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Using trademarks to fend off import competition: Evidence from the top R&D-spending companies

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ABSTRACT

This study focuses on the use of trademarks (TMs) in response to import competition from China. As intangibles increasingly become a source of competitive advantage in international markets, firms, especially multinational enterprises (MNEs) based in developed countries, need to leverage their unique resources against increased price-based competition from low-wage countries. We argue that TMs are market-based intangible resources used by highly innovative MNEs to signal superior quality and to differentiate themselves in industries that are more exposed to imports. We test our hypotheses using a panel of the world's most innovative companies that combine financial information and trademarking activities in the years 2009–2014. We find evidence that Chinese competition increases the likelihood that MNEs based in industrialised countries file TM applications and incorporate both services and goods into their product portfolios, in line with the *servitisation* of manufacturing firms.

1. Introduction

Intangible assets such as brands, knowledge, and skills play an ever-increasing role in determining the competitiveness of economic systems and individual companies (Haskel & Westlake, 2018; Hazan et al., 2021; Orhangazi, 2018). Indeed, Corrado et al. (2022) show that, between 1985 and 2021, intangible investment as a share of private GDP rose from around 11 to nearly 17%, while the corresponding figures for tangible assets drifted down from 12.5% to 8.5%. An important feature of intangibles is that they are less likely to be appropriated by other firms and are especially important in global value chains, where most of the value accrues to non-manufacturing stages of production such as design or after-sale services (Buckley et al., 2022; Teece, 1998). In fact, the share of value-added captured by intangibles is estimated at around 30% (WIPO, 2017) and already surpassed that of physical capital (Haskel & Westlake, 2018). Accordingly, the management of these assets assumes strategic relevance, and it is crucial to take advantage of them, especially for firms facing greater competition.

In parallel, the last two decades have seen a marked increase in competitive pressure from low-wage countries such as China, which has become a particular concern for many firms in advanced economies that are less oriented to cost- and price-based competition (Bernard et al., 2006; Morandi Stagni et al., 2021; Seyoum, 2007). The rise of China and its impact on OECD firms and workers is subject to intense scrutiny owing to the scale and speed of the phenomenon. In less than ten years (2000–2009), China moved from being the tenth-largest exporter in the world to the top of the ranking; by 2017, its global market share jumped to 11.4% (from a meagre 1.9% in 2000; see Woetzel et al., 2019). However, only two Chinese companies are amongst the list of the world's 100 most valuable brands compiled by Interbrand, a specialist consultancy, suggesting that companies based in advanced economies still have an edge in terms of global recognition.[1] Hence, these firms must leverage their less imitable and unique resources, such as intangibles, to sustain their competitive advantage in the face of increased import penetration (Barney, 1991; Barney & Hesterly, 2019; Gómez & Vargas, 2012; Teece, 2014, 2007).

To shed light on the joint role of market-based intangibles and import penetration in shaping firm behaviour, we focus on the use of

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[1] See https://interbrand.com/best-global-brands/ for additional information on the list.

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trademarks (TMs) by multinational enterprises (MNEs) in developed countries in response to Chinese competition. In so doing, we speak both to the business literature that looks at the role of intangibles in determining firms' internationalisation strategies (Buckley et al., 2022; Denicolai et al., 2019, 2014; Pyper & Doherty, 2022; Sutherland et al., 2020) and to studies that investigate how technological leaders respond to increased competition (Aghion et al., 2005; Becerra et al., 2020; Morandi Stagni et al., 2021; Seyoum, 2007).

International business (IB) studies devoted considerable attention to the development of intangibles, both at home and abroad (Almeida, 1996; Dunning, 1998; Rugman & Verbeke, 2001), mostly in the form of technological assets. However, there is still limited evidence on how MNEs use more customer- or market-related intangibles such as brands and TMs (Barroso et al., 2019; Denicolai et al., 2014; Sutherland et al., 2020) to address harsher trade-induced competition, especially from low-wage countries such as China.

We frame our analysis in terms of the resource-based view (RBV) of the firm (Barney, 1991; Wernerfelt, 1984) and its evolutionary approach in the context of changing external environment, i.e. the dynamic capabilities view (DCV) (Teece et al., 1997). According to the RBV, firms exploit valuable, rare, and imperfectly imitable resources to obtain a sustainable competitive advantage (Beamish & Chakravarty, 2021; Kozlenkova et al., 2014; Srivastava et al., 2001). The DCV builds upon the same notion, but emphasises the ability to recombine existing resources or create new ones when firms face a change in the competitive environment (Bowman & Ambrosini, 2003). TMs are one such market-based intangible resource (alongside branding, customer relations or marketing knowledge, etc.) used by firms to strengthen their competitive position and fend off competition (Srivastava et al., 2001). They are particularly relevant for firms facing price-based import competition from low-wage countries as they allow companies to signal quality and leverage their reputation. In fact, existing research shows that firms use TMs to build long-lasting relationships with customers (Ramello & Silva, 2006), fight imitation (Reitzig, 2004) or compete against confusingly similar brands (Fink et al., 2022), signal their innovation capabilities (Block et al., 2015; Mendonça et al., 2004), and pursue competitive advantage based on diversification (Castaldi & Giarratana, 2018; Crass & Schwiebacher, 2017). Firms may also acquire externally developed TMs to enter new market segments in a specific country or exploit brands that are already well-known in foreign markets, thus avoiding the long delay necessary to establish their own reputations (Denicolai et al., 2019; Sutherland et al., 2020). In the face of changing external conditions such as rising Chinese competition, trademarking fits the three-pronged characterization of dynamic capabilities (Teece, 2007, p. 1319) as the capacity to *sense* the threat from import penetration, *seize* the opportunity given by the firm reputation and its innovation portfolio, and *maintain* competitiveness by (among other actions) the protection of its intangible assets. In fact, Intellectual Property Rights (IPR) management and defending against imitation by competitors are explicitly mentioned by Teece (2007) as examples of strategies that show firms' ability to adapt to a changing environment and make the best use of their internal assets.

Studies on firms' responses to increased competition due to import penetration highlight the roles of internationalisation (Wiersema & Bowen, 2008), innovation (Aghion et al., 2005; Autor et al., 2020; Bloom et al., 2016; Hombert & Matray, 2018), diversification (Becerra et al., 2020; Hombert & Matray, 2018; Morandi Stagni et al., 2021) and quality upgrading (Fernandes & Paunov, 2013). In particular, the response of innovation deployed heterogeneous behaviour consistent with the inverted U-shaped relationship between innovation and competition (Aghion et al., 2005), whereby firms at the technological frontier react with increased innovation, while competition lowers the incentive to innovate for laggards. This framework suggests that technological leaders are better equipped to cope with the negative effects of the competition induced by imports from emerging countries.

Our analysis combines two streams of existing literature in an innovative manner. The first is the body of work that treats TMs as market-based intangibles, while the second focuses on firms' responses to increased import penetration. Our main hypothesis is that firms use TMs to fend off competition from low-wage countries, such as China. Given that TMs signal "consistent quality" (Crass, 2020) and reduce uncertainty amongst customers, they are particularly useful to incumbents who find their market position challenged by price-based competition from abroad, because consumers value the informational content of well-known brands. Hence, we postulate that import penetration increases the incentive to integrate trademarking into a firm's strategy, based on three intertwined mechanisms: *distinguish* one's products from those of competitors; defend and promote *brands*; *differentiate* in the market. In addition, we posit that manufacturing firms filing for TMs in service classes may signal a shift towards the provision of services, that is, *servitisation* (Baines et al., 2017). In this instance, firm-specific resources are used to strengthen competitive advantages or chase higher margins and new opportunities in response to tighter competition in existing market segments, a form of adaptation that is consistent with the DCV.

We test our arguments on a novel dataset of 1326 firms obtained by merging two waves of the JRC-OECD COR&DIP© database (Dernis et al., 2015), which contains the trademarking activities of the top R&D-spending companies in the years 2009–2014 with headquarters located in advanced countries. We found that firms operating in sectors particularly affected by Chinese competition are more likely to register TMs. In contrast, import penetration does not affect the number of TMs filed by firms. Our second result is that manufacturing firms exposed to higher import competition integrate services into products in line with a process of *servitisation*.

In addition to the novelty of the empirical analysis, this study advances IB literature in at least two complementary ways, stemming from the interplay between the RBV (e.g. Beamish & Chakravarty, 2021) and the DCV (Zahra et al., 2022). First, we provide evidence of how firms use market-related intangibles such as TMs in the context of a changing international competitive landscape (Becerra et al., 2020; Bloom et al., 2016; Buckley et al., 2022; Denicolai et al., 2014; Morandi Stagni et al., 2021; Sutherland et al., 2020). Second, the role of *servitisation* as a strategy to compete internationally has not been investigated much from an IB perspective, at least relative to the plethora of studies that have concentrated on the domestic market (Bıçakcıoğlu-Peynirci & Morgan, 2023).

The remainder of this paper is organised as follows. Section 2 outlines the conceptual framework of reference, and Section 3 describes the data and empirical methodology. Section 4 reports and discusses the results. Finally, Section 5 presents the main conclusions.

2. Conceptual framework

2.1. The resource-based and the dynamic capabilities views

The RBV claims that a firm's competitive advantage relies on a bundle of valuable, rare, imperfectly imitable, and well-organised resources: the so-called "VRIO" framework (see, e.g. Barney, 1991; Barney & Hesterly, 2019; Beamish & Chakravarty, 2021). Even firms operating in the same narrowly defined industry possess heterogeneous resources. A firm achieves competitive advantage when it can generate more economic value than its competitors. This competitive advantage becomes 'sustained' when other firms are unable to replicate its source (Peteraf & Barney, 2003). Within the RBV, firm-specific intangibles play a crucial role as they are difficult to imitate (Galbreath & Galvin, 2008). Regarding market-related intangibles in the international context, the literature recognises that reputation, brand image, and closer relationships with customers are particularly relevant (Balakrishnan & Fox, 1993; Gómez & Vargas, 2012).

The DCV (Teece, 2007; Teece et al., 1997) builds upon the RBV in the sense that firm-specific resources maintain a central role in allowing

firms to achieve superior performance, although they are not sufficient. If an enterprise possesses resources/competences but lacks dynamic capabilities, it can achieve a competitive return for a short period, but it will not be able to sustain high returns for long periods of time (Teece, 2007, p. 1319). The DCV, which is the "evolutionary version" (Bowman & Ambrosini, 2003) of the RBV, emphasises the firm's aptitude to modify its resource base through resource creation, integration and recombination in response to changing competitive conditions. Without dynamic capabilities a firm will not be able to capitalize on its tangible and intangible assets. Hence, while RBV is inherently static, dynamic capabilities relate to firms' ability to *sense* and *seize* opportunities and to *transform* assets to generate competitive advantage and profits, especially in the context of rapid change. While the RBV identifies firm-specific resources related to competitive advantage, the DCV stresses the need to adapt firms' strategies and redeploy those resources to generate in-imitable advantage.

In this study, we posit that TMs are part of the internal market-related VRIO-type resources (Srivastava et al., 2001). As such, they belong to the firm-specific resources conceptualized by the RBV. Trademarking to fend off Chinese competition thus represents a dynamic capability to respond to external change by making internal intangible resources in-imitable.

2.2. Trademarking strategies to face competition

MNEs develop intangible assets at home and abroad and use them to compete in international markets (Buckley, 2014; Buckley et al., 2022). These intangibles offer firm-specific advantages, and can be deployed across international borders. The IB literature mostly investigates tangibles in terms of technological knowledge (Manolopoulos et al., 2005), whereas customer-oriented intangibles (such as TMs) receive scant attention (Denicolai et al., 2019).

IPRs, such as TMs, are widely used to achieve and sustain competitive advantage because they ensure the appropriation of innovation rents, guarantee time-limited technological leadership, protect creative works from imitation, and promote and reinforce brands (Reitzig, 2004). Different IPRs serve specific purposes: TMs identify a good or service offered by a firm and allow customers to recognise and distinguish it from those of its competitors. TMs require the exclusive and actual use of an image or name, whereas novelty is not a requirement as it is for patents (Sandner & Block, 2011). As such, TMs tend to be used by many companies and are considered market-oriented IPRs.

Traditional and more recent literature identifies different ways in which firms may use TMs to reinforce or defend their market positions. First, the primary function of TM is to connect a good to its source and act as a signal of *distinctness*. TMs convey information about a product and may overcome the problem of unobservable attributes, which are difficult and costly to unpack. By making a product recognisable, TMs reduce consumer search costs and uncertainty. Information asymmetry is exacerbated in the case of services that are often difficult to assess without first-hand experience (Castaldi & Giarratana, 2018; Crass & Schwiebacher, 2017).

Second, TM can be used against competitors to distinguish products in a crowded marketplace by connecting goods to the company as part of a marketing strategy (Ramello & Silva, 2006). Consumers may not know the product from past experiences but can speculate about its features based on the company providing it. Firms build a reputation around their product portfolios so that they have a strong incentive to market their products coherently with their image (Block et al., 2015). All activities that enhance awareness of a company's product portfolio and affect how customers perceive those offerings are referred to as *branding*. Investment in building and strengthening brands lowers substitutability between competing products and increases customer loyalty. For certain goods, brands enable firms to associate their products with a particular image that yields significantly higher prices, such as luxury goods, for which well-known brands face a lower price elasticity of demand. Using brands (and associated TMs) to compete in the international marketplace is a well-established concept in IB studies (Efrat & Asseraf, 2019; Pyper & Doherty, 2022).

New TMs support the introduction of new products to *differentiate* either vertically (e.g. premium versions) or into new product segments (e.g. gain power along the value chain or enter new markets) (Greenhalgh & Rogers, 2012). This supporting role in the commercialisation of new products may be especially relevant for innovative firms, which are amongst the most extensive users of TMs (Block et al., 2015; Castaldi, 2019; Crass, 2020; Flikkema et al., 2014; Mendonça et al., 2004; Schautschick & Greenhalgh, 2016). New TMs can accompany the launch of an innovative product and are often used in conjunction with other intellectual property (IP) strategies for appropriate innovation rents (Llerena & Millot, 2020; Mendonça et al., 2004). For example, when paired with patents, TMs increase the value of the former (Thoma, 2020). Science-based sectors can also use TMs to extend the length of rent appropriation beyond the expiration date of a patent, as in the case of Bayer Aspirin (Jennewein et al., 2010; Reitzig, 2004). Although TMs might not always flag product innovation, they capture marketing and commercialisation capabilities which are often unobserved dimensions of firm innovation (Thoma, 2020) and may represent innovations that are not patentable (e.g. in service sectors or incremental innovation) (Mendonça et al., 2004).[2] Therefore, R&D-intensive firms may use TMs to increase product variety. In this sense, TMs are a form of marketing innovation (OECD, 2018), even if the degree of novelty of newly introduced products may vary greatly. When entering foreign markets, TMs can help compensate for the liabilities of newness and/or foreignness (Barroso et al., 2019).

A group of IB studies has recognised the importance of the external acquisition of brands and TMs as a strategy to successfully expand and operate abroad. Denicolai et al. (2019) explored the acquisition of both domestic and international TMs in the context of family firms. They find that acquiring TMs is positively associated with firms' international performance. Sutherland et al. (2020) suggested that trademarking as a strategy against international competition is particularly relevant for MNEs in developed economies (DMNEs). Their argument builds on the location-specific nature of assets, such as brands and TMs, as opposed to technologies and patents that are more easily transferable across countries and thus more appealing to companies from emerging markets that seek to build broad-based competences.

2.3. Responses to import penetration

Competition due to import penetration has increased considerably over the last two decades (Bloom et al., 2016) and has become a major threat to firms in advanced economies. Import penetration reduces profit margins and threatens survival (Bernard et al., 2006), hence firms are called upon to adapt their strategies to a new competitive landscape. Scholars have studied several types of strategies, including internationalisation (Wiersema & Bowen, 2008), innovation (Aghion et al., 2005; Autor et al., 2020; Bloom et al., 2016; Hombert & Matray, 2018), diversification (Becerra et al., 2020; Hombert & Matray, 2018; Morandi Stagni et al., 2021) and quality upgrading (Fernandes & Paunov, 2013).

Responses in terms of innovation receive a great deal of attention for their crucial role in shaping long-term firm competitiveness and wider policy implications (Aghion et al., 2005; Autor et al., 2020; Bloom et al., 2016; Hombert & Matray, 2018). Thus far, the empirical evidence is mixed. Bloom et al. (2016) examine the effect of Chinese import competition on European firms' innovative efforts, measured in terms of

[2] However, firms may decide not to use TMs to protect new products or services either because they adopt alternative means of protection (e.g. alternative distribution channels that protect the innovation from imitation) (Athreye & Fassio, 2020) or a more open approach to innovation (Schilling, 2017).

patenting, ICT adoption, and productivity growth. They establish a causal link whereby import competition triggers both increased innovation within firms and the reallocation of employment towards more technologically advanced companies.

On the other hand, several recent studies on North American firms detect a negative effect of import competition on some measures of innovation, namely R&D expenditures (Gong & Xu, 2017) and patents (Autor et al., 2020) amongst US firms, or self-reported process innovations in the case of Canadian firms (Yang et al., 2021). However, a deeper examination of the results suggests that this effect is mostly driven by low performers (Autor et al., 2020; Gong & Xu, 2017), that R&D expenditure is reallocated to more productive firms within the industry (Gong & Xu, 2017) and that firms with large R&D stocks are less affected by import competition through product differentiation (Hombert & Matray, 2018).

Overall, the picture that emerges is consistent with the inverted U-shaped relationship between innovation and competition postulated by Aghion et al. (2005). Here, frontier firms react by increasing their innovation efforts, while laggards reduce them (Shu & Steinwender, 2018).

Empirical evidence shows that R&D-intensive manufacturing firms not only react to foreign competition by further pursuing innovation, but are also more likely to shift toward the provision of services (Breinlich et al., 2018). While this is a general trend documented in several studies (Breinlich et al., 2018; Cusumano et al., 2015; Gu et al., 2022; Neely et al., 2011; Vandermerwe & Rada, 1988), Baines et al. (2009) note that the integration of products and services provides firms with an offering that is more distinctive and easier to defend from low-cost competition. In this respect, Woetzel et al. (2019) state that despite its rapid growth, China's global scale in services trade is not as significant as that in goods trade, so *servitisation* can indeed offer manufacturing firms from advanced countries an escape route. Moreover, within the rich literature investigating firm responses to trade liberalisation, Breinlich et al. (2018) document a significant transition toward the provision of services by UK manufacturing firms facing increased import penetration.

2.4. TMs as a response to import penetration

We examine whether trade-induced competition from China triggers a TM-related response by the world's most innovative MNEs based in developed countries. Building on the RBV and the DCV of the firm, we postulate that large MNEs in industries with high import penetration from China use TMs to defend themselves from competition. Our argument rests on the premise that large R&D spenders rely on different formal and informal IPRs to protect rents from innovation. When operating in international markets, technologically advanced firms exploit market-oriented resources such as TMs, which shows the firms' dynamic capabilities to adapt to changing environment and make the best use of its internal assets (Teece, 2007). In the following section, we propose and discuss two propositions that are subsequently applied to the data.

First, we posit *that import penetration increases the incentives for firms to seek TM protection*. These incentives are based on three intertwined mechanisms: *distinguish* their offerings from (cheaper) alternatives, defending and reinforcing reputation and *brands*, and *differentiation*.

TMs help firms *distinguish* their products as markets become more crowded by the arrival of new competitors (Crass, 2020). This is not limited to final consumption goods, as many firms that produce intermediate-input register TMs (Mendonça et al., 2019, 2004). When new products, either final or intermediate, enter a market with cost advantages, firms face shrinking demand and profit margins. To maintain a competitive position, firms may use TMs to flag their products in crowded marketplaces and convey information about the sources of their goods. This helps firms protect their products from imitation.

Regarding the *branding* mechanism, firms can use new TMs to reinforce and extend existing brands in the face of harsh competition from low-cost countries. Although brands do not necessarily require TMs, competitors could damage a firm's reputation by imitating names, logos, slogans, or selling counterfeit merchandise (Ertekin et al., 2018). Due to the crucial importance of branding in marketing strategies (e.g. decreasing substitutability amongst products), firms invest significantly in building and defending brands, often using TMs. Therefore, import penetration can push firms to use TMs to reinforce existing brands or create new ones that exploit well-known company features (Block et al., 2014).

As import penetration may reduce the revenues and profit margins of existing products, firms have an incentive to *differentiate products* either horizontally (i.e. meeting different tastes and preferences) or vertically (i.e. improving quality or removing frills) (Sutton, 1991). Consumers perceive product variety favourably (Berger et al., 2007) and can be used strategically against new entrants (Boulding & Christen, 2009; Dewan et al., 2003). Product differentiation can involve premium versions of extant products to obtain higher margins, or more basic varieties to contain demand loss due to the entry of lower-cost alternatives. TMs are particularly useful for capitalising on past customer experiences related to brands when introducing new products. TMs can also be used to support the launch of a new line of products under a new brand; for example, when a firm wants to tap into new market segments and cannot exploit its existing brand (Block et al., 2014). Firms can also enter sectors that may be less competitive or have higher margins. In this sense, TMs provide visibility for new products and, if connected to existing brands, can increase customer recognition and appreciation.

Second, we posit that *manufacturing firms that operate in industries with high import penetration use more TMs with service classes.*

Several studies on the effect of import penetration on innovation highlight that firms may leverage product diversification to face increased competition (Becerra et al., 2020; Hombert & Matray, 2018; Morandi Stagni et al., 2021). Import competition may increase the benefit of diversification, as firms can switch resources from industries with declining demand to markets with better opportunities. Becerra et al. (2020) find that US firms diversify their product portfolios when import penetration increases. Morandi Stagni et al. (2021) report that high levels of product diversification mitigate the negative relationship between import penetration and exploration-based technological search strategies. *Servitisation* is a specific form of diversification (Raddats et al., 2019). When applying for TMs in service classes, manufacturing firms signal a specific differentiation strategy that leads them towards the provision of complementary services (Crass, 2020; Crass & Schwiebacher, 2017; Nasirov, 2020; Schautschick & Greenhalgh, 2016). When facing increased competition, TMs with service classes can be used to signal the higher quality of the existing product-market portfolio and diversify into more profitable lines of business (as services tend to have higher profit margins).[3] *Servitisation* is consistent with the notion of *cospecialisation* discussed within the DCV by Teece (2007). *Cospecialisation* is one of the elements of the continuous alignment and realignment of assets of the dynamic capabilities related to "Managing threats/transforming": products become bundles or systems among which there is interdependence (e.g. electronic game consoles and video games), and filing for TMs in service classes may indicate the capacity of combining and reconfiguring around product lines into services, which is indeed a dynamic capability.

[3] It is important to stress that this prior holds for manufacturing firms only, as it is more difficult to make predictions for service firms. On the one hand, globalisation and advances in ICT may lead service firms toward a *commoditisation* of their offer, whereby a standardized set of services is bundled into a package and sold as a good (see for instance Castaldi & Giarratana, 2018 on consulting firms). On the other hand, because tradable goods face greater competition, service firms may restrain from going this route and concentrate on high-value added segments of their activities.

3. Empirical analysis

3.1. Data

We built the database using two waves of the COR&DIP© database, released in 2015 (Dernis et al., 2015) and in 2017 (Daiko et al., 2017). The COR&DIP database combines data from the EU R&D Scoreboard on top R&D-spending firms worldwide and IP data. COR&DIP© data have been used in studies as a single wave (Llerena & Millot, 2020) or as two merged waves (Baron et al., 2019). We excluded firms that were present in only one of the two versions. This choice returns technological leader companies that remain for a longer time and ensures some persistence in profitability needed to sustain a high level of R&D-spending over time. The advantage of using this dataset is that it captures the most technologically advanced MNEs in the world, and their IP data are consolidated at the parent company level. In addition, the possibility of selecting DMNEs from a world-based ranking provides a more stringent criterion than first considering developed countries and then selecting the top R&D spenders. Hence, our DMNEs are technological leaders with respect to other rising technological champions, especially those in China. The Appendix presents the dataset and merging methodology in detail.

The resulting dataset was a balanced panel comprising 1636 firms, which we later restricted to 1326. Financial data cover the years 2009–2014, while TMs filed with the United States Patent and TM Office (USPTO) refer to 2010–2014.[4] The different timespans of the two types of data are derived from the structure of the initial two waves of the dataset, where financial and IP data cover different periods (see the Appendix for further details). The COR&DIP© database associates companies with their TMs, with information on the application date and Nice classes (consisting of 34 classes of goods' and 10 of services).

3.2. Descriptive analysis

Table 1 presents the distribution of the firms by country. Most firms are from North America, Europe and Japan, with the US leading the ranking. Japan follows at some distance. The third country belongs to the lower- and middle-income groups (China). Germany is the first European country in the ranking. The distribution across countries is skewed, with the top five (the US, Japan, China, Germany, and United Kingdom) hosting almost 70% of the firms in the sample. Because of the nature of the distribution and relevance of these economies in the phenomenon under investigation (see below for further details), we restrict our econometric analysis to firms headquartered in G7 countries and Europe.[5] This sample covers 1326 firms, accounting for 81% of the initial sample.

The distribution across sectors is displayed in Table 2, which reveals that most firms (in the original dataset) operate in high-tech manufacturing industries (such as pharmaceuticals, chemicals, machinery, and computers) and high-tech knowledge-intensive services; 70% of firms are in the manufacturing sector, 26% are in the service sector, and the remaining are in the primary sector. The top five industries belong to the manufacturing sector and cover approximately half of the firms. The service industry with the highest number of firms is computer programming (e.g. Google and IBM), followed by publishing activities (e.g. Adobe Systems and Oracle), which mainly involve software companies.

Our empirical analysis focuses on firms located in Europe and the G7 countries, which produce 45% of world GDP and absorb 36% of world merchandise imports (with only the US and Germany accounting for half of that amount).[6] The subsample of the G7/European firms in the last three columns of Table 2 displays similar patterns. The percentages differ slightly; however, the ranking in terms of the number of firms is the same for the first eight positions. Moreover, the weights of the remaining sectors are similar, with the other manufacturing industries accounting for 7.95% in the entire sample and 8.36% in the selected sample, and the non-manufacturing sectors accounting for 13.88% in the former sample and 13.03% in the latter. This suggests that the selected sample replicates the distribution of the top R&D-spending firms, even if we exclude 19% of them.

When we turn to trademarking activities (Table 3, top panel), we observe that firms registered an average of 12.4 TMs in 2010–2014. The maximum number of TM per year filed by a firm (Mattel, the US, in 2013) was 960, and the distribution was highly skewed. The bottom panel of Table 3 shows the statistics for the G7/Europe sample, in which the mean and variance are slightly higher than those for the whole sample.

When we look at the trademarking activities in terms of 'goods' and 'services' classes, we can see that 82% of firms registering a TM in 2010–2014 (1088 out of 1268) have at least one TM in 'service' classes, and only 180 firms have exclusively TMs in 'goods' classes. Hence, given that 73% of firms of our restricted sample are in manufacturing sectors, it is interesting to notice that 'service' TMs are used by firms operating across different sectors. The possibility of using TMs in a mix of services and goods is consistent with the idea that TMs may flag the use of complementary services to core products (i.e. *servitisation*).

3.3. Econometric methodology

We estimated three types of models by examining different dimensions of firms' trademarking activities. First, we tested the probability of adopting TM as a function of import penetration using binary response (probit) models. Second, we tested whether import penetration influences TM intensity, defined as the number of TM applications per employee. Third, we analysed the impact of import competition on *servitisation* by examining the types of Nice classes declared in TM filings.

The following equation summarises the general regression model:

$$TM_{ijt} = \alpha_i + \tau_t + \boldsymbol{X}_{i,t-1}\beta + IMPP^{Chn}_{jt-1}\gamma + u_{it}, \quad [1]$$

with i indexing firms, t going from 2009–2014, and TM_{ijt} captures trademarking activity by firm i at time t. $IMPP^{Chn}_{jt-1}$ represents our main variable of interest, namely import penetration from China in sector j at time t-1, while $\boldsymbol{X}_{i,t-1}$ is a set of additional control variables (size, and R&D intensity), α_i and τ_t are individual and time effects, and u_{it} is the error term.[7]

[4] The original dataset includes also TMs filed at the European patent office. TMs registered at the USPTO represent 95.6% of all trademarking activity by firms located in the G7 and European countries, leaving just 16 firms headquartered in G7/Europe that file for TM protection at the EUIPO only. We use USPTO TMs because the US is a crucial market for all firms competing at the cutting edge of technology worldwide; hence, using a single office ensures comparability amongst firms. Moreover, the USPTO charges a fee for each Nice class covered by a TM, whereas the EUIPO implements a 3-for-1 pricing rule, whereby up to 3 Nice classes can be indicated at no additional cost to the firm. Such an arrangement could create some degree of 'class inflation'.

[5] The home countries of sample firms are: Austria, Belgium, Czechia, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Liechtenstein, Luxembourg, Malta, Netherlands, Norway, Portugal, Russia, Slovenia, Spain, Sweden, Switzerland, Turkey, the UK, and the US.

[6] Our calculation is based on the World Bank database for 2013.

[7] Individual fixed effects, which also capture sectoral differences in trademarking strategy, are not included in the probit model, where we use a pooled estimator. Size is measured as log sales, while R&D intensity is the log of R&D expenditures per employee. Because some firms report negative profits, we build a set of dummy variables that identify sector-year quartiles for the distribution of profits over sales.

Table 1
Firms by country of origin.

High income [1]	#	%	Group	Lower and upper middle income [1]	#	%	Group
United States	526	32.15	G7	China	126	7.70	Asia-Oceania
Japan	290	17.73	G7	India	18	1.10	Asia-Oceania
Germany	106	6.48	G7 / Europe	Brazil	7	0.43	Central-South America
UK	90	5.50	G7 / Europe	Turkey	4	0.24	Europe
Taiwan	74	4.52	Asia-Oceania	Malaysia	1	0.06	Asia-Oceania
France	66	4.03	G7 / Europe	Mexico	1	0.06	Central-South America
Korea	46	2.81	Asia-Oceania	South Africa	1	0.06	Africa-ME
Switzerland	44	2.69	Europe	Thailand	1	0.06	Asia-Oceania
Netherlands	28	1.71	Europe				
Sweden	27	1.65	Europe				
Italy	24	1.47	G7 / Europe				
Denmark	21	1.28	Europe				
Finland	17	1.04	Europe				
Canada	15	0.92	G7				
Ireland	15	0.92	Europe				
Spain	15	0.92	Europe				
Israel	12	0.73	Africa-ME				
Australia	11	0.67	Asia-Oceania				
Austria	10	0.61	Europe				
Belgium	9	0.55	Europe				
Norway	9	0.55	Europe				
Singapore	5	0.31	Asia-Oceania				
Luxembourg	2	0.12	Europe				
New Zealand	2	0.12	Asia-Oceania				
Portugal	2	0.12	Europe				
Russia	2	0.12	Europe				
Czech Republic	1	0.06	Europe				
Greece	1	0.06	Europe				
Hungary	1	0.06	Europe				
Iceland	1	0.06	Europe				
Liechtenstein	1	0.06	Europe				
Malta	1	0.06	Europe				
Saudi Arabia	1	0.06	Africa-ME				
Slovenia	1	0.06	Europe				
Venezuela	1	0.06	Central-South America				

[1] World Bank classification based on GNI per capita thresholds in US$ (Atlas methodology), 2014

Table 2
Top 15 industries by number of firms: whole sample and G7/Europe sample.

Nace rev.2 2 digits	Description	Sector	Whole sample			G7 / Europe sample		
			#firms	%	Ranking	#firms	%	Ranking
26	Manufacture of computer, electronic and optical products	M	353	21.58	1	258	19.41	1
28	Manufacture of machinery and equipment n.e.c.	M	142	8.68	2	126	9.48	2
21	Manufacture of basic pharmaceutical products and pharmaceutical preparations	M	120	7.33	3	103	7.75	3
20	Manufacture of chemicals and chemical products	M	116	7.09	4	101	7.60	4
29	Manufacture of motor vehicles, trailers and semi-trailers	M	89	5.44	5	70	5.27	5
62	Computer programming, consultancy and related activities	S	72	4.40	6	59	4.44	7
58	Publishing activities	S	69	4.22	7	63	4.74	6
32	Other manufacturing	M	49	3.00	8	46	3.46	8
27	Manufacture of electrical equipment	M	45	2.75	9	35	2.63	11
30	Manufacture of other transport equipment	M	42	2.57	10	37	2.78	10
24	Manufacture of basic metals	M	41	2.51	11	21	1.58	17
10	Manufacture of food products	M	40	2.44	12	37	2.78	9
64	Financial service activities, except insurance and pension funding	S	36	2.20	13	32	2.41	13
72	Scientific research and development	S	33	2.02	14	33	2.48	12
61	Telecommunications	S	32	1.96	15	23	1.73	15
	other manufacturing		130	7.95		111	8.36	
	other non-manufacturing		227	13.88		396	13.08	
	TOTAL		**1 636**	**100.00**		**1 326**	**100.00**	

M=manufacturing sector; S=service sector.

3.3.1. *Dependent variable: TMs*

TM_{it} is a measure of a firm's trademarking strategy. We use both a binary indicator, taking the value of one if company *i* at time *t* files a TM at the USPTO, and the actual number of TM filings per employee to capture the intensive margin of IPR protection. This measure is based on Mendonça et al. (2019), who scale product and service TMs by firm sales to account for different TM activities across firm size. We normalise by the number of employees (and not by sales) to reduce possible collinearity issues, given that we use (log) revenues to control for firm size. In addition, we investigate the *type* of TMs by taking the ratio between the number of 'mixed' TMs (i.e. those that mention both 'goods' and 'service' classes) and TMs that pertain only to 'goods'. We use TM applications rather than registered TM, which is consistent with the focus on firms' strategic responses to increased competition, which is well captured by the intention to apply for TM recognition.

Table 3
TMs by observation (years 2010–2014).

		Mean	SD	Min	Max
Whole sample	overall	12.41	35.64	0	960
	between		34.01	0	746
	within		10.68	-159.19	227
G7 / Europe	overall	14.30	38.25	0	960
	between		36.57	0	745.6
	within		11.23	-157.29	228.70

3.3.2. Explanatory variable: Import penetration

$IMPP^{Chn}_{jt-1}$ reflects the import penetration from China to the G7 countries in industry j at time t. It combines data on the value of production in different ISIC sectors taken from the OECD-Stan database with information on bilateral trade flows retrieved from the BACI dataset maintained by the CEPII (Gaulier & Zignago, 2010). We define Chinese import penetration as imports from China divided by total absorption (domestic production plus imports minus exports):

$$IMPP^{Chn}_{jt} = \frac{\sum_{c\in G7} imports^{Chn}_{cjt}}{\sum_{c\in G7}\left(production_{cjt} + imports_{cjt} - exports_{cjt}\right)}, \quad [2]$$

where c refers to G7 economies, j refers to industries, and t refers to the year.[8] The rationale for looking at the G7 group rather than single countries is based on the observation that our sample is made up of large MNEs active in several world markets. Thus, looking at import competition in, say, the Dutch market for Philips or the German market for Siemens would not adequately capture the competitive pressure faced by those firms. Moreover, the use of import penetration in G7 countries as a whole (rather than in single countries) reduces the possible concerns associated with omitted variable biases, such as country-specific demand shocks.

A small number of observations (six) were winsorised: five negative observations were set to zero, whereas a positive outlier reporting an import penetration well above one was set equal to the maximum plus one standard deviation (computed on the values between zero and one).

To limit possible endogeneity issues, we lagged the measure of import penetration by one year. Moreover, we also implement a full-fledged IV strategy that combines cross-industry variation in import penetration taken in 2005 (five years before our TM data start and before the onset of the global financial crisis to avoid picking up the rebound in trade that followed) with growth in total exports from China to the world. We consider the total Chinese export growth between 2005 and year t to add variation over time to the industry-level dispersion in import penetration in 2005. The instrument is therefore constructed as $IV_{j,t} = IMPP^{Chn}_{j,2005} \times ExpGrowth^{Chn-World}_{2005-t}$ where j indexes sectors and *ExpGrowth* stands for the growth in total Chinese exports between 2005 and year t. This shift-share approach is a workhorse of empirical research. Since Bartik (1991) and Altonji and Card (1991), it has been applied to many different domains, including the impact of China on foreign firms' innovation or labour demand. We claim that our initial shares are, in fact, exogenous (a condition for the IV strategy to work; see Goldsmith-Pinkham et al., 2020) both because the Chinese export strategy was very different in the mid-2000 s than during the sample years (when export shares stabilised) and because focusing on G7 countries as a whole limits the chance of common shocks hitting all markets simultaneously. The IV strategy is important to avoid both the reverse causality issues possibly due to Chinese firms focusing on sectors characterised by low IPR protection, and the omitted variable bias arising from the small set of controls available to us. In Section 3.4, we present evidence supporting the validity of the instrument.

[8] As production data are available at the level of ISIC sectors and trade data follow the HS classification, we convert HS codes to ISIC using the concordance tables maintained by the World Bank (https://wits.worldbank.org/product_concordance.html).

3.4. Results

3.4.1. The extensive margin of the TM strategy

We begin the analysis by employing a binary response model in which the dependent variable is a dummy that equals one if firm i has filed at least one TM with the USPO in year t. Table 4 reports the regression results from a pooled probit model in which standard errors are clustered at the firm level to capture the correlation of errors due to the panel structure of the data. The baseline specification (Column 1) includes only year effects and the import penetration measure, whereas the model in Column 2 features additional controls. The results are stable across specifications, with Chinese imports increasing the probability of filing at least one TM by 7.4–9.5%. The control variables behave as expected, with larger and more R&D-intensive companies being more likely to apply for TM protection.

Next, we adopt an instrumental variable approach to address possible endogeneity issues stemming from both reverse causality and omitted variables. The first-stage regression worked well, displaying a positive and strongly significant coefficient for the instrument and very high values for the *F*-test. A Wald test for the exogeneity of the main explanatory variable could not reject the null hypothesis of exogeneity in the baseline specification, while preferring the IV strategy when additional controls were included (p-value = 0.018). In any case, the results in columns 3 and 4 of Table 4 confirm the previous ones, with import competition increasing the likelihood of filing for TM protection by 7.6–9.5% depending on the specification.

3.4.2. TM intensity

We now turn to the intensive margin of TM activity, examining whether import competition influences the number of TMs filed by each firm, scaled by the number of employees, using a fixed-effect 2SLS instrumental variable approach. Table 5 shows that in the baseline specification, import competition exerts a positive effect on TM

Table 4
Impact of Chinese import competition on trademark use.

	pooled probit		**pooled IV probit**	
	(1)	(2)	(3)	(4)
Import penetration $G7_{t-1}$	0.256 * *	0.357 * **	0.262 * *	0.358 * **
	(0.122)	(0.123)	(0.123)	(0.124)
$\ln(sales)_{t-1}$		0.231 * **		0.231 * **
		(0.019)		(0.019)
$\ln(R\&D/empl)_{t-1}$		0.127 * **		0.127 * **
		(0.025)		(0.025)
marginal effect import pen.	0.074 * *	0.095 * **	0.076 * *	0.095 * **
Profit quartiles dummies	No	Yes	No	Yes
Year dummies	Yes	Yes	Yes	Yes
Observations	6645	6302	6645	6302
# firms	1329	1307	1329	1307
χ^2	44.22	212.2	44.69	212.2
correctly predicted (%)	78.60	79.01	78.60	79.01
exogeneity test			0.614	0.892
p-value			0.433	0.018
1st stage F-test			99,999	85,781
p-value			0	0

Dependent variable: dummy for TM use.
Clustered robust standard errors in parentheses at the firm level.
* ** $p < 0.01$, * * $p < 0.05$, * $p < 0.1$

Table 5
Impact of Chinese import competition on trademark intensity and type.

	TM intensity		TM type			
	(1)	(2)	(3)	(4)	(5)	(6)
Import penetration $G7_{t-1}$	0.011 * *	0.005	1.611 * **	1.819 * **	1.553 * *	1.693 * *
	(0.005)	(0.004)	(0.432)	(0.486)	(0.630)	(0.659)
$\ln(sales)_{t-1}$		0.001		-0.021		0.002
		(0.000)		(0.024)		(0.033)
$\ln(R\&D/empl)_{t-1}$		0.000		0.123 * *		-0.009
		(0.001)		(0.052)		(0.061)
Profit quartiles dummies	No	Yes	No	Yes	No	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	6412	6246	3462	3358	4406	4219
# firms	1304	1294	819	802	1072	1036
F-stat	2.469	2.359	13.34	14.59	8.804	4.349
exogeneity test	2.345	0.919	5.113	5.245	2.168	2.648
p-value	0.126	0.338	0.024	0.022	0.141	0.104
Kleibergen-Paap rk Wald F stat	12.112	12.191	11.372	11.233	12.171	11.933

Dependent variable: cols (1–2): number of TMs per employee; cols (3–6) number of mixed class TMs over number of TMs in goods classes. The sample in cols (3–4) contains only manufacturing firms.
Clustered robust standard errors in parentheses at the sector level.
* ** $p < 0.01$, * * $p < 0.05$, * $p < 0.1$

intensity, but the coefficient is much smaller and not significant once we include additional controls.[9] Section 3.5 sheds further light on these findings, confirming that the result is not very robust and casting doubts on the actual impact of Chinese imports on the intensive margin of TM activity.[10]

3.4.3. The servitisation of manufacturing

The last part of the analysis investigates whether competition from China affects the *type* rather than the *quantity* of TMs registered by firms located in Europe and other G7 countries. A recent line of research suggests that manufacturing firms increasingly adopt one strategy to withstand international competition: the shift from the sole production of goods to the provision of services (Blanchard et al., 2017; Breinlich et al., 2018; Crozet & Milet, 2017). In the context of trademarking activity, we can exploit the Nice classes attached to TMs to classify each filing as pertaining to 'goods' or 'services' (Nasirov, 2020).

To this purpose, we restrict the sample to firms whose primary sector of activity falls within manufacturing, and define our dependent variable as the ratio between the number of TMs referring to both goods and service classes (referred to as 'mixed TMs') and those pertinent only to goods. Columns 3 and 4 of Table 5 show that the exogeneity test rejects the null hypothesis of no correlation between the explanatory variable and the residuals, while the Kleibergen-Paap Wald test is larger than 10, indicating that the instrument is valid. The results suggest that firms more exposed to Chinese competition register a higher number of TMs containing both service and good classes relative to goods-only TMs.

These results are robust to the inclusion of service firms in the sample (Columns 5 and 6). Because the top R&D-spending firms in our sample tend to be sprawling conglomerates that are active in many industrial sectors, the distinction between manufacturing and service firms is somewhat fuzzy. Using the full sample does not modify our conclusions. Import competition has a positive effect on the ratio between mixed TMs and those that report only good classes. In addition, support for the positive impact of Chinese competition on servitisation does not hinge on the specific definition of the dependent variable. If we add service-only TMs to the numerator, that is, if we take the ratio of service and mixed TMs over goods-only TMs, we still find a strong positive and significant effect of import penetration.[11]

3.5. Robustness

The first robustness check uses registered TMs rather than simple applications. The two types of measures display a high correlation (84–87% depending on the specific variable), and the results (not shown but available upon request) are consistent across different econometric specifications. We prefer to use TM applications because they capture a firm's strategic decisions more directly, which do not depend on the results of the application process.

To assess the robustness of our results further, we performed two falsification exercises. First, we use country-specific import penetration at the company's headquarters. If we are simply picking up globalisation or a general trend in TM usage that is spuriously correlated with Chinese penetration in global markets, then the results should not change. The same would happen in the case of reverse causality, that is, if China targets sectors characterised by low IPR protection, thus triggering a defensive response from European and G7 firms.

As detailed in Table 6, the country-specific import measure loses significance both in the binary response model accounting for TM use (Columns 1 and 2), and when we investigate the *servitisation* of manufacturing (Columns 5 and 6). In Column 6, the coefficient of import penetration retains some borderline significance (p-value = 0.095), but the effect is much weaker than when imports to the G7 countries are used. In contrast, the impact of the country-specific measure on TMs per employee (Columns 3 and 4) is stronger than that found in our benchmark specification in Table 5. As such, this result casts doubt on the robustness of the effect of Chinese competition on TM intensity.

The second robustness check reshuffles the TM information across firms and reestimates the impact of import penetration on these randomly allocated TMs. We repeated the exercise 100 times on a selection of the most relevant empirical models discussed so far, and obtained the coefficients distribution. Table 7 displays the percentile of the distribution of 'reshuffled coefficients' that corresponds to the point estimates found in the original estimates. We can see that for TM use and type, the actual coefficients lie above the 95th percentile of the distribution, indicating that the results are robust and not merely statistical flukes. Once again, the same is not true for TM intensity, especially when

[9] Results are not affected by the choice of scaling TMs by the number of employees or by sales. In fact, when the dependent variable is the number of TMs over sales, import penetration is never significant.

[10] We also run several count models in which the dependent variable is the actual number of TM applications by each firm in each year. The results (not reported) indicate that import competition has no significant effects, irrespective of the specification used, which ranges from a simple OLS to Poisson to negative binomial regression.

[11] These results are not presented but available upon request.

Table 6
Impact of Chinese import competition in headquarter country.

	TM use		TM intensity		TM type	
	(1)	(2)	(3)	(4)	(5)	(6)
Import penetration $_{t-1}$	-0.014	0.010	0.026 * **	0.014 *	1.874	2.328 *
	(0.135)	(0.134)	(0.009)	(0.007)	(1.349)	(1.372)
ln(sales)$_{t-1}$		0.228 * **		0.001		-0.029
		(0.020)		(0.001)		(0.024)
ln(R&D/empl)$_{t-1}$		0.129 * **		0.000		0.113 * *
		(0.027)		(0.001)		(0.054)
Profit quartiles dummies	No	Yes	No	Yes	No	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	6295	5971	6078	5920	3362	3258
# firms	1259	1240	1236	1227	796	779
χ^2	38.17	187.2				
F-stat			2.162	2.305	16.38	23.50

Table 7
Placebo test.

Model		Table (col)	percentile
TM use	IV probit	4(3)	100
		4(4)	100
TM intensity	2SLS FE	5(1)	95
		5(2)	79
TM type	2SLS FE	5(3)	98
		5(4)	98

the model is augmented with additional controls. To mimic the results in Column (2) of Table 5, the estimated coefficient is not statistically different from its bootstrapped version, confirming the fragility of the result.

4. Conclusions

Increased competition from China can push firms that are close to the technological frontier to escape competition by investing in innovation and upgrading quality (Autor et al., 2020; Bloom et al., 2016; Fernandes & Paunov, 2013), and leveraging intangible resources less exposed to imitation and replicability by competitors (Barney, 1991; Beamish & Chakravarty, 2021). Rapid technical change and the global reach of competition make intangible assets, such as brand recognition and perceived quality, particularly valuable (Buckley et al., 2022; Castaldi & Giarratana, 2018; de Rassenfosse, 2017). However, the question of how MNEs use customer- or market-related intangibles such as brands and TMs (Denicolai et al., 2014; Sutherland et al., 2020) to face harsher trade-induced competition from China remains.

This study contributes to the IB literature on the effects of Chinese competition on the strategies of firms operating in advanced countries by focusing on trademarking activities. We do so by building on the RBV and the DCV to provide a theoretical framework from which we derive multiple propositions that are brought to the data. As TMs enable firms to distinguish their products, reinforce their brands, and differentiate themselves in the market, the RBV suggests that they contribute to defining firms' sustained competitive advantage. Rising competition based on low prices constitutes a change in the external environment that entices a dynamic response by firms. In line with the DCV, we postulate that trademarking is likely to play a major role in R&D-intensive firms' strategy to fend off competition based on low prices.

We find a strong effect of import penetration on the probability of registering for TM, whereas the evidence of an impact on TM intensity is very weak. Additionally, we find a positive effect on the use of mixed goods-and-services TM classes, which is consistent with the process of *servitisation* whereby manufacturing firms move toward the provision of high-value-added services.

This study advances the IB literature by incorporating the RBV and the DCV perspectives, which are theories of strategic management that have been successfully applied to the behaviour of MNEs (Beamish & Chakravarty, 2021; Lessard et al., 2016; Teece, 2014; Zahra et al., 2022). Because of the peculiar nature of MNEs (i.e. firms operating across borders), traditional IB theories have explained the behaviour of MNEs as the outcome of firm-specific advantages, location advantages, and internalisation advantages (Dunning, 1998; Rugman & Verbeke, 2001). Despite firm-specific advantages are central in the most influential IB theories, the RBV and the DVC have the merit to be much more focused on in-imitable internal resources and capabilities as a key source of competitive advantage. Both approaches seem particularly apt to capture the constantly changing international environment in which MNEs operate, which "demands effective and agile cross-border orchestration, integration, renewal, reconfiguration, and upgrading of critical resource bundles including the routines and capabilities vital for organizational success" (Zahra et al., 2022, p. 583).

In particular, our contribution to RBV and DCV in the IB context is twofold. First, we show that market-related intangible resources (i.e. TMs) are strategic for the competitive advantage of MNEs, since we show that they are leveraged against rising competition. Although the IB literature devoted extensive attention to the role of branding (Efrat & Asseraf, 2019; Ertekin et al., 2018), the link between TMs and competition in international markets has so far been overlooked. As far as the DCV is concerned, a strategic response that integrates trademarking shows the ability to adapt and implies activities related to "1) identification and assessment of opportunities at home and abroad (*sensing*); (2) mobilization of resources globally to address opportunities, and to capture value from doing so (*seizing*); and (3) continued renewal (*transforming*)" (Teece, 2014, p. 18). Through trademarking, MNEs make intangible resources more difficult to imitate and less exposed to quick appropriation by competitors.

Second, we incorporate in the IB literature a discussion of *servitisation* as a strategy to escape competition. *Servitisation* gained increasing attention in the domestic literature, but we have limited knowledge of its role within the international context (Bıçakcıoğlu-Peynirci & Morgan, 2023). With the lens of the DCV, *servitisation* resembles the concept of *cospecialisation* (Teece, 2014, 2007). Investing in co-specialised assets (e.g. complementary services to existing products) may help the firms to develop ecosystems within which to operate globally. Products becomes bundles or systems among which there is interdependence. Indeed, *servitisation* create new markets or expand existing ones by leveraging current firm-level resources (e.g. innovative products, reputational assets); this activity expresses the continuous alignment and realignment of assets, which is a key dynamic capability (Teece, 2007). To view *servitisation* of MNEs as *cospecialisation* contributes to the characterization of modern MNEs as orchestrators of global processes of value and wealth creation and capture, which involve the exercise of dynamic capabilities on a global basis (Lessard et al., 2016; Pitelis & Teece, 2018; Zahra et al., 2022).

Our results have valuable implications for business practices. First, it is straightforward that firms facing harsher competition on prices should

leverage their distinct and unique resources; in this sense, TMs can be used as a response, for example to reinforce existing brands, create new ones, further differentiate the product portfolio or expand into complementary services. Second, because of the inclusion of TMs in the IP strategy rather than the sheer number of TMs, firms should not overlook TMs in their competition strategies; indeed, TMs may be a faster and cheaper means to react compared to other instruments, such as product innovation, at least in the short term.

Finally, we acknowledge some limitations of this study that suggest potential avenues for further research. First, the use of US-based TMs may overlook the marketing strategies of firms that do not focus on the US, or at least not in the period considered. Although the US is a crucial market for many technological leaders worldwide, we cannot rule out the possibility that firms have different marketing strategies in different countries or macro-regions. Future studies may pair the use of TMs across firms with different expositions to the US market or consider other geographical markets (e.g. Europe). Second, we were unable to control for the stock of TMs with the data at hand, meaning that our results may capture marginal changes in a firm's strategy rather than structural modifications. Future studies may consider longer time spans by introducing elements of competitive dynamics (e.g. whether firms use TMs to respond to import competition and competitors' reactions). In addition, longer time windows would allow for a better assessment of the portfolio of TMs in terms of services and goods and how they evolve over time in an increasingly competitive environment. Third, our study provides evidence of firms' reactions to import competition; however, we do not know the effects of this response. Future studies could address the impact of TM-related responses to import competition on firm performance and innovation.

5. Appendix: Methodological notes

We use two versions of the COR&DIP© database, namely the 2015 (Dernis et al., 2015) and 2017 (Daiko et al., 2017) waves, which cover different periods. Both versions rely on two types of sources:

1. Information on the top 2 000 corporate R&D investors (source: EU Industrial R&D Investment Scoreboard), with data on the name and home country of the company, the industry to which it belongs, and some basic financial information, such as R&D, net sales, capital expenditures, operating profits, and number of employees.
2. IP information (source: PATSTAT, USPTO and EUIPO) includes patents and TMs.

The 2015 version of the database covers 2009–2012 for financial data and 2010–2012 for IP data. The source was the *2013 EU Industrial R&D Investment Scoreboard*, from which data were collected from companies' annual reports and accounts by Bureau van Dijk Electronic Publishing GmbH (BvD). For non-Eurozone companies, we transformed the currency values in the Eurozone using the 31st December 2012 exchange rate for any year. The IP data have been linked to firms and their subsidiaries as of 2012.

The 2017 version covers 2011–2014 for financial data and 2012–2014 for IP data. The source is the *2015 EU Industrial R&D Investment Scoreboard* (using data from the BvD database). For non-Eurozone companies, we transformed the currency values in the Eurozone using the 31st December 2014 exchange rate for any year. The IP data have been linked to firms and their subsidiaries as of 2014.

When we merge the two versions, three main problems arise. First, 411 companies did not match between the versions. Using online resources, we recovered 47 companies for which the failed match was due to a mere change of name (e.g. France Telecom changed its name to Orange in 2013).[12] We excluded companies that changed their names due to a merger (e.g. FIAT to FIAT Chrysler). When two merging firms were present in the previous version, we removed both the old and new firms (seven cases). Finally, we dropped the remaining firms because of failure, or simply because they were replaced in the ranking by other firms with higher R&D expenditures.

The second problem we encountered was that in each COR&DIP© database version, the financial data for non-Euro area companies were transformed into Euros using the 2014 exchange rate for all the years in the 2017 version and for 2012 in the 2015 version. When merging the two waves, we converted the value from the older version to the original currency and then back to the euro using the 2014 exchange rate for comparability across the two versions. We also deflated accounts at the 2009 price level. We applied the GDP deflator from the World Bank database by country. For Taiwan, we used the 'implicit GDP price index' from the OECD.

The third issue was the overlapping years between the two versions, 2011 and 2012. Because there was a mismatch between the two versions, we used the most recent values.

Data Availability

Data will be made available on request.

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