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US-Japanese Knowledge Transfer Program in the Aftermath of WWII*

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Abstract

In the aftermath of World War II, a large-scale management program, sponsored by the United States and known as the Productivity Program, was implemented in several European countries and Japan. The program involved sending corporate executives to observe business practices at U.S. firms and aimed to share modern management practices and enhance productivity in the recipient countries. In this paper, we first summarize the similarities and differences in how the program was implemented in Japan and European countries based on historical documents. Next, using data on Japanese firms that participated in the program, combined with a database of stock-listed firms, we document the characteristics of participating firms and compare them to other stock-listed firms during the same period. We also provide a simple comparison of firm performance over the first two decades of the program between participating firms and non-participating firms with similar initial characteristics.

Keywords: Firm performance, Management training, Technical Assistance, History
JEL classification: L25, M16, M54, N35, N65, O33

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1 Introduction

Economists have long been interested in the large productivity differences across countries. Even among current developed countries, there were large productivity gaps in the aftermath of World War II. However, in the past, examples of substantial productivity convergence took place. For instance, in the 1940-50s, manufacturing productivity in Europe and Japan was roughly one-third to half of U.S. levels (Silberman et al., 1996; Van Ark et al., 1993). These countries closed much of these gaps through rapid productivity growth by the 1980s. One potential driver of this convergence was the international transfer of knowledge on management and technology.

In the postwar period, a large-scale knowledge transfer initiative was sponsored by the US in several Western European countries and Japan. The program, also known as the Productivity Program, involved sending firm managers to observe business practices at U.S. firms and learning the state-of-the-art Training Within Industry (TWI) principles. The TWI principles involved three modules: the Job-Instructions (J-I) module taught supervisors and managers how to establish standard procedures for operations, the Job-Relations (J-R) module taught how to manage and motivate workers, and the Job-Methods (J-M) module taught how to introduce improvements to current production processes (Bianchi & Giorcelli, 2022).

This initiative aimed to diffuse modern management practices and enhance productivity in the recipient countries. Giorcelli (2019) examines the impact of the Productivity Program in Italy in the 1950s and shows that the program caused large and sustained productivity improvements for Italian firms. However, in other countries, these programs have been rarely quantitatively evaluated, possibly due to the lack of firm-level panel data that identify participating firms.

In this paper, we provide the first evaluation of the Productivity Program in Japan, using newly constructed firm-level data, along with a broad overview of the program's implementation in Japan and other countries. Specifically, the objectives of this paper are fourfold. First, we summarize the similarities and differences in the implementation of the Productiv-

ity Program in Japan and European countries based on historical documents. Second, we use newly digitized data on Japanese firms that participated in the Productivity Program to document the characteristics of participating firms. Third, by combining this dataset with a database of stock-listed firms from the same period, we examine selection into the program among listed firms. Lastly, using propensity score matching methods, we provide a simple comparison of firm performance over the first two decades of the program between participating and non-participating firms with similar initial characteristics.

This paper contributes to three strands of the literature on management and firm productivity. First, most empirical evidence on the effects of management interventions on firm performance is based on randomized controlled trials (RCTs). Using this methodology, several papers have documented that the adoption of managerial practices has large and positive effects on firm outcomes (e.g., Bloom et al., 2013; Bruhn et al., 2018; Gosnell et al., 2020; Higuchi et al., 2015; Iacovone et al., 2022). A few other works have shown that management interventions can have long-lasting effects (Bianchi & Giorcelli, 2022; Bloom et al., 2020; Giorcelli, 2019). Another body of research has explained that manager talent and interpersonal skills reduce employee attrition and turnover (Hoffman & Tadelis, 2021; Lazear et al., 2015), improve workers' allocation to jobs and their career progression (Minni, 2023), and increase productivity also in the public sector (Fenizia, 2022).

Second, for Japan's productivity program, only Mori et al. (2007) conducted an empirical analysis by using the list of trip participants between 1955 and 1975. However, their analysis is descriptive and focuses on the characteristics of trip participants. Other existing studies are based on historical records (e.g., Bando, 2014; Ito, 2009) or oral history interviews (e.g., Shimanishi et al., 2007; Umezaki, 2005). Our study is the first to match the participant list with firm-level data to examine the program's impact on firm performance.

Third, this paper also contributes to the literature on the impact of aid, with a particular focus on technical assistance. According to Silberman et al. (1996), whose first author originated the productivity support program and reviewed 5,000 pages of official documents, the program was preferred to be called "industrial productivity program," not as "technical

assistance" in its early years. The program was indeed a massive-scale technical assistance. While an increasing number of RCTs, including the aforementioned studies aiming to improve firm performance, have been conducted, only a few had a transformative impact. The productivity program targeted a large number of firms and substantially changed the economy.

2 Background and Productivity Programs in Europe and Japan

This section outlines the productivity support from the United States. The support started in the United Kingdom as part of the Marshall Plan and spread to other European countries. Then, due to the strategic shift of the United State's support to Asia after the outbreak of the Korean War, the support started in Japan. We provide a detailed background of Japan's case and briefly mention the expanded support to other Asian countries.

2.1 Productivity support from the United States: From the Marshall Plan to the Korean War

In the aftermath of World War II, the United States launched the Marshall Plan to support war-devastated European countries. The support aimed to help them recover from the war damages and prevent the spread of Communism. While a large part of the support was provided in the form of consumables, capital, and loans, technical assistance was also provided to enhance productivity. Following the domestic success of the Productivity Program during World War II in improving firm productivity, the United States sought to export the program to Europe.

Of the total support of 19.4 billion USD from 1948 to 1957, 0.3 billion USD, or 1.5% of the total cost, was used for technical assistance (Silberman et al., 1996). The core of US technical support was productivity study trips, which brought 24,000 Europeans and several thousand Japanese, Koreans, and Taiwanese to the United States in 1,500 trips (Silberman

et al., 1996). Although accounting for a small proportion of the support by the Marshall Plan, Eichengreen and Uzan (1992) and Wasser and Dolfman (2005) argue the importance of technical support.

The outbreak of the Korean War in 1950 redirected the United States' attention to Asia. In particular, Japan was expected to play a crucial role in supplying military resources to its neighboring South Korea. According to Price (1955), a total of 5.9 billion USD was provided as grants and credits to Asian countries by 1953, of which Japan and South Korea received 2.4 and 0.4 billion USD, respectively.

2.2 Program in Europe

The United Kingdom was the first country to receive the productivity support of the United States (JPC, 2005). The Anglo-American Council on Productivity (AACP), the counterpart organization to receive support from the United States, was established in 1948. The primary component of the support was to send managers, technicians, and workers to businesses in the United States. According to Tiratsoo and Gourvish (1996), 950 people were sent to the United States in 66 trips, which consisted of 47 trips focusing on a specific industry and 17 trips focusing on a particular topic, such as accounting, procurement, or labor management. In a typical industry-focused trip, the members consist of 5 managers, 5 technicians, and 5 workers. A one-week pre-trip orientation was provided, and the trip lasted four to six weeks. A report was produced after each trip and widely disseminated in the United Kingdom to share the knowledge learned. According to JPC (2005), a total of 500,000 copies were distributed in the United Kingdom.

The total cost of AACP from 1948 to 1952 was 0.23 million USD. 59% was covered by the government of the United States, 20% by the counterpart funds in the Marshall Plan, and 21% by participation fees and donations from the private sector (Tiratsoo & Gourvish, 1996). The support by the United States was ended in 1953, and AACP was dissolved. The British Productivity Council (BPC), funded by the government of the United Kingdom, took over the activities and operated until 1973.

Following the success in the United Kingdom, productivity programs were successively established in other European countries. These included Denmark and Turkey in 1949, Austria, West Germany, and the Netherlands in 1950, Belgium, Italy, and Switzerland in 1951, Greece, Sweden, and France in 1953 (JPC, 2005). According to Giorcelli (2025 book proposal[1]), 19,000 managers from 17 European countries visited the United States in 270 trips organized between 1952 to 1958. Silberman et al. (1996) describes that 246 trips were organized by the United Kingdom and France, aiming to target almost all factories with more than 50 employees.

The case of Italy was examined by Giorcelli (2019). This study empirically analyzed the newly constructed panel data of firms and found the positive and sustained impacts of the productivity program in Italy. It consists of training trips to the United States, as provided in the United Kingdom, and the provision of machines produced in the United States. While the program in the United Kingdom and France mainly targeted large firms, the Italian program specifically targeted small and medium enterprises (SMEs). This is because large Italian firms already received loans through the Marshall Plan earlier, between 1948 and 1952 (Segreto, 2002). According to Giorcelli (2019), the manufacturing firms with 10-250 employees were eligible; of the 6,065 eligible SMEs, 3,624 applied, and 3,594 were selected in 1951 to receive the trip, capital, or both. Due to the unexpected budget cut in 1952 resulting from the outbreak of the Korean War, support was provided to a subset of the selected firms. Consequently, 146 firms received the trip, 233 firms received the granted machines, and 386 firms received both support between 1952 and 1958. All the trips were industry-level, with 15 to 20 participants in each trip, and typically consisted of a one-week orientation and trips for 8-12 weeks.

2.3 Program in Japan

After the end of World War II, Japan was occupied by the U.S. Occupation authorities led by General MacArthur. Their overall mission was to break up militarism to replace the

[1]Available at: http://www.giorcellimichela.com/book-project.html

democratic system, and thousands of top managers were purged. At the same time, they recognized the importance of rebuilding Japan's economy instead of punishing it to avoid mass starvation and widespread unrest. Further, the members of MacArthur's leadership were aware of the success of the Productivity Program in the United States and felt that this program would help support the rebuilding and infuse democratic principles in Japan (Robinson & Schroeder, 1993). Despite such recognition, it took several years for the Productivity Program to be implemented.

In 1951, Japan's Ministry of International Trade and Industry (MITI) observed the success of the trips in the United Kingdom and proposed to establish a productivity center to provide similar trips for Japanese firms. The proposal, however, was not seriously taken by the government as the economy was booming with the Korean War (JPC, 2005).[2] In 1953, Mr. Kohei Goshi, one of the founders of the Japan Association of Corporate Executives (JACE), visited and observed the success of the United Kingdom and West Germany, which, like Japan, had been similarly defeated in World War II. He realized the importance of initiating such a program in Japan. Mr. Goshi was also surprised and inspired by labor unions' cooperative attitude in the United Kingdom, as the labor relationship in Japan was highly confrontational.

In 1953, the United States Embassy declared its support for the establishment of the Japan Productivity Center (JPC). The embassy initially attempted to collaborate with the Japan Business Federation (Keidanren), but they refused to take the initiative because the support from the United States reminded them of weapon production and militarization. Subsequently, the embassy approached JACE, and Mr. Goshi agreed to cooperate and take the initiative. Then, he convinced Keidanren, the Japan Federation of Employers' Associations (later merged with Keidanren), and the Chamber of Commerce and Industry to collaborate on a productivity movement.

[2] At a similar time, Japan's Ministry of Labor created the Japan Employment Problem Association (JEPA) in 1948 to administer the TWI program, and they provided TWI training to Japanese firms (Robinson & Schroeder, 1993). It is important to note that the Labor Ministry's support did not include trips to learn management.

After a year of preparation, JPC was established in 1955. It was established as a private organization, and the strong initiative of the private sector is a unique characteristic of Japan's productivity program (Shimada, 2018). Also, JACE, which consisted of young managers who replaced the purged old managers, played a key role in Japan's productivity movement. For the first half of 1955, the Japanese side contributed 0.30-0.36 million USD, and the United States supported the same amount. The Japanese side's contribution was largely borne by the private sector (Shimada, 2018).

In contrast to the United Kingdom, labor unions were not supportive. Two major umbrella organizations, the General Council of Trade Unions of Japan and the Japanese Confederation of Labour, did not join JPC when it was established in March 1955. When JPC declared three principles, including the expansion of employment, cooperation between labor and management, and fair distribution of the fruits, in May 1955, the Japanese Confederation of Labour decided to join in September 1955 (JPC, 2005).

The purpose of JPC's establishment states that Japan needs overall productivity improvement as capital accumulation was limited in the war-devastated Japan (JPC, 2005). Resource scarcity is likely related to the emergence of lean manufacturing in Japan. The four pillars of JPC's activities included (i) overseas trips and invitations of foreign experts, (ii) dissemination of scientific management methods, (iii) direct support for companies, and (iv) public awareness and promotion. Of these, the major activity is the overseas training trips. The trips followed those of the United Kingdom, and they typically consisted of three months of preparatory study and a trip of 2-6 weeks to the United States. The first trip was organized in 1955. Since 1957, a number of trips have been made to European countries as well. The support from the United States continued from 1955 to 1961, with 393 trips organized (including 48 trips to European countries), and 3,986 people participated in the trips. Even with the support from the United States, each participating firm paid 1,100 USD to JPC (Shimada, 2018). Even after the United States cut its support, the trips continued. The next section describes the exact numbers. While top managers mostly participated in the trips in the earlier phase, the share of middle managers increased after the 1960s.

Following Japan's success, Asian countries began to establish productivity centers (JPC, 2005), including Taiwan in 1955, Korea in 1957, India in 1958, and Pakistan in 1961. The Asian Productivity Organization (APO) was established in 1961. Additionally, a notable change in Japan's program was that trips to Asian countries began in 1962. One of the aims of these trips was to support the productivity improvement of firms in Asian countries (JPC, 1985). This indicates that Japan started to shift from the recipient of technical assistance to its provider.

Based on the productivity support from the United States, Japanese firms continued to adopt and improve the principle of TWI and achieved miraculous economic growth from the 1950s to the 1980s. The United States observed the rise of Japanese firms, particularly the success of automotive manufacturers, notably Toyota, and began to learn about the lean production methods adopted by these firms. Robinson and Schroeder (1993) conducted the analysis of historical documents and interviews of numerous top managers and government officials and concluded that lean production and other associated practices, such as Kaizen, are based on TWI. They even conclude that "While TWI had an impact on many countries around the world, it undoubtedly had its greatest effect on Japan (p.35)." Hence, after three decades of unique development in Japan, TWI was re-imported by the United States. Robinson and Schroeder (1993) point out two reasons why TWI died in the United States. First, while the government strongly encouraged the program during World War II for firms that sought governmental contracts, such encouragement became limited after the war. Second, since the United States was one of the few developed countries that remained intact in the aftermath of World War II, limited competition reduces the need for further productivity improvement.

In 1983, the Japan International Cooperation Agency (JICA), with a request from Prime Minister Lee Kuan Yew, started to support Singapore's productivity improvement. They introduced lean production and Kaizen, and the support continued until 1990. Since then, JICA's support expanded to Eastern Europe, Latin America, and Africa (Jin & Ohno, 2022).

3 Data

We digitized the data on the Japanese Productivity Program participants and combined it with the data of stock-listed firms that contain more information about firm characteristics and performance.

3.1 Data of Productivity Program participants

We digitized the record of Japanese Productivity Program participants to the study trips during 1955–1988 archived at JPC. In the record, participants are listed by trip, each consisting typically around 10 participants from different organizations who traveled together. The record contains the name of each trip, typically containing a name of industry or a topic of interest (or both), suggesting shared objectives among its participants. An example of industry-based trips is the Automotive Industry Study Group, which aimed to study lean manufacturing practices and production systems widely adopted in the U.S. automotive sector. An example of topic-based trips is the Top Management Productivity Study Group, which targeted broader organizational reform, with participants aiming to learn about strategic planning, labor relations, and overall productivity enhancement at the executive level.

In addition to the trip name, the original record provides information about each participant's name, firm/organization name, job title, the year and month of the trip, and the destination country. We digitized all of this information except for the participants' names.[3] The firm/organization names typically refer to names of private firms but also include central and local government institutions as well as labor unions.

3.2 Data of stock-listed firm

To link the information on program participants to their firm performance and characteristics, we use the Development Bank of Japan's *Corporate Financial Databank* (CFD) on stock-listed firms from 1957 (the initial year in which the data is available) to 1976. For

[3]Individual names were recorded but not digitized due to concerns about personal information.

each year, the CFD provides firm information collected from securities reports. We use firm names, the number of employees, total sales, and industry classifications.

Our analysis focuses on firms for which both the number of employees and total sales are available for the years 1957 and 1966. Restricting the sample in this way results in a dataset of 420 stock-listed firms.

3.3 Matching datasets

To examine the performance differences between firms that participated in the Productivity Program and those that did not (in Sections 4.3 and 5), we match the data of participants with the data of stock-listed firms using firm names.

While the stock-listed firm database is at the firm-year level, the program participant data is at participant level (i.e. individual level) for each year, and some firms sent multiple participants within a single year. Therefore, we first aggregated participant data at the firm-year level by counting each firm only once in a year when it participated, even when multiple individuals from the firm participated in the year. The resulting dataset contains 25,820 firm-year observations for the period 1955–1988.

We then apply several sample restrictions to this data. First, we limit the sample to organizations whose first participation was recorded before 1966 (6,781 firm-year observations), which covers the first ten years since 1957. We then define "Participating Firms" in our analysis as the firms that participated at least once within 1957–1966. Second, we focus on private firms (and their labor unions), by excluding public institutions such as government agencies and universities. (4,442 firm-year observations). Finally, we restrict the sample to firms that participated the program for the first time during 1957–1966, resulting in 2,138 unique firms.

We then match this set of participating firms to the set of stock-listed firms whose information is available in both 1957 and 1966. The matching process consists of three steps. First, we search for firms whose names are written exactly the same in both datasets, and identify 126 such firms. Next, among the remaining unmatched firms, we run fuzzy matching

based on firm names, retaining only pairs with a high similarity score.[4] Finally, we manually verify whether these matched pairs could be identified as the same firms. Through further manual search, we also identify 17 additional firms as valid matches from the remaining unmatched firms. Through the above matching process, we identify 143 matched firms out of 420 stock-listed firms.

4 Descriptive statistics

In this section, we present descriptive statistics on firms that participated in the Productivity Program. We begin by describing the annual number of participating firms over time, using the data of all participants, only excluding public institutions such as government agencies and universities. Using the same data, we also examine the composition of participants' job titles and various trip types. Finally, using the data matched with stock-listed firms, we compare the initial characteristics of participating and non-participating firms.

4.1 Number of firms that participated in the study trips

Figure 1 shows the annual number of individuals and firms that participated in the study trips between 1955 and 1980. Panel (a) shows the number of participating individuals (participants) in each year, and Panel (b) presents the number of participating firms each year, both indicating increasing trends since the program started in 1955. The number of participating firms stayed at around 400–500 per year from 1958 onward, even after U.S. financial support ended in 1961.

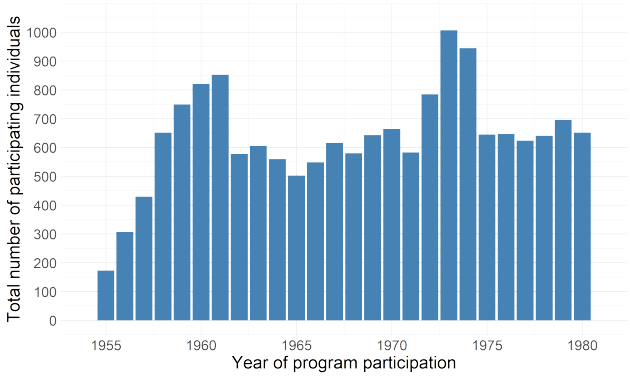
Since some firms participated in the program multiple times within and across years, Panel (c) shows the number of participating firms, counting only their first trip. The number of first-time participants peaked in 1961 at around 300 firms, then declined to about 100

[4]To measure the similarity of firm names, we use the Jaro-Winkler distance, a string similarity metric well-suited for short strings such as individual or company names. We keep the pairs with a similarity score of 0.85 or higher.

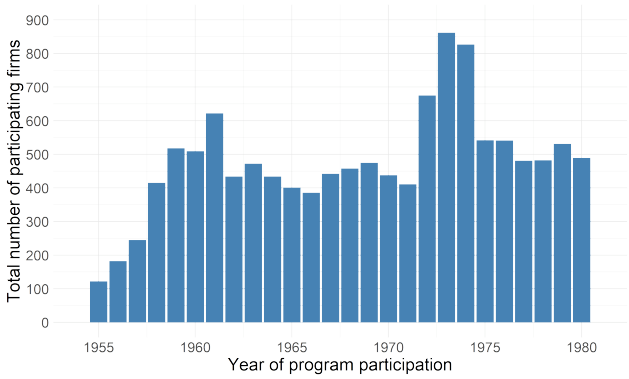
firms per year by 1980. The gap between Panels (b) and (c) suggests that many firms participated in the trips multiple times, especially after 1961.

Figure 1: Annual number of participants in the study trip program (1955–1980)

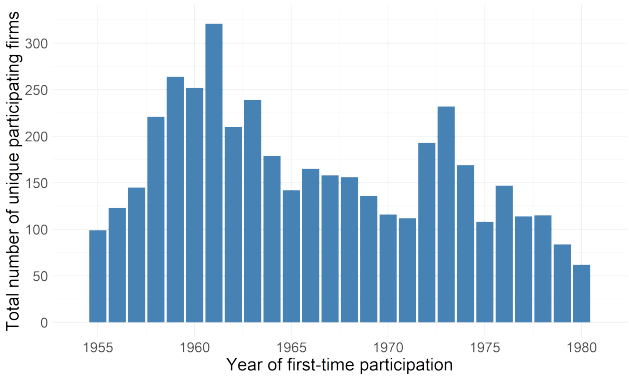
(a) Number of participants



(b) Number of participating firms



(c) Number of first-time participating firms



Note: Panel (a) shows the number of participants (individuals from firms/organizations) who participated the study trip program in each year. Panel (b) shows the number of firms that participated the program in each year. Panel (c) shows the number of firms that participated the program, counting only their first trips. In panel (b) and (c), we focus on private firms, excluding public institutions such as government agencies and universities.

4.2 Participants' job titles and trip types

As described in Section 3.1, the original data source provides participants' job titles as well as the name of each trip, which contains an industry or a topic information, or both. In

addition, the dataset includes the destination country of each trip. Table 1 provides summary statistics on firms that we identified participants' job titles, industry classifications, topic groups, and destination countries. Our analysis here focuses on all participating individuals ("participants", hereafter), excluding those from public institutions and academic organizations.

Among these participants, we identify the job titles of trip participants for 4,721 firms, which account for 99% of the sample. We also classify 4,320 firms (91% of the sample) based on industry or topic. "Industry" groups focus on specific industry, such as automobile, plastic, or transportation, and "Topic" groups focus on management-related themes (e.g., corporate strategy, human resources). Specifically, 55% of the firms can be identified as industry groups, and 59% can be identified as topic groups. These categories are not mutually exclusive, and some participants are classified in both. Lastly, the destination country is identified for 92% of the participants in our dataset.

Among the participants whose job positions are identified, Figure 2 shows the composition of the job titles in each year between 1955 and 1966. We classified the job titles into four categories. "Executives" refers to top-level managers such as CEOs. "Middle Manager" includes the rest of individuals at managerial positions, excluding "Executives." "Engineer" refers to technical personnel, including technicians and other operations specialists. "Union Members" refers to labor union representatives.

Although the earlier literature documented that top managers mostly participated in the trips in the earlier period (see Section 2.3), these results show that the share of executives and middle managers remained relatively stable over time with approximately 50% being executives and 40% being middle managers.

Until the end of US funding in 1961, about 10-20% of the participants were from labor unions. Given that one-third of trip participants in the United Kingdom were workers, the representation of workers was limited in Japan. Still, these numbers suggest that the labor unions, initially opposed to the idea of the Productivity Program, participated in the Program. After the trips started to be financed by participating organizations in 1962, the

Table 1: Information about job titles and group types

	Participants during 1955-1966	
	No. of participants	Proportion
	(1)	(2)
Position title		
Position identified	4,721	0.99
Group name		
Industry identified	2,597	0.55
Topic identified	2,781	0.59
Industry or Topic identified	4,320	0.91
Trip destination		
Country identified	4,356	0.92
All	4,740	1.00

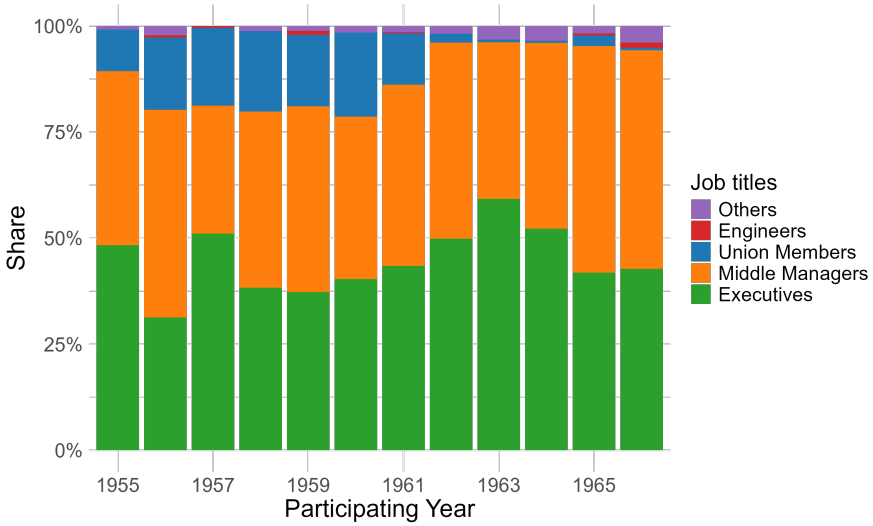
Note: This table shows the number and the share of trip participants whose information about job titles and group characteristics are identified in the participant data. We focus on individuals who participated in the study trip program between 1955 and 1966. The "Job title" field of the data records the job position of the participant at the organization (e.g. CEO). The "Group name" field refers to the name of the trip group where the participant joined. The "Trip destination" field indicates the destination country. We consider that the industry (or topic) of the group is identified from the group name if the group name suggests a certain industry (or topic, e.g., productivity). Since some group names suggest both industries and topics, these two categories are not mutually exclusive. Our analysis focuses on all participants, excluding those from public institutions and academic organizations.

share of union representatives declined to a small fraction.

Next, using the sample of participants who joined industry-based group trips (i.e., groups for which industries are identified based on the group titles), Panel (a) of Figure 3 shows the industry composition.[5] Among these industry-based trips, participants within the man-

[5]Although the original data on group titles can be classified into detailed industry categories, we present statistics using broader categories (roughly corresponding to 1 digit industry category) for illustrative pur-

Figure 2: Composition of participants' job titles (1955–1966)



Notes: This figure shows the composition of participants' job titles between 1955 and 1966. We classified the job titles into four categories: executives, middle managers, engineers, and union leaders.

ufacturing sector account for the largest share, while the shares of trips in service sectors (finance and other services) increased over time.

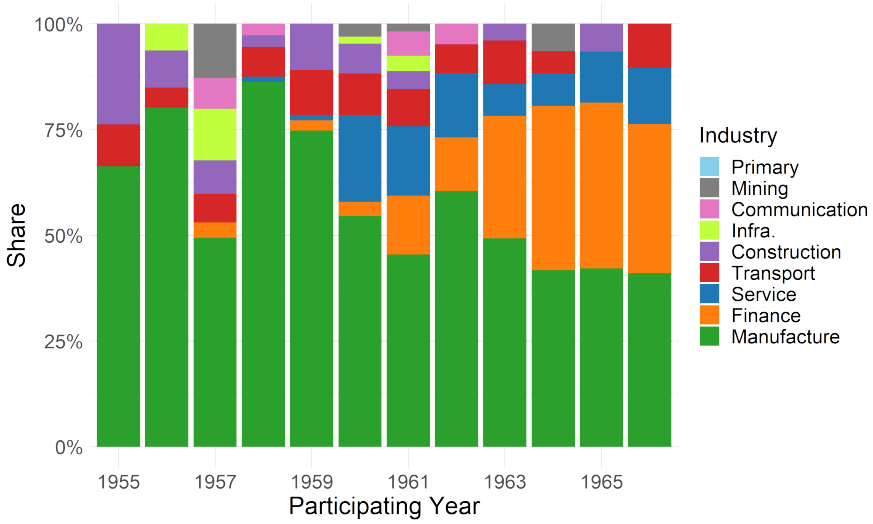
Panel (b) of Figure 3 presents the composition of topics among the participants in topic-based groups. While trips related to productivity improvement were the most common in the early years (except for the first year), the share of trips focused on human resources, strategic planning, and corporate governance grew over time.

Finally, Figure 4 shows the composition of destination countries among all participants in each year between 1955 and 1966. Before the termination of U.S. funding support in 1961, the United States accounted for approximately 80-90% of the destination countries. After that period, the share of trips to European countries increased, and the share of trips to the US declined instead. This result highlights that not only US but also European countries played a key role as the program's destination countries in later years.

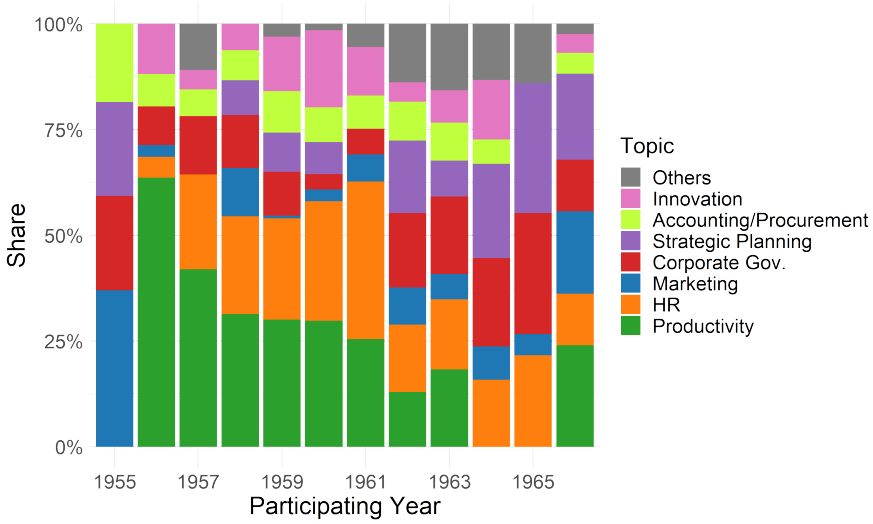
poses.

Figure 3: Composition of Industry-based groups and Topic-based groups (1955–1966)

(a) Industry Group

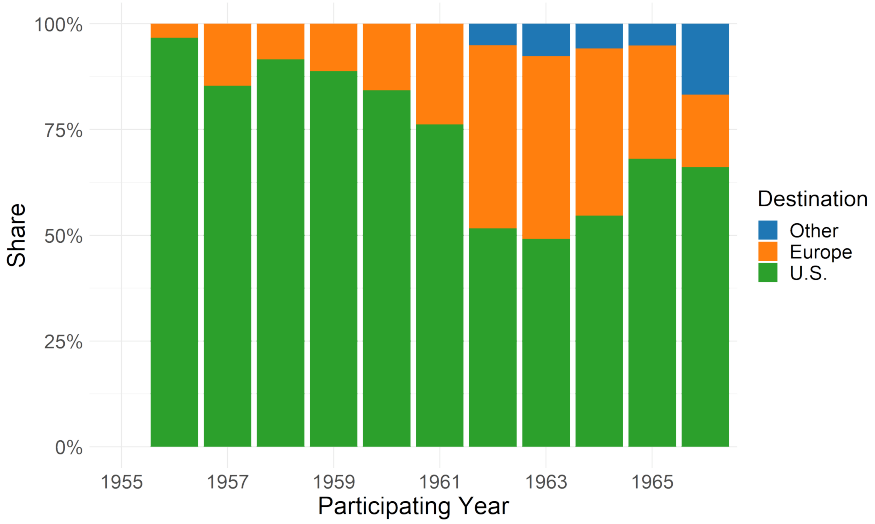


(b) Topic Group



Note: These figures show the composition of industry categories (panel (a)) and topic categories (panel (b)) between 1955 and 1966. We also classified the topic group into eight classifications (productivity improvement, human resources, corporate governance, strategic planning, accounting and procurement, innovation, and others).

Figure 4: Composition of destination countries (1957–1966)



Notes: This figure shows the composition of destination countries among participants in each year between 1955 and 1966. We classified destination countries into U.S., European countries, and other countries (including Asian countries, Latin-American countries, Oceanian countries, and African countries). The original data source does not include the trip destination in 1955.

4.3 Comparing initial characteristics between participating and non-participating firms

We now use the data of stock-listed firms and examine the differences in initial characteristics (as of 1957) between the firms that participated in the Productivity programs in 1957-1966 and those that did not.

We first compare the industry compositions of firms that participated in the program with those that did not. Using the industry classifications of each firm in the CFD database, Table 2 reports the total number of listed firms by industry, the number of participating firms, and the participation rate within each industry category.

In terms of the number of participating firms, manufacturing industry accounts for 81% of participating stock-listed firms. This may reflect the overall share of manufacturing firms among stock-listed firms (85%). Across industries, the participation rate is roughly the same at around 30% for most sectors, including manufacturing, while it is higher for electronic and construction industries.

Next, we examine the differences in observable characteristics between participating and non-participating firms. Table 3 presents summary statistics for the number of employees, total sales, and labor productivity (measured as sales per worker) in 1957. The table also includes the natural logarithm of these variables. Columns (1) and (2) report the mean for participating and non-participating firms, respectively, and column (3) presents the differences in the means with standard errors for the differences.

The results indicate that participating firms are significantly larger in terms of employment and total sales. The differences in these variables are positive and statistically significant at 5–10% level. In contrast, the difference in labor productivity is smaller and not statistically significant. These suggest the presence of positive selection into the program: firms that were already larger in scale were more likely to participate in the trip program.

Table 2: Composition of participating firms by industry among stock-listed firms

	Listed Firms		
	All Firms	Participating Firms	Share of Participating Firms
	(1)	(2)	(3)
Agriculture & Mining	9	3	0.33
Construction	4	2	0.50
Electric Power & Gas	11	9	0.82
Manufacturing	357	116	0.32
Transportation	16	5	0.31
Wholesale & Services	23	8	0.35
Total	420	143	0.34

Notes: Using data on stock-listed firms matched with trip participant records, this table reports participation rates by industry. Industry classifications are based on each firm's industry in 1957, as reported in the CFD database. Column (1) shows the number of stock-listed firms, Column (2) presents the number of participating firms, and Column (3) reports the share of participating firms among stock-listed firms.

Table 3: Comparison of initial firm characteristics

	Variables recorded in 1957		
	Participating Firms	Non-participating Firms	Dif.
	(1)	(2)	(3)
No. of Workers	5.088	3.152	1.936**
	(5.718)	(7.206)	(0.645)
Sales	21.485	11.523	9.962*
	(46.995)	(28.864)	(4.292)
Labor Productivity	6.027	5.702	0.325
	(14.894)	(12.640)	(1.458)
log(No. of Workers)	1.118	0.330	0.788***
	(1.026)	(1.112)	(0.109)
log(Sales)	2.278	1.449	0.829***
	(1.188)	(1.266)	(0.125)
log(Labor productivity)	1.160	1.118	0.041
	(0.839)	(0.884)	(0.088)
Manufacturing Firms	0.811	0.874	-0.062
	(0.393)	(0.333)	(0.038)
Observations	143	277	420

Note: Using the data of stock-listed firms matched with trip participant records, this table presents summary statistics of firm characteristics in 1957. "No. of Workers" refers to the number of employees, measured in units of 1,000 workers. "Sales" refers to annual sales, measured in millions of JPY. "Labor Productivity" is calculated as annual sales divided by the number of employees. Columns (1) and (2) report the mean of each variable for participating and non-participating firms, respectively, with standard errors in parentheses. Column (3) presents the difference in means with robust standard errors in parentheses.

5 Comparison of firm performance over the first two decades

Using the data of stock-listed firms matched with trip participant records, we investigate the effect of program participation on firm performance. Given the limited sample size of this available data and potential endogeneity concerns, the results should be interpreted as suggestive rather than conclusive.

5.1 Empirical Specification

As described in Section 4.3, participating firms are likely to be self-selected into the program. To account for this, we employ a propensity score matching (PSM) approach. Using the sample of stock-listed firms in 1957, we first estimate the probability of participating in the program using a logistic regression model:

$$P(T_i = 1 \mid X_i) = \Lambda(\gamma_0 + \gamma_1 \log(\text{Employment}_{i,1957}) + \gamma_2 \log(\text{Sales}_{i,1957}) + \gamma_3 \text{Manufacturing}_{i,1957})$$

where $T_i = 1$ if firm i participated in the program at least once between 1957 and 1966. Λ is a logistic function. As pre-treatment characteristics to predict participation, we use the log of employment, log of sales, and an indicator for the manufacturing sector, all measured in 1957. Based on the estimated propensity scores, we match each treated firm to its nearest untreated firm using one-to-one matching without replacement.

In the second stage, we compare the post-treatment outcomes (e.g., employment, total sales, and labor productivity in 1966 and 1976) between participating firms and matched non-participating firms. To further address residual differences that may remain after matching, we control for the pretreatment covariates used in the first-stage propensity score model. This improves estimation efficiency while addressing potential bias from imperfect matching. The average treatment effect on the treated (ATT), is estimated using the following specification:

$$Y_i = \alpha + \tau T_i + \boldsymbol{\beta}' \mathbf{X}_i + \varepsilon_i, \quad \text{for matched sample only}$$

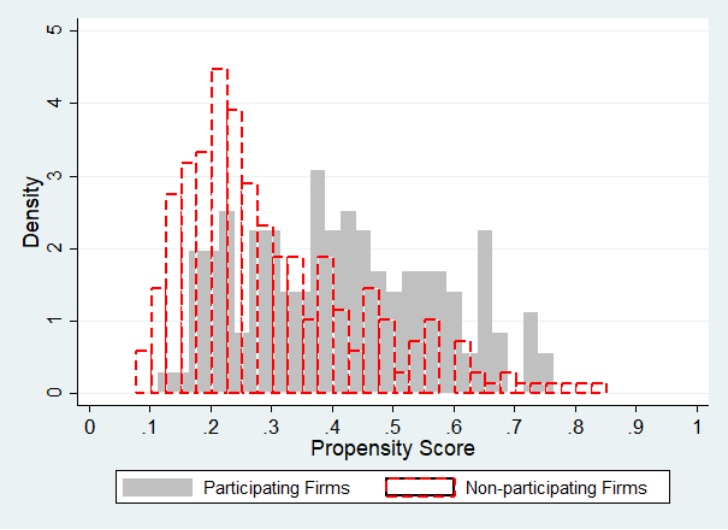
where τ captures the ATT for treated firms, conditional on control variables $\mathbf{X}_i$, within the matched sample.

As an alternative to PSM approach, we also employ inverse probability weighting (IPW) method using the inverse of the same estimate propensity score as the weight.

5.2 Propensity Score Estimates

Figure 5 shows the distribution of the estimated propensity scores for participating and non-participating firms. The figure shows that the supports of the two distributions roughly overlap.

Figure 5: Distribution of Propensity Scores



Notes: This figure shows the distribution of propensity scores for participating and non-participating firms. The grey bars represent the distribution of participating firms, and the red bars represent that of non-participating firms. Propensity scores are estimated using $\log(\text{Employment}_{i,1957})$, $\log(\text{Sales}_{i,1957})$, and a dummy variable for manufacturing.

5.3 Balance test in matched sample

Before we move on to the regression analysis, we check whether the pretreatment characteristics are balanced between participating and non-participating firms in the sample matched by PSM. Table 4 shows the results of the balance test, indicating that the baseline characteristics are mostly balanced, and the differences in means are statistically insignificant.

Table 4: Balance test

	Variables recorded in 1957		
	PSM		
	Participating Firms	Non-participating Firms	Dif.
	(1)	(2)	(3)
log(Employment)	1.118	1.000	0.118
	(1.026)	(1.075)	(0.124)
log(Sales)	2.278	2.144	0.134
	(1.188)	(1.235)	(0.143)
log(Labor Productivity)	1.160	1.144	0.015
	(0.839)	(0.997)	(0.109)
Manufacturing Firms	0.811	0.846	-0.035
	(0.393)	(0.362)	(0.045)
Observations	143	143	286

Note: This table shows the results of balance test for firms that participated in the program and those that did not, focusing on the sample matched based on the propensity score. We match each treated firm to its nearest untreated firm using one-to-one matching without replacement. Columns (1) and (2) report the mean of each variable for participating and non-participating firms, respectively, with standard deviations in parentheses. The differences in means between participating and non-participating firms are reported in column (3), with robust standard errors in parentheses.

5.4 Results

Table 5 presents the estimated effects of program participation on firm performance, using propensity score matching (PSM) and inverse probability weighting (IPW) methods. We examine three outcome variables: the log of employment (Panel A), the log of total sales (Panel B), and the log of labor productivity, measured as total sales per worker (Panel C). For each outcome, we use data recorded 10 and 20 years after the baseline year (i.e., 1966 and 1976). All specifications control for baseline values of log employment, log sales, and a manufacturing sector indicator, measured in 1957.

Columns (1) and (2) report the results based on PSM. We find that program participation has a positive and statistically significant effect on employment in both 1966 and 1976. The estimated effect increases from 0.138 in 1966 to 0.291 in 1976, suggesting that participating firms continued to expand over time. Similarly, we observe significant positive effects on total sales. In contrast, the effect on labor productivity is not statistically significant and relatively small in either year, indicating that the increase in total sales was likely driven by business scale expansion rather than improvements in efficiency.

Columns (3) and (4) present results based on the IPW method. The findings are similar to those obtained using PSM.

Table 5: Estimated Effect of Program Participation

	PSM		IPW	
	1966	1976	1966	1976
	(1)	(2)	(3)	(4)
Panel(a): Employment				
Participation	0.138***	0.291***	0.132***	0.309***
	(0.047)	(0.079)	(0.045)	(0.084)
Panel(b): Sales				
Participation	0.177***	0.252***	0.166***	0.248***
	(0.056)	(0.084)	(0.053)	(0.076)
Panel(c): Labor Productivity				
Participation	0.039	-0.039	0.033	-0.061
	(0.039)	(0.058)	(0.036)	(0.064)
Observations	286	286	420	420

Note: This table reports the estimated effects of program participation on firm performance. Columns (1)–(2) report the results based on propensity score matching (PSM), using the sample of participating firms and matched non-participating firms. We match each treated firm to its nearest untreated firm using one-to-one matching without replacement. Columns (3)–(4) report the results based on inverse probability weighting (IPW) method using the inverse of estimated propensity scores as the weight. Columns (1) and (3) use outcome variables recorded in 1966, and Columns (2) and (4) use those in 1976. Panel (a) presents the results for the log of employment, panel (b) for the log of total sales, and panel (c) for the log of labor productivity (measured as total sales per worker). We control for the baseline values of log of employment, the log of total sales, and manufacturing industry dummy (all measured in 1957). Robust standard errors are shown in parentheses.

6 Concluding Remarks

In this paper, we provide the first evaluation of Japan's Productivity Program, which sent firm managers to observe US business practices and learn the state-of-the-art Training Within Industry (TWI) principles. We digitized participant firm data and matched it with the database of stock-listed firms.

Our findings are threefold. First, participant characteristics based on the participant data align with historical documents about the program. The participants were mostly executives or mid-level managers of private firms. Most trips were organized either by industry (with manufacturing accounting for the largest share) or by topic (typically related to management and productivity), and early trips primarily went to the U.S.

Second, by matching the participant data with a database of stock-listed firms, we find that participating firms were significantly larger in terms of employment and total sales before the program began, suggesting positive selection into the program based on firm size.

Finally, using propensity score matching methods, we find that program participation had positive effects on employment and sales after 10 and 20 years, suggesting that participating firms expanded their scale over time. However, the estimated effect on labor productivity is small and not statistically significant, indicating that the sales growth was likely driven by business scale expansion rather than productivity improvements.

The interpretation of the final finding requires some caution. For one thing, potential endogeneity concerns may remain even after matching on baseline characteristics. In addition, the sample is limited to stock-listed firms, while many program participants were not listed. Stock-listed firms are typically larger and may have had less room for productivity improvement compared to smaller firms. A more rigorous assessment of the program's overall impact would require a larger firm panel dataset that includes small- and mid-sized firms and more information on each firm. For these reasons, the results presented in this paper should be interpreted as suggestive rather than conclusive.

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