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The interplay among foreign direct investment, trade, and immigration

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Effectively Opening Labor and Capital Markets: The interplay among foreign direct investment, trade, and immigration*

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Abstract

This paper presents a study of the dynamic interactions of two policies—inward foreign direct investment (FDI) promotion and immigration enhancement—together with choices of trade or FDI. Despite growing concern about FDI-migration relationships, the literature has not explored the dynamic interactions among FDI, trade, and immigration. Our analysis distinguishes the different effects of immigration from short-run and long-run perspectives and shows that larger immigration stocks induce FDI inflows, although immigration flows are substitutable for FDI inflows. Additionally, skilled (unskilled) immigration flows are complementary to (substitutable for) FDI inflows. Furthermore, the relative importance of FDI inflows increases compared to imports when skilled immigration flows increase. While the two policies are often suggested to resolve shortages of domestic savings and labor, our results have implications on how to tackle the increasingly daunting policy issue of population aging.

Keywords: Population aging, Immigration, Foreign direct investment, Work-age population
JEL Classification: F21; F22; F23

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1. Introduction

Population aging has long been observed in developed countries, but improved life expectancy in developing countries has made it a global phenomenon more recently (United Nations, 2005). The United Nations predicts that population aging will progress rapidly during this century, although the pace thereof may vary by country. Specifically, rapid aging will be an extremely marked characteristic of the Asian population. The population aging rate in China is forecasted to be 16.2% in 2030 and 28.1% in 2060 and that in South Korea will be 23.4% in 2030 and 37% in 2060. We can see the severity of the situation when we compare these figures to those in 2010 of the countries with the world's three highest population aging rates: 23% for Japan, 20.8% for Germany, and 20.3% for Italy (United Nations, 2012).

Population aging is a pressing policy concern. It usually has negative economic implications such as reduced domestic savings, a shrinking labor force, and increasing support for growing retired populations. Policies such as inward foreign direct investment (FDI) promotion and immigration enhancement are often suggested to address these situations and attain the policy goal of sustainable economic growth.

This paper presents a study of the dynamic interactive effects of two policies, inward FDI promotion and immigration enhancement. The media claim that "[i]mmigration will facilitate foreign direct investment" (Sternberg, 2013). Does increased immigration actually promote direct investment from other countries? Standard trade theory assumes a certain degree of substitution

between capital and labor. If the two factors are perfect substitutes, then an increase in immigration appears not to promote inward FDI in reality.[1] In order to examine a possible tradeoff between FDI and immigration, we study FDI–immigration interactions within the framework of FDI determination.

The standard FDI literature has devoted little attention to immigration as a determinant of FDI (see studies by Blonigen and Piger (2011) and Eicher et al. (2012) on the determinants of FDI). The role of migration was brought to light when the trade literature demonstrated that migrant networks facilitate bilateral trade (Gould, 1994; Head and Ries, 1998; Rauch and Trindade, 2002; Co et al., 2004). Migrant networks enhance trading opportunities, as they help overcome informal barriers to international trade and reduce transaction costs by providing market information and developing trust through contacts. Trade promotion is amplified when immigrants have preferences for their home products and some serve as trade brokers.

Several recent empirical studies have examined FDI–immigration relationships, with the expectation that implications similar to those in the trade literature might also apply in the relationships. Considering that FDI

[1] Standard neoclassical models predict opposite directions of factor movements: investment occurs in poor countries and immigration occurs in rich countries. However, reality diverges from this prediction. Strict assumptions of standard models such as homogeneous inputs are blamed for this puzzle. Several factors are suggested to resolve the puzzle. They include differences in labor quality (skilled labor and unskilled labor), positive externalities among skilled workers that increase the productivity of unskilled workers, imperfect capital markets due to country risks, and differences in technology across countries (Lucas, 1990; Buch et al., 2006).

commits to foreign countries over a longer term than does trade, the role of migrant networks in overcoming informal business barriers may be more important for FDI than trade (Javorcik et al., 2011). A typical FDI–migration pattern examined in the literature is the relationship between FDI from developed countries and immigration to developed countries (Kugler and Rapoport, 2007; Javorcik et al., 2011; Simone and Manchin, 2012; Wang et al., 2013). Such analyses are related to "brain drain" issues in less-developed countries, because those countries host FDI from developed countries and, in exchange, send highly educated migrants to developed countries. For example, benchmark works such as those by Kugler and Rapoport (2007) and Javorcik et al. (2011) study the relationship between outward FDI from the United States and immigration to the country. Previous studies have shown that increased immigration positively correlates with outward FDI (Kugler and Rapoport, 2007; Javorcik et al., 2011; Simone and Manchin, 2012). Additionally, the degree of positive correlation is stronger for skilled immigrants (i.e., immigrants with higher education) than unskilled immigrants.[2]

Motivated by a different policy concern, we examine a different FDI–migration pattern: relationships between inward FDI and immigration. Some works in regional economics study inward FDI–immigration relationships. Buch et al. (2006) study the relationship between inward FDI stocks and immigrant stocks in 16 German states during the 1991–2002 period, and they

[2] An exception is Wang et al. (2013), who shows that inward FDI deters the outflow of skilled labor.

show that immigrant stocks correlate positively with FDI stocks from the same country of origin when the source countries are high-income countries. Similarly, Foad (2012) shows a positive relationship between inward FDI and immigration, using data pertaining to immigrants from 10 different countries to the 50 U.S. states. Specifically, the work shows that communities with more skilled immigrants attract more FDI. The literature on FDI–migration relationships confirms the existence of so-called diaspora effects (i.e., ethnic network externalities), which are also seen in the trade literature.

Our analysis differs from previous studies in several ways. One difference is the treatment of diaspora effects. Most previous studies treat ethnic network externalities as positive relationships between immigrant stocks and FDI stocks, namely, areas with more immigrants attract more inward FDI.[3] Our analysis focuses on the relationships between FDI inflows and immigration flows, given immigrant stocks. This approach allows us to distinguish two different effects: 1)whether larger foreign communities in a host country attract more FDI (i.e., diaspora effects) and 2)FDI inflows could be deterred when a country simultaneously welcomes immigrants. Our analysis reveals the importance of such a distinction, as FDI–migration relationships differ depending on whether we are discussing the effects of immigrant stocks on FDI inflows, or the relationships between FDI inflows and immigration flows. Another difference is the empirical treatment of FDI–migration relationships. We account for the dynamic relationship between FDI

[3] Appendix 1 summarizes the characteristics and results of previous works. The information in the table helps us to understand the contribution of the current paper.

and immigration by using the system generalized method of moments (GMM) (Arellano and Bover, 1995; Blundell and Bond, 1998). Although several works address FDI–migration relationships, no study has examined the dynamic interactions between FDI and immigration. The use of system GMM can accommodate empirical issues that went unexplored in earlier works. Another difference is in the characteristics of immigration examined in this study. The validity of studying the Japanese case may be questioned because immigration in Japan is far more restrictive than in the U.S. and Europe. However, our analysis enables us to discuss the implications of recent immigration policies concerning the reversal movements of migrants. Definitions of "migrant" vary among different datasets. Migrants are defined according to several dimensions, such as country of birth, nationality, and length of stay (Anderson and Blinder, 2013). The Japanese Ministry of Justice defines those who enter Japan and stay more than 90 days as "foreign entrants with a long-term length of stay." Using data on foreign entrants, we examine the effect of immigration in a broad sense rather than focusing on foreigners permanently resident in Japan. This approach is related to the examination in immigration studies of migrant reversal movements, whereby immigrants return to their country of origin after working elsewhere. Japan is one of several countries that welcome foreign labor but do not expect the workers to stay. Our analysis contributes to the discussion on the effects of cross-border factor movements, which are not explored in previous studies, by using a broader notion of immigration. The other difference is related to modes of foreign market access. We extend our

analysis to include choices of trade or FDI. Previous works treated FDI–immigration relationships as being independent of modes of foreign market access. We construct an empirical model that refers to the representative model of Helpman et al. (2004) for modes of foreign market access and conduct comprehensive analysis of dynamic interactions among FDI, trade, and immigration with system GMM.

Our analysis uses bilateral data on FDI, trade, and immigration between Japan and each of 29 countries/areas during the 1996–2011 period. As the country with the world's highest rate of population aging, Japan is relevant for analysis for the purpose of investigating policy responses to population aging. The sample period corresponds to when the Japanese government initiated inward FDI promotion after establishing the Japan Investment Council in 1994 and when inflows of foreigners of Japanese descent increased after the revision of the Immigration Control and Refugee Recognition Act in 1990.

The results of our analysis confirm diaspora effects similar to those demonstrated in previous studies. Larger immigrant stocks in a country or area induce more inflows of FDI from the same country of origin; however, we add new insights, namely, that the enhancement of immigration flows discourages the promotion of FDI inflows. Capital–labor substitution is observed for relationships between FDI inflows and immigration flows. Additionally, the nature of the relationships varies depending on the immigration type involved. Skilled immigration flows are complementary to FDI inflows, while unskilled

immigration flows are substitutable for FDI inflows. FDI–immigration substitution under a sample of overall immigration turns out to be strongly influenced by unskilled immigration something that dominates our sample. These results are relevant even after modes of foreign market access are introduced. Inward FDI becomes more dominant compared to imports when skilled immigration flows increase, and less dominant when unskilled immigration flows increase.

The results have implications for policies related to cross-border factor movements. Several countries employ policies that welcome skilled immigrants. They are compatible with inward FDI promotion, because these two policies can be used together to address decreasing domestic savings and shrinking labor forces. On the other hand, policies that promote the entry of unskilled immigrants into sectors with labor shortages might have unexpected side effects in the short run. Since unskilled immigration is substitutable for inward FDI, a decrease in inward FDI could be offset by the increased acceptance of inflows of unskilled immigrants. However, policy implications differ when we turn our eyes to the prospect of the longer term. Increased immigration stocks encourage FDI inflows, regardless of whether they involve skilled or unskilled immigration. Predicted and actual policy impacts might be simplified or incorrect, unless we distinguish diaspora effects on inward FDI from the contemporaneous effects of immigration on inward FDI.

The paper proceeds as follows. Section 2 presents a brief review of inward FDI promotion and immigration enhancement policies in Japan,

preceded by trends on population aging across the world. Section 3 presents a summary of the data and the empirical model used for the analysis. Results of the analysis are presented in Section 4. Section 5 concludes the paper and suggests future lines of inquiry.

2. Background

Population aging is progressing in many countries. According to the U.S. Department of Health and Human Services (2013), the percentage of the population aged 65 years or over, henceforth referred to as the population aging rate, was 12.9% for the United States in 2009 and is forecasted to reach 19% by 2030. European countries have been facing more severe situations. Population aging rates were 20.8% for Germany, 20.3% for Italy, 18.2% for Sweden, 17.1% for Spain, 16.8% for France, 16.6% for the United Kingdom, in contrast to 23% for Japan and 13.1% for the United States, in 2010 (United Nations, 2012). At 25.1%, Japan had the highest population aging rate in the world in 2013 and that rate is expected to reach 31.6% in 2030 and 39.9% in 2060 (Cabinet Office, Government of Japan, 2013). Other Asian countries will face similar situations in the near future. The United Nations forecasts that the population aging rate in China, which was 8.4% in 2010, will be 16.2% in 2030 and 28.1% in 2060, while the rate in South Korea, which was 11.1% in 2010, will be 23.4% in 2030 and 37% in 2060. Population aging is often considered to be a key policy issue in developed countries, yet it is evidently an emerging and increasingly daunting issue in developing countries as well.

The rest of this section provides a brief review of Japanese policies related to cross-border factor movements. As the country with the highest population aging rate, Japan has been focused on inward FDI promotion and immigration enhancement. Its population growth is stagnant and workforce is shrinking, so its proportion of working-age population is the lowest among developed countries. Although it has the image being a closed market, Japan has a history of inward FDI promotion and immigrant labor usage.

Japan has been trying to promote inward FDI since the 1980s, when the country experienced an expanding current account surplus. Trading partners requested that Japan increase imports by opening up its market. Entry to the Japanese market through FDI was also expected to increase imports.[4] During the 1990s, the Japanese government further engaged in inward FDI promotion to revitalize the Japanese economy after the country slipped into recession after the bursting of the bubble economy. One example is the establishment of the Japan Investment Council, a ministerial-level group chaired by the prime minister, in 1994. Deregulation has advanced under the central government's initiative. After implementing the Basic Policies for Economic and Fiscal Policy Management and Structural Reform in 2002, regional governments also assumed roles. They facilitated inward FDI to revitalize local economies and increase tax revenues, since the reform package

[4] The assertion may not be obvious to those who are familiar with the proximity-concentration hypothesis, i.e., a tradeoff between trade and horizontal FDI (Brainard, 1997; Helpman at al., 2004). A possible explanation is related to vertical FDI: imports of intermediate goods are expected to increase through intra-firm trade after FDI ties up transactions across countries.

required regional governments to be less dependent on fiscal support from the central government.

Government engagement in inward FDI promotion has continued, although motivations have varied over time. Recently, inward FDI promotion has gained attention for sustaining economic growth in Japan. The aging and declining population not only results in decreasing savings, but also a shrinking labor force. FDI is expected to complement domestic savings and be substitutable for a labor force.

Opening up the labor market is another issue in Japan. Since Japan has an aging and declining population, some observers warn that the Japanese economy will be unable to grow and will have trouble maintaining its social security system. Under the circumstances, the enhancement of immigration to Japan is a policy option that can alleviate labor market shortages.

Recent developments in immigration policy in Japan have been related to labor shortages. The revised Immigration Control and Refugee Recognition Act, which went into effect in 1990, supports increased inflows of foreigners of Japanese descent, such as Japanese Brazilians, by reorganizing the classification of status of residence (i.e., visa status). Labor shortages that resulted from the bubble economy prompted the revision. Based on Economic Partnership Agreements (EPAs), Japan began to accept foreign nurses and care workers from Indonesia in 2008, the Philippines in 2009, and Vietnam in 2014. Although the demand for nurses and care workers has been rapidly increasing alongside population aging, the number of people willing to adopt those

occupations is limited due to rigorous working conditions and poor payment. More recently, a points-based preferential immigration treatment system for highly skilled foreign professionals was initiated in May 2012. The system is designed to promote the acceptance of skilled foreigners by providing preferential treatment to foreigners with professional skills, designations, and experience. Points are assigned based on factors such as educational background, work experience, and income levels, which help Japanese officials judge whether an applicant can make a significant contribution to the Japanese society.

3. Data and Model

We empirically test whether two policies, inward FDI promotion and immigration enhancement, facilitate or offset each other. Our sample includes 29 countries/areas in Asia (China, Hong Kong, Taiwan, South Korea, Singapore, Thailand, Indonesia, Malaysia, the Philippines, India), North and South America (the United States, Canada, Mexico, Brazil), the Pacific (Australia, New Zealand), Europe (Germany, the United Kingdom, France, the Netherlands, Italy, Belgium, Luxembourg, Switzerland, Sweden, Spain, Russia), and the Middle East (Saudi Arabia, the United Arab Emirates). These are the major countries/regions of origin of FDI and immigrants into Japan. Our sample does not include the Cayman Islands or Vietnam, despite the Cayman Islands being a major FDI source and Vietnam being a major immigrant source, because there is no immigration from the Cayman Islands

to Japan and the Japan External Trade Organization's (JETRO) dataset, one of the data sources used throughout our study, does not provide information related to Vietnamese FDI because inward FDI from Vietnam is negligible compared to that from other countries.

The sample period is 1996–2011. It corresponds to when the Japanese working-age population began to decline after its peak in 1995. Data accessibility limits the possible sample period. FDI data before 1995 are available yet not prepared in a style consistent with the FDI data after 1996 because of changes in FDI definition and conversion from Japanese yen to U.S. dollars. Foreign registration data before 2011 and after 2012 face similar problems of inconsistent definition.

We examine the interaction of inward FDI promotion and immigration enhancement by application of system GMM. The usage of system GMM has several merits because it can accommodate empirical issues that went unexplored in previous studies. Previous works on FDI–immigration relationships insufficiently handle endogeneity. For example, simultaneous bias between FDI and immigration was not explicitly considered until Javorcik et al. (2011) introduced an instrumental variable approach for a migration variable. Despite their contribution to the treatment of the endogeneity of migration, other concerns remain, particularly fixed individual effects. There might be unobserved fixed effects related to the heterogeneity of partner countries. Javorcik et al. (2011) attempted to mitigate such fixed effects by including country dummies. However, "the idiosyncratic disturbances (those

apart from the fixed effects) may have individual-specific patterns of heteroskedasticity and serial correlation" (Roodman, 2009). System GMM is a dynamic panel estimator designed to account for such situations.

$$FDI_{it} = \alpha + \beta_1 FDI_{it-1} + \beta_2 ForEntry_{it} + \beta_3 Mig_{it} + X_{it}\rho + \varepsilon_{it}$$

$$\varepsilon_{it} = \delta_i + \mu_{it}$$

Therein, FDI_{it} denotes the net inflow of FDI from country *i* to Japan at time *t*, $ForEntry_{it}$ denotes the net inflow of immigrants, Mig_{it} denotes the stock of immigrants, X_{it} is a set of control variables, and ε_{it} is an error term that comprises δ_i, an unobservable time-invariant country-pair specific fixed effect, and μ_{it}, idiosyncratic shocks.

While the literature often discusses the relationships between FDI stocks and immigrant stocks (Buch et al., 2006; Javorcik et al., 2011; Foad, 2012; Gheasi et al., 2013), our analysis examines the relationships between FDI inflows and immigration flows.[5] We chose flow variables because voters are not necessarily patient in evaluating policy effects and will not wait until policy effects are manifested in the long term. The effectiveness of policy, rather, is evaluated in the short term, such as by assessing yearly outcomes. Additionally, net FDI inflows (or net immigration), which account for the withdrawal of investment (or the exit of immigrants), are used because inward FDI and immigration are expected to compensate for decreasing savings and the shrinking labor force that result from population aging. Even though a host country receives decent amounts of FDI immigrants in the gross term, inflows

[5] Simone and Manchin (2012) examine data on FDI flows and migration stocks between Western and Eastern Europe during the 1995–2007 period.

do not help much to attain a policy goal such as sustainable economic growth if equivalent amounts of FDI and numbers of immigrants exit the host country within a given time period. Net figures matter.

Net FDI inflow data were taken from JETRO. We transformed the original FDI data in nominal terms to real terms using US–Japan exchange rates (inter-bank rates–central rate average) and gross domestic product (GDP) deflators in Japan (100 in 2005). The former data were taken from Principal Global Indicators. The latter data were from World Development Indicators.

We use the number of foreign entrants with a long-term length of stay as the net inflow of immigrants.[6] The Japanese Ministry of Justice defines those who enter Japan and stay more than 90 days as foreign entrants with a long-term length of stay. The data were compiled from its *Annual Report of Statistics on Legal Migrants* (Ministry of Justice, Japan, 1996, 1998–2012). The net inflow of immigrants is calculated by subtracting the number of new foreign entrants with a short-term length of stay and foreign departures from the total number of new foreign entrants. Further adjustments are conducted by adding foreign departures with reentry permits and foreign departures with a short-term length of stay in Japan and by subtracting foreign departures with reentry permits but with stays of less than or equal to 90 days. Those entrants who exit Japan but plan to come back to the country are not treated as departures.

The treatment of diaspora effects is another feature of our model.

[6] The Japanese government's statistics use nationality but not foreign-born status to distinguish the migrant population.

Previous works often treat ethnic network externalities as the relationships between immigrant stocks and FDI stocks. Our analysis focuses on the relationships between FDI inflows and immigration flows, given immigrant stocks. This specification distinguishes our analysis from that of previous studies.[7] This approach allows us to distinguish two different effects. First, we expect that immigrant stocks induce FDI inflows, because a large stock of immigrants may ease the informational and institutional challenges faced by FDI sources from the immigrants' country of origin. Ethnic networks reduce the information costs of FDI and create or expand the market for goods produced by FDI in the country where immigrants reside.[8] Second, immigrant flows may have a tradeoff effect on FDI inflows when a country welcomes both FDI and immigrants simultaneously. One factor might substitute for the other.

We use the number of foreign registrations to represent the immigrant stock. In Japan, foreigners who stay longer than 90 days are required to register under the "alien registration system."[9] These data were compiled

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[7] The nascent formation of our approach is observed in Kugler and Rapoport (2007), who examine the relationships between a change in FDI stocks and a change in immigration stocks in the United States between 1990 and 2000, given immigrant stocks in 1990.

[8] Emigrants from Japan (i.e., Japanese immigrants in foreign countries) might also help to promote inward FDI into Japan. A similar idea is mentioned in the context of trade-migration relationships in Gould (1994; footnote 16). However, Gould did not include American immigrants in foreign countries in his estimation due to data unavailability. Similarly, the literature on FDI-migration relationships does not include data on immigrants from targeted countries residing in foreign countries but only data on immigrants from foreign countries residing in targeted countries.

[9] The alien registration system was abolished in 2012.

from *Statistics on the Foreigners Registered in Japan* by the Japan Immigration Association.

In the due course of the analysis, we needed to devise diaspora effects related to Chinese and Koreans because the two datasets, *Annual Report of Statistics on Legal Migrants* and *Statistics on the Foreigners Registered in Japan*, differ in the treatment of Chinese and Korean immigrant stocks. While the foreign entrant data provide area-specific immigrant information, the foreign registration data do not distinguish among mainland Chinese, Taiwanese, and Hong Kong citizens or among North and South Korean citizens, but simply classify them as Chinese or Korean. To fill the gap, the number of foreign entrants registered as Chinese is used as the stock of immigrants from mainland China, Taiwan, and Hong Kong. Chinese network externalities are assumed to apply to the three countries/areas. The total stock of Chinese in Japan helps to attract Chinese tourists to Japan because Chinese have cultures that are similar to a certain degree.

We examine the sensitivity of overall Chinese network externalities using a different treatment of Chinese immigrant stock. After the "alien registration system" was abolished, the Japanese government's statistics began to distinguish Taiwanese from other Chinese under the "new residency management system" introduced in 2012. This allows us to distinguish Taiwanese immigrant stock from other Chinese immigrant stock during the sample period. Since the data on Taiwanese stock is only available for 2012, the ratio of Taiwanese to total Chinese in 2012 is applied to split total Chinese

immigrant stock into Taiwanese stock and other Chinese stock. Robustness of the treatment of total Chinese immigrant stock is examined by comparing the results of the analysis of the two different treatments.

Similarly, we use the number of foreign entrants registered as Korean for the category of South Korea. This treatment requires a less strict assumption compared to the Chinese case. The *Annual Report of Statistics on Legal Migrants* shows that the number of North Korean entrants to Japan is negligible compared to that of South Korean entrants and most recent North Korean entrants are "special permanent residents" with reentry permits. The category of "special permanent residents" was designed for Koreans, Taiwanese, and their offspring who had been living in Japan before September 2, 1945, when Japan signed the Instrument of Surrender. Considering that North Korea was only established in 1948, the distinction of either North or South is not crucial for entrants registered as Korean who came to Japan before the Second World War. Thus, our treatment appears to be reasonable. We take the logarithm of the foreign registration variable, which has a distribution with a positive skew, so that the distribution will be more normal.

The analysis controls for several other factors. Real GDP (constant 2005 US$) is a proxy for the market size of a host country and World Development Indicators provides the data. Distance denotes geographical distances between Japan and a country of origin of FDI and immigrants and the data are available at GeoDist, the CEPII's database on distances. Institutional factors include corporate tax rates and an EPA. Corporate tax

rates are taken from the OECD Tax Database. They are “the basic combined central and sub-central statutory corporate tax rate given by the adjusted central government rate plus the sub-central rate.” EPAs, which are comprehensive agreements that go beyond traditional free trade agreements covering goods and services, help countries integrate with the global economy by facilitating cross-border movement of investments and people. In our study, EPA dummies are included for countries with which Japan has concluded EPAs: Indonesia, Thailand, the Philippines, Malaysia, Singapore, Switzerland, and Mexico. The EPA dummy is for the year of effectiveness and henceforth, otherwise it is zero. We adjust the dummy to be zero if an EPA is effective for less than five months in the year when EPA took effect. Such adjustments are done for Thailand (EPA effective November 1, 2007), the Philippines (EPA effective December 11, 2008), Singapore (EPA effective November 30, 2002), and Switzerland (effective September 1, 2009). Information related to EPAs is available on the website of the Japanese Ministry of Foreign Affairs. The analysis also controls for quality factors. We include the corruption term, which is an evaluation of governance performance. Indicators range from -2.5 (weak) to 2.5 (strong) and evaluate dimensions of governance for each country during the 1996–2012 period, except the years 1997, 1999, and 2001. The data were taken from the Worldwide Governance Indicators. These control variables were selected according to studies on FDI determinants by Blonigen and Piger (2011) and Eicher et al. (2012). Factors such as a common language and border are often used to capture country-pair specific effects, but they are

not included in our model because Japanese is not an official language in other countries and Japan is not adjacent to any other country.

Table 1 presents the sample's summary statistics. The transition of the two key variables is plotted in Figure 1. The change in immigration stocks is positive until 2008, when Lehman Brothers bankrupted, indicating that immigration increased until that year. The change in inward FDI is slightly more volatile, with positive inflows except in 2006 and 2010.

Our analysis uses the system GMM estimator, where FDI, foreign entry, foreign registration, and GDP are treated as endogenous. Such treatment accounts not only for simultaneous decisions on factor mobility regarding FDI and immigration but also for their interaction with national output. Although a few recent studies have examined simultaneous decisions on factor mobility, dynamic interactions have not received attention in the literature. Another merit of the system GMM approach is related to the selection of instrumental variables. The system GMM enables us to use the information within a dataset as instruments so that we do not need to search for variables that are not used as independent variables in models. This allows us to examine effects, where the flows of inward FDI and immigrants are endogenously determined together with immigrant stock. It is not easy to pinpoint instruments in our analysis, as our specification examines interactions among FDI inflows, immigrant flows, and immigration stocks; these conditions make our study more complicated than previous studies.[10] In our analysis, the endogenous

[10] If we apply an instrumental variable approach to a foreign entry variable, as is done in the

variables lagged two or three periods are used as instruments for differenced equations and their once-lagged first differences are used for level equations. We apply a two-step estimator with robust standard errors, which correct for finite sample biases (Windmeijer, 2005).[11]

Finally, our concern is the substitutability/complementarity of FDI and immigration. The use of substitutability and complementarity is not necessarily consistent among previous studies, due to there being various patterns of FDI and immigration relationships. Wong (2006) explains clearly different definitions on FDI–migration substitutability and complementarity. Since he suggests that the definition in the sense of quantity is more important to and relevant for governments, our analysis also applies the quantitative definition. In due course, we need to modify the definition slightly, as Wong's discussion focuses on "brain drain" issues and does not apply to our context directly. FDI–migration relationships are classified into two types: one that features opposite directions of factor movements (outward FDI and immigration/ inward FDI and emigration), and one that features the same direction of factor movements (inward FDI and immigration). "Brain drain" issues relate to the former case. In our analysis, we define inward FDI and immigration as substitutes, if increased foreign entry negatively correlates to the level of inward FDI in a host country. They are complements if the former

literature, immigrant stock is a candidate for the instrument and subsequently it will be dropped from the model specification. Such a specification examines interactions between inward FDI and immigrant flows but not diaspora effects.

[11] Roodman (2009) describes the modest superiority of the two-step estimation approach with corrected errors to cluster-robust one-step estimation by referring to Windmeijer's simulation.

positively correlates with the latter.

4. Results

The results of our analysis are presented in Table 2. Column (1) presents the results when total Chinese are used as a proxy for diaspora effects (Dtype-1). Column (2) presents the results when Taiwanese stock is distinguished from other Chinese stock (Dtype-2).

Our benchmark analysis shows that immigration is substitutable for inward FDI in Japan. The coefficient on foreign entry is estimated as negative at the statistically significant level in Column (1). The results remain valid under the different treatment of Chinese network externalities. In Column (2), again, the coefficient on foreign entry is estimated as negative at the statistically significant level. Increasing immigration discourages inward FDI, which implies that the policies of inward FDI promotion and immigration enhancement might be mutually offsetting. For that reason, the two policies together may not effectively contribute to sustainable development in Japan.

One may wonder why the current results differ from those in previous studies. Previous studies show positive FDI–migration relationships, regardless of the direction of factor movements: specifically, more immigration in certain areas encourages inward FDI when the same direction of factor movements is under examination. However, these results do not contradict those of previous studies; rather, they offer new insights. The coefficient on immigrant stocks is estimated as positive but the one on

immigration flows is estimated as negative. The former result is in line with the diaspora effects demonstrated in previous works—immigrant stocks are positively correlated with FDI. Our analysis reveals that immigration flows may offset FDI inflows. The results imply the importance of distinguishing flows and stocks.

Our results support the prediction from standard trade theory, which could explain the negative relationship between inward FDI and immigration: either “jobs flow to workers (in a host country) or workers flow to jobs (in that host country) (Kugler and Rapoport, 2007).” Thus, host countries may not enjoy the benefits of opening capital and labor markets if those markets are opened simultaneously. The interaction of the two policies can offset their respective levels of effectiveness. Consequently, they might not contribute to sustainable development, contrary to what we initially expected.

We extended our analysis to examine whether the results can differ depending on the skill levels of immigrants. Several developed countries have proposed legislation that welcomes skilled immigrants but not necessarily unskilled immigrants. For example, a points-based preferential immigration treatment system for highly skilled foreign professionals was established in Japan in May 2012. We found that there are differences in the effects of skills-based immigration on inward FDI, which have salient implications for government policies.

We classify immigrants by type in a different style than the literature. Previous works often discuss FDI–immigration relationships by distinguishing

the educational levels of migrants. The approach makes sense, specifically when the emphasis of the investigation is on brain drain, the outflow of educated workers. However, our policy concerns differ from those in the literature. Thus, we split our sample into skilled and unskilled immigration based on *residential status* stipulated by the Japanese Ministry of Justice. The category of skilled immigration includes occupations such as professor, engineer, lawyer, and accountant, which require professional knowledge and skills to conduct tasks.[12] The classification is more useful than the classification based on education when examining policies that welcome immigrants with professional skills. Other categories such as technical intern trainee, nurse and certified care worker under an EPA, spouse or child of Japanese citizen, spouse or child of permanent resident, and college student are classified as unskilled immigration. Nurse and care worker candidates are invited to Japan from Indonesia and the Philippines based on EPAs due to the shortage of such workers. Similarly, the technical intern training program provides unskilled immigrants with job opportunities in sectors such as agriculture and construction, where it is difficult to recruit domestic workers.[13]

The results of our analysis are presented in Columns (3) and (4). The analysis reveals that FDI–immigration relationships vary depending on the

[12] More precisely, skilled immigration includes occupations and occupational categories such as professor, artist, religious activities, journalist, inventor/business manager, legal/accounting services, medical services, researcher, instructor, engineer, specialist in humanities and international services, intra-company transferee, and cultural activities.

[13] The technical intern training program is designed to support human resource development in less developed countries and expects unskilled trainees to acquire professional skills in Japan through their work experiences.

type of immigration. Skilled immigration flows are complementary to FDI inflows, while unskilled immigration flows are substitutable for FDI inflows. The coefficient on skilled foreign entry is estimated as positive and that of unskilled foreign entry is estimated as negative. The result remains valid regardless of the specification of Chinese ethnic network externalities. Our analysis reveals that immigration enhancement that welcomes skilled workers has synergies with inward FDI promotion.

We investigate what drives the complementarity of inward FDI and skilled immigration. A possible explanation is related to *residential status* labeled as *transfer within companies*. A positive correlation between inward FDI and skilled immigration may be the result of foreign companies bringing over staffs trained in their home countries. An examination of data indicates that the category of *transfer within companies* on average accounts for 25% of skilled immigrants. Moreover, its share is higher than those of other categories in our sample.[14] Some inward FDI accompanies inflows of foreigners because their businesses require company-specific knowledge and skills. However, we are uncertain about the crucialness of role that the category plays because skilled immigration on average accounts for 12% of total immigration.[15] The category of *transfer within companies* shares at most 3% of total immigration. The examination of data reveals that analysis using total immigration is under

[14] The share of *transfer within companies* within the category of skilled immigration varies within the range of 11% and 61% during 1996–2012. The annual share of the category is 25% on average.

[15] The share of skilled immigration accounts for 3–34% of total immigration during the sample period. The average across years is 12%.

the strong influence of unskilled immigration because unskilled immigration is dominant in our sample. The results in Columns (1), (2), (5), and (6) are in line with substitutability of inward FDI and unskilled immigration.

Our results could be explained by the fundamental natures of factor inputs. Capital can replace the tasks of unskilled labor but not those of skilled labor.[16] This explanation is related to that of Frey and Osborne (2013), who predict that occupational categories with lower educational attainment and wages are at a higher risk of elimination as a result of computerization in the future. In fact, we have already observed a similar situation: the burdens of care workers have been reduced in Japan with the introduction of several nursing-care robots. On the other hand, the use of advanced technologies such as computerization often requires skilled labor. Thus, the demand for skilled labor increases as technology advances.[17]

The results may be disappointing to some policy-makers, specifically, those who support globalization regardless of the skill levels of immigrants. However, the results do not discourage globalization; rather, they make clear its merits. In the short run, the interaction of FDI promotion and (unskilled) immigration enhancement can offset their respective levels of effectiveness if capital and labor markets are opened simultaneously. However, diaspora effects are acknowledged: a greater number of immigrants in a country

16 A similar concept is found in the classic work of Griliches (1969), who advocates the so-called capital−skill complementarity: capital substitutes for unskilled labor more easily than for skilled labor.

17 This logic is commonly used to explain the causes of recent income inequality between skilled and unskilled workers.

promotes FDI inflows, although most immigrants residing in Japan are classified as unskilled immigrants.[18] Thus, the current results do not deny the benefits of accepting (unskilled) immigrants in the long run. The results in Column 1 (Column 2) show that inward FDI increases by 7,727.8 (10,106.4) million dollars if immigrant stocks increase by 20,000 people, equivalent to about one percentage of the immigrant stocks in 2011. On the other hand, inward FDI decreases by 220 million dollars when immigrant flows increase by the same amount. An increase in inward FDI via increased immigrant stocks is larger than a decrease in inward FDI via increased immigrant flows. The estimated increase in inward FDI, equivalent to about half of the peak inward FDI amount during the sample period, is not negligible. The data on immigrant increases used for this calculation are reliable, as more than 20,000 immigrants were observed during the sample period, which ends with the 2008 bankruptcy of Lehman Brothers.

The analysis results confirm diaspora effects on FDI inflows from the immigrants' country of origin. We extend the analysis to examine interactions between inward FDI from the country of origin and inward FDI from other countries in the region, because FDI inflows from China may be affected by FDI inflows from other Asian countries.[19] For each year and each region (i.e., Asia, North and South America, the Pacific, Europe, and the Middle East), we

[18] The share of skilled immigrants accounts for 5.3–8.1% of total immigrant stocks during the 1996–2011 period. The average across years is 6.6% and the share increases gradually over the sample period.

[19] The idea is related to Buch et al., who show that inward FDI from the country of interest has a negative relationship with inward FDI from all other countries. However, their static analysis suffers from empirical problems such as endogeneity regarding FDI and immigration.

construct a variable named *areaFDI* that sums up inward FDI in the region except for the country of interest. For example, inward FDIs in 1996 from Hong Kong, Taiwan, South Korea, Singapore, Thailand, Indonesia, Malaysia, the Philippines and India are summed to match inward FDI in 1996 from China. The analysis results show a positive relationship between inward FDI from the country of interest and inward FDI from other countries in the region (Column 1 in the Appendix 2). Agglomeration effects are observed among FDI inflows from the same region. Similarly, we examine whether immigrant stocks from other countries in the same region affect inward FDI from the country of interest. We construct a variable named *area-imm-stocks* that sums up immigrant stocks originating from other countries for each region except for the country of interest. The term is estimated to be negative without changing the signs of the coefficients of the other terms (Column 2 in the Appendix 2). However, the effects of immigrant stocks from other countries disappears once we include both *areaFDI* and *area-imm-stocks* terms (Column 3 in the Appendix 2). Diaspora effects operate only for the country of the origin but not for neighborhood countries in the same region.

From the theoretical perspective, our empirical results suggest the necessity of developing a new theoretical framework that can accommodate the interactions of simultaneous factor inflows. The traditional theory, in which relative factor endowments play a crucial role, cannot explain the observation that all factors enter one country, because the theory implies that cross-border factor movements occur in the opposite direction (i.e., when one

factor receives a higher return in the U.S. economy, some other factor must receive less and will thus want to leave; Davis and Weinstein, 2002, p. 3). Davis and Weinstein (2002, 2005) argue that technological superiority accounts for inflows of labor and capital into the U.S. because higher productivity provides higher returns for all factors. They use a Ricardian approach, which features technological differences across countries, and attempt to quantify the losses the U.S. suffers through immigration. However, their approach does not adequately capture the characteristics related to the interactions among simultaneous factor inflows. They treat inflows of labor and capital as a composite (or single) factor because "the factors entered the United States in similar proportions…14.3 percent of the U.S. labor force and 16.5 percent of the U.S. capital stock were due to immigration and net capital inflows respectively" (Davis and Weinstein, 2005, p.5). However, the results of our analysis suggest that these proportions may be ex post proportions after the capital-labor trade-off is considered (i.e., the FDI–unskilled immigration relationship is characterized as substitutes).

Our results can be related to the core-periphery model (Krugman, 1991) used in new economic geography[20] and to variants of the new growth model, which derive the same results as those of the core-periphery model (Baldwin and Martin, 2004). Our results have similar, but not identical,

[20] Fujita and Krugman (1995) examine the "conditions under which all manufacturing firms will agglomerate in a single city" using a case whereby homogeneous workers in a single country can choose to work in either agriculture or manufacturing. This approach is more flexible than that in which the number of agricultural (or manufacturing) workers is fixed.

implications. Variants of the core-periphery model show an agglomeration of firms and skilled labor in one location when firms and skilled labor are mobile and unskilled labor is immobile (Ottaviano and Thisse, 2004; Mori and Turrini, 2005). Our empirical analysis shows a complementarity (or substitutability) between capital inflows and flows of skilled (or unskilled) immigrants when the three factors of capital and skilled and unskilled labor are all mobile across national borders. The former result is consistent with the agglomeration of firms and skilled labor in the core-periphery model. A theoretical foundation for incorporating the latter result may be provided through further elaboration of the core-periphery model.

So far we have focused on the substitutability and complementary of two inputs, foreign capital and foreign labor. However, as we observed in the literature review, arguments about FDI–immigration relationships have roots in the literature on the interactions between trade and immigration. We wondered whether our results remain valid if trade also interacts with immigration.

We further extended our analysis by introducing foreign market access, i.e., choices of trade or FDI, and examined the robustness of the results. While previous works treated FDI–immigration relationships and modes of foreign market access as two different arenas, we conduct comprehensive analysis regarding interactions among FDI, trade, and immigration. We refer to Helpman et al. (2004), who outlined the Helpman, Melitz, and Yeaple (HMY) model that explains modes of foreign market access according to differences

in within-sector firm productivity. Firms choose either international trade or international investment by taking into consideration the trade-off between the merits of being located near the foreign market, such as savings on trade costs, and those of economies of scale at the firm level relative to the plant level (i.e., the proximity-concentration trade-off). The HMY model suggests that the most productive firms engage in FDI because they can bear investment costs that are higher than trade costs. Helpman et al. (2004) empirically test these theoretical implications by using data at the industry level.

We devise the following assumptions in order to introduce aspects of the HMY model into our argument about bilateral FDI, trade, and immigration interactions at the country level. FDI tends to be preferred over trade when the host country has a larger market, the host country has higher trade costs, and the home country has a higher level of productivity. Then, the dynamic relationship of imports relative to inward FDI are expressed as

$$IM_{it}/FDI_{it} = \alpha + \beta_1 IM_{it-1}/FDI_{it-1} + \beta_2 ForEntry_{it} + \beta_3 Mig_{it} + \beta_4 Dist_{it} + \beta_5 GDP_{jt} + \beta_6 Prod_{it} + \beta_7 Corr_{jt} + \beta_8 TradeBar_{jt} + \varepsilon_{it} \quad \text{where} \quad \varepsilon_{it} = \delta_i + \mu_{it}$$

IM_{it} represents imports to Japan from country *i* (alternatively, exports of country *i* to Japan) at time *t*, $Dist_{it}$ denotes geographical distances between country *i* and Japan, GDP_{jt} denotes real GDP in Japan, $Prod_{it}$ denotes productivity, $Corr_{jt}$ denotes corruption, $TradeBar_{jt}$ denotes trade barriers. Terms $\beta_5 - \beta_8$ embed the hypothesis of the proximity-concentration trade-off. *GDP* measures how the size of the host country's market affects the mode of

foreign market access. The trade-off between trade costs and economies of scale is captured by *TradeBar* (trade costs) and *Prod* (productivity). *Corr* (corruption) is expected to operate as a proxy for the attractiveness of foreign business. Lastly, the effects of distances are not obvious. Greater distances discourage trade due to higher trade costs. At the same time, they discourage inflows of FDI because distances may imply cultural differences and greater cultural differences imply uncertainty in foreign business.

Our analysis requires compiling additional data. Bilateral import data are obtained from *Comtrade* by United Nations. Taiwan is an exception because *Comtrade* does not provide Taiwanese data that are separate from Chinese data. Imports from Taiwan (millions US$) are taken from the *Taiwan Statistical Data Book* on the Taiwanese government's website. We convert the figures to constant 2005 US$ using the U.S. GDP deflator (base year 2005) taken from World Development Indicators. Data on tariff rates are taken from the World Integrated Trade Solution of the World Bank. The analysis uses country-specific effectively applied weighted average tariff rates as an index for trade barriers set by Japan for each country. Again, Taiwanese data are unavailable, so we apply world average rates for Taiwan. Productivity in each country is measured by the total factor productivity (TFP) index taken from the Penn World Table. The index is created using the level of U.S. productivity as a benchmark value of one.

The results of our analysis are presented in Columns (5)–(8). The results are in line with our previous discussion. The relative importance of

inward FDI decreases compared to imports when flows of immigrants increase. The coefficient on foreign entry is estimated to be positive at the statistically significant level in Columns (5) and (6). Increased flows of immigrants encourage imports relative to inward FDI. Additionally, Columns (7) and (8) reveal that the relative importance of inward FDI increases as flows of skilled immigrants increase but decreases as flows of unskilled immigrants increase. Increased flows of skilled (unskilled) immigrants encourage (discourage) inward FDI relative to imports, as a negative (positive) estimate of skilled (unskilled) foreign entry shows.

What inference can we derive from our analysis, specifically, in terms of the labor market in Japan? If capital is substitutable for labor, then inward FDI takes job opportunities from domestic workers, resulting in higher unemployment rates. An alternative hypothesis is that domestic factors differ from foreign factors in nature, so that a foreign factor is not substitutable for a domestic factor. If so, inward FDI should help reduce unemployment rates in Japan. To answer the question, we apply vector autoregression to three flow variables, inward FDI, immigration, and real GDP during the sample period 1996–2011, after taking the differences of the variables until they satisfy the stationary condition. Our analysis shows that inward FDI increases unemployment rates (see Table 3). Inward FDI appears to replace domestic workers. The type of capital, either foreign or domestic, does not matter. Capital is indeed a substitute for labor. The analysis also shows that immigration does not affect unemployment. This result is related to the fact

that domestic labor accounts for most of the labor market in Japan. The result might be altered if immigration increases.

5. Concluding remarks

This paper presents a study of FDI–immigration relationships when both inward FDI promotion and immigration enhancement are used to attain the goal of sustainable economic growth. Population aging results in both decreased savings and a shrunken labor force. Inward FDI promotion and immigration enhancement are expected to address these issues. Here, the policy concerns are the dynamic interactive effects of the two policies. How does an increase in immigration affect inward FDI? If capital and labor are substitutes as they are assumed to be in standard trade theory then increased immigration appears to offset the effectiveness of inward FDI promotion in reality. To examine this possibility, we examine the relationships between FDI inflows and immigration flows, given immigrant stocks.

The results of our study support the standard assumption of capital–labor substitution under the sample of total immigration. Immigration inflows offset FDI inflows. However, further investigation reveals that the type of immigration determines FDI–immigration relationships. Specifically, skilled immigration is complementary to inward FDI, while unskilled immigration is substitutable for inward FDI. Tasks related to unskilled labor can be replaced by capital, unlike those related to skilled labor. The initial result of the capital–labor substitution turns out to be strongly influenced by unskilled immigration,

which dominates our sample. These results are in line with those obtained under an extended model, where modes of foreign market access are introduced. The relative importance of inward FDI increases compared to imports with increased skilled immigration but decreases with increased unskilled immigration.

These results support policies that welcome skilled immigrants in several developed countries. Since skilled immigration is complementary to inward FDI promotion, these two policies work to compensate for decreasing domestic savings and a shrinking labor force. On the other hand, policies that promote the entry of unskilled immigrants might have unexpected side effects, because the effects of promoting inward FDI and unskilled immigration mutually offset one another, although the use of unskilled immigrants is common in sectors that experience labor shortages.

However, the results of our analysis do not necessarily oppose unskilled immigration, as we also observe diaspora effects: larger immigrant stocks induce FDI inflows. Although unskilled immigration flows discourage FDI inflows contemporaneously (i.e., via tradeoff effects), immigration promotes inward FDI in the longer term, regardless of whether immigration is of skilled or unskilled workers. Long-run diaspora effects are shown to be more dominant than short-run tradeoff effects. This is a novel implication of this analysis, which distinguishes between two possible effects: 1)whether larger foreign communities in a host country attract more FDI (i.e., diaspora effects) and 2)FDI inflows could be deterred when a country simultaneously

welcomes immigrants (i.e., tradeoff effects). The current literature claims only a negative relationship between unskilled immigrants and inward FDI.

Our analysis is applicable to other interesting but more complicated situations. This paper specifically examines capital–labor substitution in relation to immigration. A possible extension of our research is an examination whether the effects of immigrants on inward FDI differ from those of native-born residents. Relationships between domestic labor and immigrant labor are another concern. Despite our analysis that indicated no substitutability between them (no effect on unemployment rates), the situation might vary with an increase in the number of immigrants. Another possible extension is related to empirical methodology. Our model assumes that shocks to FDI affect only current and future immigration. However, a shock to future FDI could affect past immigration if an influx of immigrants from the country where the future FDI was to come from occurs after FDI projects are announced. A new empirical methodology that accounts for this issue is expected to be developed. Both of these interesting extensions are beyond the scope of our study, but represent potential future lines of research.

Data appendix

FDI

The FDI data are referred from JETRO (http://www.jetro.go.jp/world/japan/stats/fdi/); the file name is "country2_cy12.xls"for inward FDI.

US–Japan exchange rates

We use inter-bank rates–central rate average taken from Principal Global Indicators (http://ecodb.net/exchange/usd_jpy.html).

Taiwanese information

Data were referred from the Taiwanese government website (http://win.dgbas.gov.tw/dgbas03/bs7/sdds/english/calendar.htm).

Distances

Data are available at GeoDist: the CEPII's database on distances (http://www.cepii.fr/anglaisgraph/bdd/distances.htm). We use a distance variable, which is coded as *distcap* (distances) in dist_cepii.xls file at GeoDist. Mayer and Zignago (2011) provide detailed information related to the dataset. "Geodesic distances are calculated following the great circle formula, which uses latitudes and longitudes of …the geographic coordinates of the capital cities (Mayer and Zignago, 2011, p.10)."

Corporate tax rates

Information on corporate tax rates prepared by OECD is available at the following websites:

http://www.oecd.org/tax/tax-policy/oecdtaxdatabase.htm#C_CorporateCaptial

http://taxfoundation.org/article/oecd-corporate-income-tax-rates-1981-2012

Economic partnership agreement (EPA)

Information on EPAs is available at websites of the Ministry of Foreign Affairs, Japan.

http://www.mofa.go.jp/mofaj/gaiko/fta/j_asean/indonesia/index.html

http://www.mofa.go.jp/mofaj/gaiko/fta/j_asean/thailand/index.html

http://www.mofa.go.jp/mofaj/gaiko/fta/j_asean/philippines/index.html

http://www.mofa.go.jp/mofaj/gaiko/fta/j_asean/malaysia/index.html

http://www.mofa.go.jp/mofaj/area/singapore/kyotei/

http://www.mofa.go.jp/mofaj/gaiko/fta/j_swit/index.html

http://www.mofa.go.jp/mofaj/gaiko/fta/j_mexico/index.html

Worldwide Governance Indicators

The Worldwide Governance Indicators (WGI) summarize “the views on the quality of governance provided by a large number of enterprise, citizen and expert survey respondents in industrial and developing countries. These data are gathered from a number of survey institutes, think tanks,

non-governmental organizations, international organizations, and private sector firms."

Our analyses use "Control of Corruption" in WGI. It "reflects perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests." Data are downloadable from http://info.worldbank.org/governance and details related to the data can be found in Kaufmann, Kraay, and Mastruzzi (2010).

Helpman, Melitz, and Yeaple Model

Imports

Imports data are taken from *Comtrade* by United Nations (http://comtrade.un.org/data/).

Data on imports from Taiwan (i.e., Taiwanese exports to Japan) are taken from Table 11-9a. Commodity Trade with Major Trading Partners in Taiwan Statistical Data Book 2014 that is available at the Taiwanese government website:

http://www.ndc.gov.tw/encontent/m1.aspx?sNo=0001453#.VD5JsjxxnIU

Trade barriers

Tariff rates are taken from WITS, which is available at the World Bank website

http://wits.worldbank.org/

The analysis uses AHS weighted average tariff rates.

Productivity

We use the variable “ctfp: TFP level at current PPPs (USA=1)” taken from Penn World Table. http://www.rug.nl/research/ggdc/data/penn-world-table

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Table 1 Summary statistics

	Mean	Std. Dev.	Min	Max
Inward FDI	214	1390	-8092	14473
Foreign entry	2648	9128	-30199	62412
Skilled foreign entry	279.4592	736.9097	-821	7623
Unskilled foreign entry	2368.248	8587.051	-30189	56312
Foreign registration (Dtype-1)	8.946	2.655	2.485	13.431
Foreign registration (Dtype-2)	8.844	2.541	2.485	13.390
Distances	7633	3426	1157	17693
Corruption	1.229	0.204	0.857	1.573
EPA		0: 91.55%		1: 8.45%
Tax rates	0.412	0.031	0.395	0.500
Real GDP	4487372	172329	4221408	4751194
IM/FDI	11912	147733	-44476	2442390
TFP	0.784	0.251	0.263	1.266
Tariff rates	0.032	0.029	0.000	0.241

Units: FDI, constant 2005 million US$; foreign entry, the number of long-term foreign entrants (inflows of immigrants); foreign registration, the logarithm of the number of foreign registrants (stocks of immigrants); distance, kilometers; real GDP, constant 2005 million US$; corruption, indicators ranging from -2.5 (weak) to 2.5 (strong); TFP, total factor productivity index created using the level of U.S. productivity as a benchmark value of one.

Note: Dtype-1: total Chinese are used as a proxy for diaspora effects. Dtype-2: Taiwanese stock is distinguished from other Chinese stock.

Table 2 Results: FDI dynamics

	Dtype-1	Dtype-2		Dtype-1	Dtype-2
	(1)	(2)		(3)	(4)
L1.inward FDI	0.219*	0.160**	L1.inward FDI	0.332***	0.353***
s.e.	0.130	0.078	s.e.	0.061	0.070
Foreign entry	-0.011***	-0.011***	Skilled foreign entry	0.216***	0.217**
s.e.	0.004	0.004	s.e.	0.046	0.092
Foreign registration	38.639***	50.532***	Unskilled foreign entry	-0.019***	-0.018
s.e.	8.054	15.196	s.e.	0.003	0.018
Distances	3.E-04	-0.004	Foreign registration	41.537	37.196
s.e.	0.004	0.008	s.e.	28.101	69.077
Real GDP	6.00E-4***	5.86E-4***	Distances	0.019***	0.015**
s.e.	6.40E-05	7.13E-05	s.e.	6.00E-03	7.09E-03
Tax rates	-3490.665***	-3477.166***	Real GDP	4.5E-04***	4.7E-04***
s.e.	424.479	449.437	s.e.	0.000	0.000
Corruption	-1249.683***	-1270.326***	Tax rates	-3513.333***	-3691.376***
s.e.	157.223	152.651	s.e.	961.556	863.526
EPA	1760.785***	1355.509**	Corruption	-808.272***	-793.702**
s.e.	339.371	531.908	s.e.	103.038	321.186
			EPA	422.857	496.634
			s.e.	324.823	948.490
AR(1)	0.128	0.124	AR(1)	0.113	0.102
AR(2)	0.129	0.117	AR(2)	0.149	0.155
Observations	319	319	Observations	319	319
	Dtype-1	Dtype-2		Dtype-1	Dtype-2
	(5)	(6)		(7)	(8)
L1.(IM/FDI)	-0.295***	-0.241***	L1.(IM/FDI)	-0.292***	-0.279***
s.e.	0.046	0.027	s.e.	0.037	0.040
Foreign entry	2.270***	2.342***	Skilled foreign entry	-25.349***	-25.055***
s.e.	0.195	0.162	s.e.	1.256	1.256
Foreign registration	19150.48***	20329.87***	Unskilled foreign entry	7.697***	7.726***
s.e.	3170.241	1952.614	s.e.	0.253	0.255
Distances	6.839**	9.572***	Foreign registration	-5968.825***	-6743.006***
s.e.	2.99	2.024	s.e.	1366.461	1291.424
Real GDP	-0.061***	-0.061***	Distances	14.678***	14.892***
s.e.	0.009	0.007	s.e.	1.761	1.783
TFP	143409.6***	118006***	Real GDP	0.00755	9.5E-03**
s.e.	24228.85	35771.12	s.e.	0.0051837	0.005
Corruption	-7704.877	-12044.96***	TFP	-162567.4***	-169900.9***
s.e.	4949.374	4576.726	s.e.	35733.38	37853.03
Tariff rates	-16703.17***	-17068.12***	Corruption	10659.68**	10636.03***
s.e.	2471.207	2245.583	s.e.	5015.616	5076.19
			Tariff rates	15313.37***	15749.83***
			s.e.	3063.827	3142.143
AR(1)	0.361	0.304	AR(1)	0.314	0.313
AR(2)	0.268	0.326	AR(2)	0.290	0.291
Observations	286	286	Observations	286	286

*** Statistically significant at 1%, ** at 5%, * at 10%

Note: The Arellano–Bond test was conducted to assess autocorrelation. The test for second-order correlation in differences, AR(2), shows no serial correlation in the first-difference disturbances.

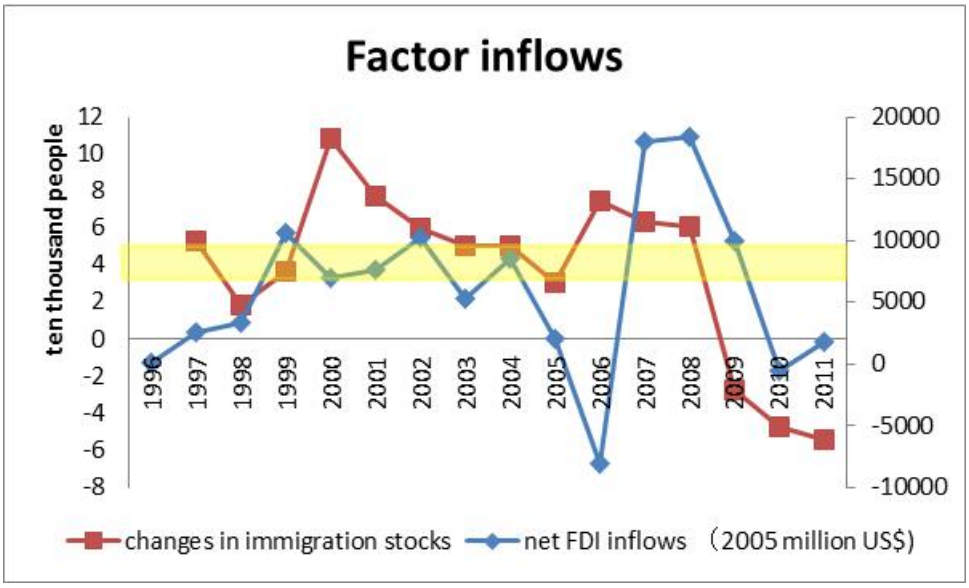
Table 3 Results: Factor mobility and the labor market

D2.unemployment	(1)	(2)
LD2.unemployment	-0.08	-0.08
s.e.	0.11	0.11
L2D2.unemployment	-0.62*	-0.63*
s.e.	0.12	0.12
Inward FDI	1.65E-5**	1.47E-5***
s.e.	7.00E-0.6	5.52E-0.6
D1.Immigration	2.22E-0.6	2.55E-0.6
s.e.	2.66E-0.6	2.54E-0.6
D1.Real GDP	-3.40E-12*	-3.53E-12*
s.e.	6.59E-13	5.74E-13
Constant	-0.03	
s.e.	0.08	
Log likelihood	4.77	4.69
AIC	0.21	0.05
HQIC	0.12	-0.02
SBIC	0.45	0.25
Observations	12	12

*** Statistically significant at 1%, ** at 5%, * at 10%

Note: D denotes difference, L denotes lag, s.e. denotes standard errors, AIC denotes Akaike's information criterion, HQIC denotes the Hannan and Quinn information criterion, and SBIC denotes Schwartz's Bayesian information criterion.

Figure 1 Factor inflows



Appendix 1

Literature review

Literature	FDI	Migration	FDI origin	FDI host	Migration origin	Migration host	Periods	FDI	Migration	Results	FDI–migration relationships
Javorcik et al. (2011)	outward FDI	immigration	U.S.	56 countries	56 countries	U.S.	2 years (immigrant stock data are available only for 1990 and 2000)	stocks	stocks	positive relationship between immigrant stocks in the U.S. and FDI stocks in immigrants' origin countries. Such a relationship is stronger for immigrants with higher education.	complements (the degree of complementarity is stronger for immigrants with higher education)
Kugler and Rapoport (2007)	outward FDI	immigration	U.S.	55 countries	55 countries	U.S.	1990 (base year; immigrant stock data are available only for 1990 and 2000)	Changes in stocks between 1990 and 2000	Changes in stocks between 1990 and 2000 and stocks in 1990	immigration increases future FDI; a negative relationship between contemporaneous FDI and immigration.	complements (effects of immigration on future FDI); substitutes between contemporaneous immigration and FDI.
Simone and Manchin (2012)	inward FDI	emigration	Western Europe (EU 15)	Eastern Europe	Eastern Europe	Western Europe (EU 15)	1995–2007	flows	stocks	positive relationship between immigrant stocks and FDI flows into immigrants' origin countries.	complements
Buch et al. (2006)	inward FDI	immigration	139 countries	16 German states	139 countries	16 German states	1991–2002	stocks	stocks	possible positive relationship between immigrant stocks and FDI from their origin countries for high-income countries (insufficient evidence owing to data limitations)	possible complements between skilled immigrants and FDI
Foad (2012)	inward FDI	immigration	10 countries	50 U.S. states	10 countries	50 U.S. states	1990–2004	stocks	stocks	more FDI observed in regions with skilled immigrants	complements (however, the case of substitutes is also observed under a process similar to cross-section analysis: negative relationship between immigrant stocks in 1990 and FDI in 1991)
Gheasi et al. (2013)	inward FDI	immigration	22 countries	U.K.	22 countries	U.K.	2001–2007	stocks	stocks	positive relationship between immigrant stocks and outward FDI stocks; no statistically significant relationship between immigrant stocks and inward FDI stocks; positive relationship between immigrants with higher education and outward/inward FDI. Data on immigrants' education are available only for 2001.	No relationships for all immigrants (however, complements for immigrants with higher education and substitutes for immigrants with lower education)
	outward FDI	immigration	U.K.	27 countries	27 countries	U.K.	2001–2007	stocks	stocks		Complements for all immigrants (however, complements for immigrants with higher education and substitutes for immigrants with lower education)

Appendix 2

Results: FDI dynamics

	Dtype-1	Dtype-1	Dtype-1
	(1)	(2)	(3)
L1.inward FDI	0.140***	0.166***	0.161***
s.e.	0.038	0.05	0.023
areaFDI	0.048**		0.074***
s.e.	0.014		0.019
Foreign entry	-0.014***	-0.010***	-0.015***
s.e.	0.003	0.004	0.004
Foreign registration from the same country of origin	35.243***	37.729*	84.483*
s.e.	13.753	22.952	43.354
Foreign registration from other countries in the same region		-53.772*	-100.354
s.e.		31.117	69.05
Distances	-0.004	-0.002	-0.013
s.e.	0.008	0.006	0.019
Real GDP	5.0E-04***	6.7E-04***	4.8E-04***
s.e.	9.E-05	1.E-04	2.E-04
Tax rates	-3249.573***	-3522.429***	-2318.183***
s.e.	509.448	406.465	761.73
Corruption	-904.739***	-871.047***	-493.674***
s.e.	151.683	124.227	182.62
EPA	917.39***	439.137*	70.542
s.e.	253.107	240.781	163.007
AR(1)	0.071	0.096	0.073
AR(2)	0.117	0.122	0.118
Observations	319	319	319

*** Statistically significant at 1%, ** at 5%, * at 10%

Note: The Arellano–Bond test was conducted to assess autocorrelation. The test for second-order correlation in differences, AR(2), shows no serial correlation in the first-difference disturbances.