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**“Productivity Dynamics in Japan and the Negative Exit Effect”**

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### **Service Sector Productivity in Japan**

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## Productivity Dynamics in Japan and the Negative Exit Effect<sup>※</sup>

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### Abstract

We conducted an analysis of productivity dynamics using the microdata of the Credit Risk Database (CRD), the *Establishment and Enterprise Census* and the *Economic Census*. We found that the negative exit effect in Japan is driven by the exit of some highly productive firms. This finding suggests that to reduce the negative exit effect policies to support SMEs should not be based on their size but by focusing on SMEs with high TFP that are actively investing.

**Key words:** Productivity dynamics, TFP, Labor Productivity

**JEL codes:** O47,O53

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## 1. Introduction

Since the 1990s, there have been a substantial number of studies examining productivity dynamics using firm- and establishment-level data to explain why Japan's total factor productivity (TFP) growth has been sluggish for a long time.<sup>1</sup> The findings of these studies can be summarized in terms of the following three points. First, Fukao and Kwon (2006) and Fukao, Kim and Kwon (2008) pointed out that the decline in productivity growth was due to a substantial drop in within-firm productivity growth. Within-firm productivity growth is determined by firms' investment in information and communications technology (ICT), research and development (R&D), and intangible assets such as human capital (see, e.g., Syverson, 2011). Against this background, possible reasons for the decline in Japanese firms' productivity growth include low investment in intangible assets (Takizawa, 2015) and the fact that Japanese firms have fallen behind in terms of ICT investment (Fukao et al., 2016).

Second, in a survey of decomposition analyses of productivity growth focusing mainly on developed countries, Bartelsman and Doms (2000) find that about 50 percent of the total productivity growth in these countries is explained by entry and exit effects as well resource allocation among surviving firms. However, studies for Japan suggest that the reallocation effect is much smaller than in other countries. Studies such as those by Nishimura, Nakajima, and Kiyota (2005), Fukao and Kwon (2006), and Caballero, Hoshi, and Kashyap (2008) show that in Japan the economic "metabolism" does not operate normally and that low-productivity firms, which should shrink or withdraw, actually continue to exist and/or even expand, while high-productivity firms, which should continue to exist and expand, actually shrink or even exit the market.

Third, a number of studies, using firm-level microdata for Japan, divide firms into large and small firms and examine the reasons for the substantial decline in productivity growth. Kim, Fukao, and Makino (2010) and Ikeuchi et al. (2013) show that large factories (firms) have enjoyed strong total factor productivity (TFP) growth even during the "two lost decades" from the 1990s onward, while the TFP growth rate of small factories (firms) has declined substantially. Reasons why SMEs were left behind that have been highlighted

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<sup>1</sup> For a detailed survey (in Japanese) of the literature, see Kim, Fukao, and Makino (2010).

are insufficient R&D investment, the fact that SMEs have been slow to internationalize through exports and foreign direct investment (Kim, Fukao, and Makino, 2010), and insufficient investment in ICT (Fukao et al., 2016). Moreover, Ikeuchi et al. (2013) argue that technology spillovers from large firms to SMEs may have declined as a result of weakening supplier-customer relationships as large firms in the manufacturing sector have shifted production abroad. Finally, Miyagawa et al. (2015) show that the management methods of SMEs lag behind those of large firms.

Although one of the key features of productivity dynamics in Japan is the negative exit effect, studies on this issue are still limited. The total exit effect in each industry is the sum of the exit effect of all exiting firms. When a large firm with very high productivity exits, this pulls down the total exit effect substantially. Therefore, in order to fully understand the negative exit effect, we need to analyze the distribution of productivity levels and of firm sizes across all exiting firms. However, such analyses have not been conducted so far.

Another shortcoming of preceding studies on productivity dynamics is that they either focus on the manufacturing sector or on medium and large-sized firms. The reason is that the *Basic Survey of Japanese Business Structure and Activities*, the only census-type government survey which covers the non-manufacturing sector and from which we can calculate each firm's TFP, does not cover SMEs. The survey only covers enterprises with 50 or more employees and whose paid-up capital or investment funds are over 30 million yen.

Against this background, the aim of the present study is to examine productivity dynamics and the distribution of TFP and firm size across exiting firms using micro data of the Credit Risk Database, which covers SMEs in both the manufacturing and the non-manufacturing sector. This allow us to capture the “anatomy” of the exit effect of SMEs.<sup>2</sup>

The Credit Risk Database is based on information on borrower firms held by the Japan Federation of Credit Guarantee Corporations and government and private-sector financial institutions. The Credit Risk Database only covers SMEs. To cope with this shortcoming, we also analyze productivity dynamics using

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<sup>2</sup> For a comprehensive recent study of SMEs in Japan, see, e.g., the study by Goto (2014), which, however, does not examine productivity dynamics.

microdata of the *Economic Census for Business Activity*, which covers Japan's entire economy. Since the *Economic Census* does not collect capital stock data, we only examine the dynamics of labor productivity when we use the *Economic Census* data.

The remainder of the study is organized as follows. Section 2 analyzes TFP dynamics among SMEs in the manufacturing and non-manufacturing sectors using the CRD. Next, Section 3 examines the cumulative labor productivity contribution of exiting firms using the *Economic Census for Business Activity*, which covers Japan's entire economy<sup>3</sup> analyzes. Finally, Section 4 summarized the results.

## **2. The Sources of the Negative Exit Effect: Analysis Based on SME Microdata**

### *2.1 Decomposition of TFP growth*

The data used for the analysis are the microdata of the Credit Risk Database (CRD) created by the CRD Association based on information on transaction partners held by the Japan Federation of Credit Guarantee Corporations and government and private-sector financial institutions. While firms included in the CRD are limited to SMEs that have borrowed from financial institutions affiliated with the CRD Association, the CRD has the major advantage that it covers not only the manufacturing sector but also a large number of SMEs in the non-manufacturing sector.<sup>3</sup> The CRD used in this study contains data on a total of 1.87 million firms from 1999 to 2013. The number of firms recorded was just under 700,000 in 1999, rose to more than 1.4 million in 2008, and then declined to about 1.2 million in 2013.<sup>4</sup> In addition, it covers a large number of micro-enterprises, and while some large enterprises are also included, their share is only about 0.1 percent. The share of firms in the CRD for which it is possible to estimate TFP is about 70 percent.

Matching the industry classification of the CRD to that of the 2015 edition of the Japan Industrial Productivity Database,<sup>5</sup> we calculate the TFP level of each firm relative to the average TFP level of the industry to which it belongs. Following Good, Nadiri, and Sickles (1997), the logarithm of the TFP level of

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<sup>3</sup> Member financial institutions of the CRD Association provide data to the CRD Association on firms classified as SMEs based on the provisions of Article 2, Paragraph 1, of the Small and Medium-sized Enterprise Basic Act and government ordinances in legislation related to SMEs (see the Appendix for details).

<sup>4</sup> It should be noted that since the CRD only includes firms that are transaction partners of member financial institutions of the CRD Association and the number of member financial institutions changes over time, changes in the number of firms recorded in the CRD reflect not only changes in economic circumstances.

<sup>5</sup> See the following link for details: <https://www.rieti.go.jp/jp/database/JIP2015/>.

firm  $f$  at time  $t$  ( $t > 0$ ) is defined in relation to the logarithm of the TFP level of the representative firm in the same industry at the start of the period ( $t = 0$ , which is 2003 in our analysis) as follows:

For  $t = 2003$ ,

$$\ln TFP_{f,t} = (\ln Q_{f,t} - \overline{\ln Q_t}) - \sum_{i=1}^n \frac{1}{2} (S_{i,f,t} + \overline{S_{i,t}}) (\ln X_{i,f,t} - \overline{\ln X_{i,t}}) \quad (1)$$

For  $t \geq 2004$ ,

$$\begin{aligned} \ln TFP_{f,t} = & (\ln Q_{f,t} - \overline{\ln Q_t}) - \sum_{i=1}^n \frac{1}{2} (S_{i,f,t} + \overline{S_{i,t}}) (\ln X_{i,f,t} - \overline{\ln X_{i,t}}) \\ & + \sum_{s=1}^t (\overline{\ln Q_s} - \overline{\ln Q_{s-1}}) - \sum_{s=1}^t \sum_{i=1}^n \frac{1}{2} (\overline{S_{i,s}} + \overline{S_{i,s-1}}) (\overline{\ln X_{i,s}} - \overline{\ln X_{i,s-1}}) \end{aligned} \quad (2)$$

where  $Q_{f,t}$  is the output of firm  $f$  at time  $t$ ,  $S_{i,f,t}$  is the cost share of production factor  $i$  of firm  $f$ , and  $X_{i,f,t}$  is the input of production factor  $i$  of firm  $f$ . Variables with a bar represent the industry average of that variable.

As factors of production, capital, labor, and real intermediate inputs are taken into account. Since firm-level data for working hours are not available, the average for each industry is used instead. Details on the data required for the measurement of TFP are provide in the Appendix. Since the number of employees in the CRD does not include executives and managers, to take their labor input into account, the number of employees plus 1 is used as the number of workers.

We define the representative firm for each industry as a hypothetical firm whose gross output, inputs, and cost share of production factors are identical to the industry average. The first two terms on the right-hand side of equation (2) denote the difference between the logarithm of firm  $f$ 's TFP level at time  $t$  and that of the representative firm at that time. The third and fourth terms denote the difference between the logarithm of the TFP level of the representative firm at time  $t$  and the base year (2003). The TFP index measured in this way captures not only the cross-section productivity distribution but also changes in the productivity distribution over time by taking into account that the TFP of the representative firm changes over time. Moreover, unlike productivity measurements based production function estimates, the approach taken here has the advantage that it can take differences in factor inputs between firms and imperfect competition in product markets into account;<sup>6</sup> on the other hand, it has the limitation that we must assume constant returns

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<sup>6</sup> As pointed out by Kasahara, Nishida, and Suzuki (2017), when using the production function approach to examine productivity dynamics, assuming that there are no differences in factor inputs across firms may lead to overestimation of the reallocation effect.

to scale and perfect competition in factor markets.

To aggregate firm-level TFP at the industry level, we follow the approach of Baily, Hulten, and Campbell (1992). We define the logarithm of industry-level TFP at time  $t$  as follows:

$$\ln TFP_t = \sum_{f=1}^n \theta_{f,t} \ln TFP_{f,t}$$

where  $\ln TFP_{f,t}$  is the logarithm of firm  $f$ 's TFP level, and the weight  $\theta_{f,t}$  is firm  $f$ 's nominal sales share in the industry to which firm  $f$  belongs. For the decomposition of industry productivity growth, we employ the approach of Foster, Haltiwanger, and Krizan (2001) (referred to as FHK below).

As shown by FKH, the growth in the TFP level of a particular industry from year  $t-\tau$  to year  $t$  can be approximated as the sum of the following five factors:

$$\text{Within effect: } \sum_{f \in S} \theta_{f,t-\tau} \Delta \ln TFP_{f,t}$$

$$\text{Between effect: } \sum_{f \in S} \Delta \theta_{f,t} (\ln TFP_{f,t-\tau} - \overline{\ln TFP_{t-\tau}})$$

$$\text{Covariance effect: } \sum_{f \in S} \Delta \theta_{f,t} \Delta \ln TFP_{f,t}$$

$$\text{Entry effect: } \sum_{f \in N} \theta_{f,t} (\ln TFP_{f,t} - \overline{\ln TFP_{t-\tau}})$$

$$\text{Exit effect: } \sum_{f \in X} \theta_{f,t-\tau} (\overline{\ln TFP_{t-\tau}} - \ln TFP_{f,t-\tau})$$

where  $S$  is the set of firms that survived from  $t-\tau$  to year  $t$ ,  $N$  is the set of firms that entered, and  $X$  is the set of firms that exited.<sup>7</sup>  $\overline{\ln TFP_{t-\tau}}$  with an upper denotes the industry-average TFP level, and  $\Delta$  represents the change from year  $t-\tau$  to year  $t$ . The first term, the within effect, represents TFP growth in the industry due to TFP increases achieved within individual firms. The second term, the between effect, represents industry TFP growth resulting from an increase in the market share of high-productivity firms and decreases in the market share of low-productivity firms. The third effect, the covariance effect, represents industry TFP growth due to an increase in the market share of firms that have increased their TFP. The sum of the second and third terms represents the effect of resource reallocation across surviving firms. Finally, the fourth and fifth terms, the entry and exit effects represent industry TFP growth due to the entry of firms whose

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<sup>7</sup> If from year  $t-\tau$  to year  $t$  a firm switches from industry  $i$  to industry  $j$  and the firm's productivity is above the average of both industries, the average of industry  $i$  will fall and that of industry  $j$  will rise, and vice versa. Our entry and exit effects include this kind of switch effect.

productivity is above the industry average and the exit of firms whose TFP is below the industry average.

To decompose industry productivity growth, we need to identify surviving firms, entering firms, and exiting firms. We do so by defining surviving firms as firms for which data are available for both year  $t-\tau$  and year  $t$  and for which there is no evidence that they went bankrupt (i.e., there is no record of a “date of actual bankruptcy,” “date of bankruptcy,” or “date of announcement” before year  $t$  in the CRD).

As will be explained later, we divide our observation period overall (2003–2013) into three subperiods, and we define entering firms as firms for which data for the end year of a period are available but not for the start year of the period, and that were established no more than three years before the start year of the period. For example, for the subperiod 2009–2013, entering firms are those that were established between 2006 and 2009. Exiting firms are defined as firms for which data for the start year of the period are available but not for the end year, and that were not classified as having become a large firm (and hence dropped out of the CRD since they were no longer classified as an SME) or firms that had fully paid off all borrowing (and hence dropped out of the CRD for this reason rather than bankruptcy).

To exclude firms that exited the database because they became too large to be classified as SMEs, we identify firms that at the time of their exit (the year after the last year for which data were available) were predicted by a regression to exceed the criteria for SMEs in terms of their employment and/or paid-in capital. Similarly, to exclude firms that exited the database because they had fully paid off their borrowing, we identify firms whose outstanding amount of borrowing at the time of their exit (the year after the last year for which data were available) was predicted by a regression to have fallen below zero.

Further, for the analysis, we divide exiting firms into those that went bankrupt and those that discontinued for other reasons. Firms that went bankrupt are defined as exiting firms for which the “date of actual bankruptcy,” the “date of bankruptcy,” or the “date of announcement” are recorded in the CRD, while discontinuing firms are exiting firms that do not meet this criterion for bankrupt firms. It should be noted, however, that if a firm changes its name or moves its headquarters to another prefecture, it will be identified as a different company in the CRD. Therefore, one limitation of the CRD is that some of the firms that we identify as discontinuing firms may be surviving firms that changed their name or moved their headquarters.



## 2.2 Results of the decomposition of TFP growth

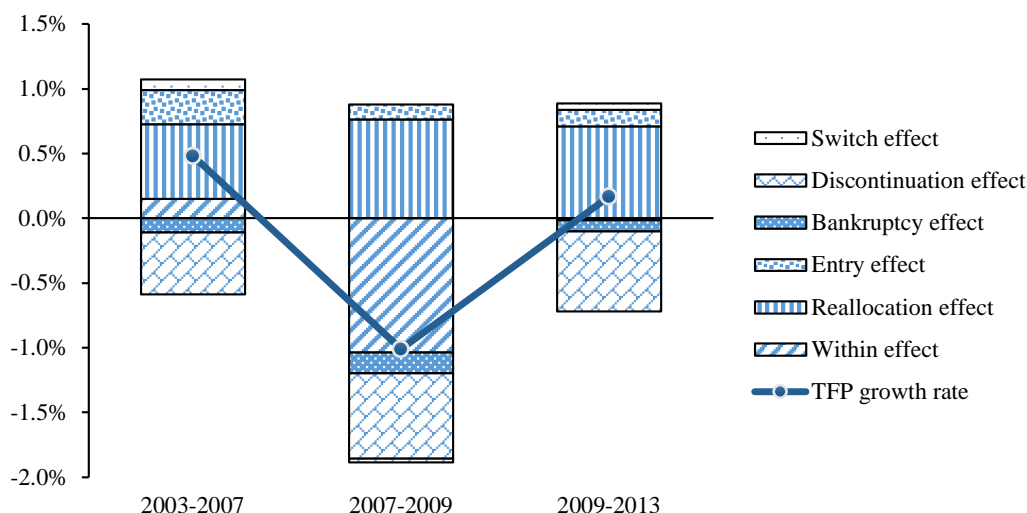
We conduct our analysis of productivity dynamics focusing on all SMEs included in the CRD from 2003 to 2013 except for firms that, as mentioned in the previous section, are likely to have dropped out of the database because they became too large or paid off all their borrowing. We divide the observation period overall (2003–2013) into the following three subperiods: (1) 2003 to 2007, during which Japan's economy was doing well; (2) 2007 to 2009, when Japan suffered the largest recession in post-war history as a result of the global financial crisis; and (3) from 2009 to 2013, which was a period of recovery from that recession.

The results of the analysis of productivity dynamics using the FHK decomposition approach are shown in Figure 1. The dynamics of TFP growth among SMEs in Japan in the period 2003–2013 can be summarized as follows.

First, regardless of the business cycle, the main source of TFP growth was the reallocation effect, which is the sum of the between effect and the covariance effect. This result differs substantially from the results obtained by Fukao and Kwon (2006) and Inui et al. (2015), who used microdata from the *Basic Survey of Japanese Business Structure and Activities* as well as micro data from the *Financial Statement Statistics of Corporations by Industry* and found that the main source of TFP growth was the within effect rather than the reallocation effect.

Results for other countries, such as for the United States by Foster, Haltiwanger, and Krizan (2001) and the United Kingdom by Disney, Haskel, and Heden (2003), show that during a recession, the reallocation effect makes a larger contribution to TFP growth than the within effect. Studies focusing on productivity dynamics among Japanese SMEs find that the reallocation effect is the main driver of increases in TFP regardless of the business cycle. This positive reallocation effect means that the size of firms with relatively high productivity increased (and/or that their productivity increased further), and that the size of firms with relatively low productivity decreased (and/or that their productivity decreased further). This result strongly suggests that competitive market mechanisms leading firms with low-productivity to shrink and firms with high-productivity to expand seem to be functioning normally among SMEs in Japan.

**Figure 1: Decomposition of TFP growth**



The second characteristic regarding the TFP growth of SMEs that can be pointed is that the within effect is very small and was substantially negative during the great recession triggered by global financial crisis. This result is the exact opposite of studies focusing on Japanese firms of a certain size including large firms, except that the negative contribution is significant during period of the great recession. These results support the conjecture that the major cause of the low productivity growth of surviving SME, as pointed out in the introduction, is that (1) they are not making sufficient investment in raising their own productivity, such as investment in R&D, ICT, the introduction of new management methods, exports and FDI, and that (2) knowledge spillovers from large firms with which SMEs had transaction relationships have been adversely affected by the weakening of such relationships through the internationalization of large firms' activities.

Third, while the entry effect is positive in all subperiods, it is relatively small compared to the exit effect. On the one hand, firms that enter the market tend to be small; on the other, they are likely to be firms with technological capabilities.<sup>8</sup>

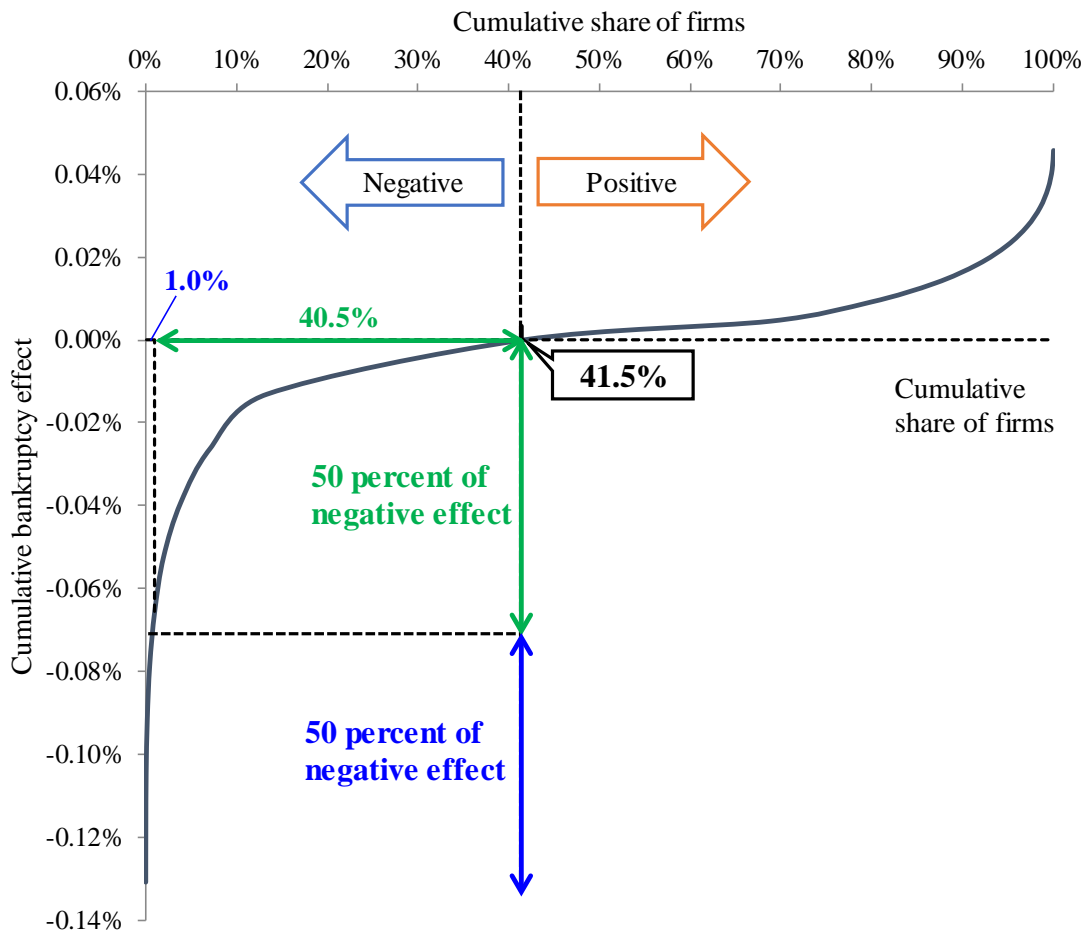
Finally, the exit effect, which this study focuses on, is negative in all periods, as in previous studies using

<sup>8</sup> It should be noted that firms that were SMEs at the time of market entry but grew into large firms within a short period of time (i.e., within four years) are excluded from our analysis of SMEs. Therefore, it is possible that the results here underestimate the entry effect of SMEs.

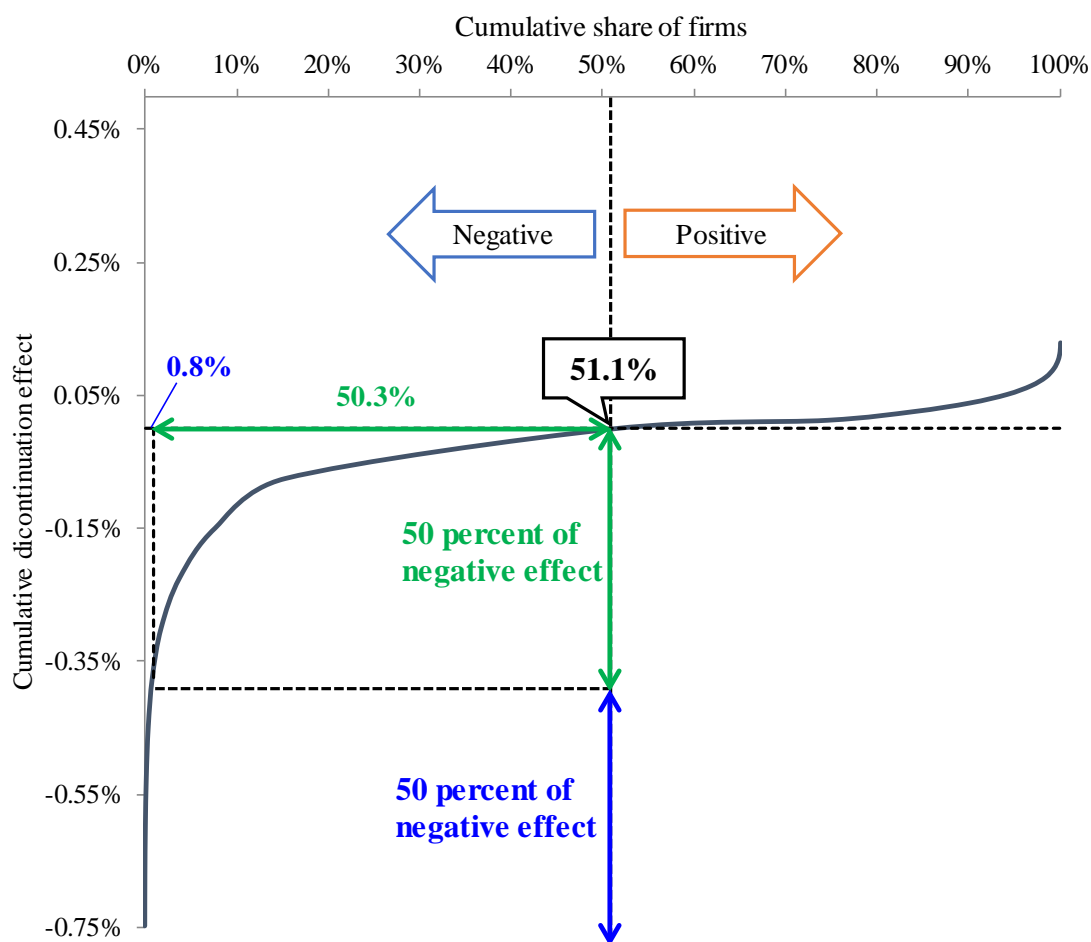
data that include large firms. What is more, this applies to both exit effects: the bankruptcy effect caused by the credit crunch and the discontinuation effect caused by problems unrelated to credit issues such as the lack of a business successor were negative in all periods. Thus, even though we find a positive reallocation effect reflecting increases in the market share of high-productivity firms, at the same time we also find that some firms with higher productivity than the industry average exit from the market, leading to the negative exit effect. Our results thus show that this curious phenomenon, which had been observed in other studies focusing on larger firms (e.g., the studies by Nishimura, Nakajima, and Kiyota, 2005, Fukao and Kwon, 2006, and Caballero, Hoshi, and Kashyap, 2008, mentioned in the introduction), can also be observed in the world of SMEs. This suggests that the natural selection mechanism due to market competition is not fully functioning.

Examining this negative exit effect in more detail, we find that the bankruptcy and discontinuation effects are negative because, although their number is small, there are some firms with relatively high TFP that go bankrupt or discontinue, and these firms are considerably larger than low-productivity firms that exit due to bankruptcy or discontinuation. The share of the number of firms with a negative discontinuation effect (i.e., firms whose TFP before discontinuation was above the industry average) in the total number of discontinuing firms is extremely small. A possible explanation of this kind of result is that healthy firms may go bankrupt or discontinue due to financial constraints as they try to expand their size through investment. This interpretation would be in line with findings by Goto (2014), who, using data from the *Basic Survey of Japanese Business Structure and Activities*, shows that the stronger a firm's financial constraints, the higher is the probability that it will exit the market.

**Figure 2: Distribution of firms that went bankrupt (2009-2013)**



**Figure 3: Distribution of firms that discontinued (2009-2013)**



The negative effect of exit caused by a small number of highly productive firms are consistent with those obtained by Watanabe and Uesugi (2008) that firms with lower performance such as profitability and productivity have higher exit rates.

Figure 2 shows that, during the period 2009–2013, only 1 percent of firms accounted for 50 percent of the negative bankruptcy effect (i.e., the effect that productivity is pushed down by the bankruptcy of relatively high-productivity firms). Ikeuchi et al. (2018) point out that firms with a large negative bankruptcy effect tend to be firms with a young executive or where no business successor has been chosen, firms with a high profit ratio, large fixed assets, a high growth rate in sales, and a high capital–labor ratio, and that are relatively large in size (in terms of the number of employees).

Moreover, as shown in Figure 3, the pattern for the negative discontinuation effect is very similar to that for the bankruptcy effect. Only 0.8 percent of firms accounted for 50 percent of the negative discontinuation effect (i.e., the effect that productivity is pushed down by the discontinuation of relatively high-productivity

firms). Again, Ikeuchi et al. (2018) point out that firms with a large negative discontinuation effect tend to be firms with a young executive, a high profit ratio, large fixed assets, a high growth rate in sales, and a high capital–labor ratio, and that are relatively large in size (in terms of the number of employees). These results suggest that there is a need for policies that reduce the negative exit effect by supporting the survival of SMEs that show good performance that are actively carrying out investments to increase their size.

### **3. The Sources of the Negative Exit Effect: Analysis based on the *Economic Census***

#### *3.1 Decomposition of labor productivity growth rates*

In this section, we use the *Establishment and Enterprise Census*, the *Economic Census for Business Frame*, and the *Economic Census for Business Activity* to examine why high-productivity firms exit the market. These censuses provide the most comprehensive coverage of business activity in Japan, covering the entire Japanese economy. They mainly focus the basic characteristics of establishments and firms, such as their industry, number of employees, etc., and their main aim is to create a directory of the population of establishments and firms for administrative purposes and as a basis for other surveys. The *Establishment and Enterprise Census* was replaced by the *Economic Census for Business Frame* in 2009, and the 2012 *Economic Census for Business Activity* integrated information previously published in the *Establishment and Enterprise Census* on firms' and establishments' sales, cost structure, value added, etc. Using such information on the output of all establishments, such as their sales and value added, from the 2012 *Economic Census for Business Activity*, we examine the impact of the reallocation of resources on labor productivity growth in the economy around the year 2012. Specifically, we take each establishment's labor productivity in 2012 and consider the contribution of changes in the number of employees of surviving establishments and the entry and exit to the labor productivity growth of the economy.

If economic resources are reallocated efficiently, the number of employees at establishments with above-average labor productivity should increase and, as a result, labor productivity in the economy as a whole should rise. In addition, the entry of establishments with higher labor productivity than the industry average and the exit of establishments with below-average productivity should also improve the labor productivity of the economy overall.

Decomposition analyses of productivity growth such as that proposed by Foster, Haltiwanger, and Krizan (2001) decompose changes in the weighted average of establishments' productivity indexes from the base year to the current year into the contribution of changes in the share and the contribution of changes in the productivity of each establishment. Here, using 2009 as the base year and 2014 as the current year, we define labor productivity in the economy in the two years ( $LP^{2009}, LP^{2014}$ ) as follows:

$$LP^{2009} = \sum_i \frac{L_i^{2009}}{\sum_j L_j^{2009}} \cdot LP_i^{2009} = \sum_i s_i^{2009} \cdot LP_i^{2009} \quad (3)$$

$$LP^{2014} = \sum_i \frac{L_i^{2014}}{\sum_j L_j^{2014}} \cdot LP_i^{2014} = \sum_i s_i^{2014} \cdot LP_i^{2014} \quad (4)$$

where  $L_i^{2009}$  and  $L_i^{2014}$  represent the number of firm  $i$ 's employees in 2009 and 2014, and  $LP_i^{2009}$  and  $LP_i^{2014}$  represent firm  $i$ 's labor productivity in 2009 and 2014.

Labor productivity growth in the economy ( $\Delta LP^{2009-2014}$ ), which is defined by subtracting labor productivity in the economy in 2014 from labor productivity in the economy in 2009, can be decomposed into the following five terms:

$$\begin{aligned} \Delta LP^{2009-2014} &= LP^{2014} - LP^{2009} \\ &= \sum_{i \in S} s_i^{2009} \cdot (LP_i^{2014} - LP_i^{2009}) + \sum_{i \in S} (s_i^{2014} - s_i^{2009}) \cdot (LP_i^{2009} - \overline{LP^{2009}}) \\ &\quad + \sum_{i \in S} (s_i^{2014} - s_i^{2009}) \cdot (LP_i^{2014} - LP_i^{2009}) + \sum_{i \in N} s_i^{2014} \cdot (LP_i^{2014} - \overline{LP^{2009}}) \\ &\quad + \sum_{i \in X} s_i^{2009} \cdot (\overline{LP^{2009}} - LP_i^{2009}) \end{aligned} \quad (5)$$

where  $S$ ,  $N$ , and  $X$  represent the set of surviving, entering, and exiting establishments, respectively. Moreover,  $\overline{LP^{2009}}$  is the average labor productivity of all establishments in a particular industry in 2009.

The first term of the equation above captures productivity growth within surviving establishments (i.e., the within effect). The second and third terms represent productivity growth due to the reallocation of resources among surviving establishments. The second term represents the productivity growth resulting from increases in the market share of establishments whose productivity is above the average in the base year (between effect), while the third term represents the productivity growth resulting from the increase in employment at establishments that increased their labor productivity (covariance effect). The fourth term shows the productivity growth due to the entry of establishments with high productivity (entry effect), while the fifth term is the increase in productivity due to the exit of low-productivity firms (exit effect).

However, as mentioned above, due to limitations in the data employed in this study, labor productivity is available only for 2012. For this reason, the impact of changes in productivity cannot be considered, so that we only focus on the contribution of changes in establishments' labor input share to value added growth. Therefore, we assume that labor productivity at establishment  $i$  is fixed at the level observed in 2012 ( $LP_i^{2012}$ ) and examine the change in economy-wide labor productivity from 2009 to 2014 ( $\Delta LP^{2009-2014}$ ) as a result of changes in labor input (from  $EMP_i^{2009}$  to  $EMP_i^{2014}$ ). For the data analysis, industry-level labor productivity in 2009 and 2014 is rewritten as follows:

$$LP^{2009} = \sum_i \frac{L_i^{2009}}{\sum_j L_j^{2009}} \cdot LP_i^{2012} = \sum_i s_i^{2009} \cdot LP_i^{2012} \quad (3')$$

$$LP^{2014} = \sum_i \frac{L_i^{2014}}{\sum_j L_j^{2014}} \cdot LP_i^{2012} = \sum_i s_i^{2014} \cdot LP_i^{2012} \quad (4')$$

The change in productivity in the economy in equation (5) ( $\Delta LP^{2009-2014}$ ) is decomposed into the following three factors:



$$\begin{aligned}
\Delta LP^{2009-2014} &= LP^{2014} - LP^{2009} \\
&= \sum_{i \in S} (s_i^{2014} - s_i^{2009}) \cdot (LP_i^{2012} - \overline{LP^{2012}}) + \sum_{i \in N} s_i^{2014} \cdot (LP_i^{2012} - \overline{LP^{2012}}) \\
&\quad + \sum_{i \in X} s_i^{2009} \cdot (\overline{LP^{2012}} - LP_i^{2012})
\end{aligned} \tag{5'}$$

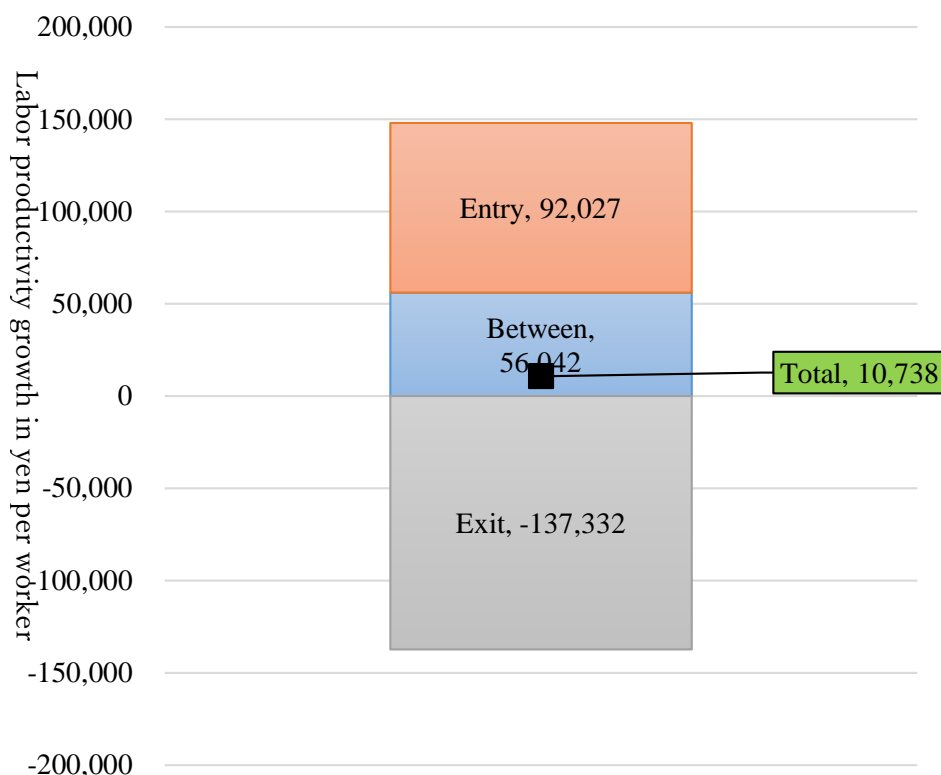
where  $S$ ,  $N$ , and  $X$  represent the set of surviving, entering, and exiting establishments, respectively.<sup>9</sup> In addition,  $(\overline{LP^{2012}})$  is the average labor productivity of all establishments in a particular industry in 2012. The decomposition represented by equation (5') contains only three effects: the between effect, the entry effect, and the exit effect.

Since the establishment-level labor productivity data used in the analysis contained some implausible values, we excluded observations falling into the top and bottom 1 percent. Figure 4 presents the results for the decomposition of labor productivity growth in the economy from 2009 to 2014 based on equation (5'). Overall, labor productivity grew by about 10,000 yen per worker. The decomposition shows that the entry of establishments pushed up labor productivity by about 92,000 yen, but the exit of establishments pushed down productivity by almost 137,000 yen, so that the net entry effect was negative at -45,000 yen. This large negative exit effect is a feature of Japan's economy already highlighted in studies on firm dynamics in Japan such as Fukao, Kim, and Kwon (2008) and Nishimura, Nakajima, and Kiyota (2005). Finally, the between effect representing the increase in the number of workers at high-productivity establishments made a positive contribution of approximately 56,000 yen.

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<sup>9</sup> Since the entry and exit of establishments in equation (5') is limited to establishments that existed in 2012, the sets of entering and exiting establishments differ from those in equation (5).

**Figure 4: Decomposition of labor productivity growth (2009–2014, in yen per worker)**

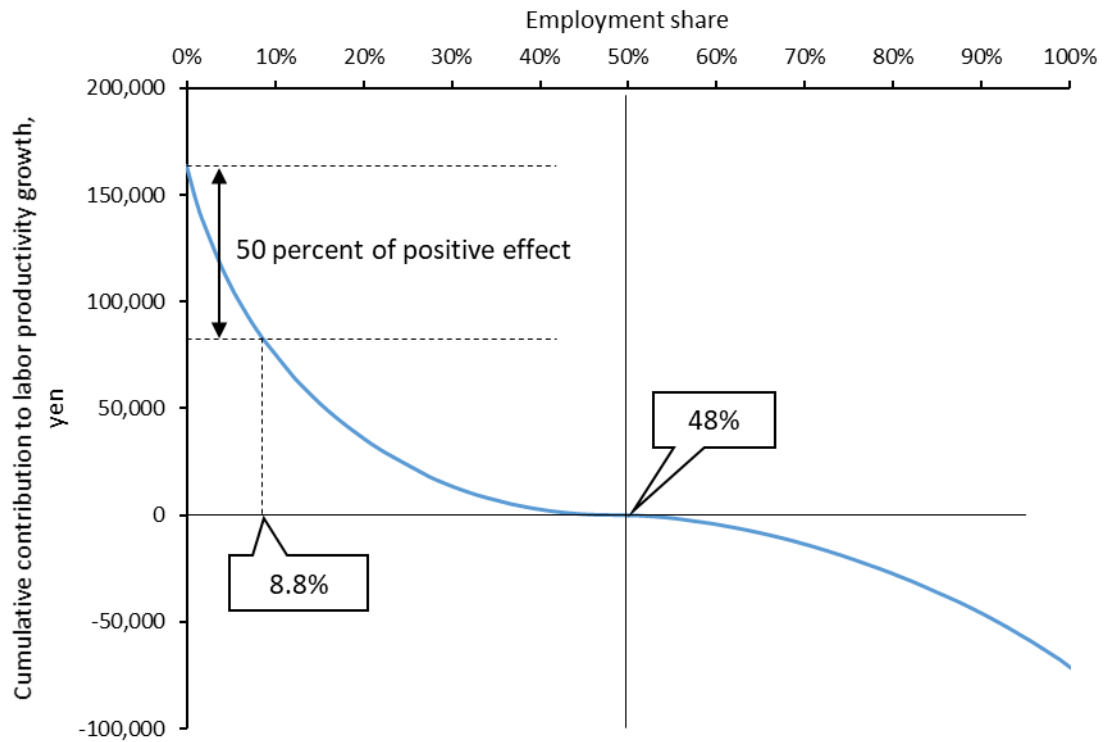


Note: Authors' calculations based on the *Economic Census for Business Frame* and the *Economic Census for Business Activity*. The figure shows the results of the decomposition of labor productivity growth from 2009 to 2014 aggregated based on equation (5').

### 3.2 The contribution of entering and exiting establishments to labor productivity growth

As also shown in Section 2, most of the entry effect and the exit effect comes from a small number of firms. This section examines the contribution of entering and exiting establishments to labor productivity growth in the decomposition analysis presented in the previous subsection. To this end, Figure 5 depicts the cumulative productivity growth contribution of entering establishments. Specifically, entering establishments are ordered in terms of their productivity (from high to low), and their productivity growth contribution (on the vertical axis) is plotted against the cumulative employment share of these establishments in the total number of employees at the entering establishments in 2014. The employment share of new establishments in 2014 was about 9 percent, and the entry of such establishments boosted productivity by 92,027 yen. The steep downward slope of the curve in Figure 5 indicates that, as also already seen in Section 2, a small number of highly productive establishments make a large contribution to productivity growth.

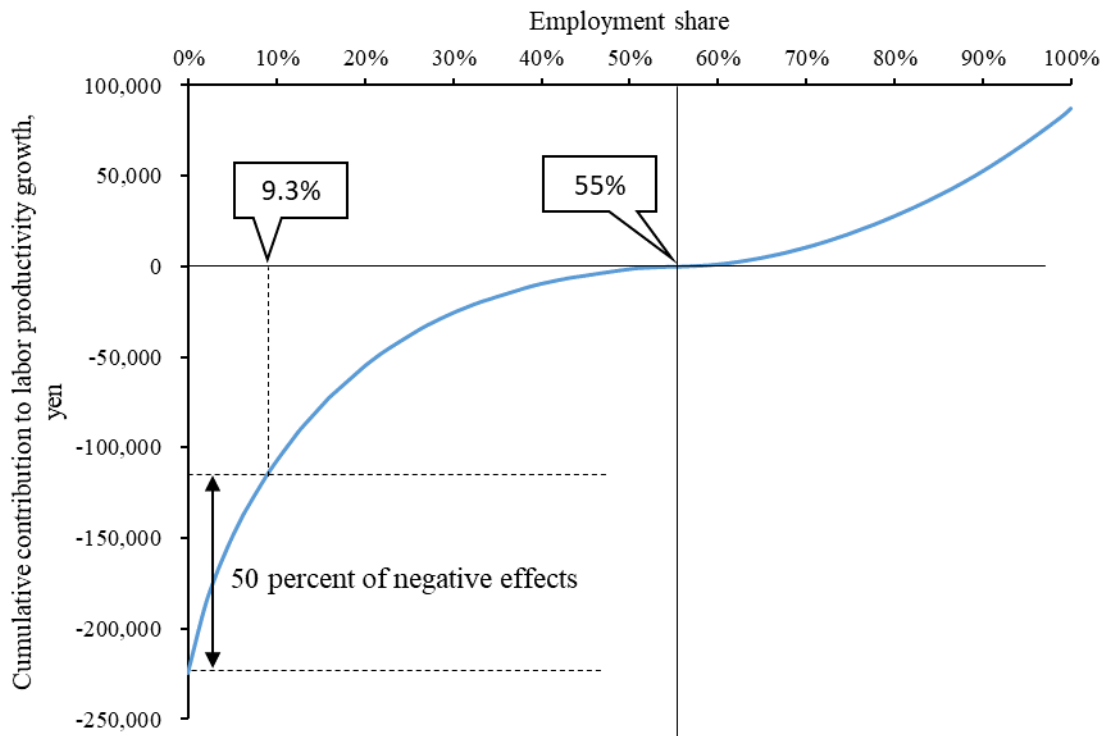
**Figure 5: Contribution of entering establishments to labor productivity growth**



Notes: Authors' calculations based on the *Economic Census for Business Frame* and the *Economic Census for Business Activity*. The figure shows the cumulative contribution to labor productivity growth when entering establishments are ordered in terms of their productivity from highest to lowest. The horizontal axis shows the cumulative employment share of entering establishments in 2014, while the vertical axis shows the cumulative contribution to productivity growth.

Next, Figure 6 presents a similar graph to Figure 5 but for exiting establishments. The figure depicts the cumulative contribution of exiting establishments in the productivity growth decomposition in Section 3.1, where exiting establishments are ordered in term of their productivity from highest to lowest. As seen in equation (5'), the higher the productivity of an establishment that exits, the greater is the negative contribution of the exit to the economy, so that establishments closer to the origin on the left make a greater negative contribution to overall productivity growth. The employment share of exiting firms in 2014 was a bit more than 12 percent, and their exit had a negative impact on labor productivity of 137,330 yen. Thus, the results again show that in the case of the exit effect, a small number of establishments made a very large negative contribution.

**Figure 6: Contribution of exiting establishments to labor productivity growth**



Notes: Authors' calculations based on the *Economic Census for Business Frame* and the *Economic Census for Business Activity*. The figure shows the cumulative contribution to labor productivity growth when exiting establishments are ordered in terms of their productivity from highest to lowest. The horizontal axis shows the cumulative employment share of exiting establishments in 2014, while the vertical axis shows the cumulative contribution to productivity growth.

#### 4. Conclusion

This study presented an analysis of productivity dynamics among small and medium-sized enterprises (SMEs) in Japan using the Credit Risk Database on SMEs and microdata from the *Economic Census*. Focusing solely on productivity dynamics among SMEs, the analysis showed that the sources of productivity growth among SMEs in Japan differ substantially from those among large firms. Unlike in the case of large firms, the within effect – that is, productivity growth within individual firms – made hardly any contribution to productivity growth. Further, while the positive reallocation effect points to a healthy market mechanism whereby high-productivity firms expand and low-productivity firms shrink, the fact that only a small number of high-productivity firms enter the market and the fact that the exit effect is negative suggest that the economic metabolism does not operate properly.

To examine these results in more detail, we conducted an analysis of productivity dynamics using the *Establishment and Enterprise Census* and the *Economic Census*. The results showed that most of the entry and exit effects were caused by the entry/exit of some highly productive establishments.

We found that the negative exit effect in Japan is driven by the exit of some highly productive firms. This finding suggests that to reduce the negative exit effect policies to support SMEs should not be based on their size but by focusing on SMEs with high TFP that are actively investing. Moreover, boosting the within effect by supporting SMEs in areas where they have fallen behind – such as R&D investment, ICT investment, and the introduction of new management techniques – should help to raise the productivity of the Japanese economy.

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## Appendix: Details of the Analytical Approach

### 1. Definition of SMES in this study

SMEs in this study are defined based on the provisions of Article 2, Paragraph 1 of the Small and Medium-sized Enterprise Basic Act and government ordinances in SME-related legislation. The details are as follows.

	SMEs (firms meeting all of the following criteria)		Micro enterprises
Industry	Paid-in capital	Number of full-time employees	Number of full-time employees
(1) Manufacturing, construction, transportation Other industries (excluding (2) to (4) below)	300 million yen or less	300 or fewer (900 or fewer in the rubber manufacturing industry)	20 or fewer
(2) Wholesale trade	100 million yen or less	100 or fewer	5 or fewer
(3) Services	50 million yen or less (30 million yen or less in the software industry)	100 or fewer (300 or fewer in the software industry, 200 or fewer in the hotel industry)	5 or fewer (20 or fewer in the accommodation and entertainment industries)
(4) Retail trade	50 million yen or less	50 or fewer	5 or fewer

### 2. Definitions of variables to measure labor productivity and TFP growth

- Value added

Value added = Sales – Sales and operating costs – Selling, general, and administrative (SG&A) expenses + Labor costs + Rental costs + Cost of taxes and public charges + Depreciation expenses

- Labor costs = Labor costs among sales and operating costs + Labor costs (among SG&A expenses)
- Rental costs = Rent + SG&A expenses related to rents
- Cost of taxes and public charges = Taxes and public charges + SG&A expenses related to taxes and public charges
- Depreciation expenses = (1) below; if missing, (2):
  - (1) Difference between accumulated depreciation on tangible fixed assets in the current period and the previous period
  - (2) Amount of depreciation

- Gross output

- (1) Other than trade: Sales

(2) Trade: Sales – Estimated cost of purchases

Estimated cost of purchases = Sales and operating costs – Labor costs – Rental costs – Taxes and public charges

- Capital stock; capital input; cost of capital

Capital input = Capital stock = Tangible fixed assets × Market-to-book ratio

Capital cost = Capital stock × Price of capital services

- Tangible fixed assets = (1) below; if missing, (2); if (2) also missing, (3):

- (1) Building structures + Machinery + Tools

- (2) Total tangible fixed assets – Land – Construction in progress

- (3) Total tangible fixed assets

- Market-to-book ratio: We use industry-level estimates by firm size based on figures published in the *Financial Statement Statistics of Corporations by Industry*

- Price of capital services: We use industry-level figures from the JIP Database.

- Indices of capital quality: We use the industry-level figures from the JIP Database.

- Definition of labor input

Labor input = Hours worked per person × Index of labor quality × (Number of employees at the end of the period + 1)

- Hours worked per person: We use industry-level estimates by firm size.

- Indices of labor quality: We use industry-level estimates by firm size.

Notes: While the number of employees does not include executives, temporary employees from agencies, and workers transferred outside the firm, labor costs do include executive remuneration and bonuses. Therefore, based on the assumption that each firm has at least one executive (manager), we add 1 to the number of workers. Further, while part-time employees are not included if they are not “regularly hired employees” (as defined in the Small and Medium-sized Enterprise Basic Act), i.e., if they only work short hours, such part-time employees working short hours are include in labor costs.

- Intermediate input

Intermediate input = Sales + SG&A expenses – Labor costs – Rental costs – Cost of taxes and public charges – Depreciation expenses

Note: For details on labor costs, rental costs, costs of taxes and public charges, and depreciation expenses, see the notes for the estimation of value added above.

### 3. Filling in of missing data

For the analysis of annual dynamics, we supplemented missing data for intermediate years through interpolation using data for previous and subsequent years. Moreover, among the data needed for the estimation of productivity, there was some missing data for value added and labor costs, which we supplemented using the value added-sales ratio and industry-level average labor costs per employee, respectively.