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Keywords: Air Transport, Direct Flight, FDI, Face-to-Face Contact, Japan

JEL classification: F21, F23, L9

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Do International Flights Promote Foreign Direct Investment? The Role of Face-to-Face Communication[†]

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Abstract

Air transportation facilitates face-to-face interactions across borders for the spatial expansion of manufacturing production. I investigate the impact of international flights on FDI entry by Japanese firms. I find that FDI entry significantly increases with the weekly frequency of flights from Japan, and the positive impact increases with a proxy for an intensity of face-to-face communication between the parent firm and foreign affiliate. The results are robust to estimation methods, additional control variables, and definitions of face-to-face communication. Thus, the results suggest that flights encourage FDI entry through a reduction in face-to-face communication costs.

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1. Introduction

The spatial expansion of manufacturing production across borders has been driven by a reduction in transportation costs and trade barriers. Information and communication technologies have reduced communication costs involved in coordinating complex production tasks from a distance. These forces have contributed to the rapid expansion of global value chains in recent decades (Baldwin and Evenett, 2015). However, there remain coordination costs such as face-to-face communication. International outsourcing requires the enforcement of contracts with foreign producers. Multinational firms tend to locate production activities in proximity to reduce the coordination costs of offshore production (Defever, 2012). Because in-person meetings are crucial for building business relationships and managing production activities, the cost of face-to-face interactions remains as a central barrier in cross-border economic activities.

Visiting foreign countries is essential for personal contacts, and air transportation services facilitate international business trips. Liberalization in air services and technological innovation, such as the introduction of jet engines, have contributed to the expansion of air services across countries (Piermartini and Rousova, 2013). The recent growth of air services helps to reduce travel time and costs, which should facilitate face-to-face interactions across borders. However, it is an open question whether air transportation contributes to face-to-face interactions that promote economic globalization. Specifically, this paper examines whether international flights promote foreign direct investment (FDI) through a reduction in face-to-face communication costs. Information collection in a foreign market through face-to-face communication is crucial for the managerial decision-making processes in making direct investment. International flights reduce travel time and costs for business visits, and encourage the decision to establish a foreign subsidiary through a reduction in face-to-face communication costs.

To assess the hypothesis, I estimate the impact of international direct flights on the new establishment of foreign affiliates by individual Japanese firms. A Poisson regression model is specified to account for determinants of FDI entry at the firm and host-country level. A key challenge is to identify whether face-to-face communication plays a role in linking direct flights and FDI entry. In this paper, my hypothesis predicts that if flights reduce face-to-face communication costs, they should have a larger effect on new FDI entry in which face-to-face communication between the parent firm and foreign affiliate is more intensive. As Japanese parent firms may send Japanese workers abroad to facilitate face-to-face communication with local workers using different

languages and business practices, I use data on Japanese workers at foreign affiliates to measure the intensity of face-to-face communication in foreign production. In sum, I examine whether these implications are consistent with the data on FDI entry.

The main results can be summarized as follow. The weekly frequency of direct flights significantly increases the number of new foreign affiliates. Such a positive impact is greater for foreign affiliates with a higher share of Japanese workers. The estimated coefficients indicate that a weekly increase of 10 direct flights is associated with an increase in the expected count of FDI entry by 7.8% when the share of Japanese workers is zero. A 10 percentage point increase in the share of Japanese workers is predicted to increase the positive effect of direct flights by 12.7%. These results are consistent with the hypothesis that international direct flights promote FDI entry through a reduction in face-to-face communication costs across borders. For a sensitivity check, I show that these results are robust to alternative estimation methods such as a negative binomial model and a logit model. The results are also robust to the inclusion of additional control variables in a main specification and to alternative definitions of face-to-face communication intensity. Finally, I highlight the fact that the interaction effect helps to alleviate endogeneity issues. Following the identification strategy in Rajan and Zingales (1998), I examine the differential effect of a country-level variable across firms that may respond differently to this variable. An interaction between country- and firm-level variables should reduce endogeneity biases arising from exploiting only cross-country variations.

There has been limited study on the relationship between international air services and FDI activity. In a closely related paper, Bannò and Redoni (2014) examine whether a new direct flight connection among European cities affects inward FDI by European firms in Italy. Comparing the growth of inward FDI in treatment and control cities, relatively larger growth of inward FDI is observed in the treatment cities. However, economic trends in each city may be positively correlated with both the opening of direct flights and the growth of inward FDI, suggesting that unobserved common trends may explain a positive relationship between flights and FDI. As a specific linkage between flights and FDI is not explicitly examined, there remains a question of how flights promote FDI activity. In this paper, I carefully check the influence of confounding factors in a wide variety of robustness checks and provide evidence for the role of face-to-face communication.

The recent literature has also paid a growing attention on the role of business air travel in cross-border economic activity. Cristea (2011) shows that business-class air travelers significantly promote international trade in the case of U.S. state exports,

pointing to the importance of in-person meetings in international trade. Hovhannisyan and Keller (2014) demonstrate the importance of international business travel in facilitating technology transfer across borders using data on foreign patenting rates in the U.S. Additionally, Helble (2014) provides evidence for the positive impact of air connectivity on tourist flows in the case of Pacific economies. Finally, another branch of related papers such as Bel and Fageda (2008) and Strauss-Kahn and Vives (2009) investigates the role of air connectivity in the headquarters location decision by multinational firms. Giroud (2013) examines the impact of direct flights on productivity and investment, suggesting that air transport services facilitate monitoring and access to information of domestic plants by headquarters within the U.S.

The rest of this paper is organized as follows. Section 2 discusses the role of international direct flights in FDI decisions and presents a Poisson regression model. The measurement of face-to-face communication intensity is explained in this section. Section 3 describes data sources. Section 4 presents the estimation results. Section 5 concludes.

2. Empirical Framework

In this section, I discuss the theoretical framework for the role of international direct flights in FDI decisions. To examine the hypothesis that direct flights promote FDI activity through a reduction in face-to-face communication costs, I specify a Poisson regression model for the number of newly-established foreign affiliates by Japanese multinational firms.

2.1. FDI Decisions and International Direct Flights

To consider the role of international direct flights in FDI decisions, the starting point is the fact that multinational firms incur fixed costs in decision-making processes for an investment project abroad. An FDI decision requires a wide range of business, economic, and political information on a foreign market to ensure the success of risky investments in an unfamiliar environment. Decision processes include acquiring information on potential host markets, conducting a feasibility study on the target market, and searching for local business partners, suppliers and customers.[1] The feasibility study requires a careful examination of local business environments in terms of laws, regulations, and practices under which foreign firms would compete with

[1] Buckley et al. (2007) conduct an experiment to show that corporate managers consider a variety of investment attributes such as production costs, return on investment, and market size for an FDI project.

potential local firms (World Bank Group, 2010). After the investment decision is made, the establishment of a foreign affiliate requires procurement of industrial land for a production plant, preparation of documents for investment approval, and training of local workers for the start-up of production. Throughout the decision-making processes over the years, there are substantial costs involved in acquiring and processing managerial information in an unfamiliar market. Based on case studies, Larimo (1995) illustrates that Finnish firms face a complex process of information collection, evaluation, and selection in FDI decisions.

Recent advances in information and communications technology have reduced barriers to acquiring codified and explicit information on foreign markets. Access to information on foreign markets has improved through various channels, including telephone calls, internet access, and in-person meetings with a domestic consultant. Nevertheless, these communication channels may not be sufficient for a corporate manager to process uncodified and relationship-specific information in foreign markets, including contract negotiation, building trust and partnership, and marketing surveys for a firm-specific investment project. Business travel for in-person meetings with business partners, consultants, and government officials is critical to acquire and process relationship-specific information.

International flights reduce travel costs and time for business travel to a foreign market and help to reduce face-to-face communication costs in FDI decisions.[2] As travel costs and time depend on aviation connectivity between a departure airport and a final destination airport, an indirect flight with many stopovers entails a long travel time due to additional layovers and inconvenience in the transit process. An indirect flight generates additional opportunity costs of travel time and inconvenience (Gronau, 1970). Using a non-stop direct flight, business passengers avoid such opportunity costs by reaching their final destination in a shorter travel time. Fujii et al. (1992) and Tveteras and Roll (2014) show that international direct flights significantly promote the number of tourist arrivals from abroad, suggesting that non-stop flights decrease travel costs and time. Additionally, the weekly frequency of direct flights affects the opportunity costs associated with waiting for flight departure. More frequent flights reduce travel costs and time for business passengers.

As international non-stop flights reduce travel costs and time for business travel, frequent direct flights should decrease face-to-face communication costs for FDI decisions. In this paper, I examine the hypothesis that international direct flights should encourage FDI decisions through a reduction in face-to-face communication costs. To

[2] Air transportation is crucial for international business travel in island economies such as Japan.

the best of my knowledge, such a hypothesis has not been subject to a formal empirical investigation in the literature on FDI determinants. Using data on Japanese firms, Blonigen et al. (2005) examine the role of information costs in FDI decisions through information sharing among firm networks.[3] Given that international direct flights facilitate efficient information processing in a foreign market through face-to-face communication, my analysis can be viewed as an alternative approach to examine the role of information costs in FDI decisions.

2.2. Poisson Regression Model

In this section, I discuss an empirical framework for the relationship between international direct flights and FDI activity. Direct flights should reduce the cost of face-to-face communication between foreign affiliates and parent firms, suggesting that individual firms are more likely to invest in foreign markets with a larger number of direct flights from a home country. Direct flights are predicted to have a positive influence on FDI activity. Given that face-to-face communication is a linkage between flights and FDI, direct flights should have a larger positive impact for FDI projects in which parent firms incur higher face-to-face communication costs to establish and manage their foreign affiliates. Thus, I examine whether the theoretical predictions are consistent with the data on FDI entry by individual firms.

To assess this hypothesis, I estimate the impact of international direct flight frequency on the number of newly-established foreign affiliates by individual firms. Since a dependent variable takes on nonnegative integer values only, a standard approach for count data is to specify a Poisson regression model in which the observed count of FDI entry is drawn from a Poisson distribution with the following conditional mean for firm *i*, sector *j*, country *k* and year *t*:

$$\mathrm{E}\left(F_{ijkt} \mid AIR_{kt}\right) = exp\left(\beta_0 + \beta_1 AIR_{kt} + \beta_2 AIR_{kt} \cdot FFC_{ik} + \boldsymbol{Z}'_{ikt}\boldsymbol{\gamma} + \mu_j + \mu_t + \varepsilon_{ijkt}\right) \quad (1)$$

where F_{ijkt} is the number of newly-established foreign affiliates by firm *i* in sector *j* and host country *k* for year *t*. AIR_{kt} is the weekly frequency of international direct flights from a departure airport in a home country to a destination airport in host country *i* for year *t*. FFC_{ik} is the measure of face-to-face communication intensity of firm *i* to establish and manage a foreign affiliate in host country *k*.[4] $\boldsymbol{Z}_{ikt}$ is a vector of

[3] They analyze Japanese industrial groups called *keiretsu*, which hold regular meetings of top management from major member firms for information sharing. Assuming that such networking effects reduce information costs, they show that the prior-year investment by the same *keiretsu* firm in a particular host market significantly increases the probability that the other *keiretsu* firms will invest in the same market.

[4] More details are explained in section 3.3.

independent variables on firm-level characteristics that determine the FDI decision by firm *i*, and on host-country characteristics that affect the attractiveness of host country *i* for foreign investors. Definitions and data sources of all the variables are shown in Appendix A. μ_j is a fixed effect of sector *j* to which each firm *i* belongs. μ_t is an aggregate time effect. Finally, ε_{ijkt} is an error term.

In this specification, my main interest is in the coefficients β_1 and β_2. If β_1 is positive, international direct flights have a positive impact on the entry of new foreign affiliates. If β_2 is also significantly positive, the positive impact of direct flights is larger for FDI entry in which face-to-face communication between the parent firm and foreign affiliate is more intensive. The interaction effect helps to identify the hypothesis for the linkage between flights and FDI. It is also useful to alleviate endogeneity issues. Following the identification strategy in Rajan and Zingales (1998), I examine the differential effect of the country-level variable across firms that may respond differently to this variable because an interaction between country- and firm-level variables is likely to alleviate endogeneity issues arising from exploiting cross-country variations only for identification. More discussion on these issues is provided in section 4.3.

To control for firm characteristics, I include the level of productivity and the length of foreign-market experiences. In a model of firm heterogeneity in Helpman et al. (2004), firms have varying levels of efficiency and serve a foreign market by export or FDI. They must pay the fixed costs of FDI to establish a local affiliate but can economize on transportation costs associated with export. They show that the high-productivity firms will undertake FDI, and the medium-productivity firms will choose to export. Yeaple (2009) further demonstrates that, conditional on making FDI, more productive firms are more likely than less productive firms to enter a larger number of markets. Thus, an estimate of firm-level productivity should positively correlate with a count of new FDI entries. However, it may contain a positive learning effect from prior FDI activity. Such learning effects are addressed by the firm's experiences in prior foreign production.

To control for host-market characteristics, I include a wide range of FDI determinants (Markusen, 2002; Barba Navaretti and Venables, 2004). First, the market size and population density are included to account for market-access motives of FDI. Market potential is also included to account for the neighboring market size in proximity to a host country. Second, vertical FDI is motivated by an international difference in factor costs, and I include GDP per capita as a proxy for the level of labor costs. Third, transport costs between home and host markets encourage market-seeking FDI, and I include the geographic distance as a proxy for international transport costs.

Because the geographic distance between countries captures differences in time zones to some extent, I also include the time difference in hours between home and host markets. Fourth, firms should consider business cycles in host markets when making direct investments, and I include the annual economic growth rate. Finally, in a robustness check, I consider a wide variety of other country characteristics that are likely to affect investment costs. These factors include the number of other foreign affiliates owned by Japanese investors in the same host market, the length of procedures to start a business, freedom to trade internationally, labor market regulations, protection of property rights, foreign ownership restrictions, and business regulations.

As explained in Wooldridge (2002, chap. 19), a Poisson quasi-maximum likelihood estimator (QMLE) gives consistency for coefficient estimates under the assumption that a conditional mean function is correctly specified as an exponential form of exogenous independent variables. The consistency does not require any additional assumptions including the Poisson distribution and the equality of conditional variance and mean. However, the latter is often criticized as a restrictive assumption for potential over-dispersion of count data. An alternative approach is to estimate a negative binomial regression model with an additional parameter of conditional variance. Nevertheless, the Poisson QMLE is a more efficient estimator under the assumption that the variance-mean ratio takes on any positive constant. It is more robust for estimating the parameters of the conditional mean. Additionally, Ver Hoef and Boveng (2007) point out that weight to observations is directly proportional to the mean for the Poisson model and concave to the mean for the negative binomial model.[5] In the case of FDI data, it is not appropriate to assign the same weight to all observations because it may lead to excessive weight being assigned to some observations with potentially large measurement errors. These considerations are in favor of the Poisson QMLE for the purpose of my empirical investigation, although I check the robustness to alternative estimation methods.

2.3. A Measure of Face-to-Face Communication Intensity

To measure the intensity of face-to-face communication in new FDI entry, I exploit the information on Japanese workers at foreign affiliate(s) owned by Japanese parent firms. The idea is that the establishment and management of foreign affiliates involve a substantial flow of technology and management know-how from parent firm to foreign

[5] They provide evidence in favor of the Poisson model in terms of the fit in a variance-mean relationship of their data on harbor seals in Alaska. In the case of trade data, Santos Silva and Tenreyro (2006) argue in favor of the Poisson model to apply the same weight to all observations.

affiliate through face-to-face contacts, including contract negotiation, building trustful relationships, and worker training. Because foreign production and distribution require the management of local workers using different languages and business practices, there is a barrier to these knowledge flows between the parent firm and foreign affiliate. In this respect, Japanese parent firms send Japanese workers abroad for face-to-face communication with local workers, and Japanese workers help to coordinate local management with the headquarters. The explicit presence of Japanese workers in a foreign affiliate should be a reasonable proxy for the intensity of face-to-face communication in a foreign market.

More specifically, I measure the *FFC* variable by the average share of Japanese workers in total workers at the foreign affiliate in host country *k* owned by Japanese parent firm *i*:

$$FFC_{ik} = 100 \cdot \frac{1}{T} \sum_{t} \frac{Japanese\ worker_{ikt}}{Total\ worker_{ikt}}$$

where *T* is the length of the sample period 1989-2006 for each foreign affiliate. The measure is divided by the total workers to account for the size of foreign production. Because longer operation may reduce the need for face-to-face communication with Japanese workers in foreign production, the share is averaged over time to mitigate the effect of the operation length of each foreign affiliate. If a Japanese parent firm owns multiple foreign affiliates in host country *k*, the shares of Japanese workers are averaged across multiple foreign affiliates. On the other hand, the absence of a foreign affiliate in a host country during the sample period can be interpreted as suggesting that there is no face-to-face communication cost. In this case, I assign a value of zero to the *FFC* variable for these observations. In section 4, I check the robustness of alternative definitions.

3. Data Description

3.1. Data on Japanese FDI

Data on foreign affiliates of Japanese companies come from *Overseas Japanese Companies Data* published by Toyo Keizai Inc. The dataset is based on an annual survey on Japanese business enterprises that maintain at least one foreign subsidiary. There is information on the overseas affiliates, including their address in the foreign country, investment year, and main lines of business. Exploiting the information on the shares or holdings of their Japanese parent firm(s), I define the overseas affiliates in the sample as those in which a Japanese firm has invested capital of 10% or more. The investment year of each foreign affiliate is used to construct the number of new foreign

affiliates in manufacturing across host countries for 1989-2006. Additionally, I use the oldest entry year of foreign affiliates owned by a parent firm to measure the length of foreign experience. Data on Japanese and total workers at foreign affiliates are used to construct a measure of face-to-face communication intensity.

3.2. Data on International Flights in Japan

Data on air flights come from *Aviation Facts & Figures* published by the Japan Civil Aviation Promotion Foundation and the Civil Aviation Bureau under the Japanese Ministry of Land, Infrastructure, Transport and Tourism. It is a statistical yearbook on Japanese aviation services, airports, and policies since the 1970s. There is information on regularly scheduled flights operated by Japanese and foreign airline companies, including the name of the airline company, the weekly frequency of passenger and cargo flights, and the location of the departure and arrival airports in Japan and foreign countries. The scheduled flights contain information on code sharing and transit airport(s).

Although *Aviation Facts & Figures* provides detailed flight information in Japan, it does not provide information on the routes of international flights operated by *foreign* airlines, making it impossible to distinguish their direct and indirect flights. For this reason, I mainly exploit international direct passenger flights operated exclusively by Japanese airlines for my analysis.[6] Total flights are used as a robustness check. To describe the flight data, Table 1 provides the weekly frequency of international passenger flights in Japan across destination countries for years 1985, 1995, and 2005. The total frequency of direct flights by Japanese airlines increased rapidly over time, with a pronounced increase in destination countries such as China, the U.S., South Korea, and Thailand. Accounting for code sharing, indirect flights, and foreign airlines' flights, I find a substantial increase in the total flights during the period.

[Table 1 here]

3.3. Other Data Sources

Data on firm-level productivity are estimated using the database of East Asian Listed Companies (EALC) provided by the Japan Center for Economic Research. This database provides data on real gross output, real capital stock, and labor inputs for listed companies in the Japanese stock markets. While I estimate total factor productivity (TFP) for parent firms to measure their productivity, the TFP estimates derived from the

[6] The exclusion of foreign airlines may lead to a modest estimate of the impact of direct flights.

production function estimation are subject to unobserved productivity shocks. If they are correlated with unobservable input variables, simple OLS estimates will be biased. To address this endogeneity issue, I apply the method proposed by Levinsohn and Petrin (2003). Intermediate inputs are used as a proxy for unobservable productivity shocks to obtain a consistent estimator of TFP.

Data on host-country characteristics are taken from the World Development Indicator (WDI) by the World Bank and the CEPII Gravity Dataset. The WDI dataset provides information for real GDP, density of population, per capita GDP, and the growth rate of real GDP. The geographic distance and time differences in hours between Japan and foreign markets are from the CEPII. Market potential is calculated from the real GDP and the geographic distance. Finally, data on the number of days required to start a business in the host market are taken from the WDI. Data on business climate are taken from *Economic Freedom of the World* by the Fraser Institute (Gwartney et al., 2014). An index of freedom to trade internationally, labor market regulation, protection of property rights, foreign ownership restrictions, and business regulation ranges from 0 (the highest restrictiveness) to 10 (the lowest restrictiveness).

4. Estimation Results

4.1. Main Results

Table 2 presents the summary statistics of the sample. The dataset covers the new establishment of foreign affiliates by Japanese firms in manufacturing for the period 1986-2006. A list of host countries in the sample is provided in Appendix Table B. Table 3 shows the estimation results of a Poisson regression model. To address serial correlation in the pooled panel data and over-dispersion of count data, I report standard errors that are corrected for clustering within the parent firm and host country (Cameron and Trivedi, 2009, chap. 18.6).

[Tables 2 and 3 here]

Column (1) shows the significantly positive coefficients for *AIR* and an interaction term between *AIR* and *FFC*, suggesting that the weekly frequency of direct flights significantly increases the number of new foreign affiliates. The positive impact increases with the intensity of face-to-face communication between the parent firm and foreign affiliate. This result is consistent with the hypothesis that international direct flights should encourage FDI decisions through a reduction in face-to-face communication costs across borders. The estimated coefficients imply that when the

FFC variable takes on a value of zero, a weekly increase of 10 direct flights is associated with an increase in the expected count of FDI entry by 7.8%, holding all other variables constant. A 10 percentage point increase in the *FFC* variable increases the positive effect of direct flights by 12.7%. Thus, an increase in direct flights is predicted to increase new FDI entry in which the proportion of Japanese workers at the foreign affiliate is higher.

In column (2), I modify an interaction term by multiplying it with the stock share of the foreign affiliate owned by the parent firm. The idea is that the communication intensity between the parent firm and the foreign affiliate may be stronger when the parent firm attempts to maintain a stronger managerial control in foreign production by holding a larger stock share. The result shows that both *AIR* and the interaction term have significantly positive coefficients, implying that the benchmark result is robust to an alternative definition of the *FFC* variable. Additionally, I use the weekly frequency of international direct and indirect passenger flights by both Japanese and foreign airline companies. The results in columns (3) and (4) show that both total flights and the interaction term have the significantly positive coefficients, consistent with the specification using direct flights. However, the estimated coefficients for total flights are smaller in magnitude, possibly indicating that indirect flights have a smaller impact than direct flights do.

I turn now to briefly discuss the result of control variables. Across alternative specifications, these variables have similar coefficients in magnitude. More productive parent firms with longer foreign experiences have a higher probability of establishing a new foreign affiliate. FDI entry is attracted to the host markets that have a large market size, high population density, and large market potential. The geographic distance as a proxy for transportation costs encourages the FDI entry. From a theoretical perspective, when a firm faces a decision between exporting and foreign production to serve a foreign market, trade barriers between countries generate an incentive for the firm to locate production facilities offshore. In this respect, the results are consistent with the market-seeking motive of FDI activity. Additionally, GDP per capita is negatively associated with the FDI entry. When the production processes can be fragmented into various stages that differ by factor proportions, FDI activity is motivated in part by differences in factor endowments across countries. Given that GDP per capita is a proxy for labor costs, the result can be interpreted as suggesting that FDI activity is attracted to a foreign country with lower production costs, consistent with the efficiency-seeking motive of FDI activity. Finally, FDI entry is discouraged by a time difference (Stein and Daude, 2007), whereas it is promoted by the growth rates in the foreign markets.

4.2. Alternative Estimation Methods and Additional Controls

To check whether the main results are sensitive to alternative estimation methods, we estimate the specification using a negative binomial model and a logit model. Columns (1) to (4) in Table 4 present the results of the negative binomial regression. Across alternative specifications, both direct and total flights have significantly positive coefficients. Also, the interaction terms between flights and the *FFC* variable have significantly positive coefficients. Thus, the main results are robust to the negative binomial specification. Additionally, the dependent variable is defined as an FDI dummy variable, which takes on unity for the presence of new foreign affiliates and zero otherwise. Columns (5) and (8) show the results of the logit regression. Both direct and total flights have significantly positive coefficients, and the interaction terms also exhibit significantly positive coefficients across specifications. The logit regression also shows a similar result. Taken together, the main results are robust to the alternative estimation methods.

[Table 4 here]

I turn now to check whether the main results are sensitive to additional control variables. In the main specification, I include the number of foreign manufacturing affiliates owned by Japanese firms in a host market for a previous year because the clustering of other Japanese foreign affiliates may indicate the presence of potential transaction partners for new local production. Column (1) in Table 5 shows that the previous Japanese affiliates are positively correlated with the number of new foreign affiliates. *AIR* and an interaction term remain significantly positive. Additionally, I include a wide range of control variables on the host-country investment climate. The results in columns (2) to (7) suggest that the new FDI entry is negatively associated with the start-up time and positively correlated with freedom to trade internationally, the ease of labor market regulation, protection of property rights, the ease of foreign ownership restrictions, and the ease of business regulation. Across these specifications, *AIR* and the interaction term remain significantly positive.

[Table 5 here]

There is concern that an interaction term between *AIR* and *FFC* may capture an interaction of industry characteristics with the development of transportation

infrastructure. Blyde and Molina (2015) show that the logistic infrastructure encourages vertical FDI more strongly in industries that are more dependent on logistics services. To address this concern, I include an interaction between *AIR* and industry dummy variables in column (8). The result shows that an interaction between *AIR* and *FFC* continues to have significantly positive coefficients. Thus, the coefficient for the interaction is not likely to pick up possible interaction effects between direct flights and industry characteristics such as logistics services.

4.3. Endogeneity Issues

Up to this point in this section, I have examined the hypothesis by looking at the differential effect of a country-level variable on international flights across firms that have different intensities of face-to-face communication. Our investigation depends crucially on the effects in which individual firms may respond differently to the country-level variable. In this respect, an interaction effect between *AIR* and *FFC* is likely to reduce a potential endogeneity bias in the *AIR* variable arising from a supply-demand relationship in business passengers (Hovhannisyan and Keller, 2014). Moreover, I specify a Poisson regression model for the number of new foreign affiliates established by individual firms. Because the firm-level decision at the micro level is not likely to strongly influence an aggregate demand for business passengers at the bilateral level, the interaction effect is less likely to be influenced by a reverse causality bias from FDI entry to *AIR*.[7]

There is a plausible concern about the firm-specific measure of face-to-face communication intensities. I examine the FDI determinants for individual firms, and the firm-specific measure is relevant for the firm-level decision on new FDI entry. However, firm-specific shares of Japanese workers may be affected by other unobserved factors at the firm-level, which are not directly related to face-to-face communication between the parent firm and foreign affiliate. To reduce such firm-specific effects, I redefine the *FFC* variable at the sector-country level by measuring an industry-level intensity of face-to-face communication between the parent firm and foreign affiliate in each host country. Table 6 presents the results using a sector-country *FFC* variable in Poisson and negative binomial models. Column (1) shows significantly positive coefficients for direct flights and an interaction term between direct flights and the sector-country *FFC* variable. In column (2), I use the total flights for the *AIR* variable and find similar results. To check whether these results are robust to an alternative estimation method,

[7] The major determinants for international flights include the size of population, the number of international tourists, and the presence of international hub airports (Bel and Fageda, 2008).

columns (3) and (4) present the results for the negative binomial model. The coefficients for the *AIR* variable and interaction term remain significant and positive. Taken together, I find that the main results are robust to the sector-level proxy of face-to-face communication intensities in each host market.

[Table 6 here]

Finally, I discuss remaining concerns about the *AIR* variable. First, air transportation services between countries are strictly regulated by governments, and airline companies must report the correct information on their flight schedules, including departure and arrival airports.[8] Since the frequency of regular international flights is well recorded, potential measurement errors in *AIR* are likely to be small. Second, there may be confounding variables that affect both FDI activity and direct flights, which may cause a bias in the estimated coefficient of *AIR*. In the prior section, I check whether the main results are robust to a wide variety of control variables on host-country characteristics. I show robust evidence for a positive correlation between direct flights and new FDI entry.

6. Conclusion

There has been rapid growth in international air services, and it is an open question as to whether international direct flights promote FDI activity. In this paper, I investigate the impact of international direct flight frequency on the number of newly-established foreign affiliates by Japanese multinational firms. Specifying a Poisson regression model, I find that Japanese multinationals increase their foreign affiliates significantly in the host countries with a higher weekly frequency of direct passenger flights by Japanese airlines from Japan. Additionally, the positive impact increases with the intensity of face-to-face communication between the parent firm and foreign affiliate as measured by the share of Japanese workers at the foreign affiliate. These results suggest that direct flights encourage FDI decisions through a reduction in face-to-face communication costs.

My findings suggest a potential economic gain from air services liberalization. Despite the increasing number of open skies agreements, the airline market for international direct flights remains subject to a variety of regulations and government

[8] For instance, air transport regulations and liberalization are discussed in Piermartini and Rousová (2013) and Zhang and Findlay (2014). Endo (2007) provides an account of the Japan-U.S. bilateral aviation policies.

controls in a number of countries. The current progress in air services liberalization should contribute not only to an improvement in air services but also to an expansion of cross-border economic activities such as FDI. The start of direct flights should promote face-to-face contacts between departure and arrival countries, which will facilitate a cross-border flow of technology and knowledge through face-to-face communication.

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Table 1. Weekly Frequency of International Passenger Flights to/from Japan

Destination	Direct Flight by Japanese Airlines			Total Flight		
	1985	1995	2005	1985	1995	2005
China	12	42	213	29	101	493
United States	45	118	138	192	460	493
South Korea	49	64	81	116	246	360
Thailand	10	22	78	30	68	137
Hong Kong	33	65	56	76	146	150
Singapore	10	31	28	24	81	79
United Kingdom	0	24	28	7	48	49
Australia	4	32	21	9	75	73
Indonesia	0	13	21	5	31	38
France	0	18	20	11	42	47
Philippines	7	9	17	15	27	45
Vietnam	0	3	15	0	6	39
Germany	0	3	14	11	24	39
Canada	2	3	7	8	25	28
Netherlands	0	3	7	4	18	21
Malaysia	5	3	7	12	28	36
Italy	0	3	6	4	10	20
India	0	3	3	4	6	10
Russia	3	3	1	13	24	15
Switzerland	0	3	0	4	8	6
Austria	0	3	0	0	3	6
Denmark	0	3	0	4	10	7

Notes: Japanese airlines include Japan Airlines, JALways, Japan Asia Airways, All Nippon Airways, Air Nippon, Air Japan, and Japan Air System; code-sharing direct flights by Japanese and foreign airlines are included only in Total Flights; international indirect flights by foreign airlines are also included in Total Flights.

Table 2. Summary Statistics of Variables

Variable	No. of Obs.	Mean	Std. Dev.	Min	Max
FDI	1,125,232	0.006	0.09	0	7
FDI dummy	1,125,232	0.005	0.074	0	1
Direct flight	1,125,232	7.50	23.54	0	220
Direct flight × FFC intensity	1,125,232	0.48	4.03	0	152
Direct flight × FFC intensity × Stock share	1,125,232	0.54	4.94	0	220
All flight	1,125,232	22.73	70.36	0	555
All flight × FFC intensity	1,125,232	1.44	12.58	0	385
All flight × FFC intensity × Stock share	1,125,232	1.62	15.44	0	555
Total factor productivity	1,125,232	3.95	0.95	0.07	74.5
Foreign experience (in years)	1,125,232	19.17	11.91	1	87
Real GDP (in logs)	1,125,232	4.54	1.82	0.04	9.51
Population density (in logs)	1,125,232	4.50	1.70	0.78	9.98
Market potential (in logs)	1,125,232	2.16	0.59	0.89	3.63
GDP per capita (in logs)	1,125,232	8.85	1.52	5.53	11.33
Distance (in logs)	1,125,232	9.03	0.52	6.86	9.82
Time difference (in hours)	1,125,232	6.59	3.29	0	12
Growth rate (in percentage)	1,125,232	3.90	4.15	-42.5	38.2
Previous Japanese affiliates (in logs)	922,990	2.51	1.96	0	7.84
Start-up time (in days)	244,280	42.22	36.60	3	168
Trade freedom	465,491	7.52	1.46	0.21	9.97
Labor market regulation	436,028	5.75	1.50	1.84	9.46
Protection of property rights	435,175	5.62	2.17	0.50	9.69
Foreign ownership restrictions	404,614	7.53	1.34	3.95	10.00
Business regulation	408,904	6.05	1.32	2.81	9.50

Table 3. Estimation Results of the Poisson Regression Model

Dependent variable: Number of new foreign affiliates

	(1)	(2)	(3)	(4)
Direct flight	0.0075**	0.0079**		
	(0.00045)	(0.00044)		
Direct flight × FFC intensity	0.012**			
	(0.0011)			
Direct flight × FFC intensity × Stock share		0.0079**		
		(0.00088)		
All flight			0.0024**	0.0025**
			(0.00019)	(0.00018)
All flight × FFC intensity			0.0039**	
			(0.00043)	
All flight × FFC intensity × Stock share				0.0025**
				(0.00033)
Total factor productivity	0.055**	0.055**	0.055**	0.054**
	(0.0082)	(0.0084)	(0.0073)	(0.0075)
Foreign experience	0.031**	0.031**	0.031**	0.031**
	(0.0014)	(0.0014)	(0.0014)	(0.0014)
Real GDP	0.77**	0.78**	0.78**	0.78**
	(0.017)	(0.017)	(0.017)	(0.017)
Population density	0.19**	0.19**	0.18**	0.19**
	(0.013)	(0.013)	(0.013)	(0.013)
Market potential	0.52**	0.51**	0.62**	0.61**
	(0.076)	(0.076)	(0.081)	(0.081)
GDP per capita	-0.25**	-0.24**	-0.27**	-0.27**
	(0.016)	(0.016)	(0.018)	(0.018)
Distance	0.68**	0.69**	0.72**	0.74**
	(0.050)	(0.050)	(0.054)	(0.054)
Time difference	-0.35**	-0.34**	-0.36**	-0.36**
	(0.013)	(0.013)	(0.013)	(0.013)
Growth rate	0.089**	0.089**	0.095**	0.095**
	(0.0040)	(0.0040)	(0.0038)	(0.0038)
Industry dummy	Yes	Yes	Yes	Yes
Year dummy	Yes	Yes	Yes	Yes
No. of observations	1,125,232	1,125,232	1,125,232	1,125,232
Log likelihood	-31270.2	-31294.8	-31366.9	-31388.6

Notes: Parentheses report standard errors corrected for clustering within the parent firm and host country; **, *, and + denote significance at the 1%, 5%, and 10% levels, respectively.

Table 4. Robustness to Alternative Estimation Methods

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Estimation	Negative Binomial				Logit			
Dependent	FDI number				FDI dummy			
Direct flight	0.0074**	0.0079**			0.0075**	0.0080**		
	(0.00044)	(0.00043)			(0.00044)	(0.00043)		
Direct flight × FFC intensity	0.015**				0.015**			
	(0.0013)				(0.0012)			
Direct flight × FFC intensity × Stock share		0.010**				0.010**		
		(0.0010)				(0.00097)		
All flight			0.0023**	0.0025**			0.0023**	0.0025**
			(0.00019)	(0.00018)			(0.00018)	(0.00018)
All flight × FFC intensity			0.0048**				0.0049**	
			(0.00046)				(0.00045)	
All flight × FFC intensity × Stock share				0.0032**				0.0032**
				(0.00036)				(0.00035)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No. of observations	1,125,232	1,125,232	1,125,232	1,125,232	1,125,232	1,125,232	1,125,232	1,125,232
Log likelihood	-30806.9	-30830.6	-30897.2	-30918.3	-28678.2	-28706.2	-28770.1	-28794.8

Notes: Parentheses report standard errors corrected for clustering within the parent firm and host country; control variables include total factor productivity, foreign experience, real GDP, population density, market potential, GDP per capita, distance, time difference, and growth rate; **, *, and + denote significance at the 1%, 5%, and 10% levels, respectively.

Table 5. Robustness to Additional Control Variables in the Poisson Regression Model

Dependent variable: Number of new foreign affiliates

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Direct flight	0.0025**	0.0028*	0.0023**	0.0032**	0.0036**	0.0030**	0.0044**	0.0074**
	(0.00052)	(0.0012)	(0.00063)	(0.00065)	(0.00065)	(0.00071)	(0.00069)	(0.0010)
Direct flight × FFC intensity	0.014**	0.014**	0.013**	0.013**	0.013**	0.013**	0.013**	0.012**
	(0.0012)	(0.0013)	(0.0012)	(0.0012)	(0.0012)	(0.0012)	(0.0012)	(0.0011)
Previous Japanese affiliates	0.72**	0.62**	0.70**	0.71**	0.67**	0.67**	0.64**	
	(0.020)	(0.045)	(0.030)	(0.028)	(0.030)	(0.031)	(0.031)	
Start-up time		-0.0074**						
		(0.0019)						
Trade freedom			0.23**					
			(0.034)					
Labor market regulation				0.073**				
				(0.019)				
Protection of property rights					0.090**			
					(0.023)			
Foreign ownership restrictions						0.044+		
						(0.025)		
Business regulation							0.10**	
							(0.026)	
Direct flight × Industry dummy	No	No	No	No	No	No	No	Yes
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No. of observations	922,990	244,280	465,491	436,028	435,175	404,614	408,904	1,125,232
Log likelihood	-29790.7	-5541.7	-14603.1	-14521.5	-12729.4	-12674.6	-12668.7	-31227.4

Notes: Parentheses report standard errors corrected for clustering within the parent firm and host country; control variables include total factor productivity, foreign experience, real GDP, population density, market potential, GDP per capita, distance, time difference, and growth rate; **, *, and + denote significance at the 1%, 5%, and 10% levels, respectively.

Table 6. Robustness to Alternative Face-to-Face Communication Intensity

Dependent variable: Number of new foreign affiliates

	(1)	(2)	(3)	(4)
Estimation	Poisson		Negative Binomial	
Direct flight	0.0094**		0.0098**	
	(0.00058)		(0.00056)	
Direct flight × Sector-Country FFC intensity	0.021+		0.018+	
	(0.011)		(0.011)	
All flight		0.0033**		0.0033**
		(0.00024)		(0.00023)
All flight × Sector-Country FFC intensity		0.0072+		0.0070+
		(0.0039)		(0.0039)
Control variable	Yes	Yes	Yes	Yes
Industry dummy	Yes	Yes	Yes	Yes
Year dummy	Yes	Yes	Yes	Yes
No. of observations	588,747	588,747	588,747	588,747
Log likelihood	-29779.1	-29845.9	-29334.7	-29397.9

Notes: Parentheses report standard errors corrected for clustering within the parent firm and host country; control variables include total factor productivity, foreign experience, real GDP, population density, market potential, GDP per capita, distance, time difference, and growth rate; **, *, and + denote significance at the 1%, 5%, and 10% levels, respectively.

Appendix A. Description of Variables and Data Sources

Variable	Description	Source
FDI	The number of new foreign affiliates in manufacturing that are established by Japanese parent firms in market *k* for year *t*	Toyo Keizai
FFC intensity	The average ratio of Japanese workers in total workers at foreign affiliate(s) in market *k* owned by Japanese firm *i* during 1989-2006	Toyo Keizai
Sector-country FFC intensity	The sector-level average ratio of Japanese workers in total workers at foreign affiliate(s) in market *k* owned by Japanese firm *i* in sector *j* during 1989-2006	Toyo Keizai
Stock share	The average ratio of foreign affiliates' stock in market *k* owned by Japanese parent firm *i*	Toyo Keizai
Foreign experience	Years since the establishment of first foreign affiliate by Japanese parent firm *i*	Toyo Keizai
Previous Japanese affiliates	Log of the number of foreign manufacturing affiliates in market *k* for year *t*-1	Toyo Keizai
Total factor productivity	Total factor productivity of Japanese parent firm *i* estimated by the method of Levinsohn and Petrin (2003)	JCER
Direct flight	Weekly frequency of international direct passenger flights operated by Japanese airlines to market *k*	Aviation Facts & Figures
All flight	Weekly frequency of international direct and indirect passenger flights by Japanese and foreign airlines including code-sharing flights in market *k*	Aviation Facts & Figures
Real GDP	Log of real GDP in 2005 U.S. dollars in market *k*	WDI
Population density	Log of population density (people per sq. km of land area) in market *k*	WDI
Market potential	Log of distance-weighted real GDP of third markets in market *k*	WDI/CEPII
GDP per capita	Log of real GDP per capita in 2005 U.S. dollars in market *k*	WDI
Growth rate	GDP growth rate in market *k* (in percentage)	WDI
Start-up time	The number of days required to start a business in market *k*	WDI
Distance	Log of population-weighted great circle distance between large cities in Japan and market *k*	CEPII
Time difference	Time difference in hours between Japan and market *k*	CEPII
Trade freedom	Index of freedom to trade internationally in market *k* (0=low to 10=high)	Fraser Institute
Labor market regulation	Index of the ease of labor market regulation in market *k* (0=low to 10=high)	Fraser Institute
Protection of property rights	Index of protection of property rights in market *k* (0=low to 10=high)	Fraser Institute
Foreign ownership restrictions	Index of the ease of foreign ownership restrictions in market *k* (0=low to 10=high)	Fraser Institute
Business regulation	Index of the ease of business regulation in market *k* (0=low to 10=high)	Fraser Institute

Appendix B. List of Host Countries

Argentina	Dominican Republic	Luxembourg	Russian Federation
Australia	Ecuador	Macao SAR, China	Saudi Arabia
Austria	Egypt	Malaysia	Singapore
Bahamas	Finland	Malta	Slovak Republic
Bahrain	France	Mauritius	South Africa
Bangladesh	Germany	Mexico	South Korea
Barbados	Greece	Netherlands	Spain
Belgium	Guatemala	New Zealand	Sri Lanka
Bermuda	Hong Kong	Nigeria	Sweden
Bolivia	Hungary	Norway	Switzerland
Brazil	Iceland	Oman	Tanzania
Cambodia	India	Pakistan	Thailand
Canada	Indonesia	Panama	Turkey
Chile	Iran	Papua New Guinea	Ukraine
China	Ireland	Peru	United Arab Emirates
Colombia	Israel	Philippines	United Kingdom
Cyprus	Italy	Poland	United States
Czech Republic	Lao PDR	Portugal	Venezuela, RB
Denmark	Lebanon	Puerto Rico	Vietnam