of input and output shares across firms over time. These findings suggest that, as the Japanese economy matured, a policy that fosters technological innovations via creative destruction process may have become increasingly important in promoting economic growth.

Journal of Economic Literature classification numbers: D21, D24, O40
Key words: productivity growth, reallocation, Japan

The authors wish to thank John Haltiwanger, John Shea, Michael Pries, Katherine Abraham, and Nathan Musick for invaluable comments and suggestions. All errors are those of the authors.

Table of Contents

1 Introduction

The dramatic slowdown of economic growth in Japan during the 1990s drew much attention from economists. Among the several hypotheses that have emerged, the most controversial one is the finding by Hayashi and Prescott (2002) that the "lost decade" was explained by a fall in exogenous total factor productivity (TFP), because that finding casts doubt on the popularly held belief that a credit crunch arising from financial-sector problems slowed down growth by reducing investment. More recently, Peek and Rosengren (2005) show that misallocation of credit, caused by Japanese banks' incentive to extend lines of credit to financially troubled "zombie" firms, contributed to the prolonged recovery from recession.[1] This paper revisits these issues: It investigates whether the reduction in productivity growth in Japan arises from a slowdown in productivity growth within firms or from misallocation of resources across firms. More specifically, the paper conducts productivity decomposition exercises to examine whether the cleansing effect of recessions (i.e., the downsizing or exit of the least productive firms) was in place during the first half of the 1990s, and to examine how much of the reduction in total productivity is explained by the fall in within-firm productivity growth, the component that is not affected by changes in shares across firms.

The 1990s marked the first decade of sluggish economic growth for the Japanese economy since the end of the Second World War. The deterioration of Japan's economic performance, which persisted for more than a decade, was a unique macroeconomic event, yet not enough evidence has been unmasked to generate a consensus about the factors that contributed to the lengthy recovery. The early stage of the discussion centered around policy failures in

[1]There has been a growing amount of research related to this topic. For a formal theoretical presentation and an excellent literature review, see Caballero, Hoshi, and Kashyap (2004). They describe a zombie firm as an insolvent borrower to whom banks continue to extend credit to prevent bankruptcy of the firm.

demand management, highlighted by a liquidity-trap hypothesis or a credit-crunch hypothesis. However, formal evidence in support of these hypotheses has yet to be found.

The proponents of the liquidity-trap hypothesis claim that the monetary authority's inability to stimulate investment by lowering interest rates or to stimulate consumer spending by creating inflationary expectations unnecessarily prolonged the recovery phase.[2] On the other hand, the credit-crunch hypothesis speculates that the poor financial condition among many Japanese banks led to the banks' reduced lending to profitable projects, thereby contributing to lower investment. However, Motonishi and Yoshikawa (1999), using the Bank of Japan's diffusion indices of real profitability and of banks' willingness to lend, find that, except for 1997, when the government finally allowed some big banks to fail, drops in investment were unrelated to banks' willingness to lend and were driven mainly by a fall in real profitability.[3]

Using aggregate growth accounting, Hayashi and Prescott argue that the economic stagnation during the 1990s in Japan is largely explained by a fall in exogenous TFP growth. As in Motonishi and Yoshikawa, they demonstrate that firms were able to finance their investment from alternative sources even during a period of constrained bank lending due to, for example, the BIS (Bank for International Settlement) capital ratio imposed on banks. Controlling for labor quality and capacity utilization, Fukao, Inui, Kawai, and Miyagawa (2003) conduct similar growth accounting exercises, by industry. Their results also produce a fall in TFP growth during the 1990s, but its magnitude is much smaller in comparison with Hayashi and Prescott's results, as Fukao et al. isolate the impact of the slower rate of labor quality growth during the 1990s in their estimates of TFP growth rates.

[2] A similar argument is the criticism that the inability of monetary authorities to prevent deflation worsened the situation, by increasing the financial burden of companies and by depressing investment. Examination of this issue is beyond the scope of the paper.

[3] Woo (2003) finds similar results.

More recent literature identifies the reallocation issue as the primary problem. For example, Peek and Rosengren (2005) find evidence of misallocation of credit by Japanese banks as they engaged in "evergreening" loans.[4] They claim that, during the 1990s, financially troubled firms were more likely to obtain additional loans from banks than their healthier counterparts were, as banks sought to make financially troubled firms look artificially solvent on their balance sheets. Likewise, using stock returns, Hamao, Mei, and Xu (2003) suggest that there was a lack of resource reallocation in Japan during the 1990s. In particular, when a firm's idiosyncratic risk is measured as the deviation of its stock return from the average response to the market rate, they show that the role of idiosyncratic risk in explaining the total time-series volatility of firm stock returns decreased during the 1990s. They point out that, as a consequence, this apparent increase in homogeneity of corporate performance may have hindered the ability of investors and managers to distinguish high-quality firms from low-quality firms, and may have discouraged capital formation.

These findings indicate that misallocation, or the lack of reallocation, may provide a key to understanding the problem. In fact, a considerable amount of research relates reallocation to economic performance and growth over the business cycle. The theoretical aspects of the literature often focus on Schumpeter's idea of creative destruction. Aghion and Howitt (1992), for instance, construct an endogenous growth model in which old technology is immediately destroyed with the emergence of new technology, thereby constituting the underlying engine of economic growth through the introduction of a competitive research sector that generates vertical innovations. In a similar spirit, Caballero and Hammour (1994, 1996) created

[4] Peek and Rosengren define evergreening as the process of banks funding firms "to enable the firms to make interest payments on outstanding loans and avoid or delay bankruptcy."

a model in which only entering firms have access to the latest vintage of capital, and therefore the destruction of firms with old vintages facilitates the flow of new entries and enhances productivity.[5]

This paper conducts productivity decomposition exercises using the Nikkei Economic Electronic Database System (NEEDS database) to examine whether the cleansing effect of recessions was taking place via downsizing and exits of inefficient businesses, and how much of the reduction in productivity growth was attributable to within-firm productivity growth. Obviously, these exercises require a micro-level data set. The main advantage of these decomposition exercises is the ability to isolate the part of aggregate productivity growth related to changes in shares that arise from the reshuffling of resources across continuing firms and via entry and exit from the part of aggregate productivity growth related to within-firm productivity growth. Accordingly, one could argue that within-firm productivity growth is a more precise measure of exogenous productivity shock than is a measure that is constructed using usual growth accounting, because within-firm productivity growth focuses on the component of productivity growth that is not affected by the changes in weight assigned to firms over time.

Foster, Haltiwanger, and Krizan (1998) show that, in the U.S. manufacturing sector, the contribution of reallocation in explaining aggregate productivity growth through the replacement of relatively inefficient establishments by more productive ones is significant and, hence, entry and exit dynamics play an important role for productivity growth. In particular, in

[5]In these models, entrants start with the highest level of productivity, and incumbents exit when their productivity levels become too low compared with the latest technology used by entrants. These models are convenient for analytical tractability, especially for understanding the role that reallocation plays in productivity dynamics. However, entrants' high productivity assumption may be too restrictive in general, as entrants often go through a phase of experimentation before becoming productive, and many of them are expected to fail during the process.

their study of U.S. manufacturing productivity growth from 1977 to 1987, roughly 30 percent of the total productivity growth is attributed to entry and exit dynamics. Foster, Haltiwanger, and Krizan's similar study for the retail sector (2002) shows that the entry and exit dynamics explain virtually all productivity growth in this sector from 1987 to 1997.

Unlike the longitudinal data sets used by Foster et al., the NEEDS database has several disadvantages, particularly in measuring the contribution of the net-entry effect. These disadvantages will be discussed in detail later.[6] Despite these disadvantages, however, the database provides some important insights into the changes in the productivity dynamics in Japan over time since 1969.

The key findings are the following: First, the TFP contribution of exits declined over time. The surprisingly weak TFP contribution of exits, despite the dramatic slowdown of economic activity during the post-bubble period before 1997,[7] is in line with the conclusion by Peek and Rosengren that banks deliberately helped financially troubled firms stay in business.[8] Second, the TFP contribution of entry made by small businesses declined over time, and it is particularly small during the sluggish-growth period. This suggests that the credit crunch may have been more severe for smaller businesses. Third, this study did not observe evidence of misallocation among continuing firms. There is some evidence, albeit mild, that inefficient firms were more actively downsizing during this period. Finally, while the overall TFP growth

[6]Unfortunately, a database as comprehensive as the Longitudinal Research Database (LRD) has not been constructed in Japan. Therefore, a comparison of productivity dynamics across time periods using a more complete establishment-level database is not yet possible.

[7]The designation of the economic periods under study into high-growth (1969-1979), bubble-economy (1979-1988), and sluggish-growth (1988-1996) periods is discussed in Section 3.

[8]Using Basic Survey on Business Activities by Enterprises, a firm-level data set constructed by the Japanese Ministry of Trade and Industry, Fukao et al. also find that the exit effect negatively contributed to overall productivity growth between 1996 and 1998 in the manufacturing sector, indicating that the least efficient firms stayed in business.

rates of the firms examined more or less remained the same for 1979-1988 and 1988-1996, within-firm TFP growth fell by about 6% between these two periods. The unusually large drop in within-firm TFP is in line with the result obtained by Hayashi and Prescott that the fall in exogenous TFP during the 1990s plays a large role in explaining the slower growth during this period.

2 Description of the Data

The NEEDS database constitutes the main data used in this paper. Since 1964, NEEDS has covered relatively large firms. The primary advantage of that database is that it allows examination of changes in productivity dynamics over time.[9] The database is an unbalanced panel, in which the majority is based on annual reports and the remainder is mostly based on semi-annual reports. This paper uses only manufacturing firms for the decomposition exercises, as the sectoral deflators (Corporate Goods Price Indices, CGPI) provided by the Bank of Japan are available only for manufacturing industries. Firms included are those that are listed on the Tokyo Stock Exchange, JASDAQ, and regional stock markets; leading unlisted companies submitting financial reports to the Ministry of Finance; and leading unlisted companies that are not included in the above categories but submit reports to their shareholders. The database has financial and employment data, with some corporate information.

One of the main concerns with this database is the treatment of entries. Unlike a longitudinal database such as the LRD, most entries into the NEEDS database begin after

[9]The prior studies on productivity decomposition in Japan, as in Fukao et al. (2003), use a more comprehensive dataset, but focus only on the 1990s due to the unavailability of a longer series. As a result, this paper cannot examine whether the characteristics observed are unique to the 1990s.

a firm's initial public offering (IPO), and not when the firm first starts its business. Thus, the entering firms in this exercise are not necessarily new players in their industries, but they are new players in the financial market. As a result, this is not a standard decomposition for the purpose of analyzing the role of entrants in Schumpeter's creative-destruction sense. However, this paper considers this decomposition important for the Japanese case, as much of the discussion of the role of reallocation during the 1990s focuses on problems in the financial sector.[10] Another issue regarding entrants is that the number of firms covered in the NEEDS database increases over time, as the number of entries into the database is larger than the number of exits from the database.[11] As such, the result for the impact of net entry should be interpreted with caution: Because the entry component is larger than the exit component, the variation in net entry is driven mostly by entry.

Furthermore, dropping out from the database could indicate either mergers or bankruptcies. Fortunately, the NEEDS database has an index of mergers, permitting this paper to sort out the two and differentiate them in the productivity decomposition.[12] Although the paper also calculates the productivity contribution of mergers, it considers only bankruptcies as exits that are relevant for the study of reallocation. The last concern is the sample selection problem: The companies used for this analysis are relatively large leading manufacturing

[10] An additional sense in which new IPO entrants relate to Shumpeter's creative-destruction theory is that new IPO entrants challenge older firms for access to capital. Moreover, if firms capable of negotiating a successful IPO are on average more productive than their counterparts, the usual creative-destruction mechanism through entry and exit should apply when analyzing the NEEDS database.

[11] Only firms listed on the Tokyo Stock Exchange were included in 1964. Firms listed on the Osaka and Nagoya stock exchanges were incorporated in 1970, other listed firms from smaller regional stock markets were incorporated in 1975, and leading unlisted companies submitting financial reports to the Ministry of Finance or reports to their shareholders were added in 1977.

[12] We used internet resources such as Teikoku databank (http://www.tdb.co.jp/watching/press/p020101.pdf) to confirm bankruptcy of the firms for which the merger index does not indicate incidence of a merger. We could not confirm the bankruptcy of 15 (out of 41) firms. Consequently, we excluded these firms from the exit component. See the appendix for the list of these firms.

companies. Accordingly, their overall performance may not be entirely representative of the extent of the deterioration of the aggregate economic performance. However, we believe that the results observed from these companies with respect to their productivity dynamics have significant implications for the economy-wide productivity growth, as most of these companies have access to leading technology. In addition, many of these companies are likely to have strong ties to large Japanese banks, and therefore the results should be relevant to the investigation of the impact of the posited misallocation of resources.

Table 1: Descriptive Statistics of Firm-Level Employment for Manufacturing Firms in the NEEDS database for 1969-1996

Period	Mean	Average Median	Average Standard Deviation	Average Minimum	Average Maximum	Average Number of Firms
All Firms						
1969-1979	2,638	1,004	6,422	41	82,174	1,144
1980-1988	2,272	817	5,794	17	75,458	1,272
1989-1996	2,266	826	5,702	13	78,504	1,338
Entering Firms						
1969-1979	671	514	794	131	4,026	32
1980-1988	695	347	1,262	68	4,992	13
1989-1996	656	554	509	306	1,410	8
Dropped Firms (Exits and Mergers)						
1969-1979	1,744	1,039	2,314	275	5,586	5
1980-1988	1,162	623	1,819	327	2,705	4
1989-1996	1,111	990	1,102	403	2,011	3

Table 1 provides descriptive statistics of firm-level employment for manufacturing firms in the NEEDS database.[13] Note that the figures correspond to the average of the annual statistics within each time interval.[14] The top part of the table gives descriptive statistics of all manufacturing firms used for the decomposition. Over time, the average firm size in terms

[13] As explained in the appendix, the rubber industry is excluded from the decomposition, for lack of a deflator.
[14] The annual average employment figure is used for firms that submit reports semi-annually.

of employment falls while the average number of firms increases, most likely reflecting the incorporation of smaller firms into the database. The middle part of the table gives the descriptive statistics of firm-level employment for entering firms only, and the bottom part of the table identifies statistics for firms that dropped from the database. Note that the average size of dropped firms, in terms of employment, is larger than the average size of entering firms, but it is smaller than the overall average. Put differently, dropped firms are smaller than average, but not as small as entering firms.

3 Productivity Decomposition

Using plant-level data from the Census of Manufacturers, Foster, Haltiwanger, and Krizan (1998) show that reallocation of outputs and inputs across establishments and reallocation through entry and exit play an important role in explaining aggregate productivity growth. In order to explain productivity dynamics among relatively large Japanese firms, two types of decomposition exercises, following Foster, Haltiwanger, and Krizan, are conducted using the NEEDS database. Denoting ΔP_{jt} as the productivity growth of industry j between $t-1$ (beginning period) and t (ending period), the first decomposition is given by the following equation:

$$\begin{aligned}\Delta P_{jt} = &\sum_{i \in C} s_{it-1} \Delta p_{it} + \sum_{i \in C} (p_{it-1} - P_{jt-1}) \Delta s_{it} + \sum_{i \in C} \Delta s_{it} \Delta p_{it} \\ &+ \sum_{i \in N} s_{it} (p_{it} - P_{jt-1}) - \sum_{i \in X} s_{it-1} (p_{it-1} - P_{jt-1}),\end{aligned} \tag{1}$$

where s_i is the share of firm i in industry j; p_i and P_j are the productivity indices for firm and industry, respectively; and C, N, and X indicate the sets of continuing firms, entering firms, and dropped firms, respectively. The second decomposition is given by:

$$\Delta P_{jt} = \sum_{i \in C} \bar{s}_{it} \Delta p_{it} + \sum_{i \in C} (\overline{p}_{it} - \overline{P}_{jt}) \Delta s_{it} \qquad (2)$$
$$+ \sum_{i \in N} s_{it} (p_{it} - \overline{P}_{jt}) - \sum_{i \in X} s_{it-1} (p_{it-1} - \overline{P}_{jt}),$$

where a bar over a variable indicates the value averaged over $t-1$ and t.

The first term in both equations (1) and (2) shows contribution of the within-firm productivity growth to aggregate productivity growth. The second term in equations (1) and (2) shows the between-firm effect, which captures the contribution arising from the reshuffling of inputs or outputs across continuing firms. Here, the changes in shares are weighted in both cases by the deviation of firm productivity from the corresponding industry productivity index. The index in the first decomposition uses beginning-period industry productivity, P_{jt-1}, while the second decomposition uses industry productivity averaged over the beginning and ending periods. The last two terms in equations (1) and (2) represent the contribution made by entrants and dropped firms, respectively. Note that a firm's entry into the database raises aggregate productivity when its productivity is above the industry productivity index, and a firm's dropping from the database raises aggregate productivity when its productivity is below the industry productivity index. As mentioned previously, dropped firms are divided into exits and mergers.

The share weight used for the within-firm effect and the productivity weight used for the between-firm effect in the second decomposition given by equation (2) are average figures and, therefore, the interaction effect between changes in share and changes in productivity (i.e., the covariance effect) is incorporated in the first two terms, while the first decomposition given by equation (1) explicitly controls for this effect with the third cross-firm term. Although the first method provides a more accurate decomposition, it is more sensitive to measurement errors, as discussed in Foster, Haltiwanger, and Krizan; thus the results using both decomposition methods will be presented.[15]

Two types of productivity measures, labor productivity (LP) and total factor productivity, are constructed for the decomposition exercises. Because the NEEDS database has information on employment but not on hours, the measure of man-hours was constructed by multiplying firm employment by sectoral average annual work hours taken from *Monthly Labor Survey*, published by the Japanese Ministry of Health, Labor and Welfare.[16] The labor productivity measure used here is the log difference of real gross output and man-hours. Note that the real gross output figures are summed over each year when firms submit reports more than once a year, and that the average employment figures are used for these firms.

The index of TFP is measured as follows:

$$\ln TFP_{it} = \ln Y_{it} - \alpha_M \ln M_{it} - \alpha_L \ln L_{it} - (1 - \alpha_M - \alpha_L) \ln K_{it}, \quad (3)$$

where Y_{it} is real gross output for firm i at year t, M_{it} is real materials, L_{it} is labor input in

[15]For instance, a measurement error in labor input generates spuriously high negative correlation between the change in share and labor productivity growth. This, in turn, raises the within-firm effect. Similarly, a measurement error in output, in the case of conducting decomposition with TFP for instance, generates a spuriously high positive correlation between the change in share and TFP growth. This reduces the within-firm effect. Because the second method uses average figures, it is less sensitive to this type of measurement error.

[16]Adjustment of hours is needed in order to take into account the decline in work hours over time during the sample period. In many sectors within manufacturing, the average work hours declined steadily between 1960 and 1975, rose slightly between 1975 and 1990, and fell again after 1990 in response to changes in the Labor Standards Law that gradually reduced statutory work hours from 48 to 40.

terms of man-hours, K_{it} is the real capital stock, α_M is material's share of total cost, and α_L is labor's share of total cost.[17] Detailed explanations of the construction of real gross output, real materials, labor input, and real capital stock using the NEEDS database are provided in the appendix.

Note that the notations for the material cost share α_M and the labor cost share α_L are simplified here, as the shares actually used vary across three-digit NEEDS industry classifications, although not over time.[18] The material and labor cost shares are first calculated at the firm level by taking a simple average across time, and are then aggregated at the industry level, using mean firm-level employment as a weight. When aggregated across all firms in the database, the material cost share is 67.5%, the labor cost share is about 16.1%, and the capital cost share is about 16.4%.

The time horizon over which the paper investigates productivity growth is set between 8 and 10 years. This time horizon indicates the distance between the subscript t and the subscript $t-1$ in equations (1) and (2). Thus, the analysis decomposes productivity growth dynamics over the long run. Ideally, the starting period and the ending period should encompass the full business cycle. This allows us to compare the results across different time periods while avoiding short-run business-cycle effects on productivity. Hence, we divided the entire productivity series into three subperiods based on the following business cycle considerations: a high-growth period (from the peak of 1969 to the peak of 1979), the bubble-economy period (from the peak of 1979 to the peak of 1988), and the sluggish-growth period (from the peak of 1988 to the peak of 1996).

[17] Again, material input values are summed over each year for firms that submit reports more than once a year.

[18] Excluding the rubber industry, the entire manufacturing sector is divided into 87 industries, based on the NEEDS three-digit industry classification.

4 Results

Table 2: Number of Firms Used in Productivity Decomposition

	Number of Firms	Entry	Dropped Firms Exit	Merger
LP				
1969-1979	1,271	312	14	26
1979-1988	1,337	115	9	25
1988-1996	1,357	57	3	16
TFP				
1969-1979	1,145	263	13	25
1979-1988	1,253	91	8	25
1988-1996	1,301	55	3	15

In this section, we present the productivity decomposition results of the entire sample, as well as the results broken down by size. Table 2 shows the number of firms used in the productivity decompositions.[19] Note that the number of entries is high during 1969 to 1979 because some regional stock markets were incorporated during this period.[20] The number of exits is small in all periods, and this trend is consistent with the evidence that, until 1997, there were relatively few bankruptcies among listed firms. Furthermore, the exit number is particularly small during 1988 to 1996. The aggregate data also show that the total number of corporate bankruptcies was particularly low during 1988 to 1996, implying that businesses were able to ride out the initial stage of the recession.[21] The list of exiting firms is provided in the appendix.

Table 3 shows the results of productivity decompositions using LP and TFP for the

[19]The number of firms is smaller for TFP decomposition compared with labor productivity decomposition, as some firms did not have complete information to construct TFP.

[20]As mentioned previously, this leads us to expect a smaller share of the exit contribution compared with the entry contribution.

[21]The data on total number of corporate bankruptcies can be obtained from the publications of Tokyo Shoko Research, Ltd. The following site (in Japanese) provides the number of corporation bankruptcies since 1952: http://www.tsr-net.co.jp/new/zenkoku/transit/index.html.

Table 3: Productivity Decomposition Results for the Manufacturing Sector Using Labor Productivity and TFP for 1969-1996

Decomposition 1

	Within (1)	Between (2)	Cross (3)	Entry (4)	Dropped Firms: Exit (5)	Dropped Firms: Merger (6)	Net Entry (4)-(5)	Overall Growth
LP								
1969-1979	65.0%	4.2%	-7.0%	3.8%	-0.05%	1.3%	3.8%	64.8%
1979-1988	53.7%	-2.1%	-1.3%	2.3%	-0.02%	0.2%	2.3%	52.4%
1988-1996	22.3%	1.3%	-2.7%	-0.1%	0.01%	0.3%	-0.1%	20.4%
TFP								
1969-1979	16.1%	-7.8%	0.4%	1.1%	-0.10%	-0.5%	1.2%	10.4%
1979-1988	12.8%	-7.5%	-0.3%	0.2%	-0.02%	0.4%	0.2%	4.9%
1988-1996	5.9%	-3.1%	2.2%	0.4%	0.03%	0.4%	0.4%	5.0%

Decomposition 2

	Within (1)	Between (2)	Cross (3)	Entry (4)	Dropped Firms: Exit (5)	Dropped Firms: Merger (6)	Net Entry (4)-(5)	Overall Growth
LP								
1969-1979	61.5%	2.17%		1.4%	-0.15%	0.5%	1.6%	64.8%
1979-1988	53.0%	-2.18%		1.4%	-0.05%	-0.1%	1.5%	52.4%
1988-1996	20.9%	-0.01%		-0.2%	0.01%	0.3%	-0.2%	20.4%
TFP								
1969-1979	16.3%	-7.56%		0.9%	-0.12%	-0.6%	1.0%	10.4%
1979-1988	12.6%	-7.63%		0.2%	-0.02%	0.4%	0.2%	4.9%
1988-1996	7.0%	-1.94%		0.4%	0.03%	0.4%	0.4%	5.0%

entire sample. The measure of the share (s_{it}) used for LP is employment, while that used for TFP is real gross output. The upper panel of the table shows the results using the first decomposition method given by equation (1), and the lower panel of the table shows the results using the second decomposition method given by equation (2). The distributions of LP and TFP growth rates for the three subperiods are provided in the appendix.

The first column shows that, in almost all cases, the within-firm component explains virtually all the productivity growth for both LP and TFP decompositions, and the combined effect of the rest is negative in almost all cases. Although the within-firm component's large share partly reflects the relatively small contribution made by entries and exits, these results indicate some interesting features. First, the overall share of the within-firm component is significantly larger for TFP because of a large and negative between-firm effect. The corresponding implications are discussed later. Second, although the overall TFP growth rate remained more or less constant for 1979-1988 and 1988-1996 for the sample firms examined, the within-firm TFP growth for these firms dropped by about 6% in both decompositions. This result is in line with Hayashi and Prescott's (2002) main finding that there was a slowdown in the exogenous productivity growth rate during the later period.

Next, signs of the between-firm effect are mostly positive for labor productivity except during the bubble-economy period (1979-1988), implying that firms with labor productivity above the industry average expanded more in terms of employment. The negative cross-firm term for labor productivity implies a negative correlation between labor productivity growth and employment growth, and this may be capturing the effect of increased capital intensity through a substitution of labor with capital, or increased TFP among downsizing firms. The negative between-firm effect for TFP indicates that, in terms of output, firms above industry average contracted more (i.e., by the dramatic fall of initially more productive firms) and/or that firms below industry average expanded more (i.e., due to the catching up of initially less productive firms).[22] Furthermore, the size of the between-firm effect is quite large, indicating a substantial reallocation across continuing firms. The positive cross-firm effect for TFP shows the expected relationship between TFP growth and output growth, and it is observed in all periods except during the bubble-economy period.

[22] As we will see later in TFP decomposition by employment size, the negative between-firm effect is observed only among large firms. Hence, it may be the case that the fall of initially productive (and large) firms dominates the overall effect.

Among the group of continuing firms examined here, we do not find any conclusive evidence of a misallocation of resources during the 1988-1996 period. This is because the between-firm and cross-firm effects are larger in most cases during the 1988-1996 period than in previous periods. As we can see from the table, the cross-firm effect for TFP is particularly strong during this period. As a result, it leads us to speculate that the downsizing of relatively inefficient firms may have taken place rather quickly during the sluggish-growth period.

Finally, we discuss changes in entry and exit effects over time. Note here that the positive sign in the exit and merger columns indicates a negative contribution to the overall growth rate, in accordance with equation (1) and equation (2). The net-entry effect is the difference between the entry effect and the exit effect. The estimated variations in entry and exit dynamics are more or less consistent across the two decompositions.

When using labor productivity, the table shows that the entry component reduces productivity by 0.1% to 0.2% during the post-bubble period, but in prior periods it boosted overall productivity growth by 1.4% to 3.8%. Although the exit contribution is small in all cases because of the small number of firms, we find that the contribution of the exit component decreased slightly during the 1988-1996 period.

In contrast, the entry effect is stronger during the post-bubble period than during the bubble period for the TFP decomposition. The increase during the post-bubble period may have been caused by the fact that more firms, including ones with low productivity, had joined the financial market during the bubble-economy era. Although the results on entry are mixed depending upon whether we use labor productivity or TFP, we will see later that the change in the contribution of entering firms to TFP growth during the post-bubble period depends on firm size. In particular, the results for smaller firms are consistent with the labor productivity results: Entrants' contribution to overall productivity growth declined during the 1988-1996 period.

As in the labor productivity decomposition, we observe that the contribution of exits to TFP growth deteriorates during the post-bubble period compared with the pre-bubble period even though the size of exit effect is small. Finally, by and large, the results show that mergers took place among the low-productivity firms, and the contribution of mergers to overall productivity growth did not change significantly between the pre- and post-bubble periods in most cases.

We also conducted similar exercises using annual productivity growth rates, in which the resulting annual share figures are averaged over the three subperiods. The main findings discussed here remained robust for the annual productivity decomposition. In these exercises, we find an even sharper decline in within-firm TFP during the sluggish-growth period. These results are shown in the appendix.

Next, Table 4 shows the results of the TFP growth rates decomposition exercises, broken down by size. Firms are categorized into large and small firms based on the average employment and capital stocks across the time they appear in the database. The threshold level of each measure is given by the median firm of each measure.[23]

We begin with the examination of the decomposition results by employment size. Whereas the overall results look similar to the previous table, there are some striking differences. Primarily, the entry contribution falls quite dramatically for small firms during the 1988-1996 period, indicating that financial resources may have been less available to productive small entrants. Second, unlike the previous results, the between-firm effects are all

[23]The results of the decomposition by output size are similar to the capital stock results.

Table 4: TFP Decomposition Results for the Manufacturing Sector, by Size

Employment

	Within	Between	Cross	Entry	Dropped Firms Exit	Dropped Firms Merger	Net Entry	Overall Growth
	(1)	(2)	(3)	(4)	(5)	(6)	(4)-(5)	
Large Firms								
1969-1979	16.3%	-8.7%	0.4%	0.5%	-0.05%	-0.3%	0.5%	8.9%
1979-1988	12.8%	-8.1%	0.0%	0.0%	0.00%	0.5%	0.0%	4.3%
1988-1996	6.0%	-3.3%	2.2%	0.4%	0.00%	0.3%	0.4%	4.9%
Small Firms								
1969-1979	13.0%	1.2%	0.1%	10.4%	-0.55%	-2.4%	11.0%	27.7%
1979-1988	12.3%	1.7%	-4.4%	2.0%	-0.20%	-0.2%	2.2%	12.1%
1988-1996	4.1%	0.9%	3.3%	0.2%	0.29%	1.3%	-0.1%	7.0%

Capital Stock

	Within	Between	Cross	Entry	Dropped Firms Exit	Dropped Firms Merger	Net Entry	Overall Growth
	(1)	(2)	(3)	(4)	(5)	(6)	(4)-(5)	
Large Firms								
1969-1979	16.0%	-8.0%	0.3%	0.6%	-0.1%	-0.3%	0.7%	9.2%
1979-1988	13.2%	-7.7%	-0.5%	0.1%	0.0%	0.5%	0.1%	4.6%
1988-1996	5.7%	-3.1%	2.0%	0.4%	0.0%	0.4%	0.4%	4.6%
Small Firms								
1969-1979	17.6%	-5.8%	1.2%	8.2%	-0.1%	-2.2%	8.3%	23.5%
1979-1988	7.9%	-3.4%	1.9%	1.3%	-0.3%	-0.6%	1.6%	8.5%
1988-1996	8.0%	-2.4%	4.6%	0.4%	0.3%	0.6%	0.0%	9.6%

positive for small firms. This finding implies that a firm's initial productivity level relative to the industry average is a good indicator of the firm's output growth over the next decade if the firm is small (in terms of employment).[24] Third, the large fall in overall TFP growth for small firms during the post-bubble period arises mainly from the drop in the within-firm component. For large firms, the large drop in within-firm TFP growth during the post-bubble period is mitigated by the improvement in between-firm effect. Finally, the variations in productivity gains and losses associated with net entry mostly appear among small firms. We find that the

[24] The table shows that the opposite can be said for large firms.

net-entry contribution is particularly low for small firms during the post-bubble period, owing to the deterioration in both entry and exit contributions.

The results based on capital stock size differ slightly for small firms, but they remain more or less the same for large firms. For small firms, the fall in within-firm TFP takes place even prior to the sluggish-growth period. That is, smaller firms that were relatively less dependent on capital usage were starting to experience a slowdown in TFP growth after the high-growth period.[25] The rest of the results are similar to the case of employment size.

5 Conclusion

The productivity decomposition exercises reveal that, among continuing firms, we do not find strong evidence of misallocation of resources during the 1990s. However, we find some evidence of misallocation in the behavior of entering firms: The contribution of entry to TFP growth decreased for smaller firms during the sluggish period. The implication of this result is important since most entrants are small. Also, the result seems to confirm the findings by Motonishi and Yoshikawa (1999) that the credit crunch was mainly a phenomenon for smaller firms.[26] Moreover, the weak and negative exit contribution, reflecting the small number of exits as well as the absence of exits by least productive firms, underscores the fact that the cleansing effect was not at work. This result is in line with the findings of Peek and Rosengren (2005) that financially troubled and heavily indebted companies were able to

[25]There are at least a couple of explanations for the difference. One is that businesses with small capital stock did not use or have access to the capital that generated high growth. The differences in the types of capital will be captured in TFP, because the paper uses one type of deflator for all capital stocks; furthermore, capital stocks are not deflated based on their vintages. Another possibility is that there was a high level of gains associated with economies of scale, especially in the usage of capital, during the 1979-1988 period.

[26]Note that the proportion of entry and exit effects may be larger than the estimates obtained in this paper, due to the database's limitation on coverage. Here, the paper notes only the direction of the change over time.

survive because Japanese banks extended them lines of credits. The lack of exits by least efficient firms contributed to a lower average productivity growth.

Furthermore, the productivity decomposition exercises demonstrate that there is a significant drop in within-firm TFP growth rates during the 1988-1996 period.[27] The only exception to this pattern this paper found was for businesses with smaller capital stocks. One possible contributor to the reduction in within-firm TFP was considerable labor hoarding because of high labor adjustment costs. Although this may partly explain the reduction in TFP, it is unlikely that labor hoarding alone can explain a decline of this magnitude.[28] As a result, we need to seek other explanations to fully account for the decline in TFP growth.

Finally, we do not intend to suggest that the reduction in within-firm TFP occurred independently from the reallocation process. To illustrate, the reallocation process may interact with the growth of within-firm TFP through a higher level of competition. If the effect of reallocation on aggregate productivity can go beyond the changes in input and output shares, we need a set of models that explain the interaction between reallocation and within-firm productivity dynamics.[29] Although the high level of aggregate productivity growth without substantial reallocation contribution prior to the 1990s does not point to the importance of reallocation, one key change may be that the Japanese economy has matured. Accordingly, it is possible that technological innovations via creative destruction channels have become

[27] Although there is also a large drop after the high-growth period, the annual productivity decomposition table in the appendix shows that the drop is particularly salient during the 1988-1996 period.

[28] Although the Employment Adjustment Subsidy covers the cost of labor hoarding in Japan, only a small fraction of manufacturing workers were covered by this, despite the wide eligibility of manufacturing establishments for coverage during this period. The take-up of this subsidy was particularly high in the iron and steel industry. For more information on this subsidy and its theoretical implications, see Griffin (2005).

[29] Aghion, Blundell, Griffith, Howitt, and Prantl (2004) ask this question by examining how entry threat spurs innovation incentives. They find that entry threat promotes innovation in technologically advanced industries, but the opposite is the case in less advanced sectors.

increasingly critical for Japan's economic performance.

Appendix

A. Construction of Variables Using the NEEDS Database

The total sales revenue (NEEDS item #90) is used as a measure of gross output. Nominal value of sales is deflated into a constant year 2000 value, using the annual averages of monthly Corporate Goods Price Indices (CGPI) for two-digit manufacturing industries, constructed by the Bank of Japan.[30] Because the CGPI for the rubber industry (NEEDS industry code #13) was not available, it was omitted from the analysis. Moreover, the CGPI for the nonferrous metals industry is used for the nonferrous metals and metal products industry (NEEDS industry code #19). Similarly, total material cost (NEEDS item #292) is deflated, using the CGPI, and is used as a measure of material input. The material and labor cost shares are calculated, respectively, by dividing total material cost (NEEDS item #292) and total labor cost (NEEDS item #293) by total cost (NEEDS item #306).

The number of employed workers (NEEDS item #158) is used as the measure of employment. To construct a measure of labor input, this figure is multiplied by average monthly work hours, by two-digit manufacturing industry, taken from *Monthly Labor Survey*, published by Japanese Ministry of Health, Labor, and Welfare.[31] Note that *Monthly Labor Survey* does not have a category "pharmaceutical" for the sample period, and the category "other manufacturing" starts in 1986. Accordingly, figures for the manufacturing sector are used for these sectors.[32] Moreover, the category "transportation equipment" is used for all sectors related to

[30]These data are formatted and made available at the Bank of Japan's website. English site for CGPI can be found at http://www2.boj.or.jp/en/dlong/dlong.htm.

[31]These data as well as other major Japanese labor statistics are formatted and made available by the Japan Institute for Labor Policy and Training, in Japanese, at the following website: http://stat.jil.go.jp.

[32]This substitution should not be a problem since the correlations of hours across sectors are very high.

transportation in the NEEDS database.

The measure of capital stock is constructed using the total tangible assets (NEEDS item #21) of the NEEDS database, which is the sum of buildings (NEEDS item #23), machineries (NEEDS item #24), transportation equipment (NEEDS item #25), other equipment (NEEDS item #26), land (NEEDS item #27), and others (NEEDS item #28). According to NEEDS item #260, the method of depreciation for tangible assets, most observations use a constant rate of depreciation, some use a combination of the constant rate and the constant value, and a very small fraction use a combination of constant rate, constant value, and the rate of depreciation proportional to output. These figures then are converted to a constant year 1995 value, using the annual average of the monthly wholesale price index (WPI) for machinery and equipment, provided by the Bank of Japan. The WPI is available at the Bank of Japan's website.

B. Lists of Exiting Firms

Table 5 lists the exiting firms that are used for the productivity decomposition. Table 6 lists firms that are excluded from the exit group because internet resources indicated existence of those firms after the year of disappearance from the NEEDS database. We determined that some of the firms had mergers (Azuma Steel, Toshin Steel, and Toyo Pulp) even though the merger index did not indicate incidence of a merger; however, we did not include these firms in the merger group because of the concern that it would create an inconsistency in the selection of firms in the merger group.

Table 5: Exiting Firms Used in Productivity Decomposition

Name	Year of Exit	Name	Year of Exit
Shinkoogyoo Kaihatsu	1970	Well	1980
Satoh Agricultural Machine Mfg.	1970	Rin Kagaku Kogyo	1980
Nagoya Seito	1971	Osaka Meter	1980
Hayakawa Iron Works	1971	Showa Crane Mfg.	1981
Monde Distilleries	1972	Nippon Tile Industrial	1982
Yamato Woolen Textile	1973	Suzue Machinery	1983
Sansei Mfg.	1974	Aiden	1983
Tokyo Tokei Seizo	1974	Mamiya Camera	1983
Yoshida Machine Tool	1975	Akimoku Kogyo	1983
Fujiya Electric	1976	Daiichibo	1992
Osaka Yogyo	1977	Oriental Photo Ind.	1994
Hashihama Shipbuilding	1977	Itami Machine Works	1994
Sankyo Special Steel Bolt and Nut	1978		
Tanaka Machinery Mfg.	1978		

Table 6: Exiting Firms Excluded from Productivity Decomposition

Name	Year of Disappearance	Name	Year of Disappearance
Funabashi Shokuhin	1971	Kikosha	1986
Ando Iron Works	1971	Azuma Steel	1987
Hitachi Ferrite	1976	Toshin Steel	1987
Hokubu Industrial	1981	Nitto Metal Industry	1987
Dai-Nippon Sugar Mfg.	1983	Toyo Pulp	1989
Meiji Sugar Mfg.	1983	KYC Machine Industry	1993
Hakodate Dock	1984	Nichibei Fuji Cycle	1995
Ohto	1985		

C. Annual Productivity Growth Decomposition

This section presents the results of the productivity decomposition exercises using annual productivity growth rates. The resulting annual share figures are averaged across three subperiods as described in the main text. Table 7 shows the average number of firms used for the decomposition, as well as the total number of entries and exits for each of the three time intervals.[33] The total number of entries and exits for the annual TFP decomposition is smaller than for the regular decomposition. This is because some firms lacked observations on material costs during the first or the last year of their time series, so we could not compute the TFP for the entering year or exiting year for those firms.

Table 7: Number of Firms Used in Annual Productivity Decomposition

	Average Number of Firms	Entry		Dropped Firms: Exit		Dropped Firms: Merger	
		Average	Total	Average	Total	Average	Total
LP							
1969-1979	1,162	31.2	312	1.4	14	2.6	26
1979-1988	1,274	12.8	115	1.0	9	2.8	25
1988-1996	1,340	7.1	57	0.4	3	2.0	16
TFP							
1969-1979	1,117	22.0	220	1.3	13	2.4	24
1979-1988	1,215	6.9	62	0.8	7	2.8	25
1988-1996	1,305	4.6	37	0.4	3	1.9	15

Table 8 gives the results of annual TFP growth decomposition. The main results are essentially the same. However, one noteworthy point is that, for the annual average share, the within-firm TFP component does not fall during the bubble-economy period. Consequently, the drop in within-firm TFP is a salient feature of the post-bubble period. By comparing Table 8 with Table 3, we also observe some reallocation characteristics. For instance, the estimated total contribution of the cross-firm component of TFP growth over each time interval, obtained by multiplying the average annual contribution by the number of years, is much higher than the actual level of contribution given by Table 3, except during the post-bubble period. Again, this appears to confirm the relative strength of the long-run reallocation mechanism for

[33] Firms that enter and exit within each time interval show up neither as entries nor as exits in the main decomposition exercise. Although these firms are picked up in both entry and exit components for the annual productivity growth decomposition, we have excluded them because we could not verify their bankruptcy status upon disappearance from the NEEDS database. There are only five such firms in our database.

incumbents during the post-bubble period compared with the earlier periods. Finally, note that the standard errors of the annual contributions are quite large because of the high level of volatility at annual frequency.

Table 8: Average Annual Productivity Decomposition Results for the Manufacturing Sector, Using Labor Productivity and TFP for 1969-1996

Decomposition 1

					Dropped Firms		Net	Overall
	Within	Between	Cross	Entry	Exit	Merger	Entry	Growth
	(1)	(2)	(3)	(4)	(5)	(6)	(4)-(5)	
LP								
1969-1979	6.5%	0.5%	-0.4%	-0.05%	-0.004%	0.13%	-0.04%	6.5%
1979-1988	6.1%	-0.1%	-0.3%	0.08%	-0.004%	-0.03%	0.08%	5.8%
1988-1996	2.7%	0.2%	-0.3%	-0.03%	0.001%	0.03%	-0.03%	2.6%
TFP								
1969-1979	1.5%	-0.9%	0.3%	0.03%	-0.010%	-0.05%	0.04%	1.1%
1979-1988	1.7%	-0.9%	0.1%	0.00%	-0.001%	0.29%	0.01%	0.6%
1988-1996	0.7%	-0.3%	0.2%	0.04%	0.004%	0.04%	0.03%	0.6%

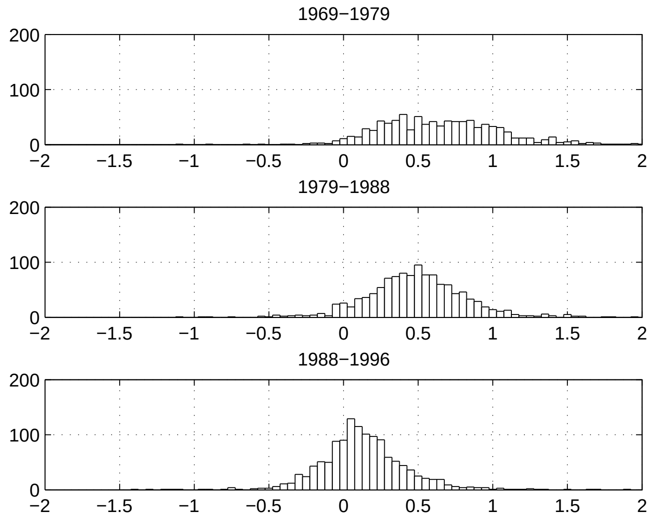
Decomposition 2

					Dropped Firms		Net	Overall
	Within	Between	Cross	Entry	Exit	Merger	Entry	Growth
	(1)	(2)	(3)	(4)	(5)	(6)	(4)-(5)	
LP								
1969-1979	6.3%	0.4%		-0.08%	-0.005%	0.12%	-0.08%	6.5%
1979-1988	6.0%	-0.3%		0.07%	-0.004%	-0.03%	0.08%	5.8%
1988-1996	2.6%	0.03%		-0.03%	0.001%	0.03%	-0.03%	2.6%
TFP								
1969-1979	1.7%	-0.7%		0.03%	-0.010%	-0.05%	0.04%	1.1%
1979-1988	1.7%	-0.9%		0.00%	-0.001%	0.29%	0.01%	0.6%
1988-1996	0.9%	-0.2%		0.04%	0.004%	0.04%	0.03%	0.6%

D. The Distributions of Productivity Growth Rates

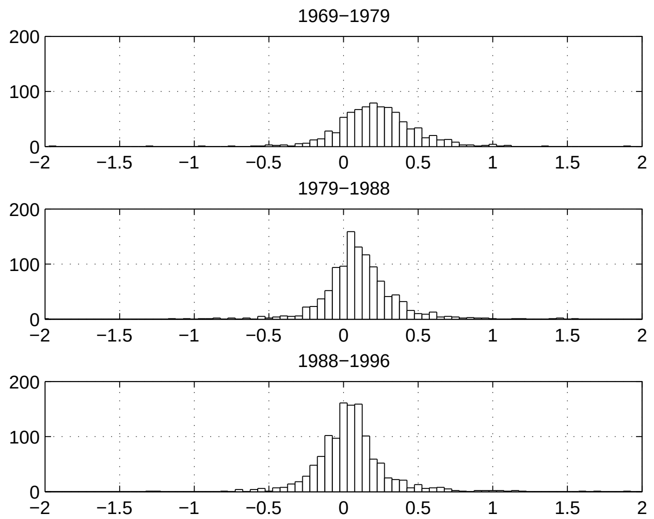
Figures 1 and 2, respectively, show the distributions of labor productivity growth rates and total factor productivity growth rates over the three time intervals defined in the main text. From Figure 1, we can characterize the changes in the distributions of LP growth rates.

Figure 1: Distributions of the Labor Productivity Growth Rates



Note: High-growth period (1969-1979), bubble-economy period (1979-1988), and sluggish-growth period (1988-1996).

Figure 2: Distributions of the Total Factor Productivity Growth Rates



Note: High-growth period (1969-1979), bubble-economy period (1979-1988), and sluggish-growth period (1988-1996).

First, the dispersion of the distribution shrinks over time. Second, the distribution shifts to the left over time. Figure 2 indicates that similar changes are observed for TFP growth rate distributions between the first two periods, whereas there is little noticeable change between the last two periods.

From both figures, we can conclude that the degree of productivity heterogeneity was highest during the high-growth period. The TFP figure tells us that the gap between high achievers and low achievers was already starting to narrow during the bubble-economy period. High dispersion of TFP growth rates during the 1970s may be partly due to the relatively high level of entries via the incorporation of smaller regional stock markets during this period, as well as the extraordinary performance achieved by some firms during the catch-up phase.

References

[1] Aghion, Phillipe, Richard Blundell, Rachel Griffith, Peter Howitt and Susanne Prantl. "The Effects of Entry on Incumbent Innovation and Productivity." Mimeo, Harvard University, 2005.

[2] Aghion, Phillipe and Peter Howitt. "Growth and Unemployment." *Review of Economic Studies*, 1994, 61(3), pp. 477-494.

[3] Aghion, Phillipe and Peter Howitt. "A Model of Growth through Creative Destruction." *Econometrica*, 1992, 60(2), pp. 323-351.

[4] Bartelsman, Eric J. and Mark Doms. "Understanding Productivity: Lessons from Longitudinal Microdata." *Journal of Economic Literature*, 2000, 38(3), pp. 569-594.

[5] Campbell, Jeffrey R. and Jonas D. M. Fisher. "Aggregate Employment Fluctuations with Microeconomic Asymmetries." *American Economic Review*, 2000, 90(5), pp. 1323-1345.

[6] Campbell, Jeffrey R. and Jonas D. M. Fisher. "Idiosyncratic Risk and Aggregate Employment Dynamics." *Review of Economic Dynamics*, 2004, 7(2), pp. 331-353.

[7] Campbell, John, Martin Lettau, Burton G. Malkiel and Yexiao Xu. "Have Individual Stocks Become More Volatile? An Empirical Exploration of Idiosyncratic Risk." *The Journal of Finance*, 2000, 56(1), pp. 1-43.

[8] Caballero, Ricardo and Mohammed Hammour. "The Cleansing Effect of Recessions." *American Economic Review*, 1994, 84(5), pp. 1350-1368.

[9] Caballero, Ricardo and Mohammed Hammour. "On the Timing and Efficiency of Creative Destruction." *The Quarterly Journal of Economics*, 1996, 111(3) pp. 805-852.

[10] Caballero, Ricardo, Takeo Hoshi and Anil K. Kashyap. "Zombie Lending and Depressed Restructuring in Japan." Mimeo, University of Chicago, 2005.

[11] Davis, Steve and John Haltiwanger. "On the Driving Forces Behind Cyclical Movements in Employment and Job Reallocation." *American Economic Review*, 1999, 89(5), pp. 1234-1258.

[12] Davis, Steve, John Haltiwanger and Scott Schuh. *Job Creation and Destruction*, MIT Press: Cambridge, 1996.

[13] Ericson, Richard and Ariel Pakes. "Markov-Perfect Industry Dynamics: A Framework for Empirical Work." *The Review of Economic Studies*, 1995, 62(1), pp. 53-82.

[14] Foster, Lucia, John Haltiwanger and C. J. Krizan. "Aggregate Productivity Growth: Lessons from Microeconomic Evidence." National Bureau of Economic Research (Cambridge, MA), Working Paper No. 6803, 1998.

[15] Foster, Lucia, John Haltiwanger and C. J. Krizan. "The Link between Aggregate and Micro Productivity Growth: Evidence from Retail Trade." National Bureau of Economic Research (Cambridge, MA), Working Paper No. 9120, 2002.

[16] Fukao, Kyoji, Tomohiko Inui, Hiroki Kawai and Tsutomu Miyagawa. "Sectoral Productivity and Economic Growth in Japan, 1970-98: An Empirical Analysis Based on the JIP Database." Economic and Social Research Institute, Cabinet Office, Discussion Paper No. 67, 2003.

[17] Griffin, Naomi N. "Labor Adjustment, Productivity and Output Volatility: An Evaluation of Japan's Employment Adjustment Subsidy." Congressional Budget Office (Washington, D.C.), Working Paper No. 2005-10, 2005.

[18] Hamao, Yasushi, Mei Jianping and Xu Yexiao. "Idiosyncratic Risk and the Creative Destruction in Japan." National Bureau of Economic Research (Cambridge, MA) Working Paper No. 9642, 2003.

[19] Hayashi, Fumio and Edward C. Prescott. "The 1990s in Japan: A Lost Decade." *Review of Economic Dynamics*, 2002, 5(1), pp. 206-235.

[20] Jovanovic, Boyan. "Selection and the Evolution of Industry." *Econometrica*, 1982, 50(3), pp. 649-670.

[21] Motonishi, Taizo and Hiroshi Yoshikawa. "Causes of the Long Stagnation of Japan during the 1990s: Financial or Real?" *Journal of the Japanese and International Economies,* 1999, 13(3), pp. 181-200.

[22] Olley, Steven G. and Ariel Pakes. "The Dynamics of Productivity in the Telecommunications Equipment Industry." *Econometrica,* 1996, 64(6), pp. 1263-1297.

[23] Peek, Joe and Eric S. Rosengren. "Unnatural Selection: Perverse Incentives and the Misallocation of Credit in Japan." *American Economic Review,* 2005, 95(4), pp. 1144-1166.

[24] Woo, David. "In Search of 'Capital Crunch': Supply Factors Behind the Credit Slowdown in Japan." *Journal of Money, Credit and Banking,* 2003, 35(6), pp. 1019-1038.