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The Penrose effect in the internationalization of professional service firms: an analysis of Japanese patent firms

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Abstract

Purpose – The Penrose effect, or the limitation of the growth rate during expansion due to managerial constraints, has been examined in the context of business diversification, withdrawal and MNE's foreign direct investment, primarily in the for-profit sector. However, insufficient attention has been paid to its impact on professional service firms, particularly in the context of their expansion through service exports. The main purpose of this study is to examine the Penrose effect in the internationalization of professional service firms through service exports.

Design/methodology/approach – This study focuses on large Japanese patent firms as traditional professional service firms and constructs panel data for 48 large patent firms over the observation period from 2002 to 2010 to test our hypotheses.

Findings – Our results demonstrate a negative relationship between degree of internationalization and international business growth, thus confirming the Penrose effect. Furthermore, we found that the degree of internationalization has a curvilinear relationship with international business growth and that institutional distance does not have a negatively moderating effect on the relationship between the degree of internationalization and international business growth.

Originality/value – This study made a theoretical contribution to Penrose's growth theory and previous studies on international management and professional service firms and international management by showing that the Penrose effect can be observed in the international expansion of professional service firms

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through service exports. Moreover, this study identifies the factors that modify the Penrose effect, thereby making a significant theoretical contribution.

Keywords Penrose effect, Managerial resources, Cross-border service exports, Degree of internationalization, Institutional distance, Patent firms

Paper type Research paper

Introduction

International expansion is one of the main growth strategies for firms (Ansoff, 1965; Capar and Kotabe, 2003; Hitt *et al.*, 2006). Among the various possible modes of international expansion, entering foreign markets via exporting is the most basic method (Chen *et al.*, 2016; Léo and Philippe, 2001). Exporting is an initial step to internationalization not only for manufacturing and service industry firms, but also for firms in professional service industries (Meyer *et al.*, 2015). As their clients expand internationally, professional service firms (hereafter, PSFs) have more opportunities to grow internationally by exporting their services to meet their clients' overseas needs (Contractor *et al.*, 2003; Nachum, 1996; Spar, 1997).

Despite the remarkable growth of PSFs in the global economy (Empson, 2017), the academic community has largely overlooked the crucial area of international expansion through service export-type internationalization (Abdelzaher, 2012; Budeva and Baumgarten, 2021; Hitt *et al.*, 2006; Netland and Alfnes, 2007) [1]. With the exception of a few existing studies, prior research on the international expansion of PSFs has focused on service MNE-type internationalization (Hitt *et al.*, 2006; Kor and Leblebici, 2005; Nachum and Song, 2011; Powell, 2014), neglecting the distinct phenomenon of service export-type internationalization (Meyer *et al.*, 2015). However, it is of utmost importance to recognize and emphasize the significant scholarly implications and field-wide impact of service export-type internationalization.

Service MNE-type internationalization is characterized by the establishment of a subsidiary in the host country and the provision of services through that subsidiary (Abdelzaher, 2012; Netland and Alfnes, 2007; Powell, 2014). With service export-type internationalization, on the other hand, services are provided across borders, with the service provider remaining in its home country. The difference between providing services through exporting versus an overseas subsidiary can be expected to be significant, as different modes of international expansion are associated with different levels of complexity in coping with foreign business environments (Ahmad, 2013; Herrmann and Datta, 2006; Lin *et al.*, 2021; Powell, 2014).

In particular, service export-type internationalization represents a critical dimension within the internationalization strategies of PSFs. This distinctive mode of international expansion warrants thorough investigation and scholarly attention due to its inherent complexities, unique challenges, and potential implications for firms operating in foreign business environments. The primary purpose of this paper is to examine the Penrose effect in the internationalization of service-exporting PSFs.

Penrose suggested a variety of insightful ideas that lead to the latest research, for example, the conditions of MNCs' internationalization (Ciravegna *et al.*, 2023; Donnelly *et al.*, 2024; Jiang *et al.*, 2022), managers' attention (Boynton, 2024), managerial capabilities (Kor and Tan, 2023; Ye *et al.*, 2021; von Nitzsch *et al.*, 2024), slack resources (Mousa *et al.*, 2023). Among these, the Penrose Effect, defined as "the managerial constraint on the rate of growth of a firm" (Lin *et al.*, 2021; Penrose, 1959; Tan and Mahoney, 2007), illustrates how internal managerial limitations can throttle a firm's expansion, despite external opportunities (Breuillot *et al.*, 2024; Lin *et al.*, 2021; Mohr *et al.*, 2018; Safón and Iborra, 2023). The Penrose Effect is particularly significant as it represents one of the earliest discussions on the impact of changes in management resources over time within the context of internationalization (Tan *et al.*, 2020). This seminal concept has remained relevant and continues to be widely applied in contemporary international business research, highlighting its enduring influence on the understanding of firm growth and expansion in global markets (Lin *et al.*, 2021; Tan and

Mahoney, 2007). By addressing this phenomenon, researchers and practitioners can gain valuable insights into the managerial factors impeding a firm's expansion and develop strategies to overcome these obstacles.

In the context of internationalization, as firms enter unfamiliar foreign markets that differ from their home markets, managerial resources become strained as managers have to spend time and effort dealing with the complexity of operating in unfamiliar foreign environments. As a result, firms' growth rates are likely to decline (Penrose, 1959; Tan *et al.*, 2020). In PSFs, a limited number of partners comprise the firm's managerial resources (Kim *et al.*, 2016; Maister, 1993; Smith *et al.*, 2011), meaning that managerial resources are easily exhausted when partners take on additional duties. For this reason, we expect that the Penrose effect will be observed in service-exporting PSFs as they internationalize. Accordingly, we test the hypothesis that, for service-exporting PSFs, there is a negative relationship between degree of internationalization and international business growth (Hutzschenreuter *et al.*, 2011; Mohr *et al.*, 2018; Tan *et al.*, 2020).

We also investigate two related issues. First, we expect the Penrose effect to weaken as the firm's degree of internationalization increases. This is because the strain on managerial resources is likely to be relieved as strategy, organizational structure and routines, and organizational reputation for exporting services are developed and as managers become more experienced at serving overseas clients (Blomstermo *et al.*, 2004; Hutzschenreuter and Horstkotte, 2013; Penrose, 1959; Steen and Liesch, 2007). Second, we expect "institutional distance"—the degree of difference between the institutional contexts of the home country and overseas markets—to negatively moderate the relationship between degree of internationalization and international business growth (Hutzschenreuter *et al.*, 2011; Mohr *et al.*, 2018; Tan and Mahoney, 2007). That is, we expect institutional distance to strengthen the Penrose effect.

The sample we used to test these hypotheses consists of 48 large Japanese patent firms, from which we collected data for the years 2002–2010. We chose these firms as our sample for two reasons. First, patent firms, unlike large corporate law firms, internationalize their business through service exports (Nachum and Song, 2011). Second, during the observation period, Japanese patent firms had a strong incentive to increase business with foreign clients because the number of patent applications filed by domestic (Japanese) clients was increasing at a slower rate than it had in the past (Fink *et al.*, 2016).

The contributions of our research may be summarized as follows. First, we studied the international expansion of service-exporting PSFs (Mayer *et al.*, 2015), while prior studies have investigated only MNE-type PSFs (Hitt *et al.*, 2006; Kor and Leblebici, 2005). We found that the Penrose effect is observed in the international expansion of service-exporting PSFs, as it is in the international expansion of MNE-type PSFs. Second, we found that the relationship between degree of internationalization and international business growth is curvilinear; that is, the Penrose effect weakens as the degree of internationalization increases. No prior studies, to our knowledge, have confirmed that the Penrose effect varies with the firm's degree of internationalization. Third, we found that greater institutional distance does not intensify the Penrose effect. This implies that service-exporting PSFs are better able to overcome the challenges of institutional distance than MNE-type PSFs. This may be because they have less direct exposure to the local environment, do not incur the costs of coordination with overseas offices, and are more likely to deploy existing home country-based resources to serve foreign clients, compared with MNE-type PSFs.

The rest of this paper is structured as follows. In Section 2, we review previous research on international expansion through service exports and the Penrose effect, and develop our hypotheses. Sections 3 and 4 present our research methods and results, respectively. Section 5 presents our conclusions and suggests directions for future research.

Literature review and hypothesis development

The Penrose effect in service-exporting PSFs

The Penrose effect states that the growth rate of a firm is constrained by the amount of managerial resources it has available. The logic of the effect is that a firm that expands significantly in one period will use up managerial resources in doing so, and will therefore have fewer available managerial resources to devote to expansion in the subsequent period (Lin *et al.*, 2021; Mintzberg and Waters, 1982; Penrose, 1959). For example, when a firm grows by entering a new market or introducing a new product, its managers must deal with new complexities in planning and implementing strategy (Ahmad, 2013; Hutzschenreuter and Horstkotte, 2013; Vidal and Mitchell, 2018). Dealing with such new complexities consumes managerial time and effort, which reduces the amount of managerial resources available for growth; thus, the firm's growth rate slows (Mintzberg and Waters, 1982; Penrose, 1959; Tan *et al.*, 2020). The Penrose effect has been expanded to explain international business growth (Goerzen and Beamish, 2007; Mohr *et al.*, 2018; Tan *et al.*, 2020).

Prior studies have shown that the Penrose effect applies when MNE-type service providers expand internationally (Hutzschenreuter *et al.*, 2011; Hutzschenreuter and Horstkotte, 2013; Lin *et al.*, 2021). Mohr *et al.* (2018) posit that the Penrose effect will also be observed in the international expansion of service exporters, as serving clients in unfamiliar foreign markets consumes a greater amount of managerial resources. The effect is expected to be particularly salient in the case of service-exporting PSFs, because the managerial team—those responsible for developing and implementing growth strategies—consists of a limited number of partners (Hitt *et al.*, 2006; Kim *et al.*, 2016; Kor and Leblebici, 2005). As it takes PSFs considerable time to train internal associates as partners (Maister, 2004), the managerial resources of PSFs are not easily expanded, and are therefore easily exhausted. Because international expansion through service exports is more complex than carrying out existing domestic operations, it requires more time and effort from partners. For these reasons, the Penrose effect is expected to be observed in service-exporting PSFs, as it is in MNE-type PSFs.

We first examine the Penrose effect in service-exporting PSFs by testing the relationship between a firm's degree of internationalization and its international business growth. We then test two related hypotheses, on the strength of the Penrose effect over time and the moderating effect of institutional distance.

Degree of internationalization and the Penrose effect

Degree of internationalization refers to the extent to which a firm is involved in foreign operations (Sullivan, 1994). Patent firms—the target of our study—internationalize their business by exporting services. Thus, below, when we refer to internationalization, we mean internationalization through exports. As explained below in Section 3, we operationalize degree of internationalization as the ratio of foreign clients to all clients.

As mentioned above, the managerial resources of service-exporting PSFs are limited to the firm's partners, who are few in number and can increase only slowly. When a PSF begins to internationalize, its partners must invest time and effort into developing international strategies and acquiring knowledge about foreign clients and markets, including organizational structures, business strategies, and financial conditions (Brymer *et al.*, 2020; Hydle and Brock, 2020). Not all needed information is publicly available (Uzzi and Lancaster, 2003, 2004), so in order to access non-public information partners must build trust with foreign clients or their representatives (Brock and Alon, 2009). These activities consume a significant amount of managerial resources.

Partners must also invest time and effort in establishing internal organizational infrastructure for exporting services to new markets (Hitt *et al.*, 2006; Kor and Leblebici, 2005). This includes two main tasks. The first is reallocating and developing human resources so they can effectively provide services to overseas clients (Brymer *et al.*, 2020; Hydle and Brock,

2020). For service-exporting PSFs, greater internationalization requires the retraining of existing professionals and the recruitment of new professionals. The second task is redesigning the organizational structure to better fit the requirements of internationalized operations. In order to gain the benefits of job specialization, firms may need to establish an international business department to operate alongside the domestic business (Chandler, 1977; Lawrence and Lorsch, 1967). This reworking of organizational structure and workplace teams also consumes significant managerial resources.

In addition to the above, partners must also invest time and effort into building reputational capital in target overseas markets. Firm reputation is often not transferable across borders (Brymer *et al.*, 2020). Reputation is especially important for PSFs, however, as the quality of professional services cannot be evaluated in advance (Lu *et al.*, 2012). Firm reputation, therefore, functions as significant signal for the initiation of transactions (Castaldi and Giarratana, 2018; Kor and Leblebici, 2005). To build reputational capital, partners need to build personal ties and trust with foreign clients and their local representatives (Adler and Kwon, 2002; Podolny, 1993; Steen and Liesch, 2007). This process takes partners' time and effort.

To summarize, service-exporting PSFs have limited managerial resources to begin with—primarily the firm's partners—and when they undertake internationalization these managers must expend significant time and effort in acquiring knowledge about foreign clients and markets, developing human resources and redesigning organizational structure, and building reputational capital (Eckardt and Skaggs, 2018; Kim *et al.*, 2016; Kor and Leblebici, 2005; Maister, 1993). This depletes the firm's available managerial resources, and is therefore expected to slow the rate of business growth. This leads to our first hypothesis:

H1. For service-exporting PSFs, the relationship between degree of internationalization and international business growth is negative.

Curvilinear nature of the Penrose effect

As described above, the process of internationalizing involves dedicating managerial resources to gathering information on international markets and formulating international strategies, redesigning organizational structure and hiring and training personnel for international operations, and building reputational capital overseas. These tasks, once completed, will enable firms to operate the international side of their business more efficiently (Bingham and Eisenhardt, 2011; Pedersen and Shaver, 2011; Steen and Liesch, 2007).

First, the knowledge of overseas clients and markets accumulated in the internationalization process enables firms to develop more effective international strategies, promoting international business growth (Bingham and Eisenhardt, 2011; Brock and Yaffe, 2008; Kano, 2023). Second, the establishment of a division of labor, by hiring and training professionals to specialize in the international side of the business and establishing a dedicated department in charge of international operations, increases efficiency and relieves management of the need to divert time and attention to internationalization (Kang *et al.*, 2012; Mohr *et al.*, 2018; Steen and Liesch, 2007). Third, once reputational capital is established in export markets, firms can expect a steady stream of overseas clients, lessening the need to devote time and effort to cultivating new clients from scratch (Adler and Kwon, 2002; Podolny, 1993). Thus, as they accumulate international experience, firms develop routines that enable them to operate their international business efficiently and grow their overseas client base more easily, reducing the negative Penrose effect on international business growth (Blomstermo *et al.*, 2004; Hadley and Wilson, 2003; Johanson and Vahlne, 1977).

In addition, as Penrose pointed out, managerial resources can be expected to increase as firms expand internationally, as current managers (partners) become more proficient at the tasks associated with internationalization (Penrose, 1959; Tan *et al.*, 2020; Tan and Mahoney, 2007), and as growth of the business allows for new partners to be added and/or for partners or

associates to be reallocated to focus on the international side of the business (Briscoe and Rogan, 2016). Thus, the experience and learning that result from expansion in one period can contribute to an increase in managerial resources in subsequent periods (Bingham and Eisenhardt, 2011; Hutzschenreuter and Horstkotte, 2013; Kano, 2023; Tan *et al.*, 2020). This can be expected to counteract the Penrose effect, to some degree, as internationalization proceeds.

In sum, as PSFs accumulate experience in exporting their services, they are able to leverage the strategic, organizational, and reputational assets they have developed during the internationalization process so that they can carry out their international business using fewer managerial resources (Bingham and Eisenhardt, 2011; Blomstermo *et al.*, 2004; Mayer *et al.*, 2015). This leaves more managerial resources available for subsequent internationalization. Hence, the effect of internationalization on international business growth is expected to vary depending on the stage of internationalization (Boehe and Jiménez, 2016; Lo *et al.*, 2023). This leads to our second hypothesis:

H2. For service-exporting PSFs, the relationship between degree of internationalization and international business growth is curvilinear, with increasing internationalization weakening the Penrose effect over time.

The moderating effect of institutional distance on the Penrose effect

Degree of internationalization, discussed in the previous section, does not fully take into account differences between countries (Sullivan, 1994). The construct of institutional distance can be used to capture the complexity that arises from differences between countries (Kostova *et al.*, 2020). Institutional distance refers to 'the extent of similarity or dissimilarity between the regulatory, cognitive, and normative institutions of two countries' (Battistuzzo and Ogasavara, 2023; Chang and Ogasavara, 2021; Xu and Shenkar, 2002). Differences in legal systems, in particular, give rise to complexity (Greenwood *et al.*, 2010). Exporting services to clients in countries where the institutional environment differs significantly from that of the home country increases the complexity that managers must deal with, and consequently consumes managerial time and effort (Kor and Leblebici, 2005; Lin *et al.*, 2021; Pitelis and Verbeke, 2007). This depletes management resources and can thus be expected to strengthen the Penrose effect.

Specifically, exporting to countries with different institutional environments requires acquiring new knowledge about country-specific business practices and intellectual property systems (Brymer *et al.*, 2020; Johanson and Vahlne, 1977; Kor and Leblebici, 2005), and develop strategies and modifying operations to adapt to those practices and systems. It also requires a higher level of partner supervision over associates (Hitt *et al.*, 2006; Kor and Leblebici, 2005), and limits the amount of work that partners can delegate to associates. In addition, associates themselves need time to familiarize themselves with new legal jurisdictions, which reduces the time they have available to assist partners (Kim *et al.*, 2016; Kor and Leblebici, 2005; Smith *et al.*, 2011). This all has the effect of depleting available managerial resources.

Large institutional distance also makes it difficult for potential foreign clients and their local agents to evaluate the quality of professional services, which means that PSF partners have to be highly engaged in maintaining relationships with foreign clients and/or their representatives (Rogan and Mors, 2017). For example, clients from countries with patent systems that differ significantly from that of Japan may not fully appreciate the value of some of the professional services that Japanese patent law firms provide, such as negotiating with the Japan Patent Office. In order to bridge gaps in understanding between PSFs and their overseas clients, partners need to spend time and effort developing and maintaining close relationships with their overseas clients (Brock and Yaffe, 2008). This likewise depletes managerial resources.

To summarize, we expect exporting services to countries with significant institutional differences, particularly in legal systems, to strengthen the Penrose effect (Kostova *et al.*, 2020; Tan and Mahoney, 2007). High institutional distance increases the complexity managers must deal with; this places additional strain on managerial resources, which in turn slows international growth. This leads to our third hypothesis:

H3. For service-exporting PSFs, institutional distance negatively moderates the relationship between degree of internationalization and international business growth; i.e. it strengthens the Penrose effect.

Method

Research setting

Japanese patent firms that serve foreign clients assist those clients with patent applications and registration in Japan. In other words, they act as domestic agents for foreign clients aiming to obtain patents in Japan. Only the legal services cross borders; the patent firm is based in Japan and the foreign clients are based in their home countries. In this way, the services Japanese patent firms provide to their overseas clients are "exports". The WTO's General Agreement on Trade in Services classifies these transactions as "cross-border supply": services delivered by post or electronic means, with the service provider and the client remaining in their respective countries (Meyer *et al.*, 2015; Snape, 1993; Winch, 2014). As noted above, this constitutes a major difference from mega corporate law firms that adopt MNE-type international expansion. While the latter have been the subject of prior research, service-exporting PSFs have received little attention. Thus, this study fills a gap in the research on professional service firms.

To understand the characteristics of the data set, some background information and contextual explanation of the internationalization of these firms over this observation period is provided. During the observation period of this study (from 2002 to 2010), the degree of internationalization (i.e. the percentage of international clients among all clients) has an average value of 0.475 (standard deviation 0.236) and the average number of countries where international applications were accepted is 15.5 (standard deviation 9.6). These figures reflect that the firms have accumulated considerable experience in service exports and are well prepared for internationalization. Furthermore, looking at the type of nationality of clients with whom they export services, the nationalities of their clients during this period were mainly developed countries with a large number of applications, such as the U.S., the UK, France, and Germany. Transactions with these nationalities are, in relative terms, less institutionally distant than those with clients in emerging economies.

Data

The subject of this study is patent firms, which are a classic type of PSF. Specifically, our analysis focuses on Japanese patent law firms. Japan has over a hundred years of experience in the practice of intellectual property law (Nicholas and Shimizu, 2013), and boasts one of the largest numbers of patent applications per year of any country (Fink *et al.*, 2016). As there has been little research on PSFs in Asian countries (Brock, 2021), our study also contributes to general research on PSFs.

Consistent with previous research on the patent industry in other countries (Mawdsley and Somaya, 2018), we chose our sample firms based on two criteria: (1) the total number of patent applications filed by the firm during the observation period, and (2) the number of patent attorneys affiliated with the firm. Our sample is composed of 48 firms that are in the top 100 in Japan in terms of the number of filings and that have at least five patent attorneys [2].

The data used in our analysis were taken from the IIP Patent Database (Goto and Motohashi, 2007), a commercial patent database (HYPAT-i2, provided by Hatsumei-Tsushin Sha), and a directory of patent attorneys published by the Japan Patent Attorney Association. Our dataset comprised approximately 980,000 patents.

The observation period is from 2002 to 2010. As described below, a one-year lag was inserted between the dependent variable and the independent and control variables. As a result, 432 observations were obtained from nine years of data from 48 firms. (Among the data from the 432 observations there were two missing values.)

Due to restrictions on access to the patent attorney registry data imposed by Japan's Personal Information Protection Law, this study's observation period is limited to the years 2002–2010. Furthermore, our methodology employs patent citation counts, necessitating the use of sufficiently time-lapsed data to ensure the citation counts accurately reflect the patents' influence and relevance.

Measures

Dependent variable. The dependent variable is international business growth. Following previous research (Mawdsley and Somaya, 2021) [3], this variable is calculated based on the number of patent applications from foreign clients, using the following formula:

> International business growth = log [the number of patent applications from foreign clients undertaken by a patent firm in year t] − log [the number of patent applications from foreign clients undertaken by a patent firm in year t−1].

Independent variables. Degree of internationalization. Degree of internationalization is measured as the ratio of the number of foreign clients to the total number of clients in the client portfolio of a firm in year t. For example, if a firm has a total of 100 clients in year t, 30 of which are foreign clients, degree of internationalization is 0.3. After centering this variable, we create the squared term to test the hypothesis of a curvilinear relationship.

Sullivan (1994) measured degree of internationalization using a multidimensional index that includes foreign sales, foreign employees, foreign assets, and the number of foreign subsidiaries. However, since this information was not available for our study, we used the ratio of foreign clients to total clients. To check the robustness of our results, we also created an alternative variable that captures degree of internationalization at the overall transaction level (the ratio of number of transactions with foreign clients to number of transactions with all clients).

Institutional distance. This variable is the institutional distance between Japan and a client's home country in year t. Following Lavie and Miller (2008), we calculated this variable using the World Bank's six governance indicators: voice and accountability (VA), political stability and absence of violence (PV), government effectiveness (GE), regulatory quality (RQ), rule of law (RL), and control of corruption (CC). Lavie and Miller (2008) used the Kogut Singh index (Kogut and Singh, 1988) to measure institutional distance, but Konara and Mohr have pointed out that this index is incorrectly specified (Konara and Mohr, 2019), so a modified formula was used. As the World Bank's survey data on governance indicators are updated only irregularly, institutional distance was calculated using the figures for the nearest year. As with degree of internationalization, this variable was calculated at the level of a patent firm's client portfolio. However, an alternative variable at the overall transaction level was also created for a robustness check.

Control variables. Based on prior studies (Mawdsley and Somaya, 2021; Sako *et al.*, 2016), we used the following control variables.

Concentration of client nationality. The complexity faced by a firm is expected to be higher if its export destinations are dispersed across more countries. We therefore used the degree of concentration of the nationalities of foreign clients a firm has transactions with in year t as a

control variable. We first calculated share of transaction volume per country, and then calculated the concentration ratio using the Herfindahl-Hirschman Index (HHI).

Foreign client transaction structure. The complexity that firms face is also related to the degree of concentration of their transactions with different clients. We therefore used the degree of concentration of foreign client transactions in year t as a control variable. This variable was calculated as a weighted average. First, the share of transaction volume per foreign client was calculated for each country, and based on this the concentration ratio was calculated for each country using the HHI. Then the concentration ratio was multiplied by the share of transaction volume per country (the ratio of the number of transactions of each country to the total number of overseas transactions).

Domestic client transaction structure. This variable is the degree of concentration of domestic client transactions for a firm in year t. Like the above variable, it was used to control for the complexity faced by a firm, and calculated as a weighted average. First, the share of transaction volume for each domestic client was calculated, then the concentration ratio was calculated using HHI.

Concentration in technology area. This variable is the degree of concentration in technology areas for a firm in year t. It is used to control for the scope of services provided by a patent firm (Eckardt and Skaggs, 2018; Mawdsley and Somaya, 2021). Following previous research (Mawdsley and Somaya, 2021), we calculate this variable at the subclass level of the International Patent Classification system [4] using the HHI.

Number of patent claims per application. This variable is the average number of claims per patent filed by a firm in year t. Since it takes more effort to process a patent with more claims, this variable is used to control for the resources invested by the firm (Paruchuri and Awate, 2017; Wang *et al.*, 2014).

Number of pages per application. This variable is the average number of pages per patent filed by a firm in year t. Like the above variable, it is used to control for the resources invested by the firm (Mawdsley and Somaya, 2021).

Patent registration rate. This is the ratio of registered patents to all patent applications filed by a firm in year t. This is used as a control variable to reflect the capability the firm (Süzeroğlu-Melchiors *et al.*, 2017).

Number of patent attorneys. This is the number of patent attorneys affiliated with a firm in year t. This variable is used to control for firm size.

Turnover rate. This is the ratio of the number of patent attorneys who left a firm to the total number of attorneys employed by the firm in year t. This variable reflects the loss in a firm's knowledge base when patent attorneys leave the firm (Brymer *et al.*, 2020; Eckardt *et al.*, 2014).

Organizational age. This is the number of years that have passed in year t since the firm's establishment. This variable is considered to reflect factors such as the establishment of organizational routine and legitimacy (Bakker and Josefy, 2018).

Domestic and foreign technological distance. This is the degree of technological difference between domestic client assignments and foreign client assignments in year t; it is measured by the correlation coefficient. The larger the technological distance, the greater the assumed costs of handling the assignments of foreign clients (Jaffe, 1986).

Year dummies. We use dummy variables for each year. The year-one dummy is excluded to avoid the problem of multicollinearity.

Model specification. In order to compare the pooled model, the random effects model, and the fixed effects model, we conducted the F test, the BP test and the Hausman test (Hausman, 1978). The results of these tests are shown at the bottom of Table 2. The test results indicated that the pooling model was most appropriate (the F test, Breusch-Pagan test, and Hausman test are all not significant.); thus, the results of the pooling model are presented below. Since variance heterogeneity of the error term was observed, robust standard errors were used to

obtain the estimation results (Wooldridge, 2010). The maximum VIF was 3.37. A one-year lag between the dependent variable and the independent and control variables was inserted to mitigate reverse causality.

Results

Tables 1 and 2 show the correlation and regression analysis results, respectively.

Degree of internationalization, with a mean of 0.475 and a standard deviation of 0.236, indicates that, on average, 47.5% of the firms' clients are international. The range of degree of internationalization (0–0.914) underscores the varying extent of firms' international activities. Notably, the slightly negative correlation between international business growth and degree of internationalization (−0.197*) implies that increased internationalization does not always correspond with higher growth rates in international business, at least in the immediate term. The squared degree of internationalization, designed to explore non-linear effects, shows a mean of 0.009 and a standard deviation of 0.016. Its positive correlation with international business growth (0.547*) suggests that the relationship between internationalization and growth might be more complex. The average institutional distance is 24.153, with a standard deviation of 17.504. Its strong positive correlation with degree of internationalization (0.719*) suggests that as firms expand their export scope, they tend to enter markets with increasingly different institutional environments from their home country.

Model 1 includes only the control variables. In Models 2 through 7, we entered independent variables. Degree of internationalization was put into Model 2, and its squared term was added to Model 3. The interaction term between degree of internationalization and institutional distance was added to Model 6. In Model 2, degree of internationalization is negative and significant. In Model 3, the squared term of degree of internationalization is positive and significant. Therefore, Hypotheses 1 and 2 were supported. However, the interaction term is not significant in Model 6. So Hypothesis 3 was not supported. For hypothesis 2, we also performed Stata's *U* test to confirm the existence of an inflection point within the domain of definition and the presence of u-shape (Lind and Mehlum, 2010).

The above results can be summarized as follows. As Hypothesis 1 asserts, the Penrose effect was confirmed: degree of internationalization is shown to have a negative effect on international business growth. The results also provide a more detailed understanding of factors affecting the Penrose effect. As predicted in Hypothesis 2, the Penrose effect is mitigated as degree of internationalization increases. On the other hand, contrary to the prediction of Hypothesis 3, the Penrose effect is not strengthened by institutional distance. Possible reasons this hypothesis was not supported are discussed below.

Robustness check

In order to check the robustness of the main results, several additional analyses were conducted. We used independent variables measured at the aggregated transaction level. For degree of internationalization, the alternative variable was calculated based on the total number of applications made by patent firms (i.e. transaction volume). For institutional distance, the alternative variable was calculated as the weighted average of institutional distance based on the share of transaction volume for each country. The results using these alternative variables were consistent with our main results. Following Ghemawat, we also checked for robustness by measuring cultural, economic, and geographic distance instead of institutional distance (Ghemawat, 2001); the results obtained were also similar to our main results. To address potential concerns over the reliability of our findings, the full results from these robustness checks are summarized in the supplement file as Tables S-I through S-V.

Table 1. Descriptive statistics and correlation coefficients

Pairwise correlations Variables	Mean	S.D.	Min	Max	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
(1) International business growth	0.04	0.629	−2.367	2.398	1.000									
(2) Degree of internationalization (DOI)	0.475	0.236	0	0.914	−0.197*	1.000								
(3) DOI (squared)	0.009	0.016	0	0.107	0.547*	−0.100*	1.000							
(4) Institutional Distance	24.153	17.504	0	104.051	−0.161*	0.719*	−0.076	1.000						
(5) Concentration of client nationality	0.38	0.198	0.111	1	0.039	−0.234*	−0.087	−0.423*	1.000					
(6) Foreign client transaction structure	0.345	0.21	0.081	1	0.198*	−0.560*	0.089	−0.446*	0.316*	1.000				
(7) Domestic client transaction structure	0.163	0.143	0.022	0.799	0.057	0.074	0.006	−0.254*	0.189*	0.152*	1.000			
(8) Concentration in technology area	0.046	0.045	0.011	0.423	0.110*	−0.143*	0.012	−0.316*	0.113*	0.219*	0.456*	1.000		
(9) Number of patent claims per application	7.756	1.772	3.901	18.81	0.061	0.317*	0.114*	0.112*	0.148*	−0.043	0.153*	0.135*	1.000	
(10) Number of pages per application	19.712	6.072	9.976	51.813	0.004	0.399*	−0.005	0.275*	−0.103*	−0.304*	−0.057	0.155*	0.285*	1.000
(11) Patent registration rate	0.45	0.085	0.226	0.706	−0.035	0.012	0.026	0.062	−0.145*	0.015	−0.112*	−0.124*	0.108*	−0.060
(12) Number of patent attoneys	3.093	0.651	1.386	4.543	0.005	0.425*	0.110*	0.675*	−0.229*	−0.267*	−0.346*	−0.367*	0.088	0.217*
(13) Turnover rate	0.119	0.145	0	1	−0.204*	−0.178*	−0.058	−0.177*	0.103*	0.082	−0.037	0.029	−0.093	−0.100*
(14) Organizational age	3.502	0.671	0.693	4.779	−0.078	0.372*	−0.048	0.509*	−0.226*	−0.244*	−0.122*	−0.386*	0.051	0.035
(15) Domestic and foreign technological distance	0.313	0.207	−0.018	0.883	−0.058	0.388*	−0.006	0.541*	−0.260*	−0.227*	−0.155*	−0.151*	0.091	0.212*

	(11)	(12)	(13)	(14)
(1)				
(2)				
(3)				

(*continued*)

Table 1.

(4)				
(5)				
(6)				
(7)				
(8)				
(9)				
(10)				
(11)	1.000			
(12)	0.153*	1.000		
(13)	−0.084	−0.163*	1.000	
(14)	0.246*	0.366*	−0.207*	1.000
(15)	0.050	0.506*	−0.144*	0.286*

Source(s): Authors' work

Table 2.
Results of regression analysis: Pooled OLS Model

Variables	Model1	Model2	Model3	Model4	Model5	Model6	Model7
H1: DOI		−2.310***	−2.181***		−2.116***	−2.036***	−2.049***
		(0.52)	(0.47)		(0.58)	(0.54)	(0.53)
H2: DOI (squared)			9.094***				10.174***
			(2.44)				(2.57)
Institutional Distance				−0.013***	−0.007	−0.007*	−0.005
				(0.00)	(0.00)	(0.00)	(0.00)
H3: DOI × Institutional Distance						0.065	−0.035
						(0.04)	(0.05)
Control variables							
Concentration of client nationality	−0.029	−0.034	0.052	−0.062	−0.051	−0.034	0.040
	(0.13)	(0.12)	(0.11)	(0.12)	(0.12)	(0.11)	(0.11)
Foreign client transaction structure	0.206	0.165	0.214*	0.239*	0.184	0.236**	0.208*
	(0.13)	(0.12)	(0.12)	(0.13)	(0.12)	(0.12)	(0.12)
Domestic client transaction structure	0.177	0.290**	0.237*	0.166	0.275**	0.297**	0.206**
	(0.14)	(0.14)	(0.12)	(0.12)	(0.13)	(0.13)	(0.10)
Concentration in technology area	1.193*	0.628	0.680	0.867	0.515	0.430	0.639
	(0.65)	(0.66)	(0.62)	(0.67)	(0.66)	(0.67)	(0.59)
Number of patent claims per application	−0.001	−0.004	−0.006	−0.001	−0.004	−0.007	−0.005
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Number of pages per application	0.006	0.010	0.009	0.007	0.010	0.012*	0.008
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Patent registration rate	−0.052	0.120	0.124	−0.022	0.120	0.111	0.130
	(0.31)	(0.31)	(0.28)	(0.30)	(0.30)	(0.30)	(0.28)
Number of patent attorneys	0.046	0.037	0.029	0.050	0.040	0.028	0.037
	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
Turnover rate	0.064	0.017	0.017	0.057	0.017	0.004	0.024
	(0.18)	(0.17)	(0.17)	(0.18)	(0.17)	(0.17)	(0.17)
Organizational age	−0.067**	−0.087***	−0.058*	−0.072**	−0.088***	−0.081***	−0.058*
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Domestic and foreign technological distance	−0.100	−0.078	−0.074	−0.099	−0.080	−0.093	−0.067
	(0.14)	(0.14)	(0.13)	(0.14)	(0.14)	(0.14)	(0.12)

(*continued*)

Table 2.

Variables	Model1	Model2	Model3	Model4	Model5	Model6	Model7
Constant	−0.072	0.014	−0.127	−0.070	0.008	−0.012	−0.138
	(0.00)	(0.22)	(0.23)	(0.22)	(0.22)	(0.21)	(0.23)
Observations	430	430	430	430	430	430	430
Firms	48	48	48	48	48	48	48
F value	13.97***	26.47***	22.44***	16.54***	26.70***	25.30***	29.18***
R-squared	0.495	0.535	0.559	0.507	0.537	0.542	0.562
Adjusted *R*-squared	0.472	0.512	0.537	0.483	0.514	0.517	0.537
Year dummies	YES	YES	YES	YES	YES	YES	YES
F test	0.5678	0.7725	0.6456	0.7268	0.8180	0.6514	0.7347
BP test	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Hausman test	0.1212	0.3409	0.1905	0.3544	0.4979	0.2796	0.3843

Note(s): Robust standard errors in parentheses
***$p < 0.01$, **$p < 0.05$, *$p < 0.1$
Source(s): Authors' work

Discussion

International expansion is a growth strategy often used by PSFs (Faulconbridge and Muzio, 2008; Løwendahl, 2005). While internationalization of PSFs can be carried out in a variety of ways (Ball *et al.*, 2008; Brock and Alon, 2009; Lu *et al.*, 2012), previous studies have focused on MNE-type international expansion, such as that seen in large US law firms (O'Higgins *et al.*, 2022; Powell, 2014). Because little scholarly attention has been given to international expansion by PSFs through service exports (Mayer *et al.*, 2015), it was unclear how this type of expansion affects PSFs' international growth rates.

This study examines the Penrose effect—the constraint on a firm's growth rate caused by a finite amount of managerial resources having to deal with the increased complexity that comes with expansion—in the internationalization of service-exporting PSFs. As the managerial resources of PSFs consist primarily of a limited number of partners (Kim *et al.*, 2016; Kor and Leblebici, 2005; Maister, 1993), the Penrose effect can be expected to be seen in PSFs that internationalize through exporting. In other words, we expected to observe a negative relationship between a PSF's degree of internationalization and its international business growth (Hutzschenreuter and Horstkotte, 2013; Penrose, 1959; Tan and Mahoney, 2007). In addition, we hypothesized that the Penrose effect would vary with the degree of internationalization and that institutional distance would intensify the Penrose effect (Battistuzzo and Ogasavara, 2023; Chang and Ogasavara, 2021; Kano, 2023).

Analyzing 48 Japanese patent firms, we confirmed the existence of the Penrose effect, and found that its strength varies with degree of internationalization. However, we did not find that institutional distance intensifies the Penrose effect. We interpret these results as follows.

The existence of the Penrose effect in service-exporting PSFs is explained by the fact that such firms' managerial resources—that is, the available time and effort of its managing partners—are reduced by the need to undertake new tasks and deal with increased complexity when the firm internationalizes (Hitt *et al.*, 2006; Kim *et al.*, 2016; Kor and Leblebici, 2005; Maister, 1993). However, as the degree of internationalization increases, the firm becomes more adept at handling such new tasks and complexity (Bingham and Eisenhardt, 2011; Blomstermo *et al.*, 2004; Steen and Liesch, 2007). For example, specialization can be achieved through organizational restructuring and partners can save time by delegating authority to associates (Pedersen and Shaver, 2011). Once such adjustments are made, fewer managerial resources are required to maintain the firm's growth rate (Chandler, 1977; Lo *et al.*, 2023; Maister, 1993; Penrose, 1959). In this way, the Penrose effect is mitigated as firms increase their degree of internationalization.

We expected institutional distance to reinforce the Penrose effect because exporting to new countries with different institutional environments increases the complexity managers must deal with (Kor and Leblebici, 2005; Mohr *et al.*, 2018; Vidal and Mitchell, 2018). This hypothesis was not supported, however. The reason for this may be that in the case of service exports, the complexity arising from different institutional environments is relatively small (Abdelzaher, 2012; Lu *et al.*, 2012). This is because service exporters are only indirectly exposed to the host country's institutions; they do not have to replicate and transfer valuable resources across borders, and they do not incur the costs of coordinating with overseas subsidiaries. Hence, contrary to our expectations, institutional distance does not appear to strengthen the Penrose effect.

Contributions

This paper makes three theoretical contributions to our understanding of the Penrose effect in the international expansion of PSFs. First, it focuses on PSFs that expand internationally by exporting their services; prior research had found that the Penrose effect applies to the international expansion of MNE-type PSFs (Mayer *et al.*, 2015), but whether it also applies to

the internationalization of service-exporting PSFs had not been tested. Our results confirm that it does. Thus, this research fills a gap in the research on the internationalization of PSFs.

Second, we have shown that the negative relationship between degree of internationalization and the international business growth rate is curvilinear, with the Penrose effect becoming weaker as degree of internationalization increases. This result is consistent with and explained by Penrose's argument that available managerial resources gradually increase as managers accumulate experience and organizational changes are made that reduce the burden on management imposed by growth (Hutzschenreuter *et al.*, 2011; Lin *et al.*, 2021; Steen and Liesch, 2007).

Third, our study illuminates the moderating effect of institutional distance on the Penrose effect. While the results of prior research suggest that institutional distance strengthens the Penrose effect in the internationalization of MNE-type PSFs (Ahmad, 2013; Lin *et al.*, 2021; Powell, 2014), we did not find that it has the same moderating effect for service-exporting PSFs. This may be because, compared to MNE-type PSFs, service-exporting PSFs are less affected by the complexity arising from institutional distance because they have little direct exposure to the host country institutional environment and no need to coordinate with overseas subsidiaries or offices (Brock and Alon, 2009). Moreover, compared to other corporate legal services, the services provided by patent firms are relatively standardized—basically filing and registering patents—which makes them less sensitive to institutional distance.

The practical implications of our study are twofold. First, in the early stage of PSF expansion via exports, partners should expect the rate of international business growth to slow, but this should not discourage them from pursuing internationalization. Rather, they should keep in mind that the slowdown in growth will likely be reversed as knowledge is accumulated, organizational adjustments are made, and overseas reputation is built. These developments will relieve the strain on managerial resources so that growth can resume.

Second, partners need not be overly concerned about institutional differences between countries. As service exporters, as opposed to operators of overseas subsidiaries, they have relatively little direct exposure to the institutional environment in their target markets. Our research suggests that these PSFs should prioritize accumulating and gaining the benefits of internationalization experience rather than focusing on how institutions in the countries they export to differ from those of their home country.

Limitations and future research

There are at least three limitations to the present study that should be addressed in future research.

The first has to do with generalizability. Our study is relatively narrow in the sense that it focuses on service-exporting Japanese patent firms. PSFs are highly heterogeneous (Malhotra and Morris, 2009), and so it is possible that different results would be observed in other settings. Future research on PSFs exporting different types of services would be valuable for gauging the degree to which our findings apply to PSFs in other service industries.

Second, it is possible that our results have endogeneity problems due to omitted variable bias. We used and based our estimates on variables that have been employed in previous studies, but some potentially important variables, such as the leverage ratio of human assets (Maister, 1993; Sherer, 1995), were not included because data were not available. It would be valuable for future studies to include additional variables which were not available for our analysis.

Third, this study focuses on firms that internationalize solely through service exports. We did not consider other entry modes (e.g. MNE-type internationalization) or business expansion directions (e.g. market and product expansion strategies) that PSFs may pursue

simultaneously with exporting. Such cases would involve higher levels of complexity (Hitt *et al.*, 2006; Kor and Leblebici, 2005). Thus, it would be valuable for future research on PSFs and the Penrose effect to take into account multiple entry modes and directions of international expansion.

Notes

1. The WTO General Agreement on Trade in Services classifies the delivery of services to foreign clients into four categories: (1) cross-border supply, (2) consumption abroad, (3) commercial presence, and (4) movement of natural persons. The service exports focused on in this study are "cross-border supply."
2. The number of applications filed per patent attorney in Japan was almost double that of the United States until 2006. In Japan, non-licensed assistants help prepare drafts of patent applications under the supervision of patent attorneys. This is partly due to the fact that the Japanese patent attorney examination is very difficult; the pass rate during the observation period was approximately 6%–8%. Persons who are unlicensed work as assistants in patent firms until they pass the exam. Taking this difference in practice between Japan and the U.S. into account, we selected firms with five or more patent attorneys while previous studies conducted in the U.S. selected firms with ten or more patent attorneys.
3. As with previous studies, financial data for individual firms were not available for this study. According to prior research (Somaya *et al.*, 2008), the number of patent applications filed by a firm is correlated with its financial indicators.
4. The International Patent Classification was revised during our observation period. For our analysis, all patent classifications have been unified to match the revised 8th edition.

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Appendix

The supplementary material for this article can be found online.

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