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The link between entrepreneurial activities and angel investment: an international comparison\*

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#### Abstract

This study explores the link between the probabilities of becoming an entrepreneur and an angel investor. Using data from the Global Entrepreneurship Monitor, we examine what types of individuals invest in new businesses. We present the estimation results for the odds ratio of entrepreneurial activities and angel investment, which may reflect the extent of entrepreneurial ecosystems at the country level. The results reveal the existence of a positive and significant link between entrepreneurial activities and angel investment, indicating that individuals who have experience in entrepreneurial activities are more likely to invest in new businesses. Moreover, we find that the link between entrepreneurial activities and angel investment differs across countries. Specifically, while the proportion of individuals who engage in angel investment in Japan is much lower than in some countries, the link between entrepreneurial activities and angel investment in Japan is greater than in other countries.

Keywords: Angel investment; Entrepreneurial activities; Entrepreneurial ecosystem; International comparison; Link; Odds ratio

JEL classification: G11, L26, M13

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# 1. Introduction

Recently, there has been increasing interest in the interacting components of entrepreneurship—namely, "entrepreneurial ecosystem" or "start-up ecosystem"—in the literature (e.g., Isenberg, 2010; Pitelis, 2012; Acs et al., 2017, 2018; O'Connor et al., 2018). Entrepreneurial ecosystems are a set of interdependent actors and factors coordinated in such a way that they enable productive entrepreneurship within a particular territory (Stam and Spigel, 2018). Entrepreneurial ecosystems are combinations of social, political, economic, and cultural elements within a region, which support the development and growth of innovative startups and encourage nascent entrepreneurs and other actors to take the risks of starting, funding, and otherwise assisting high-risk ventures (Spigel, 2017). Despite considerable attention to entrepreneurial ecosystems, there exist few measures that capture the extent of entrepreneurial ecosystems. It is not easy to measure the relationship between actors, including assistance for entrepreneurial activities, and to evaluate entrepreneurial ecosystems in regions and countries.

Potential entrepreneurs often face difficulties in initial funding when they start businesses. In view of such financial difficulties, the role of investors—especially those who invest in new ventures, called "angel investors" or "business angels"—is crucial for the promotion of entrepreneurship in entrepreneurial ecosystems.<sup>1</sup> Governments in many countries may identify angel investors as a key player in vibrant entrepreneurial ecosystems (OECD, 2011; Mason and Botelho, 2016). Therefore, the interactions between entrepreneurs and angel investors play a pivotal role in the development of entrepreneurial ecosystems. How potential entrepreneurs raise initial funding is essential for the success of new businesses. However, little attention has been paid to the impact of angel investment on entrepreneurial activities. Thus, it is worthwhile to clarify the link between entrepreneurial activities and angel investment to gain better understanding of how to promote entrepreneurial ecosystems. As such, the development of measures that describe the interactions among entrepreneurial activities, including assistance for activities, is useful

<sup>&</sup>lt;sup>1</sup> In the literature, angel investors (business angels) are often defined as private investors who provide risk capital to new and growing businesses in which they have no family connection (Mason and Harrison, 1995).

for the promotion of entrepreneurial ecosystems in regions and countries.

This study explores the link between the probabilities of becoming an entrepreneur and an angel investor. Using data from the Adult Population Survey (APS) conducted by the Global Entrepreneurship Monitor (GEM) National Teams, we examine what types of individuals invest in new businesses. We present the estimation results for the odds ratio of entrepreneurial activities and angel investment, which may reflect the extent of entrepreneurial ecosystems at the country level, in some Organisation for Economic Cooperation and Development (OECD) countries. The results reveal the existence of a positive and significant link between entrepreneurial activities and angel investment, indicating that individuals who have experience in entrepreneurial activities are more likely to invest in new businesses. More specifically, the odds ratio of entrepreneurial activities and angel investment is over three times.

Moreover, we explore whether the interactions between entrepreneurs and angel investors differ across countries. In particular, we focus on angel investment in Japan, which is well regarded as having a lower level of entrepreneurship among developed countries (Honjo, 2015; Small and Medium Enterprise Agency, 2017). It is also recognized that private equity capital is underdeveloped, while the debt-financing system is well established in Japan.<sup>2</sup> The results reveal that the proportion of individuals who engage in angel investment in Japan is approximately 1%, which is lower than in the United States (US) and some European countries. Specifically, while the proportion of individuals who engage in angel investment in Japan is much lower than in some countries, the link between entrepreneurial activities and angel investment in Japan is greater than in other countries. Furthermore, the results show that in Japan, individuals with higher educational levels are less likely to engage in angel investment.

The remainder of this paper is organized as follows. The next section discusses the determinants of angel investment, including the literature review. Section 3 provides information on data used in this study and explains the method used in constructing a

<sup>&</sup>lt;sup>2</sup> Honjo and Nagaoka (2018) argued that private equity capital is underdeveloped in Japan using the case of Japanese biotechnology start-ups.

measure for the extent of entrepreneurial ecosystems at the country level. Section 4 shows the estimation results. Finally, Section 5 presents the conclusions.

## 2. Research background

#### 2.1. Financing for entrepreneurship

Many scholars have emphasized the importance of start-up firms resulting from entrepreneurship, as these firms are expected to stimulate economic growth through job creation and innovation (e.g., Van Stel et al., 2004; Wong et al., 2005; Van Praag and Versloot, 2007). The emergence of start-up firms leads to future economic growth, and entrepreneurial ecosystems promote regional entrepreneurial activities through new firm formations (Mack and Mayer, 2015). Entrepreneurs and other actors play a significant role in the growth of start-up firms in entrepreneurial ecosystems. In this context, entrepreneurial ecosystems appear to be established as a key concept to promote economic growth in regions and countries (Acs et al., 2017, 2018; O'Connor et al., 2018; Spigel, 2017; Stam and Spigel, 2018).

Many, if not all, entrepreneurs require capital when they start their businesses. How entrepreneurs raise initial funding is one of the essential factors for the start and success of new businesses. However, entrepreneurs often encounter difficulties in financing from external suppliers of capital, such as bank loans, mainly because of the lack of business and credit records (Cressy, 1996). Information asymmetries between entrepreneurs and external suppliers of capital are severe during the start-up stage. Such information asymmetries generate agency cost, and the cost of capital may become a burden on new businesses. Nevertheless, initial funding is inevitable for new firm creation, as many entrepreneurs do not sufficiently raise capital before starting businesses. It is well recognized in the literature that financing is one of entrepreneurs' greatest obstacles when they start businesses (e.g., Storey and Greene, 2010). Thus, the relationship between starting a business and investing in a new business is essential to the promotion of entrepreneurial ecosystems.

While banks play a key role in providing capital in many countries, they generally

hesitate to provide debt financing to start-up firms. Even though banks seek relationship lending to alleviate funding issues associated with information asymmetries, most start-up firms, especially those managed by novice entrepreneurs, tend to lack business histories and track records. Because of information asymmetries between start-up firms and banks, it is difficult for banks to play a leading role in providing funds to start-up firms. Generally, startup firms have less collateral available to pledge to banks, and the higher default risk of these firms is a further age-specific impediment to bank loans (Müller and Zimmermann, 2009). In particular, high-tech start-ups face difficulties in initial funding from banks due to a higher risk of business outcomes (Carpenter and Petersen, 2002). Instead, angel investors may help in the initial funding of high-tech start-ups because they usually have more special knowledge and practical experience in investing in new businesses than banks do. Among the components in entrepreneurial ecosystems, the interactions between entrepreneurs and angel investors are crucial for the start and success of new businesses.

Numerous scholars have argued the role of private equity capital, including angel investors, in the development of start-up firms (e.g., Mason and Harrison, 2000; Ho and Wong, 2007; Vanacker et al., 2013). In particular, the importance of the interactions between entrepreneurs and angel investors has been highlighted in the literature (e.g., Maxwell et al., 2011; OECD, 2011; Mason and Botelho, 2016). Meanwhile, initial funding from external suppliers of capital is often heterogeneous in start-up firms. In practice, some high-tech start-ups require risk capital provided by private equity funds, while other start-ups depend heavily on bank loans. It is plausible that angel investors play a critical role in the initial funding of start-up firms with growth potential, including high-tech start-ups, mainly because traditional financing sources, such as banks, are limited in providing capital to uncertain businesses.

Moreover, the heterogeneity of initial funding may result from financial conditions in the country or region. Especially in bank-centered economies, such as Japan, where private equity capital tends to be underdeveloped, the role of angel investors may be limited in the entrepreneurial ecosystem (Honjo and Nagaoka, 2018). Entrepreneurs may have few opportunities to establish relationships with angel investors in bank-centered economies. By contrast, entrepreneurs may require a strong tie with angel investors because of limited private equity capital in such economies. In this respect, the link between entrepreneurs and angel investors depends on economic conditions in the specific country or region.

#### 2.2. Role of entrepreneurs in investment

As discussed in the previous subsection, initial funding from external suppliers of capital is heterogeneous in start-up firms. While some entrepreneurs seek access to private equity capital, others do not. It is possible that such difference is derived from individual-specific characteristics. In particular, under the existence of information asymmetries between entrepreneurs and external suppliers of capital, entrepreneurs' personal attributes may affect the choice of sources of initial funding. Essentially, whether entrepreneurs can raise funds from private equity capital depends on investors' decisions. Similarly, investors' personal attributes may determine the initial funding of start-up firms.

External suppliers of capital seek to provide capital to an entrepreneur with high ability, as they can expect a higher probability of success of his or her new business. However, external suppliers of capital cannot easily recognize which entrepreneur has higher ability. Because of information asymmetries between firms and external suppliers of capital, adverse selection and moral hazard issues tend to arise in capital markets (Binks and Ennew, 1996; Carpenter and Petersen, 2002). Unless external suppliers of capital have sufficient information, including knowledge and experience, on investing in start-up firms, they become reluctant to provide capital to these firms because of such information asymmetries.

Among external suppliers of capital, individuals who have experience in investing in privately held firms are expected to provide capital to entrepreneurs. This is due to special knowledge and experience required for private equity investment. Among these individuals, those who have been involved in business start-ups have an advantage to provide capital to other entrepreneurs because of their knowledge and skills about growing industries and market timing. Additionally, such individuals are likely more interested in investing in startup firms than those without any experience in this area. Particularly, successful entrepreneurs can play a significant role in providing risk capital to other entrepreneurs as angel investors (Mason and Brown, 2013). Such entrepreneurs may appreciate economic growth through entrepreneurship and understand the importance of initial funding in business start-ups. Policymakers need to cultivate relationships among entrepreneurs to encourage them to engage in entrepreneurial recycling (Mason and Harrison, 2006). In this view, the link between entrepreneurial activities and angel investment is beneficial for the promotion of entrepreneurship; thus, it can encourage business start-ups through entrepreneurial recycling. Such link would sustain the expansion of entrepreneurial ecosystems in the country or region.

However, little attention has been paid to the interactions between entrepreneurs and angel investors in the context of entrepreneurial ecosystems.<sup>3</sup> It is important to clarify the link between entrepreneurial activities and angel investment, which could provide better understanding of how to promote entrepreneurial ecosystems in countries and regions.

## 3. Data and methods

# 3.1. Data

We obtained the sample from the APS conducted by the GEM National Teams. We target those individuals aged 18 to 64 years old for the period from 2001 to 2013. Our sample is limited to individuals from 30 countries based on the OECD list in 2001. Specifically, the sample includes Australia, Austria, Belgium, Canada, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Korea (the Republic of Korea), Luxemburg, Mexico, the Netherlands, New Zealand, Norway, Poland, Portugal, Slovakia, Spain, Sweden, Switzerland, Turkey, the United Kingdom (UK), and the US, as shown in Table A1 in the Appendix.

The observation period depends on the specific country (region) because the GEM National Team members in each country decide to participate and conduct the survey. Therefore, as shown in Table A1, the observation period and number of observations differ across countries. Moreover, from the sample, we excluded some observations if the variables

<sup>&</sup>lt;sup>3</sup> Acs et al. (2014) proposed the Global Entrepreneurship Index (GEI) as a measure of the national systems of entrepreneurship, based on data from the GEM. Acs et al. (2018) also showed the relevance of entrepreneurial ecosystems in aggregate growth using GEI.

used in the estimation were not obtainable.<sup>4</sup> Specifically, those individuals under 18 or over 64 years old were excluded from the sample. Additionally, those individuals for whom variables used in the estimation, such as gender and educational levels, were not available were excluded. As a result, there were approximately 1 million observations.

To capture the link between entrepreneurial activities and angel investment, we use variables obtainable from the APS. In this study, angel investment is measured by investment to individuals (*BUSANG*). Entrepreneurial activities are measured by two variables: new firm creation (*BSTART*), and owning and managing a business (*OWNMGE*).<sup>5</sup> In addition to new firm creation (*BSTART*), we combine these two variables into one variable regarding entrepreneurial activities (*ENTRE*); more precisely, we define that *ENTRE* = 1 if *BSTART* = 1 or *OWNMGE* = 1. Moreover, we use the variables for individuals' personal attributes that control for individual-specific characteristics in the regression: age (*AGE*), gender (*FEMALE*), and educational level (*U\_EDUC* and *G\_EDUC*). Table 1 shows the definitions of variables used in this study.

#### 3.2. Methods

We capture the link between entrepreneurial activities and angel investment using an odds ratio described as follows. Let  $P^k$  denote the likelihood of that an individual engages in angel investment in group  $k \in \{A, B\}$  where A and B indicate the groups of individuals who have or do not have experience in entrepreneurial activities in a country or region. We define a risk ratio, RR, as follows:

$$RR = \frac{P^{A}}{P^{B}} = \frac{a/(a+c)}{b/(b+d)},$$
(1)

where a and c are the numbers of individuals who have or do not have experience in

<sup>&</sup>lt;sup>4</sup> It should be noted that the observations for Australia in 2001 were excluded from the sample, even though they are included in the data source, because most data on age were not available.

<sup>&</sup>lt;sup>5</sup> In addition to new firm creation (*BSTART*) and owner management (*OWNMGE*), new business start (*BJOBST*) is used to construct a total index for entrepreneurship in the GEM survey, which is usually called "total entrepreneurial activity (TEA)." However, we do not use new business start, because this variable does not indicate the birth of start-up firms but indicates entrepreneurship within an existing organization.

angel investment in group A, and b and d are the numbers of individuals who have or do not have experience in angel investment in group B, respectively. This risk ratio indicates the relative proportion of angel invertors among individuals who have experience in entrepreneurial activities to angel investors among those who do not have, which would imply the level of the link between entrepreneurial activities and angel investment in the country or region.

When the proportion of angel investment is sufficiently small, it is well known that the risk ratio asymptotically equals the odds ratio (*OR*) as follows:

$$RR = \frac{a/(a+c)}{b/(b+d)} \simeq \frac{a/c}{b/d} = OR,$$
(2)

where  $a \ll c$  and  $b \ll d$ .

To identify the link between entrepreneurial activities and angel investment, we estimate the odds ratio for individuals who engage in angel investment in relation to entrepreneurial activities. However, it is conceivable that decisions regarding angel investment depend on individual-specific characteristics. Therefore, we employ a regression model that controls for individual-specific characteristics. Additionally, we include country dummies in the model to control for country-specific effects.<sup>6</sup> While we estimate a model of determinants of angel investment using data for each country, we use a multilevel model with fixed coefficients to identify significant differences in the entrepreneurship-investment link across countries, following Honjo (2015).<sup>7</sup> By doing so, we identify the extent of entrepreneurial ecosystems for each country and show differences in the entrepreneurship-investment link across countries.

The model is further described as follows. Consider the likelihood of individual i engaging in angel investment in country j. Let  $BUSANG_{ij}$  denote a dummy that represents

<sup>&</sup>lt;sup>6</sup> As questionnaire surveys must be translated into the country's language, bias due to language translation is also controlled by the country dummies.

<sup>&</sup>lt;sup>7</sup> Further investigation is necessary to estimate a multilevel model with random coefficients to identify significant differences in the entrepreneurship–investment link between countries.

whether individual *i* engage in angel investment. We estimate the likelihood of angel investment using the following regression model:

$$\Pr(BUSANG_{ij} = 1) = f(\beta_{0j} + \beta_{1j}ENTRE_{ij} + \beta_{2j}X_{ij}).$$
(3)

where  $ENTRE_{ij}$  is a variable for entrepreneurial activities,  $X_{ij}$  is a vector of controls,  $f(\cdot)$  is the cumulative distribution function of an error term,  $\beta_{0j}$  is a constant term,  $\beta_{1j}$  is the coefficient of entrepreneurial activities, and  $\beta_{2j}$  is the coefficient (vector) of controls.

We assume that the parameters  $\beta_{0j}$  and  $\beta_{1j}$  depend on country *j*. To identify differences in the entrepreneurship-investment link across countries, we estimate the parameters using data for each country, and obtain the odds ratios. We also estimate them using the entire sample, and the specifications of the parameters  $\beta_{0j}$  and  $\beta_{1j}$  are written as follows:

$$\beta_{0j} = \gamma_{00} + \zeta_{0j} \tag{4}$$

$$\beta_{1j} = \gamma_{10} + \zeta_{1j}.\tag{5}$$

Using this specification, we can rewrite Equation (3) as follows:

$$\Pr(BUSANG_{ij} = 1) = f(\gamma_{00} + \zeta_{0j} + \gamma_{10}ENTRE_{ij} + \zeta_{1j}ENTRE_{ij} + \beta_{2j}X_{ij}).$$
(6)

In Equation (6), the estimated coefficient,  $\gamma_{10}$ , indicates the inter-country link between entrepreneurial activities and angel investment. More interestingly,  $\zeta_{1j}$  indicates the link depending on country *j*. We can also calculate the odds ratio using the estimated coefficient. In this study, the estimated odds ratio can be regarded as a measure for the country's entrepreneurship–investment link. Despite the limitation of the relationship between entrepreneurial activities and angel investment, this measure indicates the extent of entrepreneurial ecosystems at the country level.

#### **3.3. Descriptive statistics**

Figure 1 describes the mean of angel investment (*BUSANG*), that is, the ratio of individuals who engage in angel investment to the total number by country in the sample. As shown in Figure 1, the mean of *BUSANG* in Japan is almost 1%, which is the lowest among the 30 countries. We find a lower level of angel investment in Japan, which is well known as a bank-centered economy.

Table 2 presents the summary statistics of the variables, including individuals' personal attributes, used in this study. Table 2 shows that the mean of *BUSANG* is 0.033, indicating that about 3.3% of individuals have experience in angel investment. The mean of *BSTART* is 0.054, indicating that about 5.4% of individuals in our sample have experience in starting a new business. Additionally, the mean of *OWNMGE* is 0.126, indicating that about 13% of individuals have experience in owning and managing a business. Furthermore, the mean of *ENTRE* is 0.158, indicating that about 16% of individuals have experience in starting a new business or owing and managing a business, and they are regarded as having experience in entrepreneurial activities in this study.

Table 3 presents the cross tables of entrepreneurial activities and angel investment. As shown in Table 3, the proportion of individuals who engage in angel investment is about 40% among those who have experience in entrepreneurial activities, while it is 15% among those who do not. The odds ratio of entrepreneurial activities (*ENTRE*) and angel investment (*BUSANG*) is about 3.8, indicating that individuals who have experience in entrepreneurial activities are more likely to engage in angel investment. Moreover, the odds ratio of new firm creation (*BSTART*) and angel investment (*BUSANG*) is about 4.5, and we find similar relationship with entrepreneurial activities.

Moreover, to identify differences in the entrepreneurship-investment link across countries, Table 4 presents the odds ratio of entrepreneurial activities, including new firm creation, and angel investment by country. Table 4 also provides the means of *BUSANG*, *ENTRE*, and *BSTART*. As shown in Figure 1, the proportion of individuals who engage in angel investment in Japan is almost 1%, which is the lowest among the 30 countries. The findings are consistent with the notion that, as discussed in the introduction, private equity capital

is underdeveloped in Japan (Honjo and Nagaoka, 2018). In addition, the mean of *BSTART* in Japan is under 3%, which is also lower than in most countries. The findings also support the notion that Japan is well recognized as having a lower level of entrepreneurship, compared to other countries. However, the odds ratio of *ENTRE* and *BUSANG* in Japan is over 7, which is the highest among the 30 countries. The results indicate that the link between entrepreneurial activities and angel investment in Japan is greater than in other countries.

# 4. Estimation results

#### 4.1. Entrepreneurship-investment link

Using the regression model, we estimate the odds ratio that indicates the link between entrepreneurial activities and angel investment. Table 5 provides the estimation results for angel investment (*BUSANG*), including the effect of entrepreneurial activities (*ENTRE*) on angel investment. Table 5 shows our estimation of the odds ratio of entrepreneurial activities and angel investment while controlling for individual-specific characteristics and country dummies. The variables for entrepreneurial activities, individual-specific characteristics, and country dummies are included in column (i) of Table 5.<sup>8</sup> The reference category for country dummies is the dummy for the US. In columns (ii), we include the variables for new firm creation (*BSTART*) and owning and managing business (*OWNMGE*), instead of *ENTRE*. Moreover, the cross terms of entrepreneurial activities and country dummies are added to column (iii). The estimated coefficients are also shown in Table A2 of the Appendix.

In Table 5, we find that the odds ratios of entrepreneurship (*ENTRE*) are greater than one, which is consistent with the results shown in Table 4. We find a positive and significant link between entrepreneurial activities and angel investment, indicating that individuals who have experience in entrepreneurial activities are more likely to invest in new businesses.<sup>9</sup> Specifically, the likelihood of that individuals who have experience in

<sup>&</sup>lt;sup>8</sup> Because of splace limitations, Table 5 shows the estimation results for part of the dummies only for countries that have often been surveyed by the GEM National Teams and have large economic scale: France, Germany, Italy, the Netherlands, Spain, the UK, and the US (reference), in addition to Japan. Table 6 shows the estimation results for these eight countries.

<sup>&</sup>lt;sup>9</sup> In the APS, entrepreneurial attitudes were inquired, and the variable for entrepreneurial network labelled

entrepreneurial activities would engage in angel investment, on average, is three times greater than that for other individuals. In column (ii), we also find that both new firm creation (*BSTART*) and owning and managing a business (*OWNMGE*) are positively associated with angel investment. The results reveal that individuals who have experience in entrepreneurial activities are more likely to invest in new businesses. Our findings suggest a significant link between entrepreneurial activities and angel investment in the countries included in this study.

With respect to individuals' personal attributes, the odds ratios of the variable age are greater than one. The results indicate that older individuals are more likely to invest in new businesses, which is consistent with Honjo (2015). By contrast, the odds ratios of the variable female are smaller than one, indicating that females are less likely to invest in new businesses. Moreover, educational level is measured by two variables for undergraduate education and graduate education, and these variables have a significantly positive effect on angel investment. The results indicate that individuals with higher educational levels are more likely to invest in new businesses.

The country dummies indicate the different levels of angel investment across countries. Specifically, the dummies for Japan are significant for angel investment and smaller than one, indicating that the likelihood of angel investment is lower in Japan. In addition, the dummies for Germany, Italy, the Netherlands, Spain, and the UK are negative and significant for angel investment. The results indicate that the likelihood of angel investment is lower in these European countries, compared to that in the US.

In column (iii) of Table 5, the cross terms of entrepreneurial activities and some country dummies are significant, indicating that individuals who have experience in entrepreneurial activities in these countries are more likely to invest in new businesses. In particular, the cross term of entrepreneurial activities and the dummy for Japan is significant

*KNOWENT* was included in the entrepreneurial attitudes. In practice, we estimate the effect of entrepreneurial network, instead of entrepreneurial activities, on angel investment, and the odds ratio of entrepreneurial network and angel investment is larger than that of entrepreneurial activities and angel investment, suggesting that individuals with entrepreneurial networks are more likely to invest in new businesses. Moreover, Honjo (2015) pointed out that the proportion of individuals with entrepreneurial attitudes in Japan is lower than in other countries and that entrepreneurial network is significantly related to angel investment.

at the 1% level, and the odds ratio of the cross term and angel investment is greater than one. Meanwhile, while the proportion of individuals who engage in angel investment in Japan is much lower than in other countries, the effect of entrepreneurial activities on angel investment in Japan is greater than in other countries, including the US. The results indicate that the link between entrepreneurial activities and angel investment in Japan is greater than in other countries, consistent with the findings shown in Table 4 and Figure 2. By contrast, the odds ratios of the cross terms of entrepreneurial activities and the dummies for some European countries, such as Germany, Italy, and Spain, and angel investment are smaller than one. This indicates that the likelihood of angel investment among individuals who have experience in entrepreneurial activities in these countries is lower than that in the US.

## 4.2. Entrepreneurship-investment link by country

We estimate the odds ratio that indicates the link between entrepreneurial activities (*ENTRE*) and angel investment (*BUSANG*), based on the data set of each country. Table 6 provides the estimation results (odds ratios) for angel investment (*BUSANG*) using data for the following eight countries: Japan, France, Germany, Italy, the Netherlands, Spain, the UK, and the US. Moreover, the estimated coefficients are shown in Table A3 of the Appendix.

In Table 6, we find that the odds ratios of entrepreneurial activities and angel investment are greater than one in these countries. The results indicate that individuals who engage in entrepreneurial activities are more likely to invest in new businesses in these countries, consistent with the results shown in Table 4 and Figure 2. The findings provide support for the existence of a positive and significant link between entrepreneurial activities and angel investment in these countries.

Table 6 also shows how the link between entrepreneurial activities and angel investment differs across countries. In Table 6, the odds ratio of entrepreneurial activities and angel investment can be used as a measure that indicates the relative link between entrepreneurial activities and angel investment in each country. For the eight countries, we find that the odds ratios of entrepreneurial activities and angel investment are greater than one in all these countries. In particular, the odds ratio of entrepreneurial activities and angel investment in Japan is over 5, while the odds ratio in Spain is under 3. As shown in column (iii) of Table A2, the cross term of entrepreneurship and the dummy for Japan is significant and positive. The findings indicate that individuals who have experience in entrepreneurial activities in Japan are more likely to invest in new businesses, and that the odds ratio of entrepreneurial activities and angel investment in Japan is greater than in the other countries. While the proportion of individuals who engage in angel investment in Japan is much lower, the link between entrepreneurial activities and angel investment in Japan is greater than in the other countries.

To clarify the relationship between the entrepreneurship–investment link and new firm creation by country, Figure 2 describes the entrepreneurship–investment link, measured by the estimated odds ratios of *ENTRE* and *BUSANG* in the regression model, and new firm creation. To show economic development in the countries, we provide information on gross domestic product (GDP) per capita in Figure 2. The mean of *BSTART* is lower in Japan and some European countries, such as Belgium, Demark, Finland, Germany, Italy, Spain, Sweden, and the UK. Among these countries, Japan and Belgium are located in the lower right corner, while Finland, Italy, Spain, and Sweden are located in the lower left corner of Figure 2. The results indicate that although business start-ups are inactive in Japan, the link between entrepreneurial activities and angel investment in Japan is much greater than in other countries. The findings suggest that the entrepreneurship–investment link is much greater even in countries with a lower level of new firm creation, such as Japan, implying that entrepreneurial communities are limited to special individuals within a narrow network in the countries.

More interestingly, we find that educational level is not significantly related to angel investment in Japan, while a significant relationship for graduate education is found in the other countries. The results reveal that individuals with higher educational levels in Japan are not likely to engage in angel investment, which differs from the results shown in the other countries. The results indicate that individuals with higher educational levels in Japan have less incentive to invest in new businesses. Furthermore, we find that the odds ratio of age and angel investment in Japan is greater than one, which is also larger than in the other countries. The results indicate that older individuals in Japan tend to invest in new businesses.

#### 4.3. Additional estimation: average level of angel investment

For robustness check, we capture the aggregate level of entrepreneurial activities and angel investment in each country and examine the relationship between entrepreneurial activities and angel investment by constructing the aggregate variables.<sup>10</sup> To do so, we calculate the means of entrepreneurial activities and angel investment by country and year. More precisely, we construct the data set of country–year observations, based on the proportions of individuals who engage in entrepreneurial activities or angel investment. This data set, which is unbalanced panel data, consists of 280 country–year observations. Using the means of entrepreneurial activities and angel investment (*AV\_BUSANG*), and the independent variable is the mean of angel investment (*AV\_ENTRE*). Instead of *AV\_ENTRE*, we also use the means of new firm creation (*AV\_BSTART*) and owning and managing a business (*AV\_OWNMGE*).

Table 7 provides the estimation results (coefficients) for the aggregate level of angel investment. While we measure entrepreneurship by *AV\_ENTRE* in columns (i)–(iii), we include *AV\_BSTART* and *AV\_OWNMGE*, instead of *AV\_ENTRE*, in columns (iv)–(vi). To estimate the relationship between entrepreneurial activities and angel investment, we use pooled ordinal least square (OLS), random-effects, and fixed-effects models.

In Table 7, we find that the coefficients of entrepreneurship are positive and significant for angel investment. We also find similar results, regardless of the estimation method used. The country-year estimation results indicate that the proportion of

<sup>&</sup>lt;sup>10</sup> In the above estimation, we ignore the causality between entrepreneurial activities and angel investment because we cannot identify whether individuals who already have experience in entrepreneurial activities engage in angel investment after that, using data from the GEM. Additionally, it is possible that individuals who do not have experience in entrepreneurial activities play a role in angel investment in entrepreneurial ecosystems. In this subsection, we thus identify the relationship between the average levels of entrepreneurial activities and angel investment in each country.

individuals who engage in angel investment is higher in countries where the proportion of individuals who have experience in entrepreneurial activities is high. The findings suggest that angel investment is more active in countries with a higher level of entrepreneurial activities. In particular, angel investment is more prevalent in countries where starting a new business, rather than owing and managing a business, is more active.

# 5. Conclusions

This study explored the link between the probabilities of becoming an entrepreneur and an angel investor using data from the GEM. We presented the estimation results for the odds ratio of entrepreneurial activities and angel investment. The results revealed the existence of a positive and significant link between entrepreneurial activities and angel investment, indicating that individuals who have experience in entrepreneurial activities are more likely to invest in new businesses. Moreover, we found that the link between entrepreneurial activities and angel investment differs across countries. Specifically, the proportion of individuals who engage in angel investment in Japan, where the debt-financing system is well established, is much lower than in other OECD countries. However, the link between entrepreneurial activities and angel investment in Japan is greater than in other countries. Furthermore, the results showed that individuals with higher educational levels are less likely to engage in angel investment in Japan.

In this study, we contribute to the literature on entrepreneurship by proposing the use of the odds ratio of entrepreneurial activities and angel investment, which may reflect the extent of entrepreneurial ecosystems at the country level. Using the sample of individuals in 30 OECD countries, we empirically provided evidence that individuals who have experience in entrepreneurial activities, including new firm creation, are more likely to invest in new businesses. Presumably, such individuals play a pivotal role in angel investment because they not only have knowledge and skills about new businesses but also understand the importance of start-up firms stemming from entrepreneurship in the economy. In particular, entrepreneurs with successful business experiences are expected to serve as connoisseurs in new businesses paving the way for the creation of next-generation businesses. While the odds ratio proposed in this study is useful for understanding the link between entrepreneurial activities and angel investment in entrepreneurial ecosystems at the country level, this measure represents the link between non-entrepreneurial activities and non-angel investment. In other words, higher odds ratio indicates that many individuals do not participate in either entrepreneurial activities or angel investment in the country. According to Small and Medium Enterprise Agency (2017), the proportion of individuals with no interest in business start-ups in Japan is higher than in western countries. In this respect, our findings suggest that the majority of Japanese individuals have less interest in entrepreneurial communities. If policymakers seek to increase business start-ups, it may be important to promote more opportunities to participate in entrepreneurial communities in Japan. In particular, it is favorable if individuals with higher educational levels participate in entrepreneurial ecosystems for the promotion of start-up firms with growth potential.

As discussed, it is well recognized that Japan is characterized by a lower level of entrepreneurship (e.g., Honjo, 2015; Small and Medium Enterprise Agency, 2017). This study also provided empirical evidence on the lower proportion, as compared to other OECD countries, not only of individuals with entrepreneurial activities, but also of angel investors in Japan. The lower level of angel investment may, in part, originate from economic conditions on the flow of funds whereby households' assets are cycled into debt financing based on banks' credit; that is, individuals tend to deposit household savings to banks. Our findings imply that the flow of funds through equity capital is significantly associated with entrepreneurial activities in countries, and such association may generate robust entrepreneurial ecosystems. In this study, the link between entrepreneurial activities and angel investment is found to be significant in Japan. If the flow of funds shifts to individuals' investment, it may be possible for entrepreneurial ecosystems to be more developed in Japan.

# Appendix

Table A1 shows the list of countries in our sample. Tables A2 and A3 show the estimation results for the coefficients, which correspond to Tables 5 and 6, respectively.

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Table 1

Definitions of variables

Variable	Symbol	Definition
(Individual observation	ıs)	
Angel investment	BUSANG	1: if the individual is, in the past three years, personally provided funds for a new business started by someone else, excluding any purchases of stocks or mutual funds; 0: otherwise.
Entrepreneurial activities	BSTART	1: if the individual is, alone or with others, currently trying to start a new business, including any self-employment or selling any goods or services to others; 0: otherwise.
	OWNMGE	1: if the individual is, alone or with others, currently the owner of a company you help manage, self-employed, or selling any goods or services to others; 0: otherwise.
	ENTRE	1: if <i>BSTART</i> =1 or <i>OWNMGE</i> =1; 0: otherwise.
Age	AGE	Current age (in years).
	ln <i>AGE</i>	Logarithm of <i>AGE</i> .
Gender	FEMAIL	1: if the individual is female; 0: if the individual is male.
Education	U_EDUC	1: if the individual has post-secondary experience (undergraduate education); 0: otherwise.
	G_EDUC	1: if the individual has graduate experience (graduate education); 0: otherwise.
(Country-year observa	tions)	
Average level of angel	AV_BUSANG	Ratio of individuals for <i>BUSANG</i> = 1.
investment		
Average level of	AV_BSTART	Ratio of individuals for <i>BSTART</i> = 1.
entrepreneurship	AV_OWNMGE	Ratio of individuals for <i>OWNMGE</i> = 1.
	AV ENTRE	Ratio of individuals for <i>ENTRE</i> = 1.

Variable	Mean	SD	25%	Median	75%
BUSANG	0.033				
ENTRE	0.158				
BSTART	0.054				
OWNMGE	0.126				
AGE	41.8	12.8	32.0	42.0	52.0
ln <i>AGE</i>	3.680	0.337	3.466	3.738	3.951
FEMAIL	0.521				
U_EDUC	0.265				
G_EDUC	0.128				

Table 2 Summary statistics of variables

Notes: SD indicates standard deviation. The number of observations is 1058114.

		BUSANG					
		No	Yes	Total	%	OR	$\chi^2$
ENTRE	No	870651	153023	1023674	0.150	3.833	16060***
	Yes	20577	13863	34440	0.403		
	Total	891228	166886	1058114	0.158		
BSTART	No	973161	50513	1023674	0.188	4.461	12572***
	Yes	27965	6475	34440	0.049		
	Total	1001126	56988	1058114	0.054		

Table 3 Cross table of entrepreneurial activities and angel investment

Notes: % indicates the ratio of *BUSANG* (Yes) to the total number. OR indicates the odds ratio.  $\chi^2$  is a test statistic that the odds ratio is 1.

	BUSANG	ENTRE		BSTART	
Country	Mean	Mean	OR	Mean	OR
Australia	0.028	0.222	2.786	0.070	2.535
Austria	0.036	0.175	2.845	0.063	3.755
Belgium	0.024	0.104	6.409	0.042	6.650
Canada	0.039	0.204	4.912	0.101	3.807
Czech Republic	0.074	0.197	3.088	0.101	3.462
Denmark	0.025	0.117	4.848	0.033	4.595
Finland	0.030	0.160	3.175	0.039	3.703
France	0.033	0.109	3.943	0.057	4.206
Germany	0.033	0.155	3.411	0.065	3.591
Greece	0.028	0.238	2.235	0.058	2.876
Hungary	0.024	0.145	4.654	0.050	5.404
Iceland	0.070	0.247	4.463	0.077	3.312
Ireland	0.029	0.182	4.117	0.067	4.430
Italy	0.020	0.117	3.276	0.035	3.864
Japan	0.010	0.113	7.327	0.028	6.888
Republic of Korea	0.035	0.237	2.320	0.071	3.526
Luxemburg	0.050	0.142	4.085	0.103	3.621
Mexico	0.067	0.232	5.304	0.153	4.741
Netherlands	0.024	0.148	4.203	0.349	5.005
New Zealand	0.048	0.284	4.138	0.117	3.775
Norway	0.044	0.171	4.656	0.060	4.624
Poland	0.031	0.192	4.076	0.079	3.977
Portugal	0.022	0.177	4.798	0.062	5.058
Slovakia	0.073	0.267	2.427	0.152	2.503
Spain	0.030	0.140	2.681	0.037	3.551
Sweden	0.027	0.117	3.429	0.027	4.007
Switzerland	0.044	0.183	2.850	0.059	3.361
Turkey	0.105	0.249	2.514	0.099	2.795
UK	0.013	0.127	5.307	0.037	5.774
US	0.047	0.230	4.116	0.123	3.647

Table 4Entrepreneurial activities and angel investment by country

Notes: OR indicates the odds ratio. For the number of observations by country, see Table A1.

	(i)	(ii)	(iii)
Variable	All	All	All
ENTRE	3.135***		3.814***
	(0.037)		(0.177)
BSTART		2.618***	
		(0.042)	
OWNMGE		2.394***	
		(0.031)	
ln <i>AGE</i>	1.119***	1.168***	1.114***
	(0.020)	(0.021)	(0.020)
FEMALE	0.658***	0.657***	0.659***
	(0.008)	(0.008)	(0.008)
U_EDUC	1.389***	1.382***	1.382***
	(0.018)	(0.018)	(0.018)
G_EDUC	1.705***	1.695***	1.693***
	(0.029)	(0.028)	(0.028)
Japan	0.273***	0.294***	0.230***
	(0.019)	(0.020)	(0.021)
France	0.935	0.989	0.990
	(0.042)	(0.045)	(0.056)
Germany	0.890***	0.929**	0.981
	(0.028)	(0.030)	(0.042)
Italy	0.586***	0.628***	0.651***
	(0.030)	(0.032)	(0.041)
Netherlands	0.641***	0.692***	0.662***
	(0.028)	(0.030)	(0.038)
Spain	0.819***	0.898***	0.968
	(0.022)	(0.024)	(0.035)
UK	0.378***	0.403***	0.358***
	(0.012)	(0.013)	(0.016)
Other country dummies	Yes	Yes	Yes
$ENTRE \times$ Japan			1.659***
			(0.227)
$ENTRE \times$ France			0.937

Table 5Estimation results (odds ratios) for angel investment: all countries

			(0.090)
$ENTRE \times$ Germany			0.814***
			(0.052)
$ENTRE \times$ Italy			0.792***
			(0.086)
$ENTRE \times$ Netherlands			0.966
			(0.085)
$ENTRE \times Spain$			0.649***
			(0.034)
$ENTRE \times UK$			1.229***
			(0.077)
<i>ENTRE</i> $\times$ Other country dummies	No	No	Yes
Year dummies	Yes	Yes	Yes
Ν	1058114	1058114	1058114
Log likelihood	-139451	-138964	-139152
LR statistics	24760***	25735***	25359***

Notes: Standard errors are in parentheses. \*\*\*, \*\*, and \* indicate the 1%, 5%, and 10% significance levels, respectively. *N* indicates the number of observations. The dependent variable is *BUSANG*.

	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)
Variables	Japan	France	Germany	Italy	Netherlands	Spain	UK	US
ENTRE	5.549***	3.216***	3.002***	3.046***	3.384***	2.501***	4.600***	3.922***
	(0.743)	(0.276)	(0.137)	(0.308)	(0.262)	(0.066)	(0.201)	(0.184)
ln <i>AGE</i>	2.752***	1.187	1.706***	1.579***	1.033	1.318***	1.070	0.728***
	(0.685)	(0.139)	(0.121)	(0.237)	(0.125)	(0.051)	(0.075)	(0.051)
FEMALE	0.736**	0.548***	0.629***	0.719***	0.568***	0.748***	0.629***	0.641***
	(0.101)	(0.044)	(0.028)	(0.066)	(0.044)	(0.018)	(0.027)	(0.031)
U_EDUC	1.310*	1.630***	1.433***	1.841***	1.942***	1.507***	1.082	1.362***
	(0.189)	(0.145)	(0.068)	(0.274)	(0.154)	(0.043)	(0.059)	(0.076)
G_EDUC	1.183	1.862***	2.182***	1.676***	2.331***	1.661***	2.037***	1.762***
	(0.249)	(0.220)	(0.254)	(0.206)	(0.319)	(0.058)	(0.107)	(0.115)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Ν	23810	21983	68833	25839	32711	246886	180592	43115
LR statistics	276***	474***	1053***	199***	558***	1826***	1733***	1114***

# Table 6Estimation results (odds ratios) for angel investment in the eight countries

Notes: Standard errors are in parentheses. \*\*\*, \*\*, and \* indicate the 1%, 5%, and 10% significance levels, respectively. N indicates the number of observations. The dependent variable is

BUSANG. The observation period for each country is shown in Table.

Estimation result	Estimation results (coefficients) for the average level of anger investment								
	(i)	(ii)	(iii)	(iv)	(v)	(vi)			
Variable	OLS	RE	FE	OLS	RE	FE			
AV_ENTRE	0.206***	0.204***	0.203***						
	(0.019)	(0.025)	(0.026)						
AV_BSTART				0.303***	0.274***	0.259***			
				(0.027)	(0.030)	(0.035)			
AV_OWNMGE				0.077***	0.088***	0.096***			
				(0.026)	(0.033)	(0.032)			
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes			
Ν	280	280	280	280	280	280			
R <sup>2</sup>	0.464	0.463	0.463	0.554	0.504	0.504			

Estimation results (coefficients) for the average level of angel investment

Table 7

Notes: Robust standard errors are in parentheses. \*\*\*, \*\*, and \* indicate the 1%, 5%, and 10% significance levels, respectively. *N* indicates the number of observations. R<sup>2</sup> indicates within R squared in columns (ii), (iii), (v), and (vi). OLS, RE, and FE indicate pooled OLS, random-effects, and fixed-effects models, respectively. The dependent variable is *AV\_BUSANG*. The number of countries is 30.

Table A1 List of countries in the sample

Country	Observation years	N
Australia	2002–2006, 2010, 2011	13,390
Austria	2005, 2007, 2012	8,474
Belgium	2001–2013	31,388
Canada	2001–2003, 2006, 2013	8,277
Czech Republic	2006, 2011, 2013	8,509
Denmark	2001-2012	31,449
Finland	2001-2013	24,018
France	2001-2013	21,983
Germany	2001–2006, 2008–2013	68,833
Greece	2003-2013	21,749
Hungary	2001, 2002, 2004–2013	25,410
Iceland	2002-2010	16,674
Ireland	2001–2008, 2010–2013	21,529
Italy	2001–2010, 2012, 2013	25,839
Japan	2001-2013	23,810
Republic of Korea	2001, 2002, 2008–2013	15,535
Luxemburg	2013	1,888
Mexico	2001, 2002, 2005, 2006, 2008, 2010–2013	18,699
Netherlands	2001–2013	32,711
New Zealand	2001-2005	7,276
Norway	2001–2006, 2008–2013	21,316
Poland	2001, 2002, 2004, 2011–2013	12,895
Portugal	2001, 2004, 2007, 2010–2013	11,243
Slovakia	2011-2013	5,915
Spain	2001-2013	246,886
Sweden	2001–2007, 2010–2013	42,710
Switzerland	2002, 2003, 2005, 2007, 2009–2013	18,859
Turkey	2006–2008, 2010–2013	47,142
UK	2001-2013	180,592
US	2001–2013	43,115

	(i)	(ii)	(iii)
Variable	All	All	All
ENTRE	1.143***		1.339***
	(0.012)		(0.046)
BSTART		0.963***	
		(0.016)	
OWNMGE		0.873***	
		(0.013)	
ln <i>AGE</i>	0.112***	0.155***	0.108***
	(0.018)	(0.018)	(0.018)
FEMALE	-0.418***	-0.420***	-0.417***
	(0.012)	(0.012)	(0.012)
U_EDUC	0.328***	0.323***	0.323***
	(0.013)	(0.013)	(0.013)
G_EDUC	0.534***	0.528***	0.527***
	(0.017)	(0.017)	(0.017)
Japan	-1.297***	-1.225***	-1.471***
	(0.068)	(0.068)	(0.093)
France	-0.067	-0.011	-0.010
	(0.045)	(0.045)	(0.057)
Germany	-0.116***	-0.074**	-0.019
	(0.032)	(0.032)	(0.043)
Italy	-0.534***	-0.465***	-0.429***
	(0.051)	(0.051)	(0.063)
Netherlands	-0.445***	-0.369***	-0.412***
	(0.044)	(0.044)	(0.058)
Spain	-0.200***	-0.107***	-0.032
	(0.027)	(0.027)	(0.036)
UK	-0.972***	-0.908***	-1.028***
	(0.032)	(0.032)	(0.044)
Other country dummies	Yes	Yes	Yes
$ENTRE \times Japan$			0.506***
			(0.137)
$ENTRE \times$ France			-0.065

Table A2Estimation results (coefficients) for angel investment: all countries

			(0.096)
$ENTRE \times$ Germany			-0.206***
			(0.064)
$ENTRE \times$ Italy			-0.233**
			(0.109)
$ENTRE \times$ Netherlands			-0.034
			(0.088)
$ENTRE \times Spain$			-0.432***
			(0.053)
$ENTRE \times UK$			0.206***
			(0.063)
<i>ENTRE</i> $\times$ Other country dummies	No	No	Yes
Year dummies	Yes	Yes	Yes
Ν	1058114	1058114	1058114
Log likelihood	-139451	-138964	-139152
LR statistics	24760***	25735***	25359***

Notes: Standard errors are in parentheses. \*\*\*, \*\*, and \* indicate the 1%, 5%, and 10% significance levels, respectively. *N* indicates the number of observations. The dependent variable is *BUSANG*.

	a) for anger mye		eveloped coulie	100				
	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)
Variables	Japan	France	Germany	Italy	Netherlands	Spain	UK	US
BSTART	1.714***	1.168***	1.099***	1.114***	1.219***	0.917***	1.526***	1.367***
	(0.134)	(0.086)	(0.046)	(0.101)	(0.077)	(0.026)	(0.044)	(0.047)
ln <i>AGE</i>	1.012***	0.172	0.534***	0.457***	0.032	0.276***	0.068	-0.317***
	(0.249)	(0.117)	(0.071)	(0.150)	(0.121)	(0.038)	(0.070)	(0.070)
FEMALE	-0.307**	-0.602***	-0.464***	-0.330***	-0.566***	-0.290***	-0.464***	-0.445***
	(0.137)	(0.080)	(0.044)	(0.092)	(0.077)	(0.024)	(0.044)	(0.048)
U_EDUC	0.270*	0.489***	0.360***	0.610***	0.664***	0.410***	0.079	0.309***
	(0.145)	(0.089)	(0.048)	(0.149)	(0.079)	(0.029)	(0.055)	(0.056)
G_EDUC	0.168	0.622***	0.780***	0.516***	0.846***	0.507***	0.711***	0.567***
	(0.211)	(0.118)	(0.117)	(0.123)	(0.137)	(0.035)	(0.053)	(0.066)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	23810	21983	68833	25839	32711	246886	180592	43115
LR statistics	276***	474***	1053***	199***	558***	1826***	1733***	1114***

# Table A3Estimation results (coefficients) for angel investment: some developed countries

Notes: Standard errors are in parentheses. \*\*\*, \*\*, and \* indicate the 1%, 5%, and 10% significance levels, respectively.



Figure 1 Mean of angel investment by country

Source: Authors' elaboration based on the APS.

# Figure 2





Source: Authors' elaboration based on the APS and the website of OECD.

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Notes: Entrepreneurship–investment link is measured by the estimated odds ratio of *ENTRE* and *BUSANG* in the regression model. New firm creation is measured by the mean of *BSTART*. The colors of markers indicate GDP per capita in 2014.