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TM-Link: An internationally linked trade mark database

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Abstract

This paper describes a new database – called TM-Link – that contains 12 million trade mark applications and registrations across six jurisdictions. A feature of the database is the identification of trade mark equivalents (or families) within and across national trade mark offices. Equivalent trade marks are two, or more, insignias for the same product applied for by the same company. Unlike patents, the incentive to file for global priority is comparatively weak since legal priority for trade marks is territorial. To identify the number of true trade mark equivalents we therefore create synthetic links using a neural network-based machine learning algorithm.

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INTRODUCTION

Trade marks are signs used as a 'badge of origin'[1] to identify the commercial source of the products claimed in the specification.[2] They consist of any combination of letters, words, names, numerals, devices or brand elements, *inter alia*.[3] Trade marks also provide information on the quality,[4] function and origin of products or businesses. Trade mark signals are considered most socially valuable when the buyers and sellers are not personally known to each other; when a producer wants to leverage its reputation to sell a new product; or when the transaction occurs at arm's length. In these situations, the trade mark or brand substitutes for personal trust.[5]

However, for marks to fulfil this function, the owner needs to be assured his or her mark cannot be used by competitors (i.e. infringed). Registering the trade mark with a government trade mark office makes it easier to enforce this right of exclusivity. As trade marks are territorial (i.e. jurisdiction specific),[6] firms need to file for the same mark with each national office that they want legal protection from other firms using that mark. The information embodied in these international marks provides a wealth of evidence about the activities and strategies of the firm, region, country or market.

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[1] Use as a trade mark to indicate a 'badge of origin' came from a passage in *Coca-Cola Co v All-Fect Distributors Ltd* (1999) 96 FCR 107 approved by the High Court in *E & J Gallo Winery v Lion Nathan Australia Pty Ltd* (2010) 241 CLR 144.

[2] Protection is implemented by granting the trade mark owner the exclusive right to use, or authorise others to use, the registered sign in relation to the particular goods and services claimed. The registered owner also has the right to obtain relief from the judiciary for trade mark infringement where others may use similar signs in the market for similar products and services.

[3] Under the *Trade Marks Act 1995* (Cth), the list of signs is non-exhaustive and includes can include three-dimensional shapes, colours, scents and sounds. See the definition of a 'sign' in section 6 of the *Trade Marks Act 1995* (Cth).

[4] It was first recognised that trade marks indicate quality in the Second Reading Speech of Senator McGregor, Vice-President of the Executive Council; Parliamentary Debates 1904, Vol xx, 3538 (27 July).

[5] As such, trade marks aide dynamic efficiency by providing incentives for firms to improve the quality of their product and aide static efficiency by reducing the cost of consumer search and unsuitable purchase (Landes and Posner 1987).

[6] Priority means the second or subsequent filing retains the 'new-to-the-world' or 'new-to-the-market' status as the first filing. Applications for both trade marks and patents can claim priority (based on an earlier filing date) providing certain conditions are met.

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However, use of this information by economists has been limited by the fact that registrations at different trade mark offices are not readily identifiable as equivalent.

Two types of formal international equivalence exist: Paris legal priority based on the prior application for the same mark in another jurisdiction,[7] and international filing through the Madrid System (or the International Trademark System).[8] However, an unknown number of equivalent trade marks are filed directly with national IP offices, without claiming priority based on an earlier filing elsewhere. It is not officially known whether these formal international equivalents (Paris and Madrid) represent a small or large fraction of all trans-national marks. The trade mark equivalence database we constructed suggests that the bulk of true equivalents are not registered through these two formal legal priority mechanisms.

This paper reports on the construction of a new database – called TM-Link – that connects 12 million trade mark applications and registrations across five jurisdictions – Australia (from 1983), Canada (1978), New Zealand (from 1968), the United States (from 1961) and the European Union (from 1996). We plan to incorporate data from other jurisdictions as they become available. At the time of writing, data from the United Kingdom had been included in TM-Link but had not yet been linked to the other five jurisdictions.

The paper is organised as follows. The next section discusses the largely unexploited potential of trade mark data and provides an overview of the limited literature that has used trade mark data; Section 3 gives an overview of how the database was constructed; and Section 4 presents a descriptive analysis of TM-Link; and Section 5 concludes.

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[7] Paris Convention for the Protection of Industrial Property (as amended on September 28, 1979).

[8] The Madrid Agreement Concerning the International Registration of Marks (Madrid Agreement 1891) and the Protection Relating to the Madrid Agreement Concerning the International Registration of Marks (Madrid Protocol 1989), collectively known as the Madrid System (or the International Trade mark System), is an international mechanism that allows applicants to submit a single trade mark application with a set of fees can designate the countries in which the application seeks registration. The system administered by WIPO allows applicants to seek protection in up to 117 countries. The intention of the Madrid System is to reduce the administrative burden on applicants filing in multiple jurisdictions and facilitates the maintenance of trade mark rights abroad.

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BACKGROUND

Why trade mark data?

For economists, management scientists and legal scholars, trade mark data are a valuable source of information that sheds light on three areas of interest. First, the operation of the economy, especially in relation to exporting and global value chains. Second, the branding and marketing strategies of firms, and, third the proficient operation of the trade mark system with respect to its dynamic and static efficiency goals (Schmoch and Gauch 2009; Millot 2009; Nasirov 2018; Castaldi 2019).

Trade mark data has several advantageous features compared with other firm-level innovation and export data. The low cost of trade mark registration makes it an attractive tool for brand promotion, especially for small business. Trade marks are used by all industries and sectors and the data do not suffer from the sectoral biases inherent in patent and design statistics.[9] They cover consumer goods as well as intermediate inputs that are traded in supply chains. Trade marks are firm-level records, but the location of the owner can be aggregated up to city, region and country levels using embedded geo-coded information.

Analysts can also link trade mark data to other data sources utilising information on the trade mark owner. It is this linkage to other administrative and survey datasets, such as patents, export, sales and employment data, which enables analysts to address the most interesting questions, such as branding strategies for new products, export intentions or agglomeration economies. Trade mark applications, and the details of their owners, can be used to identify the name and location of would-be innovators and exporters (see, for example, Petrie *et al.* 2019). The information embodied in trade mark data are also typically quite timely, and unlike most business data collected by national statistical offices, they may be used for predictive analysis and forecasting.

[9] It has been well documented that patents, as statistics, have a biased coverage of inventions by industry (see Arundel and Kabla 1998) and that the coverage of registered designs is similarly biased.

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As in the case of patent data, trade mark data nevertheless have drawbacks as indicators of innovative activities, and, depending on their use, they can be biased or unreliable sources of information. For instance, not all signs and brands need be registered to be considered trade marks. In common law countries, firms may rely solely on the protection offered from the common law (i.e. unregistered trade marks), such as an action for passing off or equivalent consumer protection laws. In addition, strategic decisions may affect the decision to apply for trade mark registration which limits its value as a predictor of innovative products and exports. There are anecdotes that some firms register marks in off-line territories to avoid giving information to competitors. Moreover, trade mark data's predictive qualities may be compromised if firms delay applying for registration until use has been established in jurisdictions where ownership of trade marks is awarded to those that first use the trade mark in the territory.[10] This can lead to firms using the trade mark in the territory to accumulate evidence of use before filing to secure trade mark registration. Giarratana and Torrisi (2010) have also suggested that foreign trademark registrations can be used as an indicator of entry into a foreign market.

This strategic use of trade marks, along with different trade mark laws in different jurisdictions (e.g. trade mark law in China is an area of study in itself) can diminish the value of the data as a source of information about innovation, exports and foreign investment. In addition, some sectors use many trade marks to do their business (e.g. cleaning chemicals), but others will use relatively few (e.g. services or industries where few high value products are the norm). This will impact on the value of any individual trade mark. Finally, there could be sampling bias. Baroncelli, Fink and Javorcik (2005) believe that firms from developing countries are less likely to trade mark in developed countries due to a lack of established reputation or reliable trade performance.

[10] Common law countries such as Australia, NZ, US, Canada, Singapore, UK are is a first to use jurisdiction. Civil law countries such as China have a 'first to file' rule.

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What have trade mark data told us?

Business performance

The information content of trade mark data has not gone unnoticed and there is an emerging empirical literature which uses trade mark applications and registrations data. A recent review of the literature (Nasirov 2018) finds that the focus has been on explaining firm value, productivity and profitability. Economists have modelled how well trade mark applications reflect firm-level innovation and, its twin, intangible assets (Economides 1988; Hall 1999; Bosworth and Rogers 2001; Feeny and Rogers 2003; Schmoch 2003; Mendonça, Pereira and Godinho 2004; Malmberg 2005; Greenhalgh and Rogers 2006; Buddelmeyer, Jensen and Webster 2010; Helmers and Rogers 2011; Griffiths, Jensen and Webster 2011; Sandner and Block 2011; Greenhalgh and Rogers 2012; González-Pedraz and Mayordomo, 2012; González-Pedraz and Mayordomo, 2012; Ceccagnoli and Jiang (2013); Gotsch and Hipp 2014; Flikkema *et al.* 2014; de Rassenfosse 2017; Castaldi 2018; Flikkema et al 2019; Dinlersoz *et al.* forthcoming). Furthermore, the econometric study by González-Pedraz and Mayordomo (2012) found that diverse trademark portfolios are not necessarily good measure of intangible assets. In economic modelling, trade marks as indices of innovation or intangible assets are used as both the dependent and explanatory variables. Trade marks have also been used to identify product innovation (Jensen and Webster 2009) and study market survival (Buddelmeyer, Jensen and Webster 2010; Helmers and Rogers 2010).

Trade mark data are increasingly being used to understand and measure firm brand value. In this regard, trade mark data have the practical advantage that data are more available than company's investment in brand. This approach is based on the notion that trademarks and brands are closely related, because trademarks are the legal basis for a brand (Aaker 1991; Cohen 1986, 1991). The use of trademark counts as an indicator for brand investment is relatively new but is becoming increasingly common in the recent literature. (Krasnikov *et al.* 2009; Castaldi and Giarratana 2018; Drivas and Iliopoulos 2017 and Grashuis 2017).

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However, very little use has been made of trade mark data to inform us about international economic activities such as export and foreign investment. One plausible reason for this is that, unlike global patent databases such as PATSTAT,[11] a fit-for-purpose global trade mark database has not been readily available as a research tool. This serves as one of the main motivations behind our construction of the TM-Link database.

Strategic use of trade marks

According to Nasirov (2018), there is a general lack of systematic evidence about management engagement in the use of trade marks and the literature is dominated by anecdotal evidence. Many articles on strategic objectives are based on relatively small samples of data (Mendonça, Pereira and Godinho 2004; Amara, Landry and Traoré 2008; Krasnikov, Mishra and Orozco 2009; Semadeni and Anderson 2010; Gotsch and Hipp 2014; Block *et al.* 2015; Li and Deng 2017).

There is however, an emerging literature based on larger trademark datasets. These have used trade mark data in one of three way: strategies; to show how firms' behaviour is having unintended consequences; and to show how trademarking activity is a strategic tool in itself. For example, trade marks can be used to reflect the development of marketing capabilities; or to show how trademarking interacts with other R&D strategies; or to be a market strategy itself (Xiong & Bharadwaj 2011; Huang et al 2013).

In a study where trademarks reflect a firm's commercial strategy, Link and Scott (2012) and Guzman and Stern (2015) find that start-ups with more trademarks have higher employment growth. Noting the economic studies (cited in the previous section), Malmberg (2005) qualifies the accuracy of trademarks as indicators of new-to-the-firm innovation. He claims they are better indicators in industries with frequent use of trade marks and with products targeting consumers or professional end-users. Gao and Hitt (2012) provide evidence that the high trade mark turnover in the IT industry reflects their shorter product lifecycles. Semadeni and Anderson (2010) used

[11] See https://www.epo.org/searching-for-patents/business/patstat.html (Accessed on 02-Oct-2019).

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text analysis on the trademarks of 50 companies to assess when firms chose to imitate a new, unproven product, or to forgo imitation. Trademarking behaviour can also be a signal of soft innovation (Stoneman 2010), service innovation (Schmoch and Gauch, 2009), product innovation especially for brand extension (Flikkema et al. 2019), or, less plausibly, organizational innovation (Millot 2009).

As an example of when trademarking activity might be having unintended consequences, Block et al (2014) show that too few or too many trademarks can reduce financiers' valuation of start-ups. In contrast, Srinivasan *et al*. (2008) find that larger number of trade marks can assist survival in the context of product diversity. A separate study by Block, Fisch and Sandner (2014) showed that financial markets value only those trade marks that develop existing brands, not new ones. Castaldi and Dosso (2018) found that trademarking complemented R&D and patenting activities.

Finally, de Vries *et al.* (2017); Block, Fisch and Sandner (2014); Block et al (2014); Zhou *et al.* (2016) use trademark data to illustrate where trademarking is part of the strategy such as signalling to investors. Mendonça, Pereira and Godinho (2004) argue that trade marks can be used to increase the price inelasticity of demand, improve appropriation of profits, enhance the appropriation of complementary forms of intellectual property, open new markets, increase bargaining power with suppliers and signal changes in brand and corporate identity. Greenhalgh and Rogers (2007) have argued that trade marks can substitute for patents where an invention is not patentable subject matter such as the service industry or for incremental inventions. After noting the correlation between trademarking and patenting, Dinlersoz *et al.* (forthcoming) point out that the direction of causation can work two ways: trade marks may be used to appropriate innovation profits (by establishing brand loyalty and signalling quality) or trade mark profits may be used to finance product and process innovation.

Most of the above studies are based on data from one jurisdiction except for Baroncelli, Fink and Javorcik (2005) who found that the trade mark intensity of goods relates to the income of the exporting country not the importing country.

Efficiency of the trade mark system

Trade marks carry information about the quality of the wares of a particular company – in doing so, they help avoid adverse selection issues associated with the 'market for

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lemons' inefficiencies (Landes and Posner 1987; Akerlof 1970). In the face of product quality uncertainty, consumers will pay a price reflecting the average quality of goods on the market, which in turn creates an incentive for producers to only offer goods of an average or lower quality.[12] An efficient trademark system balances the costs of enforcement with the gains. Unlike technology, brands protected by trade marks are generally rival goods – that means infringing a trade mark diminishes its value to all users.[13] Clarity of the signal to consumers can be weakened where many similar or overlapping marks exist.

Investigating the efficiency of the trade mark system requires comprehensive and accurate data that goes beyond anecdotes. Scholars examining the efficiency of the trade mark system have used such data to understand the incidence of applications (Jensen and Webster 2006; Block, Fisch, Hahn and Sandner 2015; Squicciarini, Millot and Dernis 2012) and to document register cluttering (von Graevenitz 2013; Dinwoodie 2016; Zhang 2019). Both these behaviours may have implications for the health of the trade mark system. Von Graevenitz (2013) and Dinwoodie (2016) have also examined the nature of territorial overlaps and international mechanisms that could contribute to increased numbers of trade marks on registers that could ultimately lead to instances of clutter. In addition, systematic data can reveal if there is any bias in the examination decision against foreign applicants [as found by Baroncelli, Krivonos and Olarreaga (2007) in China, Hong Kong, India, and South Africa]; whether accession to the Madrid protocol increased the level of international trademarking increase;[14] or whether the Madrid protocol aided export by lowering the barriers to international trademarking?

[12] see Ramello 2006 for an introduction into the economics of trademarks

[13] Strong trade mark protection also does not stymie dynamic knowledge spill-overs, cumulative innovation or lead to the coordination and hold-up problems associated with patents over complex technology.

[14] Australia joined on July 11, 2001; Canada on June 17, 2019; New Zealand on December 10, 2012; USA on November 2, 2003.

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HOW HAS THE DATA BEEN CONSTRUCTED?

TM-Link comprises data on trade mark filings from the USPTO Trademark Case File Dataset (TCFD), the Australian Intellectual Property Open Government Data (IPGOD), the New Zealand Trade Mark Information API, the Canadian Trademarks Database, and the EUIPO Community Trade Mark Database. All these trade mark data sources capture information from applicants that are seeking trade mark registration. The data sources do not include common law trade marks, which firms may rely upon in the course of trade.

To identify equivalent trade marks, we developed a neural network linking algorithm which identifies similar trade marks across different countries, as described previously by Petrie *et al.* (2019). This involves assessing trade mark equivalence through comparison of: trade mark text (i.e. the words or text depicted in the trade mark)[15]; filing date; Nice classification; and applicant name. Once we have cleaned the data from each national office and consolidated duplicate records[16], we algorithmically identify equivalent trade marks across jurisdictions – i.e. families of trade marks from a given firm filed across different national offices. We apply this international trade mark linking algorithm to all applications that contain trade mark text (i.e. 96% of all trade mark applications include text). To date we have linked trade mark applications from the USA, Canada, Australia, New Zealand and the European Union. Note that we define the 'country of owner' of a family of trade marks as the address of the first filed application in a family. As such we have over 250 countries of ownership.

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[15] Trade marks can include words or other text as well as visual designs or typographic elements. We only consider trade mark text in our linking algorithm and do not consider the associated trade mark images (i.e. stylistic elements and visual designs).

[16] Multiple applications for the same identical trade mark can reflect recording errors, where all fields contain identical data, and we remove these. Also, for some offices, multi-Nice Class trade marks historically required separate applications each with a single Nice Class, as older applications could only be filed under a single Nice class. We consolidate any such multi-Nice applications into a single application with a single associated application number, removing any associated duplicate applications.

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The trade mark linking algorithm involves two separate stages; a blocking algorithm followed by a neural network classification algorithm (Petrie *et al.*, 2019). The blocking (or "binning") algorithm involves efficiently grouping trade mark applications together into blocks containing similar trade marks (TMs). We then further refine these groups of linked trade marks using a more computationally intensive neural network linking algorithm, which improves the linking accuracy by searching within each block to remove false positive TM-TM links.

Blocking algorithm

Our blocking algorithm groups similar trade mark applications into the same block if they share similar trade mark text, as described previously in Petrie *et al.* (2019). The process involves systematically simplifying trade mark text (e.g., removing punctuation), in order to avoid the issue that exact matching the raw trade mark text would miss many equivalent trade marks due to minor text differences. We also remove any applications which do not share Nice classification numbers with any other applications in the same block. The procedure aims to maximize the collection of similar trade marks into the same block while avoiding the generation of large, non-specific blocks which would contain many false positive associations and increase computation time for the neural network stage of the linking algorithm.

Following this blocking process, randomly sampling within-block TM-TM pairs and visually checking the accuracy of those matches indicates that approximately 40% of candidate positive links are false positives. To further reduce this false positive proportion, we trained a neural network machine learning algorithm to remove as many false positive links as possible, while retaining true positive links.

Neural network algorithm

The neural network linking algorithm is based on an adaptation of a previous inventor name disambiguation algorithm introduced by Petrie and Julius (2019).[17] The

[17] The Petrie and Julius (2019) classification algorithm obtained highly accurate results (F1 Score: 99.09%, precision: 99.41%, recall: 98.76%), outperforming the previous world standard (Li *et al.* 2014; Ventura *et al.* 2015; Kim *et al.* 2016; Morrison *et al.* 2017; Yang *et al.* 2017).

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algorithm processes a single pair of records at a time, classifying the record pair as either matched (equivalent TMs) or non-matched (not equivalent TMs). This requires that text-based record data be converted into a 2D colour image representation of that text. A modified version of the "AlexNet" neural network (Krizhevsky *et al.* 2012) is then trained to perform the pairwise match/non-match classification. Petrie and Julius (2019) provide further details on the inventor name disambiguation version of the neural network linking algorithm.

Applying the neural network linking algorithm to trade marks requires training the network on a sub-sample of labelled TM-TM pairs. As described previously in Petrie *et al.* (2019), we use a labelled sub-sample which includes a set of true positive links from the Madrid Protocol, and true negative links from a random sample of any within-block TM-TM pairs which have different filing jurisdictions, very different filing dates (over 20 years), and non-identical applicant names. We use this sub-sample of labelled TM-TM pairs to train the neural network to identify whether the image representation of a given TM-TM pair corresponds to an equivalent pair, and then deploy the trained network to classify each within-block TM-TM pair as either matched (equivalent TMs) or non-matched (not equivalent TMs).

Obtaining single firm trade mark families

To separate cases of multiple firms applying for the same trade mark, we require that all linked trade mark applications share an applicant with one or more equivalent trade marks in the same family. We do this by requiring that each application's applicant name has a high degree of string similarity to the applicant name of one or more trade marks in the same family group, as described previously in Petrie *et al.* (2019). We remove any applications that do not meet this requirement and assign them to a different family ID. Note that instances of multiple different firms applying for the same trade mark or very similar trade marks could potentially indicate squatting or competition for very similar marks, therefore trade mark groups generated prior to requiring within-group firm similarity could potentially be used to investigate these processes. However, we do not investigate such research questions in this work, focusing instead on trade mark families belonging to the same firm.

The accuracy of the linking algorithm was estimated by manually assessing a random sample of asserted positive links, with 95% of those links being true positives and 5%

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being false positives (Petrie *et al.*, 2019). Also, some TM-TM pairs are known to be linked a priori due to shared international registration number (via the Madrid Protocol), and the linking algorithm recalls approximately 92% of a priori known links. A copy of TM-Link may be found here https://www.tmlink.net.au/.

DESCRIPTIVE ANALYSES OF TM-LINK

Potential use of TM-Link

Aside from Baroncelli, Fink and Javorcik (2005), surprisingly little is known about the nature of trade mark filings abroad and the extent to which firms are engaging in international trade mark registration for their brands. The TM-Link database we constructed can assist the literature by providing firm-level information for the first time on the incidence, timing and extent of trade marking activity across multiple jurisdictions. TM-Link can provide a clearer glimpse into international trade mark activity via linked national office trade mark filings and open new research possibilities. For example, TM-Link could help to identify trade mark squatting on an international level, assist with identifying prospective exporters, especially firms entering global value chains, and aid analysis of strategic branding and marketing (Petrie *et al.* 2019).

A range of important research and policy questions could potentially be addressed, including: Are firms producing higher quality products more likely to apply for international trade marks, not so much to permit exports or foreign direct investment, but to protect their reputation abroad from squatters and imitators? Are such internationally engaged firms also more likely to create more differentiated products, as indicted by a proliferation of trade marks? What is the role of economies of scale and scope in this decision?

TM-Link not only groups multi-office trade marks into families, but also collates similar intra-office marks into a common family. These intra-office marks, which usually evolve from a single core mark, may represent a product variation or a new evolved product. Alternatively, firms may seek a thicket of marks around the core mark in order to protect the latter from look-a-likes. Although marks that remain unused are vulnerable to removal after a few years (depending on the rules of the jurisdiction), we have no evidence that they are removed from the trade mark register.

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Unused marks may thereby continue to operate as a barrier, for better or worse, for similar marks in the market. In contrast to the other offices in our (current) database, the US has an *ex officio* removal for non-use process. If the registrant cannot provide evidence of use on all the goods/services claimed 7 years after registration, the office will remove the trade mark.

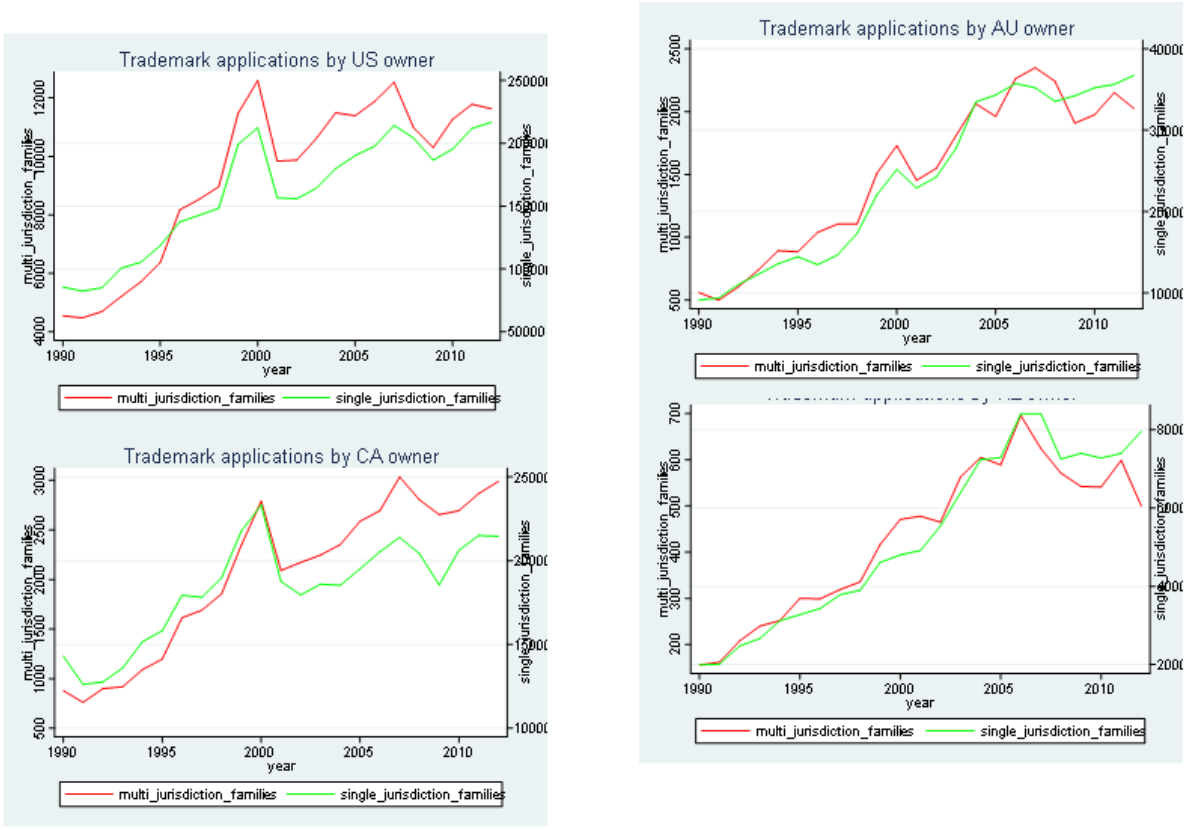
When linked to firm-level accounting and corporate datasets, TM-Link has the potential to enable further progress toward answering these questions. In addition, the data can provide more nuanced descriptive analysis on whether international trademarking varies by industry, firm size, patenting activity, corporate type and regional location.

Growth in single- and multi-jurisdiction applications

According to the TM-Link database, multi-jurisdiction applications for American, Australian and New Zealand owned firms mimic single jurisdiction applications over time. Figure 1 shows these two types of trade mark applications for each applicant country with multi-jurisdiction applications measured on the left-hand side and single-jurisdiction applications measured on the right-hand side. Although we have data on trade marks owned by over 200 countries, we only present those owned by firms whose address is in the USA, Canada, Australia and New Zealand. These four countries show strong upward trends in the number of applications with spikes. The dot.com bubble, which occurred in the lead up to 2000, is apparent in the US, Australia and Canada for both single and multi-office applications. There appears to be only a limited multi-office bubble in New Zealand. There also appears to be a downturn in both single and multi- jurisdiction applications at around the time of the global financial crisis in 2008, regardless of the owner country.

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Note: * Country of owner is defined as the address given on the first trade mark filed for each family within our dataset of five jurisdictions

Figure 1: Trend in single- and multi-jurisdiction trade mark applications by country of owner, 1990 to 2012.

filing a trade mark between 1990 and 2012) in the TM-Link database. There were 1,781,258 American trade mark-active firms, and of these 95.0 per cent filed in the United States Patent and Trademark Office (USPTO); 4.9 per cent in the Canadian Intellectual Property Office (CIPO) just over 2 per cent at IP Australia and the European Union Intellectual Property Office (EUIPO). Canadian firms are the least likely to file at their home office (80.3 per cent) with nearly a quarter filing at the USPTO. Among Australian firms, 92.5 per cent filed at IP Australia with the USPTO being the next most popular office followed by Intellectual Property Office of New Zealand (IPONZ). New Zealand firms are second most likely to file at IP Australia after IPONZ.

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Table 1: Counts of trade mark active firms by country of owner* and office applied, 1990-2012.

	Country of owner*									
Jurisdiction	USA	%	Canada	%	Australia	%	New Zealand	%	Other*	%
USPTO	1,691,312	**95.0**	55,323	25.8	17,270	6.0	3,392	5.1	271,103	45.1
CIPO	86,517	4.9	171,946	**80.3**	4,141	1.4	983	1.5	72,662	12.1
IP Aust	36,908	2.1	2,845	1.3	267,147	**92.5**	6,376	9.5	72,418	12.1
IPONZ	14,393	0.8	1,130	0.5	12,642	4.4	60,249	**89.9**	22,198	3.7
EUIPO	41,023	2.3	4,692	2.2	3,008	1.0	1,136	1.7	275,087	45.8
TOTAL	1,781,258	100.0	214,206	100.0	288,718	100.0	67,050	100.0	600,627	100.0

Note: * Country of owner is defined as the address given on the first trade mark filed for each family within our dataset of five jurisdictions. The total does not sum to 100.0 as firms can file in multiple jurisdictions.

Not all applicants apply to their country of residence first. Filing overseas can be part of the firms marketing and appropriation strategy. According to Table 2, at least one in four firms file in a jurisdiction which is not the address they put on their first application. There is a two-way relation happening. American and Canadian firms are most often likely to choose each other's office as the first office (after their own office), and the same is true for Australian and New Zealand.

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Table 2: Multi-jurisdiction trade marks by country of owner* and first office applied, 1990-2012.

	Country of owner*									
Jurisdiction of first filing	USA	%	Canada	%	Australia	%	New Zealand	%	Other*	%
USPTO	171,208	**79.9**	8,570	18.1	2,082	6.0	444	4.5	64,767	29.0
CIPO	15,317	7.2	37,152	**78.7**	363	1.1	78	0.8	21,768	9.8
IP Aust	9,618	4.5	494	1.1	27,201	**78.9**	1,950	19.7	34,618	15.5
IPONZ	6,011	2.8	245	0.5	4,329	12.6	7,250	**73.1**	11,610	5.2
EUIPO	12,133	5.7	770	1.6	508	1.5	202	2.0	90,417	40.5
TOTAL	214,287	100	47,231	100	34,483	100	9,924	100	223,180	100

Note: * Country of owner is defined as the address given on the first trade mark filed for each family within our dataset of five jurisdictions.

Approximately half of all multi-office trade mark families are filed within the 6-month limit for recognition of legal priority, as shown in Table 3. The exception are applications that were filed first at CIPO. Our preliminary inspection of the data shows that the percentage of multi-office trade mark pursing the Madrid route is low, as shown in Table 4. In 2013, when the US, Australia and New Zealand were established participants of the Madrid protocol, the percentage of domestic firms, with an international family, using this route was 15.8 per cent for Australia, 12.3 per cent for New Zealand and 7.8 per cent for the US. Canada was not a member within the window of our dataset.

Table 3: Length of time (days) between first and last filing in the multi-jurisdiction trade mark family, by first office applied and sample percentile, 1990-2012.

Jurisdiction of first filing		SAMPLE PERCENTILE		
	N	**10th**	**50th**	**90th**
USPTO	241,335	2	183	3168
CIPO	74,758	1	72	1974
IP Aust	71,563	0	123	2808
IPONZ	29,486	1	153	2624
EUIPO	104,377	3	163	2651

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TOTAL	521,519	1	176	2866

Table 4: Use of the International registration system (Madrid Protocol) by multi-office applicants, US, AU, NZ country of owner, 2013.

Country of Owner*	Number of Madrid applications	Percentage of multi-office applications using Madrid
US	3,499	7.8
AU	976	15.8
NZ	215	12.3
OT*	14,964	31.5

Note: * This is a biased sample of 'Other' country owners as is does not include applications to offices other than the 5 offices under consideration. Country of owner is defined as the address given on the first trade mark filed for each family within our dataset of five jurisdictions

The median time between first and last filing in the family varies by Nice class, as shown in Appendix Table A1. Although most classes have a median lag of less than the 182 days (the maximum allowed for legal priority recognition), there are notable exceptions. These consist of Classes 14 (precious metals), 18 (leather), 21 (kitchen utensils), 22 (rope), 24 (textiles); 25 (clothing); 26 (lace); 27 (carpets); 28 (games); 29 (meat etc); 30 (coffee etc); 31 (raw foodstuff); 32 (beverages); 33 (alcoholic beverages); 34 (tobacco); 35 (office functions); and 43 (hospitality).

Global trade marking and economic performance

It is not the intention here to undertake a definitive study on the link between global trade marking and economic performance, but to reveal the outline of what global trade mark data can say about this topic. Table 5 presents some basic data on the ratio of exports to GDP and the ratio of multi-nation to all trade marks for the four countries in the TM-Link database. A multi-jurisdiction trade mark family contains equivalent marks filed in two or more jurisdictions (out of the sample of five jurisdictions). We have classified each family by the country-of-origin of the first filed mark.

Table 5 shows that between 1990 and 2012, New Zealand and Canada both had the highest rate of exports to GDP and the highest rate of multi-nation trade marks to all trade marks. We find different patterns if we look at rates of growth, as shown in

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Table 6. Over the same period, the USA had the fastest growth in both exports and exports relative to GDP but the slowest growth in relative multi-nation trade marks. Canada had the fastest growth in relative multi-nation trade marks (last column).

Table 5: Average annual level, 1990 to 2012

Country	GDP ($m) (a)	Exports ($m) (b)	(b)/(a) %	All trade mark app (c)	Multi-nation trade mark app (d)	(d)/(c) %
USA (USD 2012 prices)	13,001,758.2	1,362,428.9	10.5	169,430.2	6,522.3	3.8
Canada (CAD 2007 prices)	1,321,932.2	424,489.0	32.1	20,654.1	1,653.7	8.0
Australia (AUD 2015 prices)	1,115,165.3	179,626.8	16.1	25,227.3	1,247.9	4.9
New Zealand (NZD 2009 prices)	157,437.3	44,104.9	28.0	481.5	105.3	21.9

Source: OECDStats and TM-Link.

Table 6: Average annual growth rates, percentage, 1990 to 2012

Country	GDP (a)	Exports (b)	(b)/(a)	All trade mark app (c)	Multi-nation trade mark app (d)	(d)/(c)
USA (USD 2012 prices)	2.7	5.0	2.3	4.2	4.0	-0.2
Canada (CAD 2007 prices)	2.7	3.7	1.0	2.4	6.5	4.1
Australia (AUD 2015 prices)	3.4	4.4	1.0	6.9	6.8	-0.1
New Zealand (NZD 2009 prices)	3.0	3.9	0.9	5.3	7.9	2.6

Source: OECDStats and TM-Link.

CONCLUSION

Internationally linked trade mark data can reveal new information about the export, investment and marketing strategies of firms. For the first time, a database[18] of trade mark equivalents has been constructed using data from the USA, Canada, Australia,

[18] https://www.tmlink.net.au/

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New Zealand and the European Union, and we have released the database as an open tool for researchers and policy makers.

We found that at least one in four firms file in a jurisdiction which is not the address they put on their first application. Furthermore, American and Canadian firms are most often likely to choose each other's office as the first office (after their own office), and the same is true for Australian and New Zealand firms. We also found that countries with higher rates of exports relative to GDP seemed to have higher rates of multi-nation trade marks to all trade marks, but further investigation is required to investigate potential links between global trade marking and economic performance.

Going forward, the TM-Link team is in the process of making further improvements in reducing the rate of false positive matches, integrating new offices' data into the database and introducing processes to make the data more timely.

REFERENCES

Aaker, D. A. 1991, *Managing Brand Equity*. The Free Press, New York.

Akerlof, G. A. 1970. 'The Market for Lemons: Quality Uncertainty and the Market Mechanism.' *Quarterly Journal of Economics*, vol. 84, pp. 488-500.

Amara, N., Landry, R. and Traoré, N. 2008. Managing the protection of innovations in knowledge-intensive business services. *Research policy*, vol. 37, pp. 1530-1547.

Arundel, A. and Kabla, I. 1998. What percentage of innovations are patented? Empirical estimates for European firms. *Research policy*, vol. 27, pp. 127-141.

Baroncelli, E., Fink, C., and Javorcik, B. 2005. The Global Distribution of Trademarks: Some Stylised Facts' *World Economy*, vol. 28, pp. 765-782

Baroncelli, E., Krivonos, E. and Olarreaga, M. 2007. Trademark Protection or Protectionism? *Review of International Economics*, vol. 15, pp. 126-145.

Block J. H., De Vries, G., Schumann, J. H. et al. 2014a, Trademarks and venture capital valuation. *Journal of Business Venturing*, vol, 29, pp. 525–542.

Block, J. H., Fisch, C. O. and Sandner, P. G. 2014b, Trademark families: Characteristics and market values. *Journal of Brand Management*, vol. 21, pp. 150–170.

Block, J. H., De Vries, G., Schumann, J. H. and Sandner, P. 2014. Trademarks and venture capital valuation. *Journal of Business Venturing*, vol. 29, pp. 525-542.

This article is protected by copyright. All rights reserved.

Author Manuscript

Block, J. H., Fisch, C. and Sandner, P. G. 2014. Trademark families: Characteristics and market values. *Journal of Brand Management*, vol. 21, pp. 150-170.

Block, J. H., Fisch, C. O., Hahn, A. and Sandner, P. G. 2015. Why do SMEs file trademarks? Insights from firms in innovative industries. *Research Policy*, vol. 44, pp. 1915-1930.

Bosworth, D. and Rogers, M. 2001. Market value, R&D and intellectual property: an empirical analysis of large Australian firms. *Economic Record*, vol. 77, pp. 323-337.

Buddelmeyer, H., Jensen, P. H. and Webster, E. 2010. Innovation and the determinants of company survival. *Oxford Economic Papers*, vol. 62, pp. 261-285.

Castaldi, C. 2018, To trademark or not to trademark: The case of the creative and cultural industries. *Research Policy*, vol. 47, pp. 606–616.

Castaldi, C. and Dosso, M. 2018, From R&D to market: Using trademarks to capture the market capability of top R&D investors, JRC working papers on Corporate R&D and Innovation no. 01/2018. Brussels: Joint Research Centre.

Castaldi, C. and Giarratana, M. S. 2018, Diversification, branding, and performance of professional service firms. *Journal of Service Research*, vol. 21, pp. 353–364.

Castaldi, C. 2019, All the great things you can do with trademark data: Taking stock and looking ahead. *Strategic Organization*. https://doi.org/10.1177/1476127019847835

Ceccagnoli, M. and Jiang, L. 2013, The cost of integrating external technologies: Supply and demand drivers of value creation in the markets for technology. *Strategic Management Journal* vol. 34, pp. 404–425.

Cohen, D. 1986, Trademark Strategy, *Journal of Marketing*, vol. 50, pp. 61–74.

Cohen, D. 1991, Trademark Strategy Revisited, *Journal of Marketing*, vol. 55, pp. 46–59.

de Rassenfosse, G. 2016. An assessment of how well we account for intangibles. *Industrial and Corporate Change*, vol. 26, pp. 517-534.

De Vries, G., Pennings, E., Block, J. H. and Fisch, C. 2017. Trademark or patent? The effects of market concentration, customer type and venture capital financing on start-ups' initial IP applications. *Industry and Innovation*, vol. 24, pp. 325-345.

Dinlersoz, E., Goldschlag, N., Myers, A., Zolas, N. (forthcoming). An Anatomy of U.S. Firms Seeking Trademark Registration, in *Measuring and Accounting for Innovation in the 21st Century*, (eds) Carol Corrado, Jonathan Haskel, Javier Miranda, and Daniel Sichel, Conference held March 10–11, 2017, Forthcoming from University of Chicago Press, in NBER Book Series Studies in Income and Wealth

This article is protected by copyright. All rights reserved.

Author Manuscript

Dinwoodie, G.B. 2016. Territorial Overlaps in Trademark Law: The Evolving European Model. *Notre Dame Law Review.*, vol. 92, p.1669.

Drivas, K. and Iliopoulos, C. 2017, 'An empirical investigation in the relationship between PDOs/PGIs and trademarks.' *Journal of the Knowledge Economy*, vol. 8, pp. 585-595.

Economides, N. 1996. The economics of networks. *International Journal of Industrial organization*, vol. 14, pp. 673-699.

Feeny, S. and Rogers, M. 2003. Innovation and performance: Benchmarking Australian firms. *Australian Economic Review*, vol. 36, pp. 253-264.

Fink, C., Helmers, C. and Ponce, C. 2014. *Trademarks Squatters: Evidence from Chile* (No. 22). World Intellectual Property Organization-Economics and Statistics Division.

Flikkema M. J., Castaldi, C., de Man A. P. et al. 2019, Trademark's relatedness to product and service innovation: A branding strategy approach. *Research Policy* vol. 48, pp. 1340–1353.

Flikkema, M. J., de Man, A. P. and Castaldi, C. 2014, Are trademark counts a valid indicator of innovation? Results of an in-depth study of new Benelux trademarks filed by SMEs. *Industry and Innovation*, vol. 21, pp. 310–331.

Flikkema, M., de Man, A. P. and Castaldi, C. 2014. Are trademark counts a valid indicator of innovation? Results of an in-depth study of new Benelux trademarks filed by SMEs. *Industry and Innovation*, vol. 21, pp. 310-331.

Gao, G. and Hitt, L. M. 2012, Information technology and trademarks: Implications for product variety. *Management Science*, vol. 58, pp. 1211–1226

Giarratana, M. S. and Fosfuri, A. 2007, Product strategies and survival in Schumpeterian environments: Evidence from the US security software industry. *Organization Studies*, vol. 28, pp. 909–929.

Giarratana, M. S. and Torrisi, S. 2010 Foreign entry and survival in a knowledge-intensive market: Emerging economy countries' international linkages, technology competences, and firm experience. *Strategic Entrepreneurship Journal*, vol. 4, pp. 85–104.

González-Pedraz, C. and Mayordomo, S. 2012, Trademark activity and the market performance of US commercial banks. *Journal of Business Economics and Management* vol. 13, pp. 931–950.

Gotsch, M. and Hipp, C. 2014. Using trademarks to measure innovation in knowledge-intensive business services. *Technology Innovation Management Review*, vol. 4.

Grashuis, J. 2017, 'Branding by US farmer cooperatives: An empirical study of trademark ownership', *Journal of Co-operative Organization and Management*, vol. 5, pp. 57-64.

This article is protected by copyright. All rights reserved.

Author Manuscript

Greenhalgh, C. and Rogers, M. 2006. Market valuation of UK intellectual property: Manufacturing, utility and financial services firms. Bosworth, D. and Webster, E. (eds) 2006, *The Management of Intellectual Property*, Edward Elgar, Cheltenham. pp.132-145.

Greenhalgh, C. and Rogers, M. 2012. Trade marks and performance in services and manufacturing firms: evidence of Schumpeterian competition through innovation. *Australian Economic Review*, vol. 45, pp. 50-76.

Greenhalgh, C. and Rogers, M., 2007. Trade Marks and Performance in UK Firms: Evidence of Schumpeterian Competition through Innovation. Oxford University Research Archive.

Griffiths, W., Jensen, P. H. and Webster, E. 2011. What creates abnormal profits?. *Scottish Journal of Political Economy*, vol, 58, pp. 323-346.

Guzman, J. and Stern, S. 2015, Where is Silicon Valley? *Science*, vol. 347, pp. 606–609

Hall, B.H. 1999, *Innovation and market value*, (No. w6984). National Bureau of Economic Research.

Helmers, C. and Rogers, M. 2010. Innovation and the Survival of New Firms in the UK. *Review of Industrial Organization*, vol. 36, pp. 227-248.

Helmers, C. and Rogers, M. 2011. Does patenting help high-tech start-ups? *Research Policy*, vol. 40, pp. 1016-1027.

Huang, P., Ceccagnoli, M., Forman, C., Wu, D. J. 2013, Appropriability mechanisms and the platform partnership decision: Evidence from enterprise software. *Management Science* vol, 59, pp. 102–121.

Jensen, P.H. and Webster, E. 2006. Firm size and the use of intellectual property rights. *Economic Record*, vol. 82, pp. 44-55.

Jensen, P.H. and Webster, E. 2009. Another look at the relationship between innovation proxies. *Australian Economic Papers*, vol. 48, pp. 252-269.

Kim K., Khabsa, M. and Giles, C. L. 2016, Random Forest DBSCAN for USPTO Inventor Name Disambiguation. arXiv:1602.01792, [cs.IR]

Krasnikov, A., Mishra, S. and Orozco, D. 2009. Evaluating the financial impact of branding using trademarks: a framework and empirical evidence. *Journal of Marketing*, *73*(6), pp.154-166.

Krizhevsky, A. & Sutskever, I. and Hinton, G. 2012. ImageNet Classification with Deep Convolutional Neural Networks. *Neural Information Processing Systems*. 25. 10.1145/3065386.

Landes, W. M. and Posner, R. A. 1987. Trademark law: an economic perspective. *The Journal of Law and Economics*, vol. 30, pp. 265-309.

This article is protected by copyright. All rights reserved.

Author Manuscript

Li, Q. and Deng, P. 2017, From international new ventures to MNCs: Crossing the chasm effect on internationalization paths. *Journal of Business Research*, vol. 70, pp. 92–100.

Li, G. C., Lai, R., D'Amour, A., Doolin, D. M., Sun, Y., Torvik, V.I., Yu, A. Z., and Lee, F. 2014, Disambiguation and co-authorship networks of the U.S. patent inventor database (1975-2010). *Research Policy*, vol. 43, pp. 941–955.

Link, A.N. and Scott, J.T. 2012, Employment growth from the small business innovation research program. *Small Business Economics vol.* 39, pp. 265–287.

Malmberg, C., 2005, 'Trademark Statistics as Innovation Indicators? - A Micro Study', CIRCLE Electronic Working Paper Series, 2005-17, CIRCLE (Centre for Innovation, Research and Competence in the Learning Economy), Lund University

Mendonça, S., Pereira, T. S. and Godinho, M. M. 2004. Trademarks as an indicator of innovation and industrial change. *Research Policy*, vol. 33, pp. 1385-1404.

Mendonça, S., Pereira, T. S. and Godinho, M. M. 2004, 'Trademarks as an Indicator of Innovation and Industrial Change', *Research Policy*, vol. 33, pp. 1385-1404.

Millot, V. 2009, *Trademarks as an Indicator of Product and Marketing Innovations* (No. 2009/6). Paris: OECD Publishing.

Morrison, G., Riccaboni, M. and Pammolli, F. 2017, Disambiguation of patent inventors and assignees using high-resolution geolocation data. *Scientific Data*, vol. 4, pp. 1–21.

Nasirov, S. 2018. The Use of Trademarks in Empirical Research: Towards an Integrated Framework. *Available at SSRN 3296064*.

Petrie, S., and Julius, T. 2019. A novel text representation which enables image classifiers to perform text classification, *arXiv:1908.07846*, [cs.CL].

Petrie, S., Kollmann, T., Codoreanu, A., Thomson, R., and Webster, E.M. 2019. International Trademarking and Regional Export Performance (August 22). Available at SSRN: https://ssrn.com/abstract=3445244 or http://dx.doi.org/10.2139/ssrn.3445244

Ramello, G.B. 2006, 'What's in a Sign? Trademark Law and Economic Theory.' *Journal of Economic Surveys*, vol. 20, pp. 547-565.

Sandner, P. and Block, J. 2011. The market value of R&D, patents, and trademarks, *Research Policy*, vol. 40, pp. 969-983.

Schmoch, U. and Gauch, S. 2009, Service marks as indicators for innovation in knowledge-based services. *Research Evaluation*, vol. 18, pp. 323–335

Schmoch, U. 2003, 'Service Marks as Novel Innovation Indicator', *Research Evaluation*, vol. 12.

This article is protected by copyright. All rights reserved.

Author Manuscript

Semadeni, M. 2006, Minding your distance: How management consulting firms use service marks to position competitively. *Strategic Management Journal*, vol. 27, pp. 169–187.

Semadeni, M. and Anderson, B. S. 2010, The follower's dilemma: Innovation and imitation in the professional services industry. *Academy of Management Journal*, vol. 53, pp. 1175–1193

Semadeni, M., Anderson, B. 2010. The Follower's Dilemma: Innovation and Imitation in the Professional Services Industry. *Academy of Management Journal*, vol. 53, pp. 1175-1193. doi:10.5465/AMJ.2010.54533232.

Squicciarini, M., Millot, V. and Dernis, H. 2012. Universities' trademark patterns and possible determinants. *Economics of Innovation and New Technology*, vol. 21, pp. 473-504.

Srinivasan, R., Lilien, G. L. and Rangaswamy, A. 2008, Survival of high tech firms: The effects of diversity of product–market portfolios, patents, and trademarks. *International Journal of Research in Marketing*, vol. 25, pp. 119–128.

Stoneman, P. 2010, *Soft Innovation: Economics, Product Aesthetics, and the Creative Industries*. Oxford: Oxford University Press.

Ventura S. L., Nugent, R., and Fuchs, E. H. R. 2015, Seeing the non-stars: (Some) sources of bias in past disambiguation approaches and a new public tool leveraging labeled records. *Research Policy*, Vol. 44, pp. 1672–1701.

von Graevenitz, G. 2013. Trade mark cluttering–evidence from EU enlargement. *Oxford Economic Papers*, vol. 65, pp. 721-745.

Xiong, G. and Bharadwaj, S., 2011. Social capital of young technology firms and their IPO values: The complementary role of relevant absorptive capacity. *Journal of Marketing*, vol. 75, pp. 87-104.

Yang G.-C., Liang, C., Jing, Z., Wang, D.-R., and Zhang, H.-C. 2017, A Mixture Record Linkage Approach for US Patent Inventor Disambiguation. Advanced Multimedia and Ubiquitous Engineering. FutureTech 2017, MUE 2017. Lecture Notes in Electrical Engineering, vol. 448, pp. 331–338

Zhang, H. 2019. 'Does trade mark cluttering exist in Australia?' IP Australia Economic Research Paper 07, Office of the Chief Economist June 2019

Zhou, H., Sandner, P. G., Martinelli, S. L. and Block, J. H. 2016. Patents, trademarks, and their complementarity in venture capital funding. *Technovation*, vol. 47, pp.14-22.

APPENDIX A: INTERNATIONAL REGISTRATION

International cooperation primarily takes the form of international agreements to harmonise trade mark law in jurisdictions. Harmonisation involves minimum standards in administration, enforcement and remedies for intellectual property rights.

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The purpose is to reduce the possibility of discrimination against foreign nationals and disparities in protection across jurisdictions. The Paris Convention for the Protection of Industrial Property is the most well-known agreement providing national treatment (which means national offices must treat foreign applicants on an equal basis with local applicants). The Paris Convention provides for a six-month right of priority for applicants filing internationally. This allows applicants to retain the filing date of their domestic application if they claim a subsequent application within six-months of that date in a country that is a signatory of the Convention.

The *Agreement on Trade-Related Aspects of Intellectual Property Rights* (TRIPS) sets the minimum standards for trade mark protection providing for procedures and remedies to be implemented in national laws on, *inter alia*, trade mark enforcement. Such standards allow firms to expand their brands with confidence that others will not file speculative applications for trade marks and seek enforcement where there is dishonest use of a similar mark.

Alongside these mechanisms is the supernational registration systems that coexist alongside national offices. The European Union Intellectual Property Office, the African Intellectual Property Organisation and the African Regional Industrial Property Organisation, for example, provide registration systems where applicants can submit a single application to register a trade mark and obtain simultaneous protection in multiple jurisdictions.

APPENDIX

Table A1: Multi-office trade marks by length of time (days) between first and last filing in the family, by Nice class, 1990-2012.

Nice class	Number of applications	p10	p50	p90
1	224,797	1	179	3086
2	212,375	1	180	3156
3	205,565	1	181	3052
4	149,351	2	180	2954
5	167,441	2	182	3163
6	94,026	2	181	3218

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7	58,576	1	177	3338
8	81,075	1	181	3134
9	183,113	1	176	2864
10	31,326	1	178	2896
11	26,845	1	176	3364
12	23,254	1	179	3628
13	2,010	2	182	3928
14	16,348	2	254	4023
15	2,198	1	185	4268
16	55,723	2	181	3318
17	11,622	1	180	3622
18	21,415	2	359	4183
19	13,840	1	179	3352
20	21,347	2	182	3696
21	20,400	2	207	3815
22	4,395	2	236	4189
23	1,872	1	176	3628
24	13,054	3	244	4088
25	50,265	2	264	3762
26	4,848	3	295	4266
27	4,916	2	222	4367
28	34,550	1	180	3271
29	17,372	2	242	3996
30	25,325	1	215	3893
31	10,566	2	186	3643
32	14,309	2	245	3859
33	16,928	1	225	3616
34	3,902	2	324	4318
35	71,423	2	181	3018

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36	27,472	2	180	3062
37	20,826	1	181	3306
38	28,718	1	174	2403
39	15,492	2	182	3371
40	11,900	2	179	2978
41	54,932	2	181	2958
42	72,465	2	179	2912
43	10,644	2	226	3627
44	12,741	2	182	2786
45	9,397	2	181	2879

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