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製品市場の効率性と全要素生産性
—日韓企業の比較研究—

Product Market Efficiencies and Total Factor Productivity: A Comparison of Japanese and Korean Firms

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製品市場の効率性と全要素生産性 ―日韓企業の比較研究―

文部科学省 科学技術・学術政策研究所　第 1 研究グループ

要旨

本研究は、日本と韓国の企業データを利用して、1995 年から 2008 年の期間における両国企業の配分効率の違いを分析したものである。我々は、Hsieh and Klenow (2009)の分析手法を用いて、企業レベルの資源配分の歪みを全要素生産性 (TFP)、生産量、資本について計測し、分析した。まず、資源配分の歪みの大きさは、日本よりも韓国において企業間のバラツキがより大きく、経済全体の配分効率も日本よりも韓国のほうが低かった。ただし、日本においても配分効率は改善しておらず、むしろ時間を追って低下している。さらに、両国において、生産性の低い企業が最適水準よりも過剰に生産する傾向が確認され、このことは、生産性の低い企業から高い企業への資源が移動してはいないことを示唆している。日韓両国において、急速な高齢化により近い将来の労働不足が予測される中、資源配分の効率性の向上による生産の増加は、喫緊の課題であり、迅速な政策対応が求められる。

Product Market Efficiencies and Total Factor Productivity: A Comparison of Japanese and Korean Firms

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ABSTRACT

Using a large-scale dataset including both Japanese and Korean firms, we examine differences in allocative efficiency over the period 1995 to 2008. We measure firm-level distortions in terms of total factor productivity, output, and capital employing the Hsieh and Klenow (2009) approach and find a greater dispersion of these distortions in Korea than in Japan. Further, allocative efficiency in Korea is lower than in Japan and there has not been any improvement in allocative efficiency in either country during the sample period. Moreover, in both countries, less productive firms tend to overproduce, suggesting that resources do not move from low productivity firms to high productivity firms. Improvement in resource allocation is then an urgent policy issue for both countries so they can realize an efficient level of output, especially in that both countries will face serious labor shortages in the near future because of major demographic changes associated with depopulation and population aging.

Keywords: Total factor productivity; Output; Capital; Efficiency; Japan; Korea
JEL Classification: E22, E23, O14, O47

概要

1. 研究の背景と目的

日本経済が長期低迷から抜け出せない要因の一つとして、多くの研究者が政策対応の遅れや不足のために市場が機能不全に陥り、効率的な資源配分を実現できず生産性が低迷しているからだと指摘している。一方、日本経済が低迷する中、韓国をはじめ近隣のアジア諸国は経済成長を続け、例えば韓国のサムスン電子や現代自動車など、いくつかの企業は世界市場でのプレゼンスを拡大してきた。

しかし、Kim and Ito (2013) が一国経済全体の全要素生産性 (TFP)水準を日韓で比較したところ、韓国の TFP 水準は日本よりも依然としてかなり低く、その格差があまり縮まっていなかった。その理由の一つとして、韓国では一部に生産性の高い企業が存在するものの、企業間の生産性格差は大きく、平均すると韓国企業の TFP 水準は、日本企業のそれよりも低いことが挙げられている。

標準的な経済成長理論によれば、生産性の向上は技術進歩によってもたらされ、技術進歩のスピードは研究開発や人的資本投資によって決定される。つまり、各企業が研究開発や技術水準向上に努力して生産性を上げていくことが経済全体の生産性向上につながる。一方で、経済全体の生産性は、個々の企業の生産性水準を各企業の市場シェアをウェイトとして加重平均して求めるため、各企業の生産性が上がらなくても、高生産性企業が市場シェアを増やせば、経済全体の生産性が上がる。これを資源の再配分効果といい、市場の資源配分機能に歪みがなく効率的に市場が機能すれば、高生産性企業により多くの資源が配分され、より多くを生産し、結果的に経済全体の生産性が向上することになる。言い換えれば、個々の企業努力による生産性を経済全体の生産性向上により効果的に反映させるためには、資源配分機能が重要なのである。

本稿では、経済全体の生産性を決めるもう一つの要因である資源配分効果に着目し、日韓の生産性格差の要因を分析する。

日本では、「失われた 20 年」の議論から、資源の再配分効果が低い状態が続いてきたことが示唆されている。具体的には、「貸し渋り」や「貸し剥がし」といわれた銀行の行動により、非効率な企業が資金の供給によって延命されたり、または、バブル崩壊後の過剰投資の記憶が消えない企業が、生産性が向上しても設備投資や雇用を十分に増やさなかった、という事例が指摘された。韓国においても、日韓の生産性格差がなかなか埋まらない要因の一つに非効率な資源配分があるのではないであろうか。本稿では、1995 年から 2008 年までの日韓企業の年次パネルデータを利用して、企業レベルで資源の再配分の非効率を計測し、この仮説を検証する。

2. 利用したデータ

まず、日本企業については、経済産業省が毎年調査・収集している『企業活動基本調査』の個票データを利用する。本調査は、従業者数が 50 人以上でかつ資本金 3000 万円以上の企業を調査対象にしている。韓国企業については、Korea Information Service (KIS)が提供する企業データベースを利用する。KIS データベースは、財務報告が義務付けられている一定規模以上 [1]の企業と

[1] 財務報告が義務付けられる企業規模はたびたび変更されてきたが、アジア通貨危機の 1998 年

韓国証券取引所に上場する企業のデータを収録している。日本の企業データと、企業規模を整合的にするため、韓国企業についても従業者数 50 人以上、資本金 3 億ウォン（日本円換算でほぼ 3000 万円に相当）以上の企業のみを分析対象とする。

これらのデータベースに収録された企業について、1995 年～2008 年までの年次パネルデータを作成し、分析対象とした。両国企業データの入手可能性とサンプル数の断層、2008 年のリーマンショックの影響を考慮し、当該期間を分析対象と設定する。日本については、各年 26,000～28,000 社のサンプルが分析データに含まれ、韓国については、1995 年は約 3,700 社のサンプル、2008 年は 8,400 社のサンプルが分析データに含まれる。韓国では、分析期間を通じてサンプル数が増加しているが、これは韓国経済の成長に伴い新規企業が誕生し、企業規模を拡大した企業が新たに KIS データベースに入ってきたことによる。

また、日韓の両データベースとも、非製造業企業も収録しているが、非製造業企業については産業分布が両国で大きく異なっており比較分析が困難である。そこで、本稿の分析では、製造業企業に焦点を当て、両国の資源配分の効率性を比較分析する。

3. 分析方法

本稿では、Hsieh and Klenow (2009)によって提唱された分析方法に従って、企業レベルの資本と生産の歪みを計測する。まず、市場に歪みがなく、資源配分が効率的に行われている状態を定義する。市場に歪みがない場合、価格の影響を取り除いた「真の生産性」（「物的生産性」とも呼ばれ、物的投入量 1 単位に対する物的生産量をさす）が高い企業は多く生産し、低い価格で市場に供給する。一方、物的生産性が低い企業は生産が少なく、高い価格で市場に供給する。そのため、資源配分が効率的な状態においては、「真の生産性」が高い企業はより多くの労働や資本を投入し、より多く生産、低価格で多くを供給する。

一方、資源配分の非効率がある状態とは、物的生産性の高い企業が最適生産量よりも生産を少なくして価格を高く設定し、利潤を多くとったり、または物的生産性の低い企業が、例えば補助金や何らかの保護によって守られて、最適生産量よりも多く生産して低価格で供給したりしている状態をいう。このような場合、価格の影響を含んだ生産性指標は、物的生産性と乖離することになる。

以上のような想定に基づいて、各企業の生産の歪み (output distortion) を計測できる。また、最適な生産量を実現するときの労働と資本の相対的投入量と、現実の労働と資本の相対的投入量とを比較することにより、各企業の資本の歪み (capital distortion）を計測する。

こうして、生産の歪みと資本の歪みを各企業について計測し、それを用いていくつかの分析を行う。まず、生産の歪みと資本の歪みがすべての企業においてゼロであった（資源配分が効率的な状態）と仮定し、その場合の経済全体の生産量を推計することができる。この値と実際の経済全体の生産量との差から、経済全体の配分効率 (allocative efficiency)を計測する。つぎに、生産性水準別に歪みの大きさを分析し、資源配分の歪みは生産性の高い企業において大きいのか、または

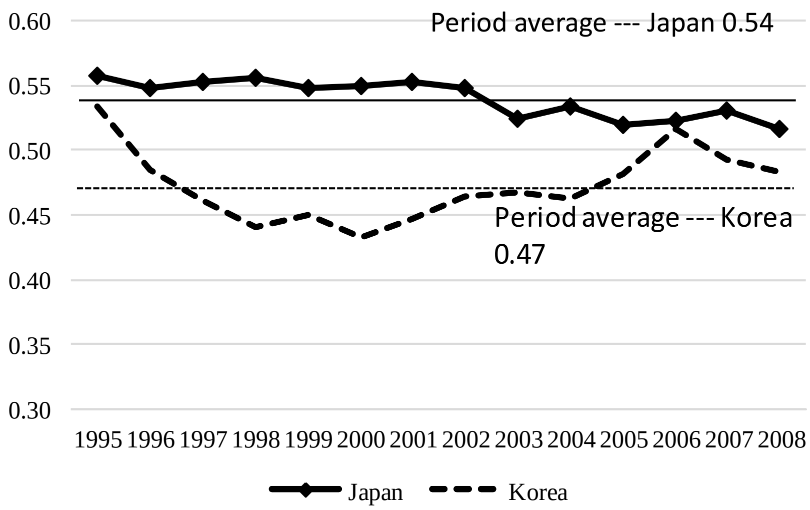
以降は、総資産が 70 億ウォン以上の企業とされている。

生産性の低い企業において大きいのか、生産性と歪みの関係について、日韓で比較しながら考察する。

4. 分析結果

まず、資源配分の歪みの指標は、日本よりも韓国において企業間のバラツキが大きく、また、分析期間を通じて、韓国製造業全体の配分効率は日本製造業全体のそれよりも低かった。しかし、日本の配分効率が改善しているわけではなく、2000 年代以降、景気回復にもかかわらず資源配分の効率性は向上せず、むしろ若干低下した。韓国については、通貨危機というショックもあり、1990 年代の後半から末にかけて配分効率は大きく低下した。2000 年代に入って配分効率が改善してきたものの 2008 年時点でもまだ 1995 年時点の水準には達していない（概要図表 1）。

概要図表 1: 日韓製造業の配分効率の推移



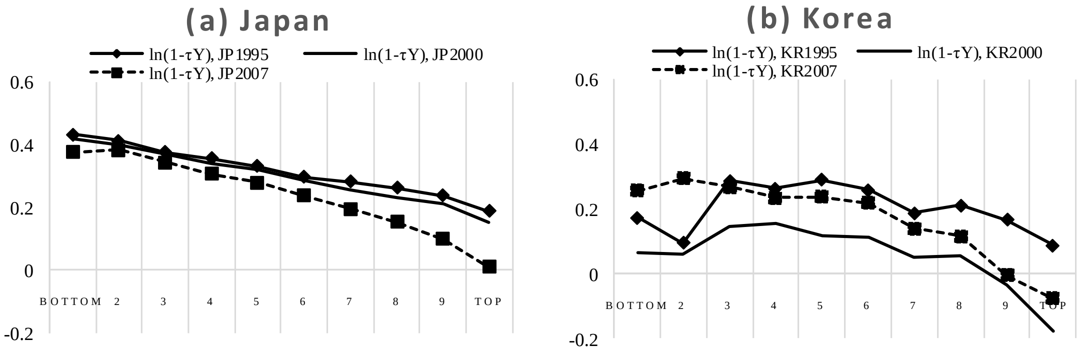
（注）本文中の Figure 3 に相当する。縦軸は、100 パーセントの効率の場合を 1 とし、1 より小さいほど効率が低いことを示す。

次に、両国において、生産性の低い企業が最適な水準よりも過剰に生産している傾向が明らかになった。このことは、資源が低生産性企業から高生産性企業にシフトするのではなく、その逆であり、資源配分が非効率であることを示唆する。日本では、生産の歪みは、生産性が最も高いグループでは小さく、時間を追って徐々に解消されてきている。しかし、ほとんどの企業では生産の歪みが正の値であり、このことは最適な水準よりも過剰に生産していることを示している。また、概要図表 2(a)のとおり、生産性水準と生産の歪みとの関係を示すグラフは右下がりとなっており、生産性水準

が低い企業ほど、過剰生産の度合いが大きいことを示唆している。このことは、深尾 (2012) が推察するように、生産性の高い企業が投資や雇用に積極的でなかったために、低生産性企業が労働や資本を保持し続けなければならなかった結果、資源配分に歪みが生じた可能性を示している。また、日本の硬直的な雇用システムも、低生産性企業から高生産性企業への資源の移動を妨げているのかもしれない。

韓国においても、概要図表 2(b)のとおり、生産性の高い企業ではむしろ過少生産になっており、生産性の低い企業は過剰に生産している状態が見てとれる。

概要図表 2: 日韓製造業企業の生産性水準と生産の歪みの平均値



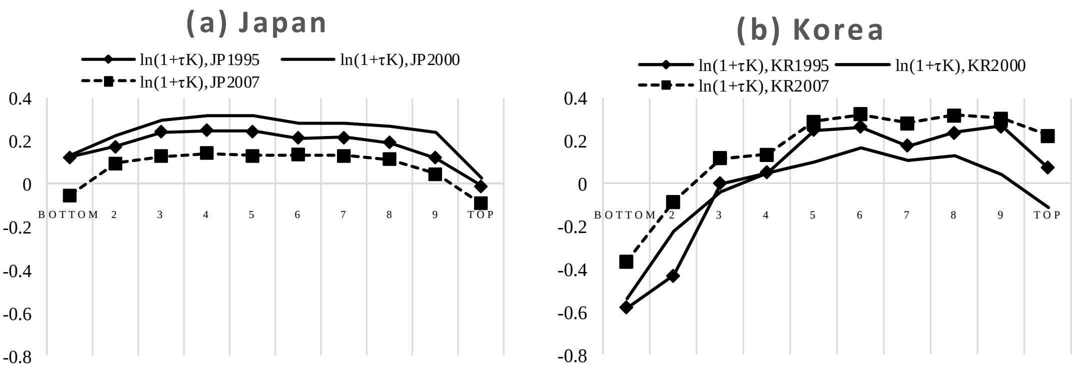
(注) 本文中の Figure 5 に相当する。横軸は、生産性水準の下位 10 パーセントから上位 10 パーセントまでの十分位を表す。縦軸が 0 の場合に歪みのない状態を示し、正の場合は過剰生産、負の場合は過少生産である状態を意味する。

また、韓国では、概要図表 3 (b)のとおり、生産性が低い企業において資本の歪みが大きくマイナスの値になっている。これは、低生産性企業にとっては、資本コストが労働コストに比べて相対的に低く、最適な資本労働比率よりもより資本を多く投入していることを示している。何らかの保護政策により低生産性企業が労働よりも割安な価格で資本を調達できている結果、資本を過剰に投入していると解釈される。一方、生産性の高い企業は労働よりも資本の価格が割高で、結果的に最適な資本労働比率よりも資本を過少に、労働を過剰に投入していることを示している。このことは、韓国における金融市場が十分に機能しておらず、生産性の高い企業に十分な資本が行き渡っていないことを示唆する。

日本では、多くの企業において資本の歪みが正の値となっており、多くの企業にとって労働よりも資本の価格が割高で、最適な資本労働比率よりも資本を過少に、労働を過剰に投入していることを示している。我々の分析期間において、日本の金利は極めて低く、資本調達コストが高かったとはいえないが、労働の調達コストはさらに低く、結果的に労働を過剰に投入していたと解釈され

る。

概要図表 3: 日韓製造業企業の生産性水準と資本の歪みの平均値



(注) 本文中の Figure 6 に相当する。横軸は、生産性水準の下位 10 パーセントから上位 10 パーセントまでの十分位を表す。縦軸が 0 の場合に歪みのない状態を示し、正の場合は労働に対して資本を過少に投入、負の場合は過剰に投入している状態を意味する。

5. 結論と政策的含意

本稿では、日本と韓国の企業データを用いて、両国の企業間資源配分の効率性を分析した。日本は、すでに少子高齢社会となって人口減少が始まり、いくつかの産業では労働不足にも悩まされているが、韓国も近い将来、日本と同様な状況に直面することが予想されている。両国にとって、資源配分の効率性の向上は、労働制約のもとで生産性の上昇、経済成長を実現するために喫緊の課題である。低生産性企業の過剰生産を解消するには、低生産性企業の延命よりも、円滑な企業再生を推進するような政策を重視すべきであろう。また、日本の「失われた20年」の経験は、政策対応の遅れや不十分さが、市場の歪みを助長し、長期にわたる配分効率の悪化を招くことになりかねないことを示している。韓国の配分効率の改善のためには、迅速かつ十分に大胆な政策対応が求められる。

本稿では、データの制約から 2008 年のリーマンショック後の分析はできていないが、大きな経済ショックが構造変化をもたらし、資源配分にも何らかの影響をもたらすことが予想される。実際、韓国では、1990 年代末期の金融危機により大幅に配分効率が悪化し、その後改善したものの、危機以前の水準にまでは戻っていない。日本についても、リーマンショック前後の配分効率の変化を分析することによって、ショック時の緊急的な企業保護政策などの効果を厳密に検証できるであろう。今後の研究課題の一つとして挙げておきたい。

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本文（英語）

1. Introduction

Japan was the first country in East Asia to develop a world-class technological capability, through which it became one of the world's highest income countries. However, the Japanese economy has suffered from productivity stagnation since the early 1990s, and as of late 2015, has not yet been successful in boosting its economy, now almost three years after the launch of Abenomics (the major policy program encompassing fiscal stimulus, monetary easing, and structural reforms).[2] Over the last 20 years, many have pointed out that the Japanese government's sluggish and inadequate policy actions following the bursting of the bubble economy resulted in long-term market distortions and malfunctions of the market mechanism, which ultimately accounted for Japan's prolonged productivity stagnation.

In contrast, other East Asian economies, including Korea, have been growing much faster than Japan in recent decades, and many large Asian companies outside Japan have realized a significant presence in global markets. For example, Korean companies such as Samsung and Hyundai have been steadily increasing their global market share at the expense of their Japanese counterparts, suggesting that Korean firms have been catching up with the productivity of Japanese firms. However, in comparing the productivity levels and not the growth of Japanese and Korean firms, several studies, including that of Kim and Ito (2013), find that Korea's aggregate total factor productivity (TFP) is much lower than that for Japan and that there is then evidence of a persistent TFP gap between the neighboring countries, as shown in Figure 1. Kim and Ito (2013) also conclude that firm-level TFP is much lower on average for Korean than for Japanese firms in most industries, which can help at least partly explain the substantial TFP gap at the aggregate level between Japan and Korea.

[2] By analyzing the productivity gaps for Japanese and US industries over nearly 60 years, Jorgenson et al. (2015) argue that the Japan–US productivity gap widened after 1991 when Japan nearly achieved parity with the US.

INSERT FIGURE 1 HERE

However, we can also explain the level of aggregate productivity level by reallocation across firms. Aggregate productivity is the weighted average of firm productivity using each firm's market share as a weight. Therefore, aggregate productivity can be high when the productivity of all firms is high and/or when highly productive firms hold relatively large market shares and less productive firms hold relatively small market shares. The latter is the so-called reallocation effect, which we generally expect will be large when the market is efficient and not subject to distortions. Therefore, the misallocation of resources across firms has a negative impact on aggregate productivity, and so differences in allocative efficiency between Japan and Korea may partly explain the aggregate TFP gap between the two countries. Indeed, previous studies such as those of Andrews and Criscuolo (2013) and Oh (2015) do suggest that allocative efficiency is lower in Korea than Japan.

In fact, the improvement of market efficiency and resource allocation among firms has been one of the most challenging issues confronting Japan over the last two decades. More recently, this has attracted the attention of policy makers and others concerned with the decline in the size of the Japanese workforce from depopulation and population aging. Productivity improvement is now firmly at the fore of the policy agenda in Japan. In Korea, improvements in market efficiency should also be an urgent policy issue, particularly because it will soon face similar demographic challenges.

In this paper, we examine firm-level distortions and the magnitude of the misallocation of resources among firms using a large panel dataset for Japanese and Korean firms over the period from 1995 to 2008. We also briefly review the major arguments concerning market distortions and allocative efficiency in Japan during the Lost Two Decades, and discuss their relationship with quantitatively measured market distortions. Finally, by comparing the results for Japan and Korea, we discuss the lessons Korea may learn from the Japanese experience.

The remainder of the paper is structured as follows. Section 2 briefly reviews government economic policy and its impacts on productivity and allocative efficiency in Japan during the last two decades. Section 3 describes the dataset used in the analysis and explains the methodology used for measuring the market distortion. In Section 4, we measure firm-level distortions on capital and output and examine any changes over time in both Japan and Korea. Finally, Section 5 discusses possible causes of firm-level distortions in Japan and provides a brief conclusion for the paper.

2. Productivity Growth and Market Distortions in Japan

Although the level of TFP in Japan remains higher than that of Korea, as shown in Figure 1, many existing empirical studies have shown that its rate of growth slowed in the 1990s. There are various explanations for this productivity slowdown, including insufficient and ineffective use of information and communication technology (ICT), the reduction in research and development (R&D) and human capital investment, and slow changes and improvements in firm management and business practices. However, in this paper, we focus on the efficiency of resource reallocation as a cause for the productivity slowdown in Japan and briefly review the background on market distortion and firm behavior in the last two decades.

As already discussed in a large literature, numerous Japanese banks holding many nonperforming loans (NPLs), were reluctant to issue new loans and forcibly withdrew funds from their customer firms following the bursting of the bubble in the early 1990s. However, for some large firms, other banks rolled over their lending, even where there was little prospect of the borrower firm being able to repay the loans. This was because the banks did not want to write off their NPLs.[3] This possibly caused efficient firms (at least in terms of TFP) to go out of business while inefficient firms survived through to the late 1990s, as argued by Nishimura et al. (2005) and Fukao and Kwon (2006). Such a malfunctioning of the natural selection mechanism in a market economy was highly likely to deteriorate resource allocation and aggregate productivity growth in Japan in the 1990s. In evidence, Hosono and Takizawa (2015) examine plant-level distortions on capital and output and conclude that they can result from financial constraints.[4]

In the early 2000s, the Japanese economy started to pick up and the productivity of many Japanese firms improved. However, Fukao (2012) points out that this improvement in productivity was largely through cost cutting, i.e., the reduction of inputs, rather than any increase in output. Fukao (2012) also argues that large firms were reluctant to increase physical capital investment and employment in the first half of the 2000s, even though their productivity improved much faster than did that of smaller firms. If high productivity firms expanded their production while low productivity firms reduced their production (or even exited the market altogether), production factors such as capital and labor would have moved from low productivity firms to high productivity firms. Because of this resource reallocation effect, aggregate productivity would have improved much more in the 2000s. However, drawing on his findings, Fukao (2012) conjectures that the reallocation effect was less likely.

Thus, existing arguments suggest that market efficiency, i.e., efficient resource reallocation, has not improved during the Lost Two Decades in Japan, although reasons for the low reallocation effect may differ markedly between the 1990s and the 2000s. To examine this conjecture, we use

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[3] Caballero et al. (2008) termed such forbearance lending, “zombie lending”.
[4] They use the same approach as we do, although their analysis uses plant-level data while we use firm-level data.

Japanese firm-level data to quantitatively measure firm-level distortions in capital and output and investigate differences in the magnitude of the distortions between firms. We also examine the distortions for Korean firms using comparable Korean firm-level data and compare the distributions of these firm-level distortions between Japan and Korea.

3. Data and Measurement of Allocative Efficiency

3.1 Data

The firm-level panel data for Japan are from the *Basic Survey of Japanese Business Structure and Activities* (BSJBSA), conducted annually by the Japanese Ministry of Economy, Trade, and Industry (METI). This survey is mandatory and covers all firms with at least 50 employees and 30 million yen of paid-in capital in the Japanese manufacturing, mining, commerce, and service sectors.[5] The BSJBSA contains information on firm sales, the number of employees, the book value of tangible fixed assets, the wage bill, intermediate materials, R&D, and other indicators. Total sales by firms in our database account for about 140 percent of nominal gross output in 2005 for the manufacturing sector. This greater than 100 percent coverage is possible because many large Japanese manufacturing firms provide a variety of services, and so service-related sales have increased alongside structural changes in the Japanese economy. Thus, the coverage of our data on Japanese firms is very high in terms of total sales.

The data source for the Korean firms is the *Korea Information Service* (KIS) database. This database covers firms subject to statutory audit as well as those firms listed on the Korea Stock

[5] The firm-level data underlying the BSJBSA are from a research project entitled "Study on Innovation Process based on Micro Data," conducted at the National Institute for Science and Technology Policy (NISTEP). Although the BSJBSA data are the result of government official surveys subject to confidentiality restrictions, we were able to merge the datasets because a private company provides the KIS data and there were no confidentiality restrictions.

Exchange. Firms subject to statutory audit comprise firms existing after 1998 with total assets of more than 7 billion Korean won. Total sales for manufacturing firms in the KIS data represent approximately 60 percent of manufacturing nominal gross output in 2005, as reported in the Korea Industrial Productivity Database provided by the Korea Productivity Center. Although our coverage for Korea is much smaller than that for Japan, we consider that it is sufficient for our two-country comparison. Nevertheless, we should interpret the results with some caution. We should also note that the differences highlighted might reflect differences in industrial organization and economic development in the two countries.

For our comparative analysis, we use firm-level data from 1995 to 2008 for both Japan and Korea.[6] Moreover, we restrict our sample to firms with 50 or more employees and 30 million yen (300 million won for Korean firms[7]) or more paid-in capital to enhance the comparability of the results. For Japan, our dataset includes 26,000–29,000 firms each year, while for Korea the number of observations increases from about 3,700 firms in 1995 to around 8,400 firms in 2008. The reason for the substantial increase over time in the number of Korean firms in our dataset may be that many Korean firms have grown alongside the development of the Korean economy and have become sufficiently large to be included in the KIS database. On average, the number of Korean firms in the KIS database increased annually by 13 percent from 1985 to 2000, and by 4 percent from 2000 to 2008.

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[6] We selected the period from 1995 to 2008 for our analysis because we could obtain a sufficiently large number of observations for both countries. Although the number of Korean firms included in our database increases over time, it increased substantially from 1994 and 1995 (by some 30 percent). Yearly panel data for Japanese firms are available to us after 1994. Therefore, to enhance the comparability of results between the two countries, we decided to select the period from 1995 to 2008 for analysis.

[7] The 300 million won of paid-in capital is comparable to 30 million yen as follows. The annual average market exchange rate for the period 1995 to 2008 was 0.11 won per yen with a standard deviation of 0.016, so 300 million won is equivalent to 0.29 million US dollars while 30 million yen is equivalent to 0.27 million US dollars. Moreover, the *Survey of Business Activities* commenced in 2006 when Statistics Korea started to collect data for firms with 50 workers or more and capital of 300 million won or more.

Table 1 compares the coverage of our data set with the government firm-level survey data for Japan and Korea. As discussed, we use the firm-level data underlying the BSJBSA conducted by METI for Japan, and so can calculate firm-level TFP for more than 95 percent of the firms included in the survey. In contrast, we use firm-level data collected and sold by a private company, KIS, for Korea, and so expect that the coverage of our data set for Korea should not be as high as that for Japan. The Korean government commenced the *Survey of Business Activities (SBA)* by Statistics Korea, for which the survey framework is very similar to that for the BSJBSA for Japan. Comparing the summary statistics based on the SBA for Korea, our database compiled from the KIS database represents more than 70 percent of employees and more than 90 percent of sales in 2007. Although the coverage of our data for Korea is admittedly much lower than that for Japan, we consider that we have a sufficient number of observations for our comparative study.

Table 2 details the total number of observations by industry over the period 1995–2008. The industry classification used is that employed in the International Comparison of Productivity among Asian Countries (ICPA) project conducted at the Japanese Research Institute of Economy, Trade and Industry (RIETI). As shown in Table 2, about half of the firms in the Japanese sample and slightly more than 60 percent in the Korean sample are manufacturing firms. Further, in the case of Japan, more than 70 percent of services firms are in the trade (either wholesale or retail) sector, whereas in the Korean sample, the industry distribution for the services sector is rather more even. That said, in the manufacturing sector, the industry distributions for Japan and Korea appear very similar. We exclude some industries such as metal and nonmetallic mining from our analysis because the number of observations for these industries is zero or extremely small for one of the two countries. Given the differences in industry distribution in the services sector, we mainly focus on manufacturing firms in the following analysis.

INSERT TABLES 1 AND 2 HERE

3.2 Measurement of Allocative Efficiency for Korea and Japan

Following the methodology proposed by Hsieh and Klenow (2009), we measure firm-level distortions on capital and output. We first explain the most efficient resource allocation (i.e., no distortion) in their framework. Hsieh and Klenow (2009) assume that real productivity, i.e., the ratio of output quantities to input quantities—or so-called physical productivity, denoted by Foster et al. (2008) as TFPQ—varies across firms even within the same industry, which implies the marginal cost of production also varies across firms. They also assume that, when there is no distortion, each firm’s output price is a fixed markup over its marginal cost. In other words, higher TFPQ firms set a lower price because their marginal costs are lower. If resources are allocated efficiently across firms, high productivity (TFPQ) firms will then employ more labor and capital and produce more at a lower price than do low TFPQ firms.

Next, let us consider the two kinds of distortions, namely, output and capital distortions, which lead to marginal revenue diverting from the marginal cost. First, consider output distortion. For example, let us assume that a firm receives some output subsidies. This firm’s marginal revenue products of labor and capital are then smaller than their optimal level because this firm uses more inputs and produces more than the optimal level.[8] In contrast, if a firm faces disincentives in production, it would use fewer inputs and produce less. As a result, its marginal revenue products of labor and capital are larger than their optimal levels. Moreover, if a firm faces financial friction and higher capital costs, it would use less capital input and its marginal revenue product of capital would be higher than the optimal level. In contrast, if a firm receives a preferential interest rate, it would use greater capital input and its marginal revenue product of

[8] As in standard texts, we assume diminishing marginal product for all factor inputs.

capital would be lower than the optimal level. Therefore, with such distortions, firms do not produce at the socially optimal level, which we consider socially inefficient because there is not the efficient allocation of resources according to any real productivity differences (TFPQ).

The Hsieh and Klenow (2009) approach estimates the output and capital distortions as the difference between the optimal and actual marginal revenue product. The output distortion for producer *i* in industry *s*, τ_{Ysi}, is then negative for firms that receive output subsidies such as preferential treatment and that produce more than the optimal level, while it is positive for firms that are taxed and/or restricted by government and that produce less than the optimal level. In turn, the capital distortion, τ_{Ksi}, is negative for firms with preferential access to credit but positive for firms that face financial frictions. The optimal (i.e., no distortion) value is zero for both τ_{Ysi} *and* τ_{Ksi}.

Another important concept of productivity is revenue productivity, denoted by TFPR vis-à-vis TFPQ. TFPR is the ratio of output revenue (output quantities multiplied by the output price) to the input quantities. Therefore, although TFPQ varies across firms, TFPR should equalize across firms within an industry when there are no distortions because firms with larger output quantities sell their products at lower prices. However, if there are output and/or capital distortions, some firms charge higher (lower) markups reflecting their higher (lower) marginal products of labor and/or capital and then exhibit higher (lower) levels of TFPR. Therefore, a high TFPR implies that the firm confronts barriers that raise its marginal revenue products of capital and labor, rendering the firm smaller than optimal. In fact, regulated or protected firms may happily restrict their output and realize a high TFPR. However, we consider that this is not socially efficient and that aggregate TFP will be higher if these firms expanded their output.

For each industry, we can calculate the ratio of actual TFP, i.e., quantity-based TFP with firm-level distortions, to the efficient level of TFP, i.e., quantity-based TFP without any firm-level distortions, by aggregating the firm-level ratio of TFPQ to TFPR. This ratio of actual TFP to the efficient-level TFP yields the industry-level allocative efficiency. Next, by aggregating the industry-level allocative efficiency, we calculate the ratio of the actual to efficient aggregate output achievable without distortions while keeping industry-level capital and labor inputs at their actual levels. Allocative efficiency is closer to one when within-industry or overall resource allocation is more efficient.

4. Firm-Level Distortions and Aggregate TFP

Following Hsieh and Klenow (2009), we calculate the output distortion (τ_{Ysi}) and the capital distortion (τ_{Ksi}) for Japanese and Korean manufacturing firms.[9] We measure firm-level capital distortion using the deviation of the firm-level labor-to-capital cost ratio from the corresponding industry-average factor share ratio. Similarly, firm-level output distortion is the deviation of the firm-level ratio of labor compensation to revenue from output from the industry-level labor share. Table 3 provides descriptive statistics for output and capital distortion for Japanese and Korean manufacturing firms.[10] The mean and median values of τ_{Ysi} for Japan are –0.44 and –0.39, respectively, while the corresponding values for Korea are –0.48 and –0.22. These values suggest that the typical firm obtains a "subsidy" for its output and thus produces more than its efficient level in both countries. Although the mean values suggest that Korean firms obtain greater subsidies on average than do Japanese firms, the median values suggest the opposite. The standard deviation and the interquartile range (75–25 percentile) are much larger for Korea than for Japan, suggesting that there is a greater dispersion of distortions in Korea. The mean and

[9] The Appendix provides details on the calculation. See also Hsieh and Klenow (2009).

[10] We calculated the industry-average factor (capital and labor) shares using both the cost share and parametric approaches. As the measured distortions are very similar, we only provide the results for the cost share approach.

median values of τ_{Ksi} for Japan are 4.56 and 0.14, respectively, while the corresponding values for Korea are 4.68 and 0.15. These positive values of τ_{Ksi} suggest that the typical firm in both countries pays "taxes" on its capital and does not have good access to credit. Although the magnitude of the capital distortion for a typical firm is only slightly larger in Korea, the standard deviation, and the interquartile range (75–25 percentile) are much larger in Korea, which also suggests the greater dispersion of distortions.

INSERT TABLE 3 HERE

Figure 2 plots the distribution of TFPR in each country. We measure TFPR as the deviation from the industry mean, i.e., $\log(TFPR_{si}/\overline{TFPR_s})$. The dispersion of TFPR is clearly greater in Korea than in Japan and it appears more dispersed in 2007 than in 1995 in both countries. The more dispersed TFPR also implies larger distortions. Therefore, Figure 2 suggests that Korean firms are more likely to face larger distortions and that resource allocation is then less efficient in Korea than in Japan. The figure also suggests that allocative efficiency in both countries was worse in 2007 than in 1995.

INSERT FIGURE 2 HERE

Figure 3 depicts aggregate allocative efficiency for Japan and Korea. Consistent with Figure 2, allocative efficiency is much smaller for Korea on average, suggesting that the level of allocative efficiency is better in Japan. However, Japan's allocative efficiency gradually deteriorated in the 2000s. Consistent with the arguments of the existing literature in Section 2, allocative efficiency did not improve in Japan despite economic recovery in the early 2000s. In the case of Korea, although allocative efficiency improved following the financial crisis in the late 1990s, it deteriorated again after 2006. As a result, the Korean manufacturing sector continues to lag Japan in terms of allocative efficiency.[11]

INSERT FIGURE 3 HERE

In order to investigate the sources of allocative inefficiency, we plot the efficient vs. actual size distribution of firms in Japan and Korea for the manufacturing sector in Figure 4. In both countries, the hypothetical efficient size distribution appears more dispersed than the actual distribution for both 1995 and 2007. Moreover, the distribution of actual size lies to the right of the efficient size distribution in all panels, suggesting that most firms are larger than the efficient size and that they tend to overproduce. However, in 2007 in Korea, the actual size of firms in the right tail of the distribution is clearly smaller than the efficient size, suggesting that a substantial number of relatively large firms produced much less than the optimal level and that such a misallocation of resources deteriorated in 2007 compared with the misallocation in 1995.

INSERT FIGURE 4 HERE

We now examine the changes in distortion over time and the relationship between firm-level distortion and productivity. We group firms by their TFPQ levels from the lowest decile (the 0–10 percentile) to the top decile (90–100 percentile), and calculate the mean value of $\ln(1-\tau_{Ysi})$ for

[11] This is also inconsistent with findings by Oh (2015). She found that TFP gains were larger for Korea than for Japan, comparing her own estimates with the result for Japan obtained by Hosono and Takizawa (2012). Oh (2015) employs the plant-level data underlying the Korean manufacturing census, which includes a large number of smaller plants, while we use firm-level data which include only relatively large firms. However, even though the data we use are very different, our results are broadly consistent with those of Oh (2015).

each group for 1995, 2000, and 2007. Figure 5 illustrates the mean values. As explained, the output distortion, τ_{Ysi}, is zero when there is no distortion, i.e. $\ln(1-\tau_{Ysi})$ is also zero. If firms produce more than their optimal level, the output distortion, τ_{Ysi}, becomes negative and the value of $\ln(1-\tau_{Ysi})$ is positive. Conversely, if firms produce less than their optimal level, τ_{Ysi} is positive while $\ln(1-\tau_{Ysi})$ is negative. Looking at Figure 5, the mean $\ln(1-\tau_{Ysi})$ is positive in most cases, suggesting that firms tend to overproduce, regardless of their TFPQ level. However, in both Japan and Korea, high productivity firms are less likely to overproduce while low productivity firms are more likely to overproduce. Although the overproduction fell, particularly for high productivity firms, during the period from 1995 to 2007, overproduction remained high for low productivity firms. As for Korea, overproduction fell on average in 2000 compared with that in 1995, likely because of business restructuring following the financial crisis of the late 1990s. However, in 2000, high productivity firms in Korea tended to produce less than their optimal level and they continued to do so in 2007. Nevertheless, overproduction by low productivity firms worsened in 2007.

INSERT FIGURE 5 HERE

Similarly, we calculate the average capital distortion for firms using the level of TFPQ. Figure 6 depicts the mean value of $\ln(1+\tau_{Ksi})$ for each group for 1995, 2000, and 2007. The capital distortion, τ_{Ksi}, is again zero when there is no distortion, i.e., $\ln(1+\tau_{Ksi})$ is also zero. If firms face financial constraints (that is, they do not have good access to credit), the capital distortion, τ_{Ksi}, is positive and the value of $\ln(1+\tau_{Ksi})$ is also positive. On the other hand, if firms have good access to credit, both τ_{Ksi} and $\ln(1+\tau_{Ksi})$ are negative. Viewing Figure 6, the mean $\ln(1+\tau_{Ksi})$ in most cases is positive, suggesting that the majority of firms tend to face some financial constraints. In Japan, the capital distortion is on average largest in 2000, likely reflecting the fact that the NPL problem for Japanese banks was especially severe at the time and many banks were reluctant to lend money. However, consistent with the so-called zombie-lending hypothesis, the lowest productivity firms tended to face less severe financial constraints even in 2000. In 2007, the capital distortion became smaller on average, and access to credit was very much improved for the lowest productivity firms.

In contrast, in Korea, the figure is more sharply U-shaped than in Japan, particularly in 1995 and 2000. This was because low productivity firms tended to enjoy large subsidies (e.g., preferential access to credit), suggesting that they used more capital input than their optimal level. Although the capital distortion for low productivity firms declined slightly in 2007, high productivity firms now faced more severe capital constraints and larger positive capital distortions.

INSERT FIGURE 6 HERE

According to Figures 5 and 6, low productivity firms tend to produce more than their optimal level in both Japan and Korea. In Korea, underproduction by high productivity firms is conspicuous. In Japan, the output distortion has fallen for firms within the top-10 percent of firms ranked by productivity, and the capital distortion has declined over time. However, most firms continue to overproduce, resulting in the persistent worsening level of allocative efficiency in the Japanese manufacturing sector depicted in Figure 3. Figures 5 and 6 also suggest that in Japan, most firms overproduce and they also face a higher capital cost relative to labor cost. This may imply that they overuse labor but underuse capital when compared with the optimal relative use, and that many firms retain labor because firing workers is difficult for many Japanese firms because of the long-term employment system. As for Korea, it appears that low productivity firms have some form of preferential access to credit and thus tend to overproduce. However, high productivity firms face tighter financial constraints and tend to produce less than their optimal level. This suggests that in Korea, the financial market does not work well and that high productivity firms receive insufficient funding.

5. Conclusion

In this paper, we measured firm-level distortions and examined the aggregate level of allocative efficiency for the Japanese and the Korean manufacturing sectors during the period from 1995 to 2008. We found that allocative efficiency in Japan has not improved and even slightly worsened in the 2000s. Although we were unable to identify a clear downward trend in allocative efficiency in Japan during the 1990s, which is at odds with existing arguments in the literature, we were able to confirm that distortions arising from financial friction worsened in the latter half of the 1990s. In the 2000s, our results suggest that the majority of firms continued overproducing, although relatively high productivity firms came closer to their optimal production levels. As conjectured by Fukao (2012), because relatively high productivity firms were reluctant to increase investment and hire additional workers, low productivity firms needed to hold excess labor and capital, resulting in a deterioration in resource reallocation. Our findings also suggest that Japan’s rigid employment system partly prevented resources from moving from low productivity firms to high productivity firms.

As for Korea, allocative efficiency severely deteriorated in the latter half of the 1990s. Although allocative efficiency improved in the 2000s, by 2008 it had still not returned to its 1995 peak. Moreover, allocative efficiency in Korea is lower than that in Japan. Most importantly, output and capital distortions are more dispersed across firms in Korea than in Japan. The firms in the lowest and second-lowest productivity groups are likely to face preferential, very low capital costs and to invest in physical capital much more than its optimal level, resulting in overproduction. In contrast, firms in the highest productivity group are more likely to face higher capital costs and to produce much less than their optimal level.

While Japan has already started suffering from labor shortages associated with depopulation and population aging, the expectation is that Korea will face a similar situation in the near future. For both countries, improvement in resource allocation remains a pressing policy issue. In order to resolve overproduction by low productivity firms, the government should support corporate revival, rather than prolonging the survival of these firms. Japan's experience tells us that slow and insufficient policy actions would worsen the problem and invoke the prolonged deterioration of allocative efficiency. Moreover, eliminating or reducing uncertainty in the business environment—for example, by stabilizing public finances and foreign exchange rates—would assist in promoting investment and expansion in production by high productivity firms. Designing an effective incentive scheme and promoting trade liberalization and rulemaking to ensure fair competition will also be important in improving resource allocation among manufacturing firms.

Appendix: Measurement of Firm-Level Distortion and Aggregate Allocative Efficiency

We follow the methodology proposed by Hsieh and Klenow (2009) and measure firm-level distortions in capital and output. Drawing on a static partial-equilibrium monopolistic competition model, Hsieh and Klenow (2009) demonstrate that profits of producer *i* in industry *s* are given by:

$$\pi_{si} = \left(1 - \tau_{Y_{si}}\right) P_{si} Y_{si} - w L_{si} - \left(1 + \tau_{K_{si}}\right) R K_{si},$$

where P_{si} is the price of the differentiated good produced by firm *i* in industry *s*, and Y_{si} is the output produced by firm *i* in industry *s*. L_{si} and K_{si} denote the labor and capital inputs of firm *i* in industry *s*, respectively. Parameters *w* and *R* denote the cost of labor (wage) and cost of capital, respectively. The output distortion, denoted by τ_{Ysi}, is the distortion that increases the marginal products of capital and labor by the same proportion, while the capital distortion, denoted by τ_{Ksi}, is the distortion that raises the marginal product of capital relative to labor. If firms face government restrictions on size, τ_{Ysi} for these firms will be higher and this restricts their output compared with the optimal level of output. Alternatively, τ_{Ysi} for firms that receive output subsidies is lower and these firms will increase their output compared with the optimal level. In turn, the capital distortion, τ_{Ksi}, is lower for firms with access to cheap credit provided by business groups or government-owned banks, while it is higher for firms that do not have access to credit. Firms without good access to credit, i.e., a higher τ_{Ksi}, reduce their capital input compared with the optimal level.

Maximization of profit, π_{si}, yields the standard condition that a firm's output price is a fixed markup over its marginal cost. We also derive the capital–labor ratio, labor allocation, and output from their model. Following Hsieh and Klenow (2009), we infer the distortions and productivity for each firm in each country-year as follows:

$$1+\tau_{K_{si}} = \frac{\alpha_s}{1-\alpha_s}\frac{wL_{si}}{RK_{si}},$$

$$1-\tau_{Y_{si}} = \frac{\sigma}{\sigma-1}\frac{wL_{si}}{(1-\alpha_s)P_{si}Y_{si}},$$

$$A_{si} = \kappa_s \frac{(P_{si}Y_{si})^{\frac{\sigma}{\sigma-1}}}{K_{si}^{\alpha_s}L_{si}^{1-\alpha_s}}\text{ , where } \kappa_s = w^{1-\alpha_s}\,(P_sY_s)^{-\frac{1}{\sigma-1}}/P_s,$$

where α_s and σ denote the capital share in industry *s* and the elasticity of substitution between firm value-added. Following Hsieh and Klenow (2009), we allow capital shares to differ across industries, but not across firms within an industry. We set $\sigma = 3$ following Hsieh and Klenow (2009). We can observe wage compensation wL_{si} and nominal output $P_{si}Y_{si}$ for each firm *si*. We calculate the cost of capital, *R*, as the sum of the real interest rate and the depreciation rate for each industry and country every year, using our firm-level data and interest rate information provided by the Bank of Japan and the Bank of Korea. The capital share for each industry is a simple average of the cost shares of each firm calculated using our firm-level data.[12] We obtain the distortions on output and capital (τ_{Ysi} and τ_{Ksi}) using these values. A_{si} is physical productivity, which Foster et al. (2008) denote TFPQ. Although we cannot observe κ_s, this does not affect A_{si} relative to the industry TFP and hence reallocation gains. Therefore, we set κ_s=1 for each industry *s*. We obtain revenue-based productivity or TFPR ($\equiv P_{si}A_{si}$) as follows:

$$TFPR_{si} = \left(\frac{\sigma}{\sigma-1}\right)\left(\frac{R}{\alpha_s}\right)^{\alpha_s}\left(\frac{w}{1-\alpha_s}\right)^{1-\alpha_s}\frac{\left(1+\tau_{K_{si}}\right)^{\alpha_s}}{1-\tau_{Y_{si}}}.$$

Thus, we obtain firm-level distortions on output and capital, TFPQ (or A), and TFPR. Using these measures, we calculate the ratio of actual to efficient aggregate output achievable without distortions while keeping industry-level capital and labor at their actual level.

[12] We also estimate the Cobb–Douglas production function for each industry for each country and use the estimated capital share to calculate distortions and TFP. As the results were qualitatively similar to that based on the capital share using the industry average cost share, we mainly report the results using the cost share-based capital share.

$$\text{Allocative Efficiency} = \frac{Y}{Y_{efficient}} \equiv \prod_{s=1}^{S}\left[\sum_{i=1}^{M_s}\left(\frac{A_{si}}{\overline{A_s}}\frac{\overline{TFPR_s}}{TFPR_{si}}\right)^{\sigma-1}\right]^{\theta_s/(\sigma-1)}.$$

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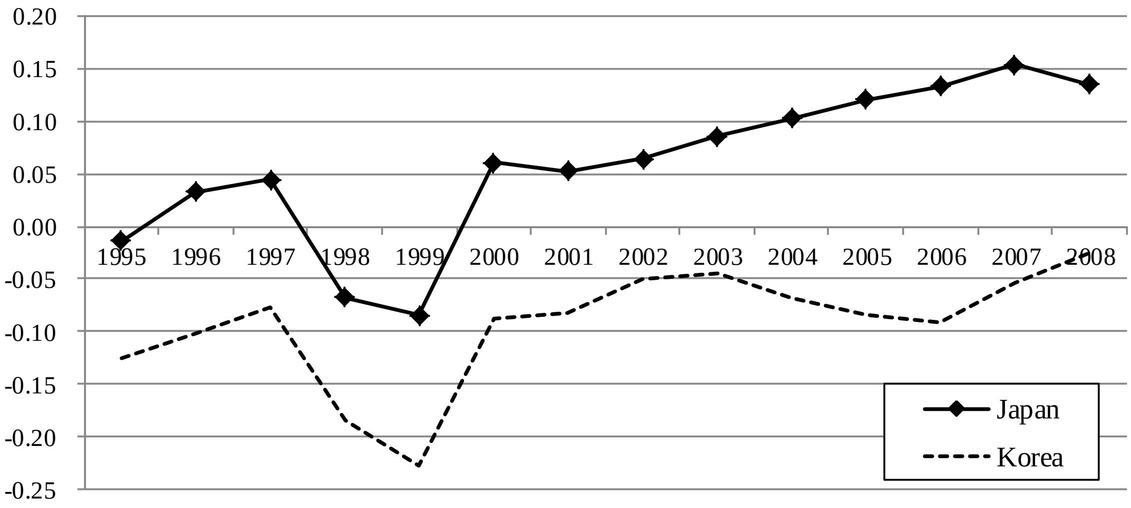
Figures and Tables

Figure 1. Comparison of aggregate TFP for Japanese and Korean manufacturing firms



Source: Kim and Ito (2013), Figure 1.

Figure 2. Distribution of TFPR: Manufacturing firms

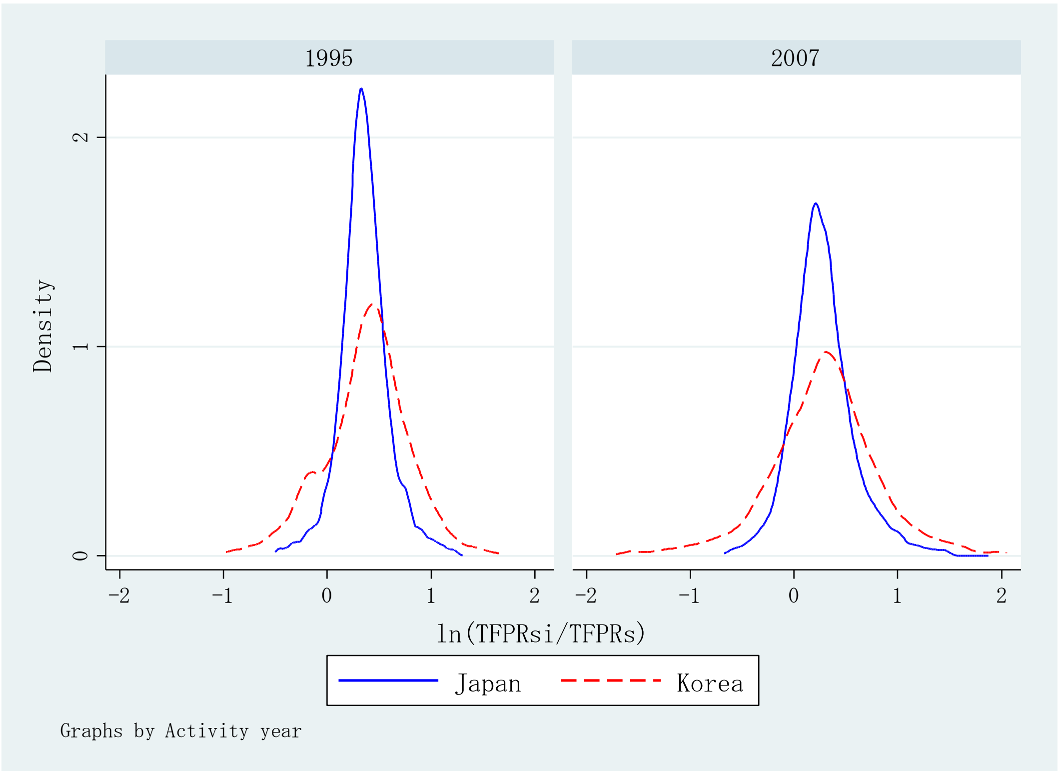


Figure 3. Trends in allocative efficiency for Japan and Korea: Manufacturing sector

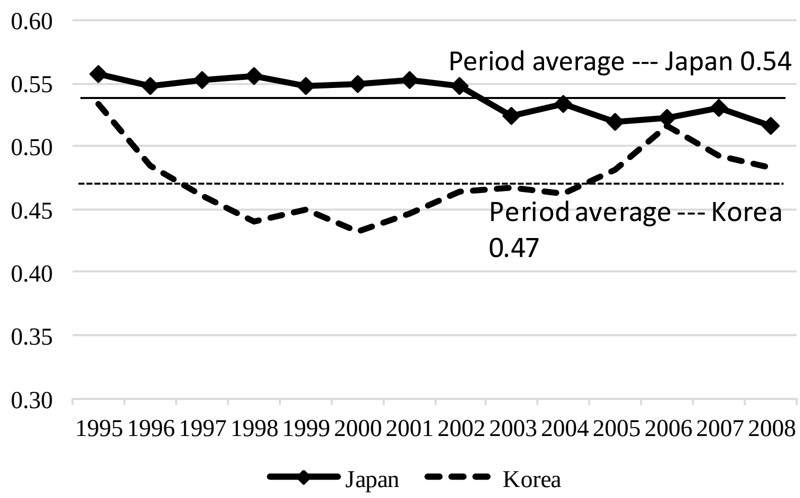


Figure 4. Size distribution: Manufacturing sector

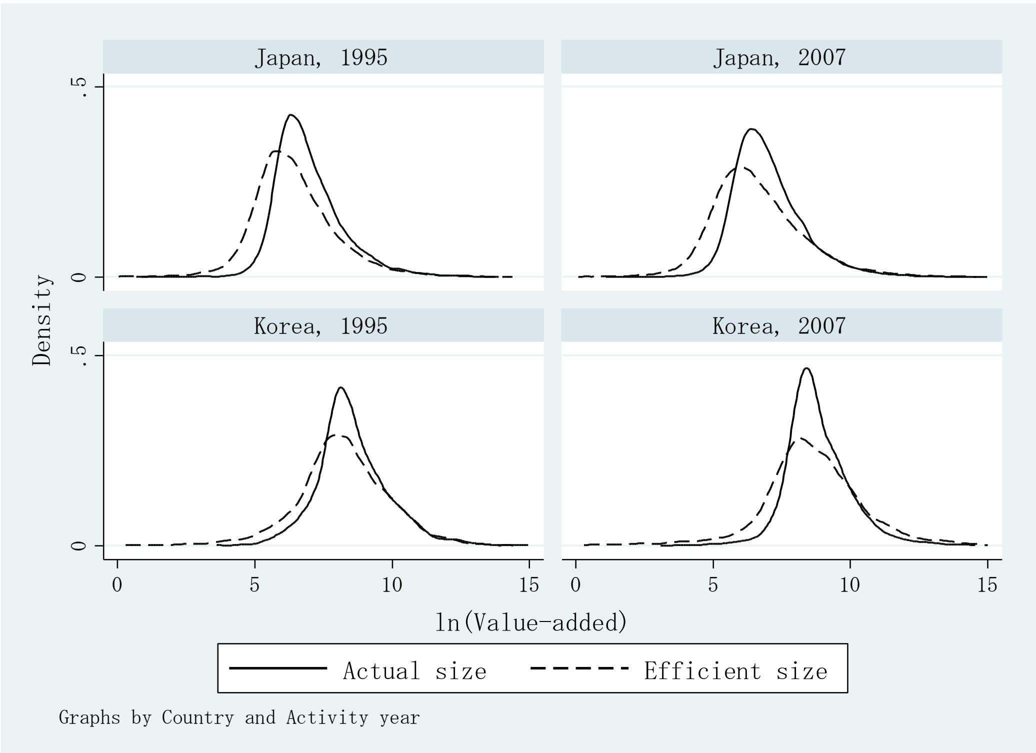


Figure 5. Average output distortion by TFPQ level: Manufacturing sector

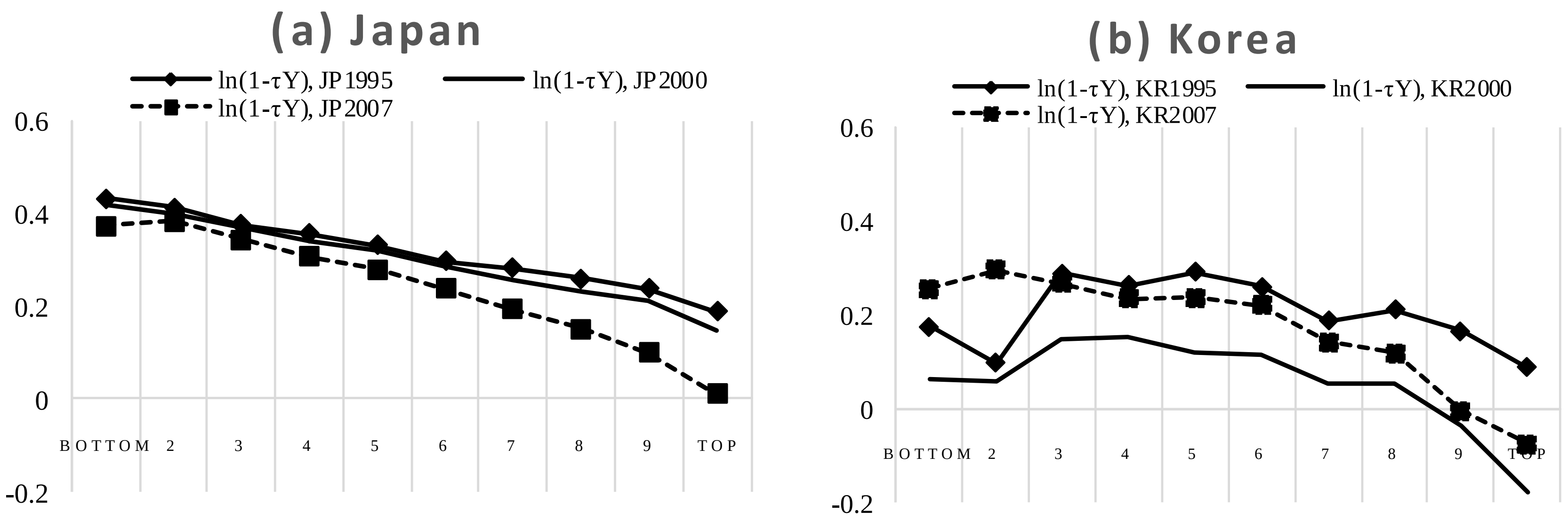


Figure 6. Average capital distortion by TFPQ level: Manufacturing sector

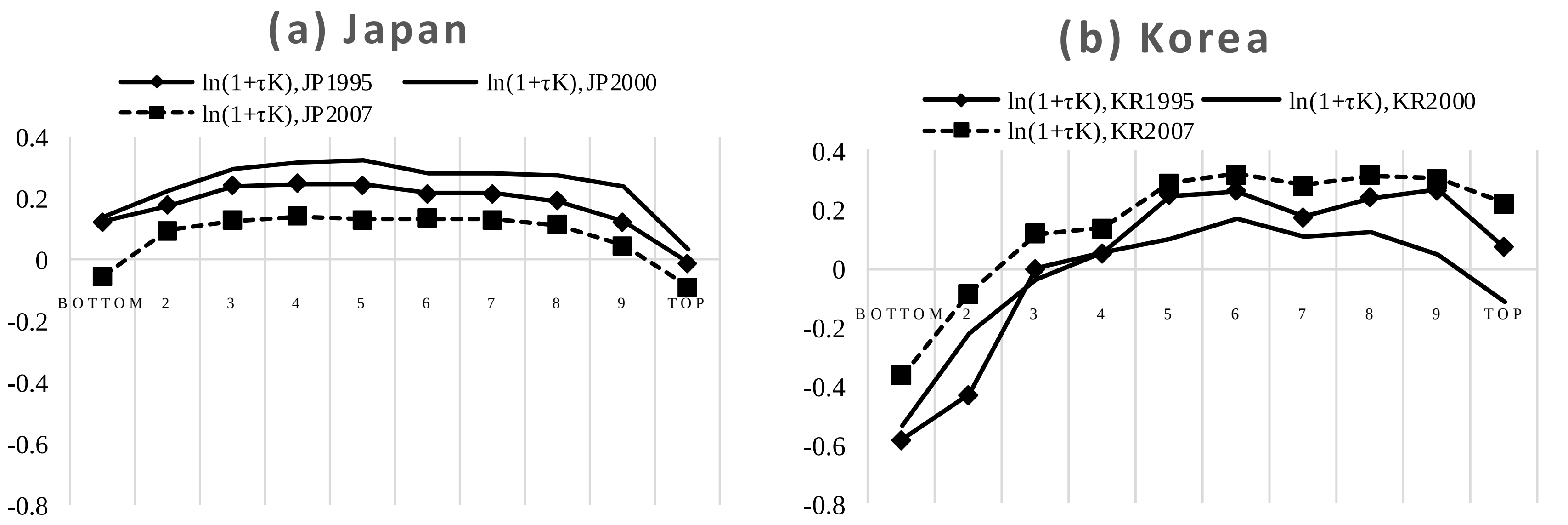


Table 1. Summary statistics for the firm-level data (2007)

	Japan			Korea		
	BSJBSA	Our data (TFP calculated)		SBA	Our data (TFP calculated)	
All industries			Coverage (%)			Coverage (%)
Total number of firms	29,080	27,882	95.9	10,749	7,081	65.9
Distribution by employment size (%)						
50-99 workers	31.7	31.2	94.4	46.7	42.7	60.2
100-299 workers	42.5	42.8	96.4	38.0	40.8	70.7
300-499 workers	10.3	10.4	96.6	6.6	6.9	69.1
500-999 workers	8.2	8.3	97.2	5.0	5.7	74.8
1000- workers	7.2	7.2	96.7	3.7	3.9	69.6
Total sales (billion yen, billion won)	745,039	729,234	97.9	1,345,843	1,219,436	90.6
Total number of regular workers	12,918,581	12,518,449	96.9	3,029,329	2,169,706	71.6
Manufacturing industries						
Total number of firms	13,354	13,176	98.7	5,927	4,833	81.5
Distribution by employment size (%)						
50-99 workers	31.8	31.5	97.8	48.7	43.7	73.1
100-299 workers	44.9	45.0	98.9	38.4	41.9	89.1
300-499 workers	10.0	10.1	99.0	6.1	6.5	86.6
500-999 workers	7.3	7.4	99.6	4.0	5.0	101.7
1000- workers	6.0	6.1	99.6	2.8	2.9	85.0
Total sales (billion yen, billion won)	334,775	332,338	99.3	834,247	765,735	91.8
Total number of regular workers	5,292,956	5,252,272	99.2	1,556,977	1,386,778	89.1

Sources: Japan: Ministry of Economy, Trade and Industry (2009) "Results of the Basic Survey of Business Structure and Activity," and authors' calculations.
Korea: Statistics Research Institute (2009) "Corporate Activities in Korea: Structure, Strategy, and Outcome." (in Korean)
Statistics Korea (2009) "Preliminary Results of the Survey of Business Activities in 2008," http://www.kostat.go.kr/portal/english/news/1/1/index.board?bmode=read&aSeq=272863 &pageNo=2&rowNum=10&amSeq=&sTarget=title&sTxt=business
Authors' calculations based on the KIS database.

Table 2. Total number of observations by industry (1995–2008)

Industry	Japan		Korea		Total	
	No. of obs.	Share (%)	No. of obs.	Share (%)	No. of obs.	Share (%)
Manufacturing						
6. Food and kindred products	22,926	(12.1)	3,576	(6.1)	26,502	(10.7)
7. Textile mill products	4,660	(2.5)	2,434	(4.1)	7,094	(2.9)
8. Apparel	5,098	(2.7)	2,233	(3.8)	7,331	(2.9)
9. Lumber and wood products	2,193	(1.2)	271	(0.5)	2,464	(1.0)
10. Furniture and fixtures	2,343	(1.2)	450	(0.8)	2,793	(1.1)
11. Paper and allied products	5,932	(3.1)	1,494	(2.5)	7,426	(3.0)
12. Printing, publishing, and allied products	11,534	(6.1)	670	(1.1)	12,204	(4.9)
13. Chemicals	13,154	(6.9)	6,252	(10.6)	19,406	(7.8)
14. Petroleum and coal products	753	(0.4)	266	(0.5)	1,019	(0.4)
15. Leather	522	(0.3)	638	(1.1)	1,160	(0.5)
16. Stone, clay and glass products	7,601	(4.0)	2,414	(4.1)	10,015	(4.0)
17. Primary metal	6,584	(3.5)	3,747	(6.4)	10,331	(4.2)
18. Fabricated metal	17,736	(9.3)	3,305	(5.6)	21,041	(8.5)
19. Non-electrical machinery	22,898	(12.1)	6,396	(10.9)	29,294	(11.8)
20. Electrical and electronic machinery	28,210	(14.9)	11,206	(19.1)	39,416	(15.9)
21. Motor vehicles	13,072	(6.9)	6,595	(11.2)	19,667	(7.9)
22. Transportation equipment and ordnance	3,326	(1.8)	1,171	(2.0)	4,497	(1.8)
23. Instruments	5,083	(2.7)	1,692	(2.9)	6,775	(2.7)
24. Rubber and miscellaneous plastics	11,932	(6.3)	3,275	(5.6)	15,207	(6.1)
25. Miscellaneous manufacturing	4,315	(2.3)	671	(1.1)	4,986	(2.0)
Manufacturing total	189,872	(100.0)	58,756	(100.0)	248,628	(100.0)
Services						
26. Transportation	1,515	(0.8)	3,372	(14.4)	4,887	(2.4)
27. Communications	457	(0.2)	5,998	(25.7)	6,455	(3.1)
28. Electrical utilitities	347	(0.2)	533	(2.3)	880	(0.4)
30. Trade	137,963	(74.8)	8,294	(35.5)	146,257	(70.4)
31. Finance, insurance, and real estate	1,521	(0.8)	2,374	(10.2)	3,895	(1.9)
32. Other private services	42,727	(23.2)	2,779	(11.9)	45,506	(21.9)
Services total	184,530	(100.0)	23,350	(100.0)	207,880	(100.0)
Others						
1. Agriculture	185		400		585	
2. Coal mining	705		64		769	
5. Construction	6,085		7,710		13,795	
Others total	6,975		8,174		15,149	
Industries excluded from our sample						
3. Metal and nonmetallic mining	0		171		171	
4. Oil and gas extraction	0		2		2	
29. Gas utilities	1,097		0		1,097	
33. Public service	15		4,630		4,645	
	1,112		4,803		5,915	
Total	382,489		95,083		477,572	

Table 3. Descriptive statistics for output distortion (τ_{Ysi}) and capital distortion (τ_{Ksi}) for the manufacturing sector

	N	Mean	Median	S.D.	75-25
τ_{Ysi}					
Japan	185,937	-0.435	-0.387	1.91	0.41
Korea	50,873	-0.481	-0.220	5.68	0.70
τ_{Ksi}					
Japan	187,919	4.560	0.139	71.20	1.23
Korea	51,917	4.682	0.147	530.44	1.44

Notes: N = number of observations, S.D. = standard deviation, 75–25 = difference between the 75 and 25 percentiles.

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Product Market Efficiencies and Total Factor Productivity:
A Comparison of Japanese and Korean Firms

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