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Exporter responses to shocks: The role of trade marks

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EXECUTIVE SUMMARY

Building a more secure and resilient Australia relies on firms diversifying their exports, successfully navigating trade barriers, and seizing new market opportunities as they arise. A more resilient Australia depends also on having a strong domestic manufacturing sector that can guarantee supply of essential goods in the event of future shocks. As the COVID-19 pandemic became global in early 2020, IP Australia's Office of the Chief Economist (OCE) began new research into how exporters respond to shocks, and the role of intellectual property (IP) in shaping export behaviour.

Using data on around 9,000 Australian manufacturing firms exporting across 12 countries, we compare the export behaviour of the same firm selling the same product in different markets.

We estimate the sensitivity of export entry, export revenue and export diversification to changes in real demand, tariffs and the real exchange rate. We compare the behaviour of the same firm selling the same product in different markets: Does a firm behave differently between markets where it faces different shocks? Will a firm respond differently to similar shocks after filing trade marks in a market?

The study uses customs and firm microdata in the Business Longitudinal Analysis Data Environment (BLADE) on a panel of around 8,937 Australian manufacturing firms per year over 2005–2017.

After filing trade marks in an export market, firms are more likely to enter, will perform better, become more resilient to exchange rate changes, and expand their exports more in response to tariff reductions.

Analysing export behaviour at the firm-product-country-year level, we find that a firm's behaviour and performance in an export market changes after it files trade marks in that market:

- *The firm is more likely to enter the export market: Among potential export entrants, after a firm increases its trade mark filings from one to 2 in a market its entry likelihood increases to nearly 3 times the average entry rate, from 0.06% (the average entry rate) to 0.16%.*
- *The firm tends to perform better in the export market: For long-term exporters (with 6 or more years' experience continuously exporting a focal product to the market) the additional trade mark is associated with a 30% increase in export revenue. Since the average long-term exporter earns $1.3m in export revenue per year, the revenue increase averages $416,000.*
- *The firm becomes more resilient to exchange rate changes: After a firm has filed a trade mark in an export market, a 10% appreciation of the home real exchange rate against the market will increase the firm's entry likelihood by under 1% (compared to a 17% decrease before filing); will increase the firm's export revenue by 1% (compared to a 6% decrease before filing); and will less negatively affect the firm's likelihood of diversifying its exports than before filing.*
- *The firm will expand its exports more in response to tariff reductions. After a firm has filed trade marks in an export market, a 10% reduction of the tariff on a relevant product will increase the firm's entry likelihood to nearly 4 times the average entry rate (compared to a 50% increase before filing); will induce a 71% increase in export revenue (compared to a 32% increase before filing); and will increase the firm's export diversity, unlike before filing when export diversity would decline.*

Trade mark data can be used to improve workhorse models of international trade, inform government advice to exporters, identify prospective exporters and target export assistance.

This study finds that after filing trade marks in an export market, Australian manufacturers will tend to expand their exports in response to home exchange rate appreciations. A possible explanation for this is that exporters with trade marks disproportionately take advantage of foreign exchange rate depreciations against their home currency to invest in building their foreign customer base. From a policy perspective, assisting exporters to develop foreign capabilities and assets that allow them to capitalise on marketing investments may increase the resilience of Australian exports to exchange rate shocks.

We find that manufacturers tend to narrow the product range they export to a market when the tariffs they face there fall or when the home exchange rate appreciates against the market. However, after filing trade marks in an export market, firms grow and diversify their exports in response to tariff reductions. Firms with trade marks can stretch their brand across product categories to compete in diverse markets. Lower tariffs can open access to export markets for Australian businesses. Enhanced access to brand protection overseas for our exporters may complement such lower trade barriers.

Standard models of trade assume that tariff and exchange rate changes will induce identical responses from exporters. We find this is far from the case, consistent with data from other countries. Going beyond the current literature, we find that trade mark activity is associated with muted responses to the real exchange rate and amplified responses to tariffs. As such, trade mark data could provide a valuable input for improving on workhorse models of international trade, informing government advice to exporters and targeting export assistance.

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1. INTRODUCTION

Many challenging policy problems hinge on the question of how exporters respond to economic shocks, such as changes to demand, tariffs and the real exchange rate. Since the Global Financial Crisis, protectionist trade policies have increased across G20 countries, even as the number of bilateral and regional trade agreements have expanded rapidly (PC, 2017). Considering these trends, how can Australian exporters be supported to diversify their exports, navigate trade barriers, and seize export market opportunities as they arise? As Australia emerges from the COVID-19 crisis, how can Australia's manufacturing sector be strengthened to guarantee supply of essential goods in the event of future shocks? What policy levers are available to encourage export diversification by manufacturers as Australia's currency advances with global growth?[1] Are actions by international trading partners that devalue their currencies equivalent to trade policy in how they influence export behaviour?

To provide evidence by which to answer these questions, we estimate the sensitivity of export entry, export revenue and export diversification to changes in tariffs, real demand and the real exchange rate. The study uses customs and firm microdata for a panel of 8,937 Australian manufacturing firms from 2005 to 2017. We predict and find that after a firm files trade marks in an export market, it is more likely to enter that market, will perform better after entry, becomes more resilient to changes in the real exchange rate, and is better able to overcome several barriers to export diversification.

Standard models of international trade assume that reductions in tariffs and depreciations of the domestic real exchange rate will induce identical responses – both should create equal incentives for firms to engage in international trade. Contrary to this expectation, evidence at both the aggregate level (e.g., Head & Ries 2001; Imbs & Mejean, 2015) and firm level (e.g. Berthou & Fontagné, 2016; Buono, & Lalanne, 2012; Fitzgerald & Haller, 2018; Fontagné, Martin & Orefice, 2018) suggests that exporters are far more sensitive to tariff changes than to changes in the real exchange rate. Why exporters vary in how they react to different shocks remains unresolved, what Ruhl (2008) has dubbed the 'international elasticity puzzle.' This study is the first to analyse how a firm's intellectual property (IP) activity shapes its responses to different shocks and we link this source of heterogeneity in export behaviour to the international elasticity puzzle.

Following the empirical strategy set out by Fitzgerald and Haller (2018) in their study of Ireland, we compare the export behaviour of the same firm selling the same product in different destination markets. where the firm faces different shocks and may register trade marks at different rates. This approach has the advantage of controlling for the marginal cost of production, since the firm is exporting the same product to different markets, and controls also for systematic firm-level differences that may influence export behaviour. We compare how the firm's behaviour differs across contexts where it faces different shocks, and how its responses to similar

[1] Since the early 2000s, the Australian dollar has appreciated strongly, driven by higher commodity prices, expansion of the resources sector, and higher aggregate incomes and consumption spending on domestic goods resulting from the rise in the terms of trade. Appreciation of the real exchange rate has led to concerns about its impacts on trade-exposed sectors of the economy (Garton, Gaudry & Wilcox, 2012).

shocks varies depending on its trade mark activity in an export market. We estimate export revenue and diversification conditional on export participation, and deal with possible selection bias by focusing on observations which, based on their export history, have a high propensity to export (Fitzgerald & Haller, 2018). We conduct a range of sensitivity analyses to determine whether trade mark activity tends to anticipate or facilitate export expansion.

Our study confirms that Australian manufacturers are far more responsive to tariffs than to the real exchange rate. We estimate, at the firm level, that in entry likelihood, firms are 2.6 times more responsive to tariff changes than to changes in the real exchange rate, and in export revenue are 2.8 times more responsive to tariffs. We go further than current literature by showing that, at the firm level, trade mark activity in an export market is associated with muted responses to the exchange rate and amplified responses to tariffs. We thereby highlight a source of heterogeneity in export behaviour which helps to reconcile evidence with trade theory.

Our study contributes evidence in support of the view, suggested in prior literature, that exporters' muted responses to the real exchange rate stem from firms' incentives to build a foreign customer base. Fitzgerald and Haller (2018) note that if advertising and marketing expenditures are incurred in the export market, exporters may increase these expenditures in reaction to foreign exchange rate depreciations against their home currency. Having filed trade marks in an export market firms may be more capable of building and protecting marketing assets. Consistent with this idea, we find that before filing trade marks, a 10% appreciation of the home real exchange rate against the market will induce a 17% decrease in entry likelihood and 6% decrease in export revenue. After filing a trade mark, the same appreciation will increase the firm's entry likelihood by just under 1% and induce a 1% increase in export revenue, these positive export effects increasing in the number of trade marks filed.

We also predict and find that after a firm files trade marks in an export market, it will increase its exports more in response to tariff reductions and will diversify its exports unlike the average exporter. For example, after a firm files a trade mark in the export market, a tariff reduction from 10% to zero on the relevant product will increase the firm's entry likelihood to nearly 4 times the average entry rate and increase its export revenue by 71%; this compares to a 50% increase in entry likelihood and 32% increase in export revenue for the firm with no recent trade mark activity.

By identifying sources of difference in how exporters respond to shocks, we provide guidance for how workhorse models of international trade and business cycles can be modified to support policy analysis. we draw particular attention to the possibility to improve existing models of international trade by incorporating micro-level indicators – such as firm data on trade mark activity – which help to characterise exporters' responses to shocks.

2. BACKGROUND AND HYPOTHESES

Standard models of international trade and business cycles assume that changes in tariffs and the real exchange rate create equal incentives for firms to engage in international trade. However, aggregate studies demonstrate that exports are far more sensitive to tariff changes than to movements in the real exchange rate (Ruhl, 2008). [2]

The difference in tariff and exchange rate elasticities is observed not only using sector level data but also with firm data. Point estimates of micro responses to tariffs fall in the range of 2 to 3, as shown for French exporters (Buono & Lalanne, 2012; Berthou & Fontagné, 2016; Fontagné, Martin & Orefice, 2018) and for Irish firms. Using data on Irish exporters, Fitzgerald and Haller (2018) estimated an elasticity of export revenue with respect to tariffs equal to –3.21, and an elasticity of revenue with respect to the real exchange rate equal to 0.54. Berman, Martin and Mayer (2012) found, for French firms, an export volume elasticity to the real exchange rate of around 0.5. Our findings, of a revenue elasticity to tariffs equal to 2.7, and a revenue elasticity to the exchange rate below unity, are close to these estimates.

Several explanations have been advanced to explain the difference in responses to tariffs and the real exchange rate. Some authors have linked the variation in how firms respond to different types of shocks to heterogeneity in firm characteristics including productivity differentials (e.g., Berman et al., 2012). We predict and find that, at the firm level, trade mark activity in an export market is associated with both muted responses to the real exchange rate and amplified responses to tariffs. In this section we develop hypotheses drawing on relevant literature.

We then describe our empirical strategy and data sources. Finally, we explain our results and their implications for research and policy.

Exporter responses to tariffs and trade marks

Theory predicts – and our study confirms – that tariff reductions will induce an increase in exports at the firm level. A fundamental parameter which shapes the transmission of shocks into export prices and volumes is the elasticity of substitution in demand between domestic- and foreign- produced varieties of a good (Armington, 1969). Following a tariff reduction on a relevant product, foreign buyers in the export market may select the less expensive variety provided by exporters over the local variety of the good.

Shocks can also have the effect of inducing increased entry and competition from rival exporters. This is particularly true in the case of tariff changes which are less volatile and more permanent than exchange rate movements, so are more likely to induce non-exporters to export (Ruhl, 2008). Increased competition may have the effect of reducing the average profitability of the market. Registering trade marks in an export market can help firms differentiate their goods or services, insulate their brands from copying, and may deter competitor entry (Barroso, Giarratana & Pasquini, 2019). This includes entry from rival exporters. Trade marks confer exclusive rights to the use of a brand attached to a product. Trade marks often embed cultural facets (Mendonça, Pereira & Godinho, 2004) including cultural features and emotional cues particular to the destination market (Barroso, Giarratana & Pasquini, 2019) or which

[2] Aggregate studies on the elasticity of exports to tariffs include Head & Ries (2001), Imbs & Mejean (2015) and Romalis (2007).

identify the brand as synonymous with a specific locality or region.

Based on these arguments, we predict the following:

Hypothesis 1a: After a firm files trade marks in a destination market, its elasticity of export entry to tariffs will increase, such that tariff reductions will have a more positive effect on export entry for the firm after it files trade marks than before it filed trade marks.

Hypothesis 1b: After a firm files trade marks in a destination market, its elasticity of export revenue to tariffs will increase, such that tariff reductions will have a more positive effect on export revenue for the firm after it files trade marks than before it filed trade marks.

Exporter responses to the exchange rate and trade marks

Theory predicts – and our study again confirms – that appreciations of the domestic real exchange rate against an export market will induce a reduction in exports, e.g. due to the elasticity of substitution in demand between domestic- and foreign-produced varieties of goods. This outcome might be different if advertising and marketing expenditures are incurred in the destination market. An exporter could choose to increase destination-specific investments in its advertising and customer base when the foreign currency depreciates against the exporter's home currency (Fitzgerald & Haller, 2008; Fitzgerald, Yedid-Levy & Haller, 2019).

There are several reasons to believe that after a firm files trade marks in the export market, it will be more likely to take advantage of foreign currency depreciations to invest in expanding its foreign customer base. Firms that have engaged in trade mark activity may possess superior advertising and marketing capabilities or have prior relationships with prestigious branding agencies familiar with the local market. Research shows that prior patterns of collaboration between firms influence their ability to form subsequent supply relationships and can also help to generate stable and productive collaborations (Ahuja, 2000; Gulati, 1995). Exporters with previous experience creating and registering trade marks in the export market may be in a stronger position to productively invest in building their foreign customer base, which is now less costly due to the exchange rate depreciation.

Trade mark registration is not an exogenous event, unlike tariff and exchange rate shocks, but rather a choice by the firm. We are careful in this study not to ascribe causal interpretations to export behaviour predicted by trade mark activity; rather, we view trade mark activity as capturing underlying activity in the firm directed at building its customer base.

Nevertheless, after filing trade marks in an export market, firms may be better positioned than their peers to capitalise on advertising and marketing investments abroad. Registering a trade mark allows firms to protect goodwill accumulated under a brand and defend against brand dilution (Dinlersov, Goldschlag, Myers & Zolas, 2018). Empirical marketing studies show that holding a stock of brand-identifying trade marks provides the basis (or even precondition) for firms to build stronger brand association (Krasnikov, Mishra & Orozco, 2009). For these reasons, trade mark holders may disproportionately invest in building a foreign customer base given an exchange rate depreciation that decreases the relative costs of advertising and marketing in the export market.

Based on these arguments, we predict the following:

H2a: After a firm files trade marks in a destination market, its elasticity of export entry to the real exchange rate will decrease, such that a home exchange rate appreciation against the destination market will have a less negative (or even positive) effect on export entry for the firm after it files trade marks than before it filed trade marks.

H2b: After a firm files trade marks in a destination market, its elasticity of export revenue to the real exchange rate will decrease, such that a home exchange rate appreciation against the destination market will have a less negative effect on export revenue for the firm after it files trade marks than before it filed trade marks.

Export diversification, trade marks and shocks

An important set of economic policy questions concern the determinants of export diversification. For instance, a live area for debate among academic economists and policy makers is whether expansion of a primary product sector (e.g., mining) cannibalises other tradeable sectors through exchange rate appreciation (see Cadot, Carrère & Strauss-Kahn, 2013). While trade theorists typically argue in favour of specialisation which accords with comparative advantage, diversification reduces an economy's exposure to sector-specific external shocks.

There is some consensus in the international trade literature that tariffs faced by countries will contribute to shaping their level of export diversification, in particular a country's *export extensive margin*, or the range of products they export. Evidence at the aggregate (industry and country) level suggests that a reduction in tariff barriers leads to an increased range of exported goods (for a review of relevant literature, see Volpe Martincus & Gomez, 2009). Nevertheless, the relationship between trade policy and diversification is likely to be complex, with various potential sources of firm heterogeneity and causation running in different directions depending on the unit of analysis. Tariff reductions can induce greater competition from rival exporters, and this may lead exporters to adopt a more focused product market strategy. For instance, tariff reductions may reduce export diversification at the firm level, because competition from rival exporters elicits greater corporate conservatism on the part of managers. To focus their resources in responding to competition, firms may export a less diverse product range by cutting back on low value and novel products (Chang, Chen, Huang, Podolski & Zhang, 2019).

We predict that trade mark activity in the destination market will attenuate the negative effect of tariff reductions on export diversification. Customers are more likely to trial new products marketed under a brand with which they are familiar, provided the brand signals quality (Claycamp & Liddy, 1969; Hoyer & Brown, 1990), and this extends to products that stretch a firm's product line across product categories (Swaminathan, Fox & Reddy, 2001). Trade marks create opportunities for brand extension and diversification abroad, while also helping to insulate exporters from competition. By stretching their brands across product categories, firms with destination-country trade marks may be better able to enter and compete across diverse markets.

Exporters may also be induced to narrow the product range they export to a country when the domestic real exchange rate appreciates against the export market, due to the softening of demand for domestic product. We predict that trade mark activity in the destination market will attenuate the negative effect of exchange rate appreciations on a firm's likelihood of diversifying its products. Firms with well-developed brands protected by trade marks are in a position to encourage customers to trial new products marketed under their familiar brands. These firms may disproportionately exploit depreciations in the foreign exchange rate to invest in "umbrella marketing".

Based on these arguments, we predict the following:

> *H3a: After a firm files trade marks in a destination market, its elasticity of export diversification to tariffs will decrease, such that tariff reductions will have a less negative effect on export diversification for the firm after it files trade marks than before it filed trade marks.*
>
> *H3b: After a firm files trade marks in a destination market, its elasticity of export diversification to the real exchange rate will decrease, such as that a home exchange rate appreciation against the destination market will have a less negative (or even positive) effect on export diversification for the firm after it files trade marks than before it filed trade marks.*

3. DATA AND EMPIRICAL STRATEGY

This study makes use of confidential microdata available in the Business Longitudinal Analysis Data Environment (BLADE). BLADE is a comprehensive database combining administrative, tax, customs and IP records at the firm level. Administered by the Australian Bureau of Statistics (ABS), data is provided on the full population of around 1.1 million firms from 2002 to 2017. Our analysis focuses on a panel of 8,937 active manufacturing firms per year over the period 2005 to 2017. In this section we discuss the study's data and sample, provide descriptive statistics and outline our empirical strategy. In the next section we describe our econometric results.

Data sources

Business Longitudinal Analysis Data Environment (BLADE)

While most Australian firms have simple structures, the firm population in BLADE includes large, complex organisations comprised of many business units operating in Australia. Through direct contact with businesses, the ABS has identified legal entities under common control and assigned group identifiers to these related businesses. We make use of this profiling in focusing on the firm as our unit of analysis.

BLADE includes administrative data from the Australian Taxation Office (ATO) including balance sheet information as well as data on business activity, entity type, industry and employment. We make use of this data in constructing our samples for analysis and conditioning on firm characteristics. In constructing our samples, we drop firms with a zero value for total revenue or with zero employees (full-time equivalent) in more than half the years they are present in the data.

Our sample is restricted to firms that appear in the dataset, *Intellectual Property Longitudinal Research Data* (IPLORD), which tracks the accumulation of IP rights filed domestically (in Australia) by Australian firms. Consequently, our sample is comprised of firms that filed at least one intellectual property right (a patent, trade mark, design right, or plant breeder's right) in Australia over the 20 years to 2017. Prior evidence suggests that Australian firms that have registered patents and design rights have higher export propensity than the average Australian firm (e.g., Kollmann et al., 2020). Supplementary analysis conducted for this project indicates that Australian firms with at least one trade mark registration in Australia enter exporting at around 1.4 times the rate of firms with no domestic trade mark registrations. Trade marks are a proxy for firm intent to create and market new products, and innovation is strongly correlated with exporting (Tuhin, 2016). Domestic trade marks may also indicate a firm's progress through the phases of domestic growth that lead into exporting.

International Merchandise Exports

Our second data source is *International Merchandise Exports*, a rich dataset from the Australian Customs Service (ACS) containing destination-specific export values. The dataset includes details of export transactions which exporters or their agents are required under law to submit to the ACS.[3] Export values are provided with information on the export's product class and destination country. Using this data, we can derive data on export entry, revenue and diversification at an annual frequency.

The export data is available for the period 2005 to 2017 and is limited to goods (it excludes services exports). We therefore restrict our analysis to this window and focus on manufacturing, as identified by a firm's industry (ANZSIC division C).[4] Export product classes are classified using the Australian Harmonized Export Commodity Classification (AHECC) scheme. The AHECC scheme accords at the 6-digit level with the Harmonized System (HS), the international nomenclature for classifying goods and services. Significant changes to the AHECC scheme occurred in 2007 and 2017, when the World Customs Organization updated the HS. Using the method described by Pierce and Schott (2012), we created a concordance table to group families of related product codes from across different versions of the AHECC.

In estimating export revenue and export diversification we use data on export activity in the full set of 3,692 products that Australian firms exported over the study period. We analyse exports of these products to the US, Canada, the UK and 9 Eurozone countries (Austria, Belgium, Finland, France, Germany, Italy, the Netherlands, Portugal and Spain). To estimate export entry, we identified the set of products that each firm might potentially export each year. We define the set of products that a firm might potentially export in a year by identifying all products exported by peers in the focal firm's industry (ANZSIC 4-digit level) over the study period. For tractability, in our entry model, we focus our attention on the 235 product markets with at least $10 million in Australian exports over the study period and restrict attention also to Australian exports to the United States, Canada and United Kingdom – countries for which we have complete national and regional trade mark data.

TM-LINK global database of trade marks

We collaborated with the ABS to integrate into BLADE a large microdataset with information on firms' foreign trade mark filings and link this at the firm level to the exports data. Our source for trade mark data was TM-LINK, a global trade mark database developed by IP Australia and its research partners. TM-LINK contains over 15 million trade mark applications consolidated at the firm level and identifies globally similar trade marks (Petrie et al., 2020). We used data from the trade mark registries of the United States Patent and Trademark Office (USPTO), Canadian Intellectual Property Office (CIPO), European Intellectual Property Office (EUIPO) and United Kingdom Intellectual Property Office (UKIPO). Using a set of name-matching and harmonisation procedures, a concordance was constructed linking trade mark assignees in the TM-LINK database with the firms in BLADE, via their Australian Business Numbers (ABNs). We aggregated the trade mark data at the firm (enterprise group) level in BLADE to create a count of destination-specific trade mark filings at an annual (fiscal year) frequency.

Exporters to Eurozone countries can choose to obtain trade mark protection by means of an application to a national IP office or seek coverage in several European jurisdictions with one application to the EUIPO. In estimating export entry, we focus on trade mark activity in the US, UK and Canada. In estimating export revenue and diversification, we include alongside these countries 9 Eurozone countries, and examine the effect of pan-European trade marks filed at the EUIPO. In the UK's case, we can control for firms' national filings (i.e., at the UKIPO); however, data limitations preclude the inclusion of equivalent controls for other Eurozone counties. In robustness checks, we estimate models restricting our samples to firm-markets for which we have complete trade mark data.

[3] Transactions subject to these reporting requirements include all exports valued over $500 per commodity (for air and sea cargo) or over $2,000 per consignment (for postal cargo).

[4] Industry is defined by the Australian and New Zealand Standard Industrial Classification (ANZSIC) of 2006.

Tariff data

We sourced longitudinal data on the tariffs faced by Australian firms in each product-country market from the World Trade Organization's *Tariffs Download Facility*. During the study period, Australia had preferential trade agreements with the US (the Australia-US Free Trade Agreement, in effect from January 2005) and Canada (the Canada-Australia Trade Agreement, first established in 1960). In countries where Australia does not have a preferential trade agreement, it faces the Most Favored Nation (MFN) tariff.

Tariff data are reported by the WTO using the HS 6-digit classification (HS6). Following Fitzgerald and Haller (2018), we restrict attention to HS6 product-market-years for which there are no non-ad-valorem tariffs (that is, we focus only on tariffs defined in terms of a fixed percentage of value) and for which there is no sub-HS6 variation in ad valorem tariffs. The HS6 classification changes in 2007 and 2012. Following the method of Pierce and Schott (2012), we created a concordance grouping families of related product codes from across different versions of the HS scheme, coverage extending over the period 2004–2017. To make use of the tariff data, we concord it with our exports data, taking advantage of the AHECC-HS link at the 6-digit level. In some cases, the concordance procedures resulted in product categories that cover multiple HS6 codes. In estimating export entry, we took the simple average of tariffs in these categories. In estimating export revenue, we used revenue at the firm-AHECC-market-year level to construct a weighted average of tariffs across HS6 codes related to a focal product category.

Macro data

Our analysis required a measure of the real consumption exchange rate between Australia and each of the study's focal destination markets. A real exchange rate is calculated as a bilateral exchange rate that has been adjusted for relative price levels, e.g.:

$$RER = e \times \frac{p*}{p} \qquad (1)$$

where *e* is the nominal bilateral rate, defined as the price of the domestic currency (AUD) in units of the foreign currency, $p*$ is the price level of the foreign currency, and p is the price level of the domestic currency. Defined as such the exchange rate increases with an appreciation of the foreign currency relative to the home market (or with a depreciation of the home currency against the foreign market).[5]

To construct indices for real exchange rates we use data on annual average nominal exchange rates and consumer price indices (CPIs) from the International Monetary Fund's (IMF's) *International Financial Statistics* (IFS) database. Annual averages are defined over the fiscal rather than calendar period to accord with our firm and exports data.
In our analyses we control for aggregate real demand in the destination market. We construct an index of real demand as Gross Domestic Product (GDP) less exports plus imports, all measured in local currency, with this aggregate deflated by the relevant country's CPI. To calculate this measure, we use National Accounts data from the OECD's *National Accounts Statistics* and CPIs obtained from the IMF's *IFS* database.

[5] An alternative method of calculation is sometimes used in the literature, where the real exchange rate is calculated as the number of foreign currency units per home currency units, so a home market appreciation is recorded as an increase in the exchange rate index.

Descriptive statistics

Firm sample

Table 1 provides descriptive statistics for our sample. The total panel comprises an average 8,937 firms per year, the full sample being our focus in estimating export entry. There are an average 1,785 active exporters per year, these being our focus in estimating revenue and diversification.

Table 1. Sample representativeness, annual averages, 2004 to 2017

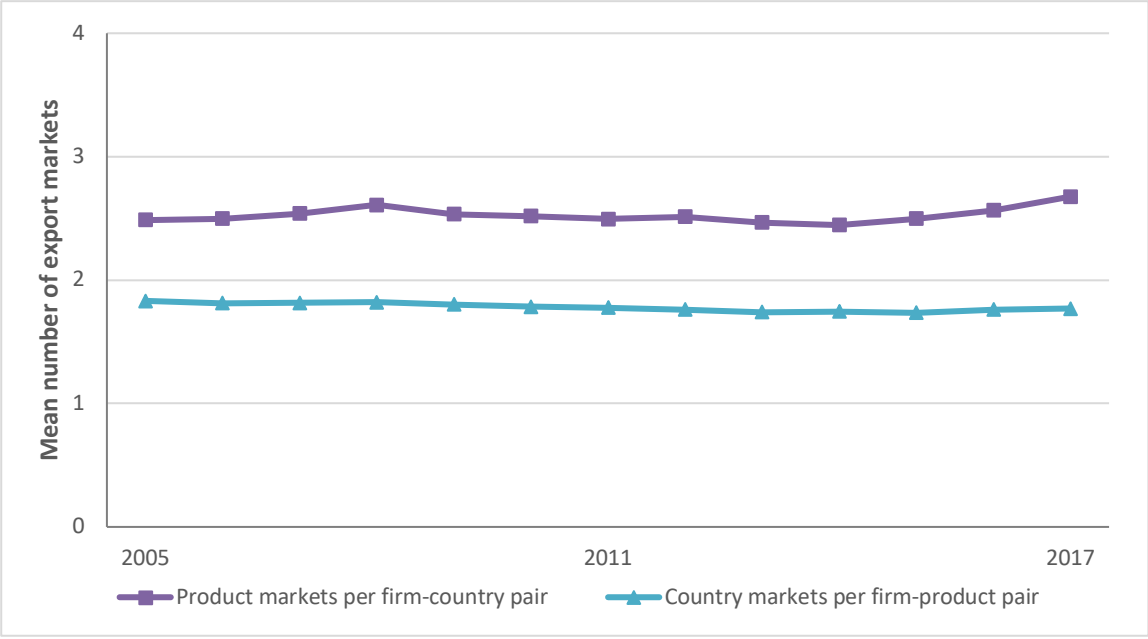
Metric	Value
Firms per year	8,937
Active exporters per year	1,785
Number of country markets per exporter	2.3
Number of product markets per exporter-country pair	2.7
Employees per firm	73
Employees per active exporter	139
SME share of observations	0.69
SME share of export participants	0.68
Firm age [years]	12
Export value in focal destination markets [$ billion]	69.787
Share of Australian goods export value in focal destination markets	0.19

Source: BLADE (ABS. 2019); *International Merchandise Exports* (ABS, 2019)

Our empirical strategy involves comparing the export behaviour of the same firm-product pairs across different destination markets. As Figure 1 illustrates, for all Australian exporters, the mean number of markets per firm-product pair has remained relatively stable over the study period, while the mean number of products per firm-country pair has slightly risen. On average, exporters in our sample export 3 products to a single destination market and operate across 2 markets.

Active exporters are around 1.9 times larger in employment terms (full-time equivalent) than non-participants (on average, exporters have 139 full-time equivalent employees while non-participants have 73 full-time equivalent employees). Nevertheless, SMEs account for 69% of observations in our sample, including 68% of active export participants. In aggregate, exporters in our sample account for around $70 billion (current prices) in export value across our focal destination markets. This equates to 19% of Australian goods export value in those markets.

Figure 1. For manufacturers, the mean number of destination markets per firm-product pair has been stable from 2004 to 2017



Source: BLADE (ABS. 2019); *International Merchandise Exports* (ABS, 2019)

Export participation and trade mark activity

Tables 2 and 3 report mean export participation, export entry and export exit rates, calculated for observations at the firm-product-country-year level, with annual averages reported. The results reported are consistent with mean participation, entry and exit rates calculated using observations at the firm-country-year level.

To calculate export participation and entry rates, we first identify the set of products that a firm might potentially export in a year. We define this to include all products exported to the focal destination markets by peers in the firm's industry (at the 4-digit ANZSIC level). We construct a sample which, for each firm-product pair, includes observations for each of the destination markets in each year over the study period. The export participation rate is calculated as the share of these observations with positive export values.

To calculate the export entry rate, we restrict the above sample to all firm-product-country observations at time t without positive export values at year $t-1$ (i.e., where the focal firm did not export the focal product to the focal market in the year prior to the window of analysis). We calculate the entry rate as the total number of these *potential entrant* observations with positive export values at time t (i.e., where the firm exported the focal product to the focal market that year but not the year prior). We later use the same sample of potential entrant observations in our regression analyses of export entry.[6]

In calculating the export exit rate, we restrict focus to the set of firm-product-country-year observations at time t with positive export values at time $t-1$ (i.e., where the focal firm did export the focal product to the focal market in the year prior to the window of analysis). The exit rate is calculated as the total number of these *potential exiter* observations with no export value at time t.

In Table 2, we present average participation, entry and exit rates of observations for different-sized firms, and for observations pertaining to different destination markets. Unlike in Fitzgerald and Haller (2018), we do not find strong descriptive evidence that firms of different size vary in the rates at which they participate or enter relevant product-country markets. We also do not find descriptive evidence that current exporters of different size exit product-country markets at different rates. Exporting to the US is characterised by high steady state churn, with a high rate of export entry and high exit rate also compared to other countries. Exporting to Germany is characterised by a high exit rate and below average rate of entry.

Table 2. Average export participation, export entry and export exit rates for SMEs and large firms, annual averages, 2005 to 2017

	Firm type			Destination market			
Variable	*All firms*	*SMEs*	*Large firms*	*US*	*Canada*	*UK*	*Germany*
Participation rate	0.12%	0.11%	0.12%	0.22%	0.06%	0.12%	0.07%
Entry rate	0.06%	0.06%	0.06%	0.11%	0.03%	0.05%	0.04%
Exit rate	47.74%	48.66%	46.04%	47.51%	45.67%	46.52%	52.63%

Notes: The set of potential entrants used to estimate entry in year t includes all firm-product-market-year observations active at date t which did not export to that product-market at date *t*–1, and firm-products born in year *t.* The set of potential exiters used to estimate exit in year *t* includes all firm-product-market-year observations active at date *t* with positive revenues in that product-market at date *t*–1. In-sample destination markets include the US, Canada, UK and Germany.

Source: BLADE (ABS. 2019); *International Merchandise Exports* (ABS, 2019); *TM-LINK* (IP Australia, 2020)

[6] Though exporting comprises only one form of internationalisation, it is an appropriate focus for examining entry behaviour. According to the behavioural theory of internationalisation, firms internationalise in steps, in many cases relying initially on exports or intermediate modes of entry (e.g., licensing and joint ventures) as a means to minimise commitment and reduce risk while experimenting with foreign venture before expanding their geographical coverage and presence (Giarratana & Torrisi, 2010; Kogut & Zander, 1993).

Table 3 reports mean export participation, export entry and export rates for 'TM filers' and 'Non-TM filers.' TM filers include all observations at the firm-product-country-year level that filed at least one trade mark in the focal country that year. Non-TM filers include all observations that filed no trade marks in the focal country that year. On average, the export participation rate of TM-filers is around 8 times that of the Non-TM filers. TM-filers have a higher export entry rate than Non-TM filers, by a factor of 4.5. The export exit rate of TM-filers is about three quarters that of Non-TM filers: firms that file trade marks when exporting a product to a market persist longer in exporting that product to the market. The differences in export behaviour between the two sample groups is clearer with respect to large firms than SMEs.

Table 3. Average export participation, export entry and export exit rates for firms with or without trade mark filing activity in a focal destination market in a given year, annual averages, 2005 to 2017

	Sample		SMEs		Large firms	
Variable	*TM filers*	*Non–filers*	*TM filers*	*Non–filers*	*TM filers*	*Non–filers*
Participation rate	0.87%	0.11%	0.56%	0.11%	1.32%	0.11%
Entry rate	0.37%	0.05%	0.24%	0.06%	0.56%	0.05%
Exit rate	36.82%	48.41%	39.20%	49.00%	35.29%	47.23%

Notes: The set of potential entrants used to estimate entry in year *t* includes all firm-product-market-year observations active at date t which did not export to that product-market at date t–1, and firm-products born in year t. The set of potential exiters used to estimate exit in year *t* includes all firm-product-market-year observations active at date *t* with positive revenues in that product-market at date *t*–1. In-sample destination markets include the US, Canada, UK and Germany.

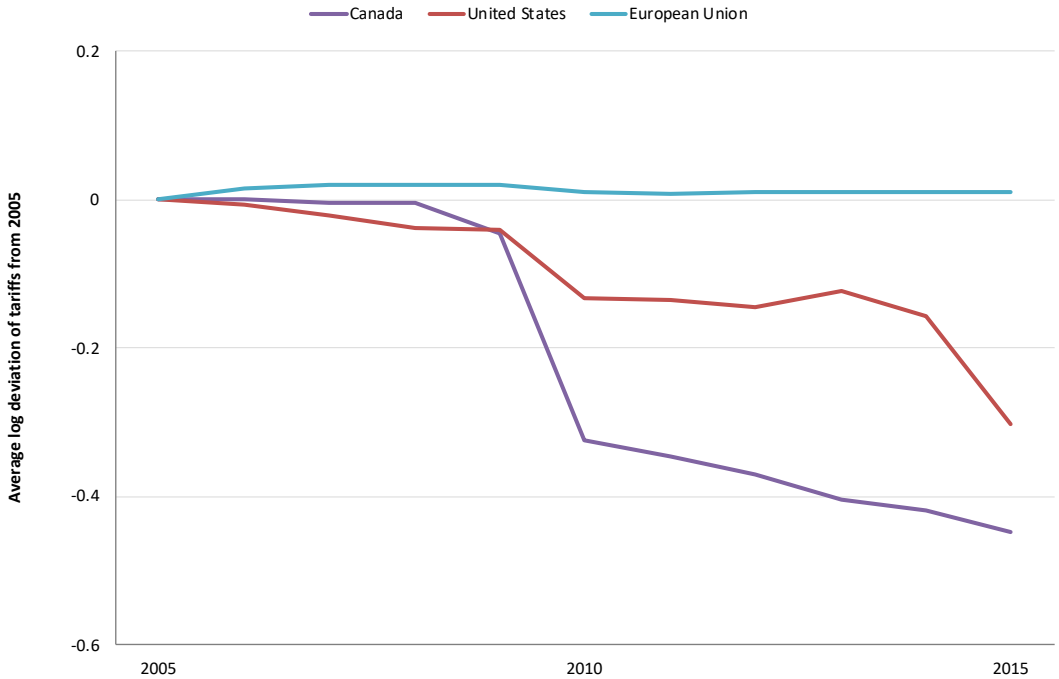
Source: BLADE (ABS. 2019); *International Merchandise Exports* (ABS, 2019); *TM-LINK* (IP Australia, 2020)

Evolution of tariffs and real exchange rates

In our analyses, to identify micro-level responses to tariffs, real exchange rates, real demand and trade mark activity, we rely on time-series variation in these variables over the study period, rather than cross-sectional variation. Key sources of time-series variation in tariffs faced by Australian exporters include preferential duty rates on limited products provided under (a) the Australian-US Free Trade Agreement, and (b) the Canada-Australia Trade Agreement. Following Fitzgerald and Haller (2018), we illustrate this variation by regressing, market-by-market, the log gross ad valorem tariff[7] on HS6 fixed effects and year dummies. Figure 2 plots the coefficients on the year dummies for the US, Canada and the European Union (EU) customs union. As illustrated by Figure 2, average tariffs faced by Australian exporters have fallen in the US and Canada but remained relatively constant in the EU since 2005.

[7] Following Fitzgerald and Haller (2018), the log gross ad valorem tariff is specified as $\ln\left(1 + T_t^{jk}\right)$, where superscripts i, j and k stand for firm, product and destination country, respectively.

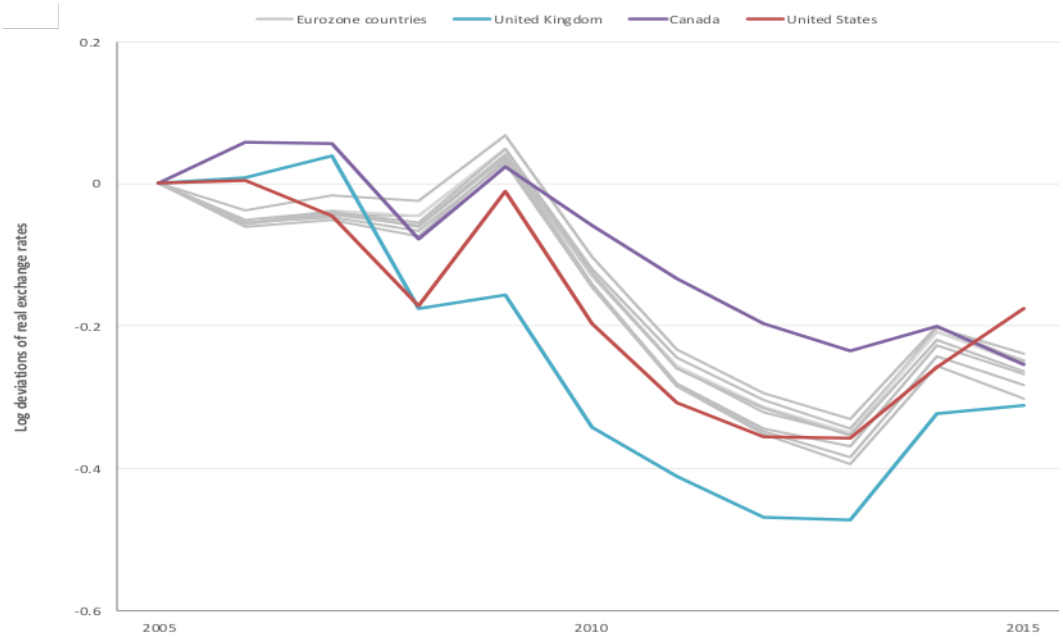
Figure 2. Tariffs faced by Australian exporters have fallen in the US and Canada, while remaining flat in the European Union



Notes: Figure 2 shows coefficients on year dummies in country-by-country regressions of $\ln(1+T_t^{jk})$ on HS6 fixed effects and year dummies.
Source: World Trade Organization *Tariff Download Facility* (WTO, 2019).

Figure 3 charts the evolution of bilateral real exchange rates between Australia and the study's focal destination markets. The bulk of variation in the real exchange rate involved appreciation of the Australian dollar, with the resources boom a key driver of appreciation (Garton, Gaudry & Wilcox, 2012).

Figure 3. The Australian dollar has appreciated against US, Canada, UK and European currencies



Notes: Figure 2 charts over time the log deviations in the real exchange rate for the US, Canada, UK and Eurozone countries (Austria, Belgium, Finland, France, Italy, Netherlands, Portugal and Spain). *Source:* *International Financial Statistics* (IMF, 2019)

Empirical strategy

To estimate the sensitivity of export behaviour to trade marks and shocks, we follow closely the empirical strategy set out by Fitzgerald and Haller (2018). We estimate export entry, export revenue and export diversification using log-linear equations which we specify in this section. Exports and tariffs vary at the product-market-year level. Real exchange rates vary at the market-year level, as does our measure of aggregate real demand. Given incomplete class information in the trade mark data, we could measure trade mark activity only at the market-year level.

To estimate the sensitivity of export behaviour to trade marks and shocks, we follow closely the empirical strategy set out by Fitzgerald and Haller (2018). The strategy involves examining the differential behaviour of the same firm selling the same product in different country markets, where the firm faces different shocks. To implement this strategy, in estimating entry and revenue, we include firm-product-year fixed effects. We also include product-market fixed effects; as such, coefficient estimates can be interpreted as the average marginal effect on the dependent variable of log deviations in the independent variable from their average value over the sample in a given product-country market (Fitzgerald & Haller, 2018). We analyse export diversification at the firm-country-year level and include firm-year and market fixed effects in the diversification models.

In addition to our main variables of interest, we control for a firm's history of exporting in a given product-country market using a rich set of indicator variables. Past research finds, and our results confirm, that exporting is history dependent, such that a firm's net profits in exporting will depend not only on the firm's contemporaneous actions (e.g., its decision to participate in an export market) but also on its prior participation in the market (e.g., Tuhin & Swanepoel, 2016; Zaheer & Mosakowsi, 1997).

Export entry

We estimate the elasticity of export entry to tariffs, the real exchange rate, aggregate real demand, and trade mark activity for the set of potential entrants in our sample. These include all firm-product-market-year observations active at date *t* which did not export to that product-market at date *t*–1, as well as firm-product-market observations born in year *t*. Our baseline specification is a linear probability regression model. We use a log-linear formulation, with the tariff, exchange rate, demand and trade mark variables all entered into the regression in logs.

Estimation is based on the following econometric specification:

$$\begin{aligned}\Pr\left[\mathrm{Part}_t^{ijk}=1\middle|\mathrm{Part}_{t-1}^{ijk}=0\right] &= \theta_t^{ij}+\theta^{jk}+\beta_1\boldsymbol{\alpha}_t^{ijk}+\beta_2 ln\left(\boldsymbol{z}_t^{jk}\right)+\beta_3 ln\left(dem_t^k\right)+\ \beta_4 ln\left(tmark_{t-1}^{ik}\right)\\ &+\beta_5 ln\left(tmark\_uk_{t-1}^{ik}\right)+\eta_t^{ijk}\end{aligned} \tag{2}$$

where superscripts i, j and k stand for firm, product and destination market, respectively.

The dependent variable in equation (1), $\Pr\left[\mathrm{Part}_t^{ijk}=1\middle|\mathrm{Part}_{t-1}^{ijk}=0\right]$, is an indicator variable set to one where a firm participates in a focal product-country market at date t and set to 0 otherwise. We include firm-product-year fixed effects (θ_t^{ij}) to control for the marginal cost of production, as well as product-market fixed effects (θ^{jk}). A firm's prior export history is controlled for using a vector of indicator variables ($\boldsymbol{\alpha}_t^{ijk}$) denoting when a firm's last participation selling product j in market k was at date $t-2$, and for when its last participation was before date $t-2$, with the omitted category being observations with no past participation in the market (e.g., Fitzgerald & Haller, 2018). As a baseline, data on exports in 2004 are used to identify potential entrants in 2005, avoiding left censorship of the data.

Our main shock variables of interest are captured, in log terms, in the vector ($\boldsymbol{z}_t^{jk}$). This includes two variables, (1) the log real exchange rate of exporter i's home currency against market k, and (2) the log gross ad valorem tariff faced by exporter i of product j in market k. In addition to these variables, we include in the entry equation a log measure of aggregate real demand in market k at time t (dem_t^k). Our main trade mark variable ($tmark_{t-1}^{ik}$) is a log measure of the number of trade marks filed by firm i in market k at time $t-1$, set to 0 if the firm filed no trade marks in that market that year. In constructing this measure we only include applications that either proceeded to registration or could still

proceed to registration as at the time of data extraction. We include a separate variable ($tmark\_uk_{t-1}^{ik}$) for applications filed at the UKIPO at time $t-1$, to control for the national filing activity of exporters to the UK.

Export revenue

In estimating export revenue, we allow elasticities with respect to tariffs, the exchange rate, demand and trade marks to differ between observations with long and short export history at the product-country market level. To implement this, we interact all the main variables of interest with an indicator variable set to one for observations with long market tenure – six or more years continuous history of exporting a given product to the focal market – and zero for those with shorter market tenure, of 5 or less years.

Our baseline specification for revenue is a log-linear equation as follows:

$$\begin{aligned} Rev_t^{ijk} = {} & \theta_t^{ij} + \theta^{jk} + \gamma_1 \boldsymbol{\alpha}_{t-1}^{ijk} + \gamma_2\left(ln\left(\boldsymbol{z}_t^{jk}\right) \times long_t^{ijk}\right) + \gamma_3\left(ln\left(\boldsymbol{z}_t^{jk}\right) \times short_t^{ijk}\right) \\ & + \gamma_4\left(ln(dem_t^k) \times long_t^{ijk}\right) + \gamma_5\left(ln(dem_t^k) \times short_t^{ijk}\right) + \gamma_6\left(ln\left(tmark_{t-1}^{ik}\right) \times long_t^{ijk}\right) \\ & + \gamma_7\left(ln\left(tmark_{t-1}^{ik}\right) \times short_t^{ijk}\right) + \gamma_8\left(ln\left(tmark\_uk_{t-1}^{ik}\right) \times long_t^{ijk}\right) \\ & + \gamma_9\left(ln\left(tmark\_uk_{t-1}^{ik}\right) \times short_t^{ijk}\right) + \gamma_{10}\left(ln\left(\boldsymbol{z}_t^{jk}\right) \times ln\left(tmark_{t-1}^{ik}\right) \times long_t^{ijk}\right) \\ & + \gamma_{11}\left(ln\left(\boldsymbol{z}_t^{jk}\right) \times ln\left(tmark_{t-1}^{ik}\right) \times short_t^{ijk}\right) + \varepsilon_t^{ijk} \end{aligned} \tag{3}$$

Here, Rev_t^{ijk} is the log of export revenue of firm i from selling product j to market k at date t. We include firm-product-year fixed effects (θ_t^{ij}) and product-market fixed effects (θ^{jk}). Export history is controlled for with a vector of indicator variables ($\boldsymbol{\alpha}_t^{ijk}$) denoting a firm's number of years continuously exporting to the product-market, top-coded at 7 years, and an indicator denoting where an observation's market tenure is left censored. As in the case of entry, z_t^{jk} is a vector of shocks including (1) the log real exchange rate of exporter i's home currency against market k, and (2) the log gross ad valorem tariff faced by exporter i of product j in market k. The variable dem_t^k measures aggregate real demand. The variables $tmark_{t-1}^{ik}$ and $tmark\_uk_{t-1}^{ik}$ measure firm i's trade mark activity in market k at time $t-1$. Finally, $long_t^{ijk}$ is an indicator variable set to for observations with long export history (tenure of 6 years or more, or tenure censored by the beginning of the sample) and set to zero otherwise, while $short_t^{ijk}$ is equal to $1 - long_t^{ijk}$. A key focus of our analysis is the interactions between the shock and trade mark variables for observations with long export history.

Export diversification

As with export revenues, we analyse the elasticity of export diversification to shocks and trade marks focusing on incumbent exporters. As our baseline specification, we use a log-linear model with the dependent variable being the log number of distinct products a firm exports to a focal destination market in a given year. We include in our regressions firm-year and market fixed effects. As a result, we identify responses based on the differential behaviour of the same firm in different destination markets.

We allow elasticities with respect to our main variables to differ between observations with long and short export histories in a destination market. To implement this analysis, we needed a measure of trade liberalisation at the country level. We use the coefficients on year dummies obtained after regressing, country-by-country, tariffs at the HS6 level on HS6 fixed effects and year dummies.

Our baseline specification has the following econometric specification:

$$\begin{aligned} Diver_t^{ik} = {} & \theta_t^{i} + \theta^{k} + \phi_1 \boldsymbol{\alpha}_{t-1}^{ik} + \phi_2\left(ln(\boldsymbol{z}_t^{k}) \times long_t^{ik}\right) + \phi_3\left(ln(\boldsymbol{z}_t^{k}) \times short_t^{ik}\right) + \phi_4\left(ln(dem_t^k) \times long_t^{ik}\right) \\ & + \phi_5\left(ln(dem_t^k) \times short_t^{ik}\right) + \phi_6\left(ln\left(tmark_{t-1}^{ik}\right) \times long_t^{ik}\right) \\ & + \phi_7\left(ln\left(tmark_{t-1}^{ik}\right) \times short_t^{ik}\right) + \phi_8\left(ln\left(tmark\_uk_{t-1}^{ik}\right) \times long_t^{ik}\right) \\ & + \phi_9\left(ln\left(tmark\_uk_{t-1}^{ik}\right) \times short_t^{ik}\right) + \phi_{10}\left(ln(\boldsymbol{z}_t^{k}) \times ln\left(tmark_{t-1}^{ik}\right) \times long_t^{ik}\right) \\ & + \phi_{11}\left(ln(\boldsymbol{z}_t^{k}) \times ln\left(tmark_{t-1}^{ik}\right) \times short_t^{ik}\right) + \zeta_t^{ik} \end{aligned} \tag{4}$$

Here, $Diver_t^{ik}$ is the log number of products exported by firm i to market k at date t. We include firm-year fixed effects (θ_t^i) and market fixed effects (θ^k). We control for export history using a vector of indicator variables ($\boldsymbol{\alpha}_t^{ik}$) denoting a firm's market tenure at the country level. Our main variables of interest are $\boldsymbol{z}_t^k$, a vector of shocks including (a) the average tariff rate on products in the market and (b) the real exchange rate; dem_t^k, or aggregate real demand; $tmark_{t-1}^{ik}$ and $tmark\_uk_{t-1}^{ik}$, measuring trade mark filing activity at the international level and at the UKIPO, respectively. Finally, $long_t^{ik}$ is an indicator variable for firm-country pairs with long export history or left censored entry, while $short_t^{ijk}$ is equal to $1 - long_t^{ijk}$.

When estimating all equations in this study, we implement robust standard errors to correct for non-independence in the data, using multiway clustering (at the firm-product-year and market levels for equations (2) and (3), and at the firm and market levels for equation (4)). We centred all continuous variables, after which the mean Variance Inflation Factor (VIF) across all model variables fell in the range 1.10–1.30, an acceptable level (Chatterjee & Hadi, 2006). We can therefore exclude the possibility that our findings are the result of multicollinearity.

Analytical approach to econometric challenges

Why exporters differ in their responses to tariffs and the real exchange rate is a puzzle for economists and policy makers. In the analyses that follow, we confirm that the sensitivity of Australian manufacturing exporters to tariffs is large while their sensitivity to the real exchange rate is muted. Our estimates align within the ranges for tariff and exchange rate elasticities found using data from other countries. To understand why exporters vary in their responses to shocks, we investigated the role of a firm's foreign trade mark activity in shaping their responses.

A key issue in estimating the elasticity of export revenue and diversification with respect to shocks is the possibility of selection bias. We estimate the export revenue and diversification of firms conditional on their export participation. However, as Fitzgerald and Haller (2018) note, a tariff or real exchange rate change that is favourable (unfavourable) to exporters may induce higher (lower) export participation by observations with weak unobserved idiosyncratic demand. This selection bias is dealt with by focusing on observations involved in long export spells since, based on their export history, these exporters have a very high propensity to export.

Despite including a rich set of control variables, our analyses may still be affected by endogeneity due to omitted variable bias or reverse causality affecting the relationship between our dependent variables, independent variables and error terms. For example, larger (smaller) firms may both tend to export in higher (lower) volumes and be more (less) likely to file trade marks. In comparing the export outcomes of the same firm in different markets our study uses time-series rather than cross-sectional variation to identify the coefficients of interest. The empirical approach controls for certain systematic firm-level differences that may affect both a firm's export behaviour and propensity to file trade marks. Nevertheless, due to data limitations, our inability to adequately control for the characteristics of firms' regional divisions could inflate the standard errors for our variables of interest or alter the sign of these variables' coefficients if the measures are linked to a division's trade mark activity and its export behaviour.

Reverse causality may also be at play: when a firm anticipates a tariff reduction will occur in a focal export market, pre-empting its own export expansion in that market the firm may file for additional trade marks in the market. Export expansion allows a firm to spread the fixed costs of creating and registering a trade mark across a larger customer base, thus increasing the firm's incentive to file (Dinlersov et al., 2018). Similarly, due to the irreversibility in export decisions (e.g., sunk costs of export participation), having made the decision to enter an export market a firm may be both more likely to file for trade marks in that market and more resilient to exchange rate variations in its entry decisions.

To account for endogeneity, direction of causality, and unobserved heterogeneity we conduct a series of additional analyses to investigate the robustness of our results. These tests included using different model specifications, changing the measurement of dependent and independent variables, and varying the estimation sample. First, we examine the elasticity of export outcomes with respect to trade mark applications that are rejected or cancelled, based on the view that the status of applications would be immaterial to our results if the results are an artefact of pre-emptive filing behaviour.

Second, we replace our trade mark variables with "depreciated trade mark stocks," an alternative measure of trade mark activity defined as the number of depreciated trade marks that a firm has accumulated in a focal destination market since 2005, with each trade mark depreciated at an annual rate of 15% from the trade mark application year. In conducting tests using the depreciated stock variables, we avoid problems arising from left censorship of the trade mark data by focusing our analysis on a restricted time-period from 2011 to 2017. The trade mark stock variable captures trade mark activity over an extended period prior to the window of analysis and so estimated effects of this variable are less likely to be influenced by export expansion planned in anticipation of tariff changes or changes in the real exchange rate. In addition, we re-estimate models using 2-year lags to test whether our results hold for filing behaviour less likely to reflect pre-emptive filing behaviour.

Third, we conduct additional tests where we include key variables in differences rather than levels to address concerns over omitted variable bias. Lastly, we vary our estimation sample in three ways: (1) by focusing on a restricted set of country markets for which we have complete information on the trade mark activity of firms, (2) by dropping the largest exporters (all firm-country-product-year observations in the top 1% for annual export revenue) from the samples, and (3) by dropping firms with small annual export values (all firm-country-product-year observations with annual export values less than $2,000).[8]

[8] In robustness checks that drop observations with export values below $2,000, we follow the approach taken in studies of Australian exporters by Tuhin & Swanepoel (2016) and Bruno & Swanepoel (2020).

4. EXPORT ENTRY

Entry likelihood increases with trade mark activity, tariff reductions and home exchange rate depreciations

Table 4 presents our results from estimating export entry (Model 1). First, entry likelihood is history dependent, decreasing with the number of years since an observation's most recent participation in the product-country market. Second, entry likelihood increases when tariffs fall and when the domestic real exchange rate depreciates against the destination market, in line with theory. Entry is far more responsive to tariffs than to changes in the real exchange rate, echoing findings from other countries. In Table 4, the tariff and exchange rate elasticities are –0.003 and 0.001. Entry is 3 times more responsive to tariffs than to the real exchange rate, consistent with prior evidence (Fitzgerald & Haller, 2018). A Chow test reveals the difference between tariff and exchange rate elasticities to be significant at the 5% level.

Table 4. Export entry responses to trade marks and shocks

	(1) Entry – baseline	
	Coeff.	Std error
$ln\ tariff_t^{jk}$	–0.003	(0.002)†
$ln\ RER_t^k$	0.001	(0.000)***
$ln\ demand_t^k$	–0.001	(0.000)***
$ln\ tmarks_{t-1}^k$	0.001	(0.000)***
$ln\ tmarks\_uk_{t-1}^k$	0.000	(0.001)
$ln\ tmarks_{t-1}^{jk} \times ln\ tariff_t^{jk}$	–0.020	(0.006)**
$ln\ tmarks_{t-1}^{jk} \times ln\ RER_t^k$	–0.002	(0.001)†
Export history controls		
last part. 2 years prior	–0.167	(0.004)***
last part. 3+ years prior	–0.075	(0.003)***
Firm–prod–yr f.e.	Yes	
Prod–mkt f.e.	Yes	
N	25,913,264	
R^2	0.44	
R^2–adjusted	0.15	
Average in-sample entry rate	0.06%	
Quantification of interaction effects		
Change in the effect of tariff given increase in trade marks		
$0 \rightarrow 1\ tmark$	–0.003 → –0.016	
$0 \rightarrow 5\ tmarks$	–0.003 → –0.038	
Change in the effect of RER given increase in trade marks		
$0 \rightarrow 1\ tmark$	0.001 → –0.000	
$0 \rightarrow 5\ tmarks$	0.001 → –0.002	

Notes: Export entry is estimated using a linear probability regression model. In-sample destination markets include the US, Canada and the UK. Robust standard errors, clustered by firm-product-year and product-market, are in parentheses. † $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Source: *BLADE* (ABS. 2019); *International Merchandise Exports* (ABS, 2019); *TM-LINK* (IP Australia, 2020); World Trade Organization *Tariff Download Facility* (WTO, 2019); International *Financial Statistics* (IMF, 2019); *National Accounts Statistics* (OECD, 2019).

The economic significance of these point estimates can be interpreted as follows. The average in-sample entry rate for Australian manufacturers in our sample is 0.06%. Assume that this is a firm's likelihood of entering a product-country market where there is a 10% tariff on the relevant product. A reduction in the tariff on that product from 10% to zero will increase the firm's entry likelihood from 0.06% to 0.09%, around 50% over the average entry rate. In contrast, a 10% depreciation of the home real exchange rate against the destination market has a more muted effect, increasing the firm's entry likelihood from 0.06% to 0.07%, around 17% above the average entry rate.

In our baseline entry analysis (Model 1 in Table 4), the coefficient on our variable for aggregate real demand is negative, implying that demand at the country level subdues entry at the firm-product-market level. In supplementary analysis (reported in chapter 6), we find that this negative result holds only for non-diversifying entrants – i.e., firms that are not exporting to the same destination market any products other than the focal product about which entry is analysed. Aggregate real demand is a positive predictor of entry for firms that are diversified in the market.

Based on Model 1, trade mark activity in the destination market is a positive predictor of export entry at the 0.1% significance level. Among potential export entrants, a firm increasing its trade mark filings in a destination market from one to 2 will increase the firm's entry likelihood from 0.06% to 0.16%, nearly 3 times the average entry rate.

After a firm has filed trade marks, a tariff reduction induces a greater increase in entry likelihood

Model 1 in Table 4 contains a test of Hypothesis 1a, that trade mark activity in the destination market will amplify the positive effect of tariff reductions on export entry. In Model 1, the interaction effect of trade marks on the relationship between tariffs and entry is negative and significant at the 1% level, providing support for Hypothesis 1a.

In Table 4 we provide a quantitative assessment of the interaction effect of trade marks on the relationship between entry and tariffs. We report how the entry elasticity to tariffs changes following an increase in the number of trade marks a firm files in the destination market. The results indicate that the elasticity of entry with respect to tariffs increases with the number of destination-country trade marks filed. Before a firm files a trade mark, a tariff reduction from 10% to zero will induce an increase in the firm's entry likelihood from 0.06% to 0.09%, around 1.5 times the average entry rate. After the firm has filed a single trade mark, the same tariff reduction induces an increase in the firm's entry likelihood from 0.06% to 0.22%, nearly 4 times the average entry rate. For the recent filer, the increase in its entry elasticity to tariffs is around 5 times that of the firm with no recent trade mark activity.

After a firm has filed trade marks, an exchange rate appreciation may increase its entry likelihood

Model 1 in Table 4 also contains a test of Hypothesis 2a, that trade mark activity is associated with muted responses to the real exchange rate. The interaction effect of trade marks on the relationship between entry and the real exchange rate is negative and significant at the 10% level, offering partial support for Hypothesis 2a.

Table 4 provides a quantitative assessment of the interaction effect of trade mark activity on the relationship between entry and the real exchange rate. We report how the entry elasticity with respect to the real exchange rate changes following an increase in the number of trade marks filed in the destination market. Before a firm files a trade mark, a 10% appreciation of the home real exchange rate against the market will induce a 17% fall in entry likelihood, from 0.06% to 0.07%. After the firm has filed a single trade mark in the market, the same 10% appreciation induces an increase in the firm's entry likelihood by less than 1%. The estimated marginal effects for firms with 2 or more trade marks suggest a disordinal (crossover) interaction whereby the relationship between export entry and the real exchange rate shifts from positive for observations with zero recent trade marks to negative for observations with one or more recent filings. For example, for firms with 5 recent trade mark filings, our estimates suggest that a 10% appreciation will induce a 33% increase in entry likelihood. However, it must be noted, the marginal effects estimates are non-significant at values of 2 or more trade marks.

Trade marks have a greater effect on entry for large firms; tariffs have a greater effect for SMEs

In Table 5, Model 2 presents average marginal effects for large firm observations and, separately, for observations of small and medium enterprise (SMEs). We estimate separate elasticities for these two sample groups by interacting all independent variables with an indicator variable that equals one for SMEs and which equals zero otherwise.

Table 5. Export entry responses: marginal effects for firms of different size

	(2)			
	Entry - SMEs		Entry – Large firms	
	Coeff.	Std error	Coeff.	Std error
$ln\ tariff_t^{jk}$	–0.003	(0.002)*	–0.001	(0.002)
$ln\ RER_t^k$	0.001	(0.000)**	0.001	(0.000)**
$ln\ demand_t^k$	–0.001	(0.000)***	–0.001	(0.000)***
$ln\ tmarks_{t-1}^k$	0.001	(0.000)***	0.002	(0.000)***
$ln\ tmarks\_uk_{t-1}^k$	0.000	(0.001)	–0.001	(0.001)*
$ln\ tmarks_{t-1}^{jk} \times ln\ tariff_t^{jk}$	–0.023	(0.006)***	–0.017	(0.009)†
$ln\ tmarks_{t-1}^{jk} \times ln\ RER_t^k$	–0.001	(0.001)	–0.002	(0.001)
Average in-sample entry rate	0.06%		0.06%	
Share of observations	66.6%		33.4%	
Export history controls	Yes			
Firm–prod–yr f.e.	Yes			
Prod–mkt f.e.	Yes			
N	25,913,264			
R^2	0.44			
R^2–adjusted	0.15			

Notes: Export entry is estimated using a linear probability regression model. In-sample destination markets include the US, Canada and the UK. . Export history controls included but not reported. Robust standard errors, clustered by firm-product-year and product-market, are in parentheses.
† p < 0.10, * p < 0.05, ** p < 0.01, *** p < 0.001.

Source: BLADE (ABS. 2019); *International Merchandise Exports* (ABS, 2019); *TM-LINK* (IP Australia, 2020); *World Trade Organization Tariff Download Facility* (WTO, 2019); *International Financial Statistics* (IMF, 2019); *National Accounts Statistics* (OECD, 2019).

The results suggest that the elasticity of export entry to tariffs is 2.3 times larger for SMEs than for large firms. Using a Chow test, the difference in elasticities is significant at the 5% level. In contrast, the elasticity of entry to the real exchange rate is consistent for SMEs and large firms: there is no statistically significant difference in their entry elasticities with respect to the real exchange rate.

By our estimates, destination-country trade marks are a stronger predictor of entry for large firms than for SMEs. The difference in their entry responses to trade marks is significant at the 0.1% level. There is no significant difference between SMEs and large firms looking at the interaction effect of trade marks on the relationship between trade marks and tariffs, or in the interaction term between trade marks and the real exchange rate.

Entry robustness

We performed a number of tests to examine the robustness of our results. These tests included different model specifications and changes to the measurement of key independent variables. We present the results of these robustness tests before turning to an analysis of export revenue responses.

Rejected/cancelled trade mark applications have no discernible effect in shaping entry responses to shocks

In the first column of Table 6, we include a count variable measuring trade mark applications that were ultimately rejected/cancelled, alongside the trade mark variables which measure accepted/registered applications. In this specification (Model 3), the main effects of tariffs, the real exchange rate, demand and trade mark activity are consistent with our baseline entry analysis. We no longer find any significant interaction terms between trade marks and shocks, either using rejected/cancelled applications or accepted/registered applications.

Table 6. Export entry responses: robustness to measurement of trade mark variables

	(3) Entry - Rejected/cancelled applications		(4) Entry – Depreciated stock	
	Coeff.	Std error	Coeff.	Std error
$ln\ tariff_t^{jk}$	–0.003	(0.002)†	–0.002	(0.002)
$ln\ RER_t^k$	0.001	(0.000)***	0.001	(0.000)***
$ln\ demand_t^k$	–0.001	(0.000)***	–0.001	(0.000)***
$ln\ tmarks_{t-1}^k$	0.001	(0.000)***	0.002	(0.000)***
$ln\ tmarks\_uk_{t-1}^k$	–0.001	(0.001)	–0.001	(0.000)**
$ln\ tmarks_{t-1}^{jk} \times ln\ tariff_t^{jk}$	–0.006	(0.006)	–0.022	(0.005)***
$ln\ tmarks_{t-1}^{jk} \times ln\ RER_t^k$	–0.001	(0.001)	–0.001	(0.001)
$ln\ tmarks\_rejected_{t-1}^{jk}$	0.002	(0.000)***		
$ln\ tmarks\_rejected_{t-1}^{jk} \times ln\ tariff_t^{jk}$	–0.004	(0.013)		
$ln\ tmarks\_rejected_{t-1}^{jk} \times ln\ RER_t^k$	–0.002	(0.001)		
Export history controls	Yes		Yes	
Firm–prod–yr f.e.	Yes		Yes	
Prod–mkt f.e.	Yes		Yes	
N	25,913,264		25,913,264	
R^2	0.44		0.49	
R^2–adjusted	0.15		0.32	

Notes: Export entry is estimated using a linear probability regression model. In-sample destination markets include the US, Canada and the UK. Export history controls included but not reported. Robust standard errors, clustered by firm-product-year and product-market, are in parentheses. † p < 0.10, * p < 0.05, ** p < 0.01, *** p < 0.001.

Source: BLADE (ABS. 2019); *International Merchandise Exports* (ABS, 2019); *TM-LINK* (IP Australia, 2020); *World Trade Organization Tariff Download Facility* (WTO, 2019); *International Financial Statistics* (IMF, 2019); *National Accounts Statistics* (OECD, 2019).

It is conceivable that firms that have made the decision to enter an export market are more resilient to exchange rate changes, having already outlaid the sunk costs of export participation. Firms in such a position may also be more likely to seek trade mark registrations as an 'entry ticket' into competing in the export market. We find no evidence that rejected/cancelled trade marks are associated with muted entry responses to the real exchange rate, as might be expected if exporters were pre-empting exchange rate changes by filing trade marks. Similarly, we find no evidence rejected/cancelled applications are associated with amplified responses to tariffs, as might occur if exporters file in anticipation of export expansion precipitated by the lowering of trade barriers.

Earlier trade mark activity predicts amplified entry responses to tariffs

Several additional tests were undertaken to assess whether our baseline results can be explained by pre-emptive filing behaviour on the part of firms that have decided to expand their exports. First, as reported in Table 6 above, we use a "depreciated trade mark stock" variable instead of the trade mark variable based on annual filing activity (Model 4). Second, as reported in Table 7 below, we use 2-year lagged versions of all independent variables (Model 5). In both specifications, the main effect of trade marks on entry is positive and significant at the 0.1% level. In both models, the interaction effect of tariffs on the relationship between entry and trade marks is significant and negative, consistent

with Hypothesis 1a. In direction, the interaction term between trade marks and the real exchange remains consistent with our baseline entry analysis, however the interaction term is no longer significant. Relation to trade marks and tariffs, the results increase confidence that our findings are not the result of firms pre-empting export expansion by increasing their trade mark activity.

Table 7. Export entry responses: specification robustness

	(5) Entry – Independent variables lagged 2 years		(6) Entry – Independent variables in differences	
	Coeff.	Std error	Coeff.	Std error
$ln\ tariff_t^{jk}$	–0.001	(0.001)	–0.003	(0.002)†
$ln\ RER_t^k$	0.001	(0.000)**	0.000	(0.000)
$ln\ demand_t^k$	0.001	(0.000)	–0.000	(0.004)
$ln\ tmarks_{t-1}^k$	0.001	(0.000)***	0.000	(0.000)
$ln\ tmarks\_uk_{t-1}^k$	–0.001	(0.000)*	0.000	(0.000)
$ln\ tmarks_{t-1}^{jk} \times ln\ tariff_t^{jk}$	–0.017	(0.005)**	–0.044	(0.044)
$ln\ tmarks_{t-1}^{jk} \times ln\ RER_t^k$	–0.001	(0.001)	0.001	(0.002)
Export history controls	Yes		Yes	
Firm–prod–yr f.e.	Yes		Yes	
Prod–mkt f.e.	Yes		Yes	
N	22,948,551		30,607,836	
R^2	0.42		0.34	
R^2–adjusted	0.13		0.13	

Notes: Export entry is estimated using a linear probability regression model. In-sample destination markets include the US, Canada and the UK. Export history controls included but not reported. Robust standard errors, clustered by firm-product-year and product-market, are in parentheses.
† p < 0.10, * p < 0.05, ** p < 0.01, *** p < 0.001.

Source: BLADE (ABS. 2019); *International Merchandise Exports* (ABS, 2019); *TM-LINK* (IP Australia, 2020); *World Trade Organization Tariff Download Facility* (WTO, 2019); *International Financial Statistics* (IMF, 2019); *National Accounts Statistics* (OECD, 2019).

Entry responses are not predicted by differences in trade mark activity or the real exchange rate

In the second column of Table 7 above we report the findings from a model in which we include all independent variables in differences rather than levels (Model 6). In the differenced version, the coefficient on the tariff variable is significant at the 10% level, and all other model variables apart from the export history controls are non-significant. Based on these results, we cannot exclude the possibility that the response of export entry to trade marks and shocks is driven omitted variables such as characteristics of the regional divisional level of the firm.

5. EXPORT REVENUE

Export revenue increases with trade mark activity, tariff reductions and exchange rate depreciations

Table 8 presents the results from estimating our baseline export revenue equation. We present two sets of estimated elasticities: those for observations with a long history of exporting (market tenure of 6 or more years, or entry censored by the beginning of the sample) and those for observations with a short history of exporting (market tenure of between one to 5 years). In the analyses that follow, we focus on the elasticities for observations with long export histories for which selection bias is likely less severe (Fitzgerald & Haller, 2018).

Table 8. Export revenue responses to trade marks and shocks

	(7) Revenue – baseline	
	Coeff.	Std error
	Long export history	
$ln\ tariff_t^{jk}$	–2.700	(1.226)*
$ln\ RER_t^k$	0.973	(0.253)***
$ln\ demand_t^k$	0.116	(0.254)
$ln\ tmarks_{t-1}^k$	0.302	(0.087)**
$ln\ tmarks\_uk_{t-1}^k$	0.818	(0.244)***
$ln\ tmarks_{t-1}^{jk} \times ln\ tariff_t^{jk}$	–5.368	(2.970)†
$ln\ tmarks_{t-1}^{jk} \times ln\ RER_t^k$	–1.214	(0.504)*
	Short export history	
$ln\ tariff_t^{jk}$	–2.216	(0.746)**
$ln\ RER_t^k$	0.014	(0.259)
$ln\ demand_t^k$	–0.092	(0.251)
$ln\ tmarks_{t-1}^k$	0.084	(0.073)
$ln\ tmarks\_uk_{t-1}^k$	0.268	(0.200)
$ln\ tmarks_{t-1}^{jk} \times ln\ tariff_t^{jk}$	0.908	(2.435)
$ln\ tmarks_{t-1}^{jk} \times ln\ RER_t^k$	0.049	(0.435)
Export history controls		
2 years tenure	0.468	(0.027)***
3 years tenure	0.739	(0.034)***
4 years tenure	0.824	(0.039)***
5 years tenure	1.036	(0.044)***
6 years tenure	1.123	(0.056)***
7+ years tenure	1.226	(0.062)***
censored tenure	0.472	(0.046)***
Firm–prod–yr f.e.	Yes	
Prod–mkt f.e.	Yes	
N	65,592	
R^2	0.84	
R^2–adjusted	0.72	
Quantification of interaction effects (long export history)		
Change in the effect of tariffs given increase in trade marks		
$0 \rightarrow 1\ tmark$	–3.231 → –7.092	
$0 \rightarrow 5\ tmarks$	–3.231 → –13.212	
Change in the effect of RER given increase in trade marks		
$0 \rightarrow 1\ tmark$	0.613 → –0.129	
$0 \rightarrow 5\ tmarks$	0.613 → –0.870	

Notes: Export revenue is estimated using log-linear OLS regression model. In-sample destination market include US, Canada, the UK and Eurozone countries (Austria, Belgium, Finland, France, Italy, Netherlands, Portugal and Spain). Robust standard errors, clustered by firm-product-year and product-market, are in parentheses. † p < 0.10, * p < 0.05, ** p < 0.01, *** p < 0.001.
Source: BLADE (ABS. 2019); *International Merchandise Exports* (ABS, 2019); TM-LINK (IP Australia, 2020); *World Trade Organization Tariff Download Facility* (WTO, 2019); *International Financial Statistics* (IMF, 2019); *National Accounts Statistics* (OECD, 2019).

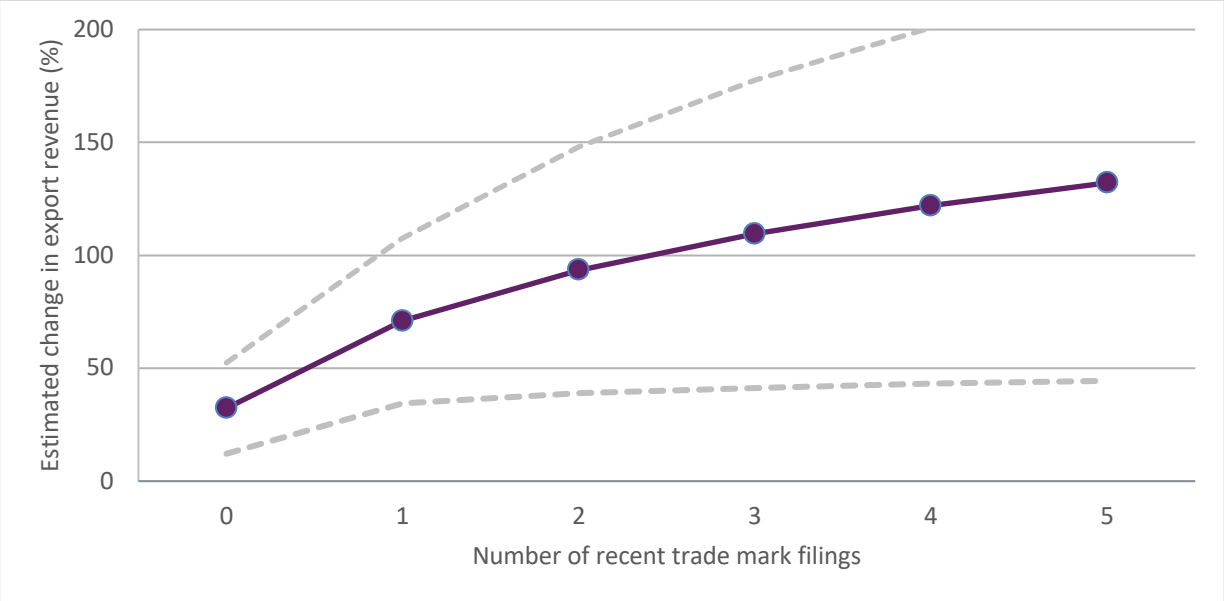
The first thing to note in Table 8 (Model 7) is that export revenue is increasing in a firm's years of market tenure. Second, the results suggest that revenue increases with tariff reductions and with depreciations of the home real exchange rate against the destination market, in line with theory. Export revenue is highly sensitive to tariff changes and only weakly sensitive to movements in the real exchange rate, consistent with findings from other countries. By our estimates, for incumbent exporters, revenue is 2.8 times more sensitive to tariffs than to the real exchange rate.

The elasticity of export revenue to trade mark filing activity is positive and significant at the 1 per cent level. By our estimates, an increase in trade mark filings from one to 2 in the destination market % is associated with a 30.2% increase in export revenue. For the average incumbent exporter in our sample, which earns AUD1.3 million in annual export revenue, the additional right predicts an increase in export revenue by $416,000 in the year after filing.

After a firm has filed trade marks, a tariff reduction will induce a greater increase in export revenue

Model 7 in Table 8 contains a test of Hypothesis 1b, that trade mark activity predicts an increase in the elasticity of export revenue with respect to tariffs. The interaction term between tariffs and trade marks is negative and significant at the 10 per cent level, offering partial support for Hypothesis 1b. In Table 8 we provide a quantitative assessment of the economic importance of trade marks in shaping exporter responses to tariffs. We report how the revenue elasticity with respect to tariffs is likely to change depending on an observation's number of recent trade mark filings. As a firm switches from having no recent trade mark filings to having a single trade mark filing, its revenue responsiveness to tariffs doubles, from –3.2 to –7.1. Before filing the trade mark, a 10% tariff reduction implies a 32.3% increase in export revenue. After filing, the same tariff reduction is associated with a 70.9% revenue increase. Graphical analysis in Figure 4 suggests that the positive response of revenue with respect to tariffs is increasing in the number of recent trade marks filed, though the precision of the marginal effects estimates declines.

Figure 4. As a firm's number of recent trade mark filings increases, the positive response of export revenue to a 10% tariff reduction becomes more pronounced



Source: BLADE (ABS. 2019); *International Merchandise Exports* (ABS, 2019); *TM-LINK* (IP Australia, 2020); *World Trade Organization Tariff Download Facility* (WTO, 2019); *International Financial Statistics* (IMF, 2019); *National Accounts Statistics* (OECD, 2019).

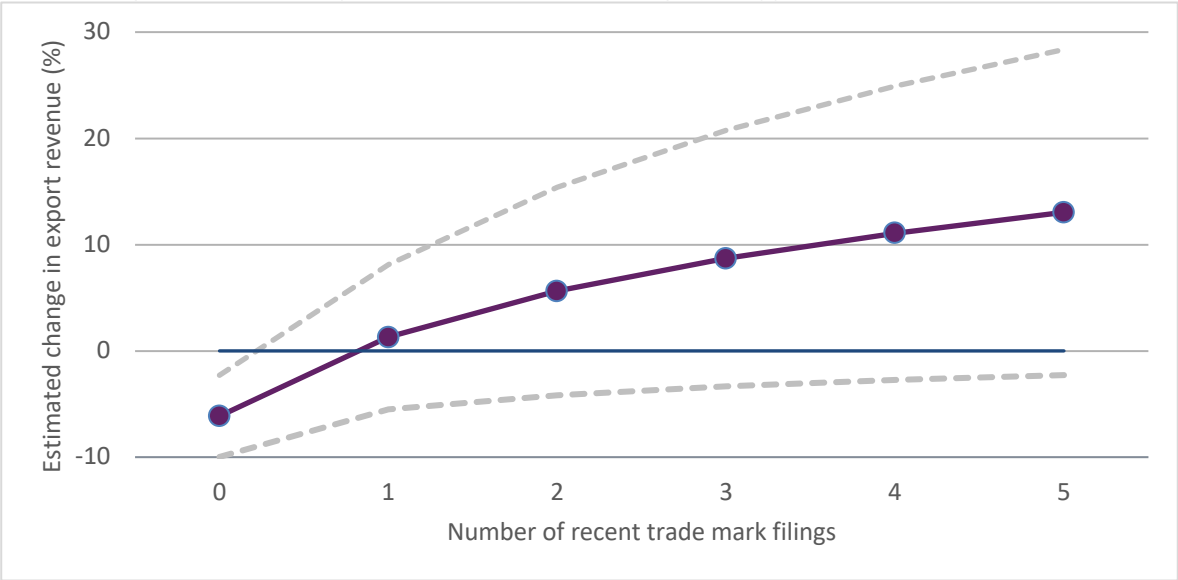
After a firm has filed trade marks, a home exchange rate appreciation will induce an increase in export revenue

Model 7 in Table 8 also contains a test of Hypothesis 2b, that the elasticity of export revenue with respect to the real exchange rate changes with a firm's trade mark activity. The interaction effect of trade marks on the relationship between revenue and the real exchange rate is negative and significant at the 5% level, validating Hypothesis 2b. The finding supports a view that firms with destination-country trade marks, due to their ability to capitalise on marketing

investments in the export market, are more likely to take advantage of a foreign currency depreciation to invest in building foreign customer base, and thereby expand their exports unlike the average exporter.

Table 8 provides a quantitative assessment of the economic importance of trade marks in shaping exporter responses to the real exchange rate. With an increase in trade mark filings from zero to 1, the elasticity of export revenue with respect to the real exchange rate shifts from 0.61 to –0.13. As with entry, the result suggests a disordinal (crossover) interaction whereby the relationship between the real exchange rate and export revenue shifts from positive among observations with no recent trade mark activity to negative among observations with destination-country trade marks. As illustrated in Figure 5, before a firm files any trade marks, a 10% appreciation of the home real exchange rate against the destination market will induce a 6.13% decrease in export revenue among incumbent exporters. After filing a trade mark, the same appreciation will induce a 1.3% increase in export revenue, and this positive response of revenue to exchange rate appreciation increases with the number of trade marks filed.

Figure 5. As a firm's number of recent trade mark filings increases, the firm shifts from reducing its export revenue to increasing its revenue in response to a 10% home exchange rate appreciation



Source: BLADE (ABS. 2019); *International Merchandise Exports* (ABS, 2019); *TM-LINK* (IP Australia, 2020); *World Trade Organization Tariff Download Facility* (WTO, 2019); *International Financial Statistics* (IMF, 2019); *National Accounts Statistics* (OECD, 2019).

Revenue responses don't clearly vary by firm size

In Table 9 we report separate revenue elasticities for firms of different size, obtained by interacting all independent variables with an indicator variable that equals one if an observation is an SME and which equals zero otherwise (Model 8). The coefficients on the tariff variable are negative and significant for SMEs at the 5% level and for large firms at the 10% level. The coefficient on the real exchange rate variable is positive and significant at the 5% level for both SMEs and large firms. With respect to both tariffs and the real exchange rate, the results for SMEs and large firms are not significantly different from one another.

In Model 8 we report that trade mark activity is associated with an increase in export revenue only for large firms and not for SMEs. Only for large firms does trade mark activity also appear to affect a firm's revenue elasticity with respect to tariffs or the real exchange rate. Despite this, Chow tests indicate that there are no statistically significant differences between SMEs and large firms either in the main effects associated with trade mark activity or in its interaction effect on the relationships between revenue and shocks.

Table 9. Export revenue responses: marginal effects for firms of different size

	(8)			
	Revenue – SMEs		Revenue – Large firms	
	Coeff.	Std error	Coeff.	Std error
	Long export history		*Long export history*	
$ln\ tariff_t^{jk}$	–3.059	(1.533)*	–3.026	(1.582†
$ln\ RER_t^k$	0.580	(0.245)*	0.622	(0.296)*
$ln\ demand_t^k$	0.136	(0.252)	0.102	(0.252)
$ln\ tmarks_{t-1}^k$	0.110	(0.142)	0.258	(0.104)*
$ln\ tmarks\_uk_{t-1}^k$	0.973	(0.632)	0.894	(0.264)**
$ln\ tmarks_{t-1}^{jk} \times ln\ tariff_t^{jk}$	3.287	(6.647)	–6.530	(3.798)†
$ln\ tmarks_{t-1}^{jk} \times ln\ RER_t^k$	–1.181	(0.896)	–1.128	(0.674)†
	Short export history		*Short export history*	
$ln\ tariff_t^{jk}$	–2.485	(0.814)**	–0.651	(1.383)
$ln\ RER_t^k$	0.354	(0.248)	0.050	(0.287)
$ln\ demand_t^k$	–0.051	(0.251)	–0.086	(0.252)
$ln\ tmarks_{t-1}^k$	0.211	(0.105)*	0.030	(0.098)
$ln\ tmarks\_uk_{t-1}^k$	0.464	(0.626)	0.215	(0.216)
$ln\ tmarks_{t-1}^{jk} \times ln\ tariff_t^{jk}$	0.920	(5.174)	–0.292	(2.207)
$ln\ tmarks_{t-1}^{jk} \times ln\ RER_t^k$	–1.300	(0.674)†	0.624	(0.528)
Export history controls	Yes			
Firm–prod–yr f.e.	Yes			
Prod–mkt f.e.	Yes			
N	65,725			
R^2	0.84			
R^2–adjusted	0.72			

Notes: Export revenue is estimated using a log-linear OLS regression model. In-sample destination market include US, Canada, the UK and Eurozone countries (Austria, Belgium, Finland, France, Italy, Netherlands, Portugal and Spain). Export history controls included but not reported. Robust standard errors, clustered by firm-product-year and product-market, are in parentheses. Export history controls included but not reported. † $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Source: BLADE (ABS. 2019); *International Merchandise Exports* (ABS, 2019); *TM-LINK* (IP Australia, 2020); *World Trade Organization Tariff Download Facility* (WTO, 2019); *International Financial Statistics* (IMF, 2019); *National Accounts Statistics* (OECD, 2019).

Revenue robustness

Rejected/cancelled trade mark applications have no discernible effect in shaping revenue responses to shocks

As for entry, we conducted a series of additional robustness checks. In Table 10, we report a model which includes a measure of rejected/cancelled applications, in addition to the trade mark measures based on accepted/registered applications (Model 9). The relationship between rejected/cancelled applications and export revenue is positive and significant at the 5 per cent level, indicating the potential presence of filing activity pre-empting export expansion. Unlike for accepted/registered applications, which remain a significant moderator of revenue responses to the real exchange rate, there is no evidence that exporters increase export activity pre-empting export expansion in response to tariff or exchange rate changes. The results contribute to ameliorating concerns that reverse causality is driving our main results.

Table 10. Export revenue responses: robustness to measurement of trade mark activity

	(9) Revenue – Rejected/cancelled applications		(10) Revenue – Depreciated stocks	
	Coeff.	Std error	Coeff.	Std error
	Long export history		*Long export history*	
$ln\ tariff_t^{jk}$	–2.614	(1.237)*	–3.152	(1.791)†
$ln\ RER_t^k$	0.961	(0.251)***	2.059	(0.429)***
$ln\ demand_t^k$	0.102	(0.252)	–0.410	(0.391)
$ln\ tmarks_{t-1}^k$	0.255	(0.076)**	0.171	(0.098)†
$ln\ tmarks\_uk_{t-1}^k$	0.818	(0.272)**	0.545	(0.252)*
$ln\ tmarks_{t-1}^{jk} \times ln\ tariff_t^{jk}$	–3.737	(2.705)	–8.066	(3.257)•
$ln\ tmarks_{t-1}^{jk} \times ln\ RER_t^k$	–1.311	(0.467)**	–1.424	(0.538)**
$ln\ tmarks\_rejected_{t-1}^{jk}$	0.213	(0.090)*		
$ln\ tmarks\_rejected_{t-1}^{jk} \times ln\ tariff_t^{jk}$	–7.756	(5.590)		
$ln\ tmarks\_rejected_{t-1}^{jk} \times ln\ RER_t^k$	0.525	(0.500)		
	Short export history		*Short export history*	
$ln\ tariff_t^{jk}$	–2.196	(0.746)**	–2.680	(1.091)*
$ln\ RER_t^k$	0.011	(0.256)	0.846	(0.413)*
$ln\ demand_t^k$	0.105	(0.250)	–0.597	(0.387)
$ln\ tmarks_{t-1}^k$	0.009	(0.070)	–0.046	(0.074)
$ln\ tmarks\_uk_{t-1}^k$	0.140	(0.213)	0.204	(0.225)
$ln\ tmarks_{t-1}^{jk} \times ln\ tariff_t^{jk}$	1.447	(2.434)	–0.394	(1.703)
$ln\ tmarks_{t-1}^{jk} \times ln\ RER_t^k$	–0.163	(0.443)	–0.671	(0.406)**
$ln\ tmarks\_rejected_{t-1}^{jk}$	0.304	(0.095)**		
$ln\ tmarks\_rejected_{t-1}^{jk} \times ln\ tariff_t^{jk}$	1.538	(5.297)		
$ln\ tmarks\_rejected_{t-1}^{jk} \times ln\ RER_t^k$	0.817	(0.525)		
Export history controls	Yes		Yes	
Firm–prod–yr f.e.	Yes		Yes	
Prod–mkt f.e.	Yes		Yes	
N	65,725		35,424	
R^2	0.84		0.84	
R^2–adjusted	0.72		0.71	

Notes: Export revenue is estimated using a log-linear OLS regression model. In-sample destination market include US, Canada, the UK and Eurozone countries (Austria, Belgium, Finland, France, Italy, Netherlands, Portugal and Spain). Robust standard errors, clustered by firm-product-year and product-market, are in parentheses. Export history controls included but not reported. † $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Source: BLADE (ABS. 2019); *International Merchandise Exports* (ABS, 2019); *TM-LINK* (IP Australia, 2020); *World Trade Organization Tariff Download Facility* (WTO, 2019); *International Financial Statistics* (IMF, 2019); *National Accounts Statistics* (OECD, 2019).

Earlier trade mark activity is associated with amplified revenue responses to tariffs

In Table 10 above, we find that results are similar to our baseline using a depreciated trade mark stock variable instead of a trade mark measure based on annual filing activity (Model 10). The interaction effect of trade marks on the relationship between revenue and tariffs is negative and significant at the 5% level. The interaction term between trade marks and the real exchange rate is positive and significant at the 1% level. Both results conform with our hypotheses and baseline analysis.

In Table 11 below we find that results are broadly similar in a model using 2-year lags of all independent variables (Model 11). The interaction effect of trade marks on the relationship between revenue and tariffs has doubled in magnitude from our baseline analysis and is significant at the 1% level. In direction the result is consistent with Hypothesis 1b. The interaction term between trade marks and the real exchange rate is negative in line with Hypothesis 2b but non-significant in this specification.

Table 11. Export revenue responses: specification robustness

	(11) Revenue – Independent variables lagged 2 years		(12) Revenue – Dependent and independent variables in differences	
	Coeff.	Std error	Coeff.	Std error
	Long export history		*Long export history*	
$ln\ tariff_t^{jk}$	–0.211	(1.338)	–4.605	(2.248)*
$ln\ RER_t^k$	0.802	(0.272)**	1.056	(0.342)**
$ln\ demand_t^k$	0.103	(0.252)	1.672	(0.701)*
$ln\ tmarks_{t-1}^k$	0.430	(0.088)***	–0.004	(0.049)
$ln\ tmarks\_uk_{t-1}^k$	0.655	(0.234)**	0.242	(0.183)
$ln\ tmarks_{t-1}^{jk} \times ln\ tariff_t^{jk}$	–10.573	(3.599)**	–3.079	(2.079)
$ln\ tmarks_{t-1}^{jk} \times ln\ RER_t^k$	–0.502	(0.487)	–1.846	(0.874)*
	Short export history		*Short export history*	
$ln\ tariff_t^{jk}$	1.036	(0.779)	–9.379	(1.237)***
$ln\ RER_t^k$	0.092	(0.263)	0.399	(0.340)
$ln\ demand_t^k$	–0.085	(0.249)	1.502	(0.639)*
$ln\ tmarks_{t-1}^k$	0.097	(0.075)	–0.070	(0.057)
$ln\ tmarks\_uk_{t-1}^k$	–0.191	(0.378)	0.576	(0.188)**
$ln\ tmarks_{t-1}^{jk} \times ln\ tariff_t^{jk}$	–0.102	(4.385)	–3.901	(3.982)
$ln\ tmarks_{t-1}^{jk} \times ln\ RER_t^k$	0.320	(0.463)	0.397	(0.992)
Firm–prod–yr f.e.	Yes		Yes	
Prod–mkt f.e.	Yes		Yes	
N	59,449		59,449	
R^2	0.84		0.94	
R^2–adjusted	0.72		0.89	

Notes: Export revenue is estimated using a log-linear OLS regression model. In-sample destination market include US, Canada, the UK and Eurozone countries (Austria, Belgium, Finland, France, Italy, Netherlands, Portugal and Spain). Export history controls included but not reported. Robust standard errors, clustered by firm-product-year and product-market, are in parentheses. † $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Source: BLADE (ABS. 2019); *International Merchandise Exports* (ABS, 2019); *TM-LINK* (IP Australia, 2020); *World Trade Organization Tariff Download Facility* (WTO, 2019); *International Financial Statistics* (IMF, 2019); *National Accounts Statistics* (OECD, 2019).

Change in trade mark activity shapes revenue responses to change in the real exchange rate

In Table 11 above we report a differenced version of the baseline specification, including the dependent variable and key independent variables in differences rather than levels (Model 12). Here, the response of revenue with respect to tariffs and with respect to the real exchange rate are statistically significant and in directions as predicted by theory. Focusing on incumbent exporters, change in revenue is around 4.4 times more responsive to change in tariffs than to change in the real exchange rate. The coefficient on the trade mark variable is not significantly different from zero, with a 95% confidence interval ranging from –0.10 to 0.09. The interaction effect of trade marks on the relationship between revenue and the real exchange rate is negative and significant, further validating Hypothesis 2b. The interaction term between trade marks and tariffs is negative in line with Hypothesis 2a but non-significant.

Robustness to varying the estimation sample

Table 12 presents results from varying the estimation sample. First, we report results focusing on a restricted set of destinations for which we have complete (national and regional) trade mark data (Model 13). The results for revenue responses with respect to shocks are consistent with our baseline analysis. The coefficient on the trade mark variable is non-significant, though the control variable for a firm's national filings at the UKIPO is positive and significant. Consistent with our predictions and main analysis, the interaction term between trade marks and tariffs is negative and significant. The interaction term between trade marks and the real exchange rate is negative in line with our predictions but non-significant.

As the customs exports data is skewed, with a predominance of small export values and a small number of exporters contributing large export values, we varied the estimation sample in two further ways. First, in Model 14, we dropped from the sample observations with the largest export values (in the top 1% for export revenue at the firm-product-country-year level). Using this sample specification, the main effects of the trade mark variables are non-significant.

The interaction term between trade marks and tariffs is significant at the 10% level, as is the interaction term between trade marks and the real exchange rate, in both cases consistent in direction with our baseline analysis. Second, we dropped from the main sample all observations associated with less than $2,000 in export revenue at the firm-product-country-year level (Model 15) and obtained results reasonably consistent with our main analysis. For incumbent exporters, the coefficient on the tariff variable is no longer significant, nor is the interaction term between trade marks and tariffs. For exporters in short export spells, the interaction term between trade marks and tariffs is significant and negative, however.

Table 12. Export revenue responses: sample robustness

	(13) Revenue – Restricted set of country markets		(14) Revenue – Largest export values dropped		(15) Revenue – Smallest export values dropped	
	Std error	Std error	Std error	Std error	Std error	Std error
	Long export history		*Long export history*		*Long export history*	
$ln\ tariff_t^{jk}$	–3.333	(1.324)*	–5.374	(2.505)*	–3.037	(2.803)
$ln\ RER_t^k$	0.705	(0.355)*	0.775	(0.343)*	0.631	(0.335)†
$ln\ demand_t^k$	0.171	(0.589)	0.135	(0.398)	0.918	(0.409)*
$ln\ tmarks_{t-1}^k$	0.047	(0.085)	0.117	(0.088)	0.190	(0.082)•
$ln\ tmarks\_uk_{t-1}^k$	0.932	(0.301)**	0.502	(0.361)	0.770	(0.253)**
$ln\ tmarks_{t-1}^{jk} \times ln\ tariff_t^{jk}$	–3.261	(2.847)**	–4.854	(2.923)†	–2.527	(2.606)
$ln\ tmarks_{t-1}^{jk} \times ln\ RER_t^k$	–1.316	(0.400)	–0.831	(0.449)†	–1.017	(0.477)*
	Short export history		*Short export history*		*Short export history*	
$ln\ tariff_t^{jk}$	–1.829	(1.121)	–4.101	(2.565)	–1.716	(2.856)
$ln\ RER_t^k$	–0.116	(0.333)	0.323	(0.377)	0.092	(0.382)
$ln\ demand_t^k$	–0.005	(0.604)	0.006	(0.397)	0.772	(0.407)†
$ln\ tmarks_{t-1}^k$	0.139	(0.087)	0.137	(0.122)	0.203	(0.125)
$ln\ tmarks\_uk_{t-1}^k$	0.062	(0.278)	–0.631	(0.346)†	–0.593	(0.624)
$ln\ tmarks_{t-1}^{jk} \times ln\ tariff_t^{jk}$	–0.174	(2.094)	–6.330	(4.735)	–9.269	(4.517)*
$ln\ tmarks_{t-1}^{jk} \times ln\ RER_t^k$	0.154	(0.438)	0.320	(0.649)	0.357	(0.717)
Export history controls	Yes		Yes		Yes	
Firm-prod-yr f.e.	Yes		Yes		Yes	
Prod-mkt f.e.	Yes		Yes		Yes	
N	29,624		32,474		30,261	
R^2	0.87		0.83		0.81	
R^2–adjusted	0.72		0.71		0.67	

Notes: Export revenue is estimated using a log-linear OLS regression model. In-sample destination market include US, Canada, the UK and Eurozone countries (Austria, Belgium, Finland, France, Italy, Netherlands, Portugal and Spain). Export history controls included but not reported. Robust standard errors, clustered by firm-product-year and product-market, are in parentheses. † $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Source: BLADE (ABS. 2019); *International Merchandise Exports* (ABS, 2019); *TM-LINK* (IP Australia, 2020); *World Trade Organization Tariff Download Facility* (WTO, 2019); *International Financial Statistics* (IMF, 2019); *National Accounts Statistics* (OECD, 2019).

Export quantities and markup adjustment

The impact on exports of shocks depends not only on actions by exporters to build foreign customer base but also on how exporters pass shocks into export prices, then how importers pass them into consumer prices. Several authors have explored whether the insensitivity of exports to the real exchange rate reflects markup adjustment behaviour by exporting firms. When an exporter's home currency depreciates against the buyer's currency, the exporter may absorb the exchange rate shock by increasing its markup (Krugman, 1987). Further, firms are heterogeneous in adopting this "pricing-to-market" behaviour. Berman et al. (2012) found that in response to a home exchange rate depreciation, high performing exporters will tend to increase their prices more than the average exporter and increase their export volumes less.

Based on available evidence, only a small part of a real exchange rate shock tends to be absorbed in export prices (typically less than 3%). Further, recent studies have found that exporters will also absorb a large part of tariff changes in their export prices (Fontagné et al., 2018). Markup adjustment may therefore be an insufficient explanation for muted exchange rate responses relative to strong tariff responses (Fitzgerald, Yedid-Levi & Haller, 2019). In order to

test whether our results are driven by markup adjustment behaviour – e.g., instead of exporters taking advantage of shocks to build foreign customer base – we estimated export price and export quantity responses to trade marks and shocks (Table 13).

Table 13. Export price and export quantity responses to trade marks and shocks

	(16) Export price		(17) Export quantity	
	Std error	Std error	Coeff.	Std error
	Long export history		*Long export history*	
$ln\ tariff_t^{jk}$	0.231	(0.424)	–2.854	(1.121)*
$ln\ RER_t^k$	0.227	(0.162)	0.433	(0.198)*
$ln\ demand_t^k$	0.054	(0.176)	0.177	(0.171)
$ln\ tmarks_{t-1}^k$	–0.039	(0.046)	0.148	(0.062)*
$ln\ tmarks\_uk_{t-1}^k$	0.108	(0.114)	0.788	(0.237)**
$ln\ tmarks_{t-1}^{jk} \times ln\ tariff_t^{jk}$	–0.680	(0.970)	2.480	(1.673)
$ln\ tmarks_{t-1}^{jk} \times ln\ RER_t^k$	–0.462	(0.237)†	–0.370	(0.363)
	Short export history		*Short export history*	
$ln\ tariff_t^{jk}$	0.228	(0.368)	–1.397	(0.608)*
$ln\ RER_t^k$	0.076	(0.168)	0.229	(0.179)
$ln\ demand_t^k$	0.031	(0.177)	0.077	(0.172)
$ln\ tmarks_{t-1}^k$	0.001	(0.044)	0.010	(0.047)
$ln\ tmarks\_uk_{t-1}^k$	0.250	(0.120)*	0.034	(0.113)
$ln\ tmarks_{t-1}^{jk} \times ln\ tariff_t^{jk}$	1.131	(1.108)	1.885	(1.815)
$ln\ tmarks_{t-1}^{jk} \times ln\ RER_t^k$	–0.186	(0.233)	–0.054	(0.261)
Export history controls				
2 years tenure	0.007	(0.020)	0.306	(0.020)***
3 years tenure	0.040	(0.024)†	0.474	(0.026)***
4 years tenure	0.030	(0.027)	0.601	(0.033)***
5 years tenure	0.079	(0.032)•	0.717	(0.038)***
6 years tenure	0.047	(0.038)	0.769	(0.044)***
7+ years tenure	0.077	(0.041)*	0.861	(0.051)***
censored tenure	–0.016	(0.026)	0.269	(0.037)***
Firm-prod-yr f.e.	Yes		No	
Prod-mkt f.e.	Yes		No	
N	66,106		108,744	
R^2	0.93		0.94	
R^2–adjusted	0.87		0.90	

Notes: Export revenue is estimated using a log-linear OLS regression model. In-sample destination market include US, Canada, the UK and Eurozone countries (Austria, Belgium, Finland, France, Italy, Netherlands, Portugal and Spain). Robust standard errors, clustered by firm-product-year and product-market, are in parentheses. Export history controls included but not reported. † $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Source: BLADE (ABS. 2019); *International Merchandise Exports* (ABS, 2019); *TM-LINK* (IP Australia, 2020); *World Trade Organization Tariff Download Facility* (WTO, 2019); *International Financial Statistics* (IMF, 2019); *National Accounts Statistics* (OECD, 2019).

Model 16 presents estimates of export price responses to trade marks and shocks.[9] We find no evidence of pricing-to-market by Australian manufacturers in response to tariff and exchange rate changes, nor do we find significant heterogeneity in firms' adoption of a markup adjustment response. Model 17 presents estimates of export quantity

[9] The estimation equation for export prices is as follows: $Price_t^{ijk} = \theta_t^{ij} + \theta^{jk} + \boldsymbol{\gamma_1 \alpha}_{t-1}^{ijk} + \gamma_2\left(ln\left(\boldsymbol{z}_t^{jk}\right) \times long_t^{ijk}\right) + \gamma_3\left(ln\left(\boldsymbol{z}_t^{jk}\right) \times short_t^{ijk}\right) + \gamma_4\left(ln(dem_t^k) \times long_t^{ijk}\right) + \gamma_5\left(ln(dem_t^k) \times short_t^{ijk}\right) + \gamma_6\left(ln\left(tmark_{t-1}^{ik}\right) \times long_t^{ijk}\right) + \gamma_7\left(ln\left(tmark_{t-1}^{ik}\right) \times short_t^{ijk}\right) + \gamma_8\left(ln\left(tmark\_uk_{t-1}^{ik}\right) \times long_t^{ijk}\right) + \gamma_9\left(ln\left(tmark\_uk_{t-1}^{ik}\right) \times short_t^{ijk}\right) + \gamma_{10}\left(ln\left(\boldsymbol{z}_t^{jk}\right) \times ln\left(tmark_{t-1}^{ik}\right) \times long_t^{ijk}\right) + \gamma_{11}\left(ln\left(\boldsymbol{z}_t^{jk}\right) \times ln\left(tmark_{t-1}^{ik}\right) \times short_t^{ijk}\right) + \varepsilon_t^{ijk}$, where $Price_t^{ijk}$ is the mean price (Australian dollars, current prices) of firm i in selling product j to market k in (fiscal) year t. Variables on the right-hand side of the estimation equation are as specified in this study's revenue equation (3).

responses to trade marks and shocks.[10] The coefficients of our main tariff, exchange rate and trade mark variables are significant in this specification and in directions as predicted by theory. Based on these results, exporters building foreign customer base would appear a more credible explanation for our main results than markup adjustment. However, we find no significant interaction effect of trade marks on the relationship between export quantity and tariffs, or on the relationship between export quantity and the real exchange rate. Further research is needed to confirm whether the association between trade mark activity and exporters' responses to the real exchange rate arises because trade mark holders are better positioned than non-holders to invest in foreign customer base.

[10] The estimation equation for export prices is as follows: $Quantity_t^{ijk} = \theta_t^{ij} + \theta^{jk} + \boldsymbol{\gamma_1 \alpha}_{t-1}^{ijk} + \gamma_2\left(ln\left(\boldsymbol{z}_t^{jk}\right) \times long_t^{ijk}\right) + \gamma_3\left(ln\left(\boldsymbol{z}_t^{jk}\right) \times short_t^{ijk}\right) + \gamma_4\left(ln(dem_t^k) \times long_t^{ijk}\right) + \gamma_5\left(ln(dem_t^k) \times short_t^{ijk}\right) + \gamma_6\left(ln\left(tmark_{t-1}^{ik}\right) \times long_t^{ijk}\right) + \gamma_7\left(ln\left(tmark_{t-1}^{ik}\right) \times short_t^{ijk}\right) + \gamma_8\left(ln\left(tmark\_uk_{t-1}^{ik}\right) \times long_t^{ijk}\right) + \gamma_9\left(ln\left(tmark\_uk_{t-1}^{ik}\right) \times short_t^{ijk}\right) + \gamma_{10}\left(ln\left(\boldsymbol{z}_t^{jk}\right) \times ln\left(tmark_{t-1}^{ik}\right) \times long_t^{ijk}\right) + \gamma_{11}\left(ln\left(\boldsymbol{z}_t^{jk}\right) \times ln\left(tmark_{t-1}^{ik}\right) \times short_t^{ijk}\right) + \varepsilon_t^{ijk}$, where $Quantity_t^{ijk}$ is the total quantity of product j that firm i sells to market k in (fiscal) year t. Variables on the right-hand side of the estimation equation are as specified in this study's revenue equation (3).

6. EXPORT DIVERSIFICATION

Export diversity decreases with tariff reductions and exchange rate appreciations

We also examined how tariffs, the real exchange rate and trade mark activity affects the diversity of products a firm exports to a destination market. Specifically, we assess the elasticity of export diversity (defined as the number of a products a firm exports to a market) with respect to trade marks and shocks, at the firm-country-year level. We also analyse the effect of trade marks and shocks on a firm's likelihood of product diversification, i.e., its likelihood of entry into exporting a product to a market when the firm is exporting other products to the same market.

Model 18 in Table 14 reports our baseline export diversity analysis at the firm-country-year level. We find that appreciation of the home real exchange rate against the destination market leads to decreased export diversity for manufacturing exporters. The point estimate suggests that a 10% appreciation of the home currency against the market will reduce export diversity by 4.6% at the firm level.

In Model 18, the coefficient on the tariffs variable is also positive and significant at the 5 per cent level. Based on the result, tariff reductions are associated with lower export diversity (or increased export concentration) at the firm level. The finding is consistent with the view that trade liberalisation can induce heightened competition in a market, leading incumbent exporters to narrow their product market focus, e.g., by cutting novel or low-value products from their portfolios (Chang et al., 2019). The point estimate suggests that a 10% reduction in the average tariff rate on exports to a country is associated with a 1.4% decrease in product diversity at the firm level. Export diversification appears to be more responsive to the real exchange rate than to tariffs, with the difference in elasticities significant at the 5% level.

After a firm has filed trade marks, tariff reductions may increase export diversity

In Model 18, trade mark activity is positively associated with export diversification, consistent with a view that, through brand stretching, trade mark holders can encourage customers to trial new products marketed under familiar brands. However, the coefficients on the trade mark variables are non-significant.

The interaction effect of trade marks on the relationship between tariffs and diversification is negative and significant at the 1 per cent level. Based on our estimates, trade mark activity attenuates the impact of tariff reductions in promoting export concentration. Indeed, for recent trade mark filers, trade liberalisation may promote export diversification. In Table 14 we provide a quantitative assessment of the economic importance of trade marks in shaping diversity responses to shocks. After a firm registers a trade mark, a firm will shift from narrowing its product range to expanding its product range in response to tariff reductions. For example, after filing 5 trade marks, a 10% reduction in the tariff rate faced by an exporter predicts a 2% increase in export diversity at the firm level. This shift in response, from positive (tariff reductions increasing concentration) to negative (tariff reductions increasing diversification) may reflect the ability of trade mark holders to stretch their brand across product categories and seize new market opportunities as they arise.

Table 14. Export diversity responses to trade marks and shocks

	(18) Export diversity - baseline	
	Coeff.	Std error
	Long export history	
$ln\ tariff_t^{jk}$	0.142	(0.056)*
$ln\ RER_t^k$	0.464	(0.105)**
$ln\ demand_t^k$	0.066	(0.083)
$ln\ tmarks_{t-1}^k$	0.006	(0.045)
$ln\ tmarks\_uk_{t-1}^k$	0.008	(0.039)
$ln\ tmarks_{t-1}^{jk} \times ln\ tariff_t^{jk}$	–0.168	(0.046)**
$ln\ tmarks_{t-1}^{jk} \times ln\ RER_t^k$	0.170	(0.129)
	Short export history	
$ln\ tariff_t^{jk}$	0.197	(0.062)*
$ln\ RER_t^k$	0.338	(0.092)**
$ln\ demand_t^k$	0.002	(0.087)
$ln\ tmarks_{t-1}^k$	0.024	(0.044)
$ln\ tmarks\_uk_{t-1}^k$	0.118	(0.149)
$ln\ tmarks_{t-1}^{jk} \times ln\ tariff_t^{jk}$	0.095	(0.044)†
$ln\ tmarks_{t-1}^{jk} \times ln\ RER_t^k$	–0.398	(0.181)†
Export history controls		
2 years tenure	0.102	(0.007)***
3 years tenure	0.159	(0.013)***
4 years tenure	0.196	(0.020)***
5 years tenure	0.227	(0.020)***
6 years tenure	0.247	(0.025)***
7+ years tenure	0.311	(0.018)***
censored tenure	0.101	(0.015)***
Firm-prod-yr f.e.	No	
Firm-yr f.e.	Yes	
Prod-mkt f.e.	No	
Mkt f.e.	Yes	
N	39,412	
R^2	0.62	
R^2–adjusted	0.46	
Quantification of interaction effect (long export history)		
Change in the effect of tariff given increase in trade marks		
$0 \rightarrow 1\ tmark$	0.142 →	0.025
$0 \rightarrow 5\ tmarks$	0.142 →	–0.159
Change in the effect of RER given increase in trade marks		
$0 \rightarrow 1\ tmark$	0.464 →	0.581
$0 \rightarrow 5\ tmarks$	0.464 →	0.768

Notes: Export diversification estimated using a log-linear OLS regression model. In-sample destination markets include US, Canada, the UK and Eurozone countries (Austria, Belgium, Finland, France, Italy, Netherlands, Portugal and Spain). Robust standard errors, clustered by firm-product-year and product-market, are in parentheses. † $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Source: BLADE (ABS. 2019); *International Merchandise Exports* (ABS, 2019); *TM-LINK* (IP Australia, 2020); *World Trade Organization Tariff Download Facility* (WTO, 2019); *International Financial Statistics* (IMF, 2019); *National Accounts Statistics* (OECD, 2019).

Export diversity is more responsive to tariffs for SMEs than for large firms

In Table 15, we report average marginal effects for groups of firms of different size, obtained by interacting all model variables with an indicator variable for firm size (Model 19). Export diversity is more responsive to tariffs for SMEs than for large firms: the coefficient on the tariff variable is significant for SMEs but not significant for large firms, and the difference in elasticities for the two sample groups is significant at the 1% level. In contrast, the sensitivity of export diversity to the real exchange rate is consistent — and strongly significant — across the two sample groups.

Table 15. Export diversity responses: marginal effects for firms of different size

	(19)			
	Diversification – SMEs		Diversification – Large firms	
	Coeff.	Std error	Coeff.	Std error
	Long export history		*Long export history*	
$ln\ tariff_t^{jk}$	0.189	(0.051)**	–0.012	(0.067)
$ln\ RER_t^k$	0.424	(0.084)***	0.593	(0.148)**
$ln\ demand_t^k$	0.056	(0.085)	0.069	(0.084)
$ln\ tmarks_{t-1}^k$	–0.023	(0.042)	0.042	(0.040)
$ln\ tmarks\_uk_{t-1}^k$	–0.030	(0.245)	–0.024	(0.043)
$ln\ tmarks_{t-1}^{jk} \times ln\ tariff_t^{jk}$	–0.022	(0.072)	–0.141	(0.056)*
$ln\ tmarks_{t-1}^{jk} \times ln\ RER_t^k$	–0.249	(0.177)	0.296	(0.137)†
	Short export history		*Short export history*	
$ln\ tariff_t^{jk}$	0.174	(0.065)*	0.255	(0.064)**
$ln\ RER_t^k$	0.328	(0.092)**	0.368	(0.088)**
$ln\ demand_t^k$	–0.015	(0.088)	0.030	(0.084)
$ln\ tmarks_{t-1}^k$	0.052	(0.066)	0.042	(0.039)
$ln\ tmarks\_uk_{t-1}^k$	–0.492	(0.269)†	0.193	(0.207)
$ln\ tmarks_{t-1}^{jk} \times ln\ tariff_t^{jk}$	0.184	(0.085)†	0.068	(0.064)
$ln\ tmarks_{t-1}^{jk} \times ln\ RER_t^k$	–0.595	(0.272)†	–0.345	(0.263)
Export history controls	Yes			
Firm-prod-yr f.e.	No			
Firm-yr f.e.	Yes			
Prod-mkt f.e.	No			
Mkt f.e.	Yes			
N	39,412			
R^2	0.62			
R^2–adjusted	0.47			

Notes: Export diversification estimated using a log-linear OLS regression model. In-sample destination markets include US, Canada, the UK and Eurozone countries (Austria, Belgium, Finland, France, Italy, Netherlands, Portugal and Spain). . Export history controls included but not reported. Robust standard errors, clustered by firm-product-year and product-market, are in parentheses. † $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Source: BLADE (ABS. 2019); *International Merchandise Exports* (ABS, 2019); *TM-LINK* (IP Australia, 2020); *World Trade Organization Tariff Download Facility* (WTO, 2019); *International Financial Statistics* (IMF, 2019); *National Accounts Statistics* (OECD, 2019).

In Model 19, the interaction effect of trade marks on the relationship between export diversity and tariffs is significant only for large firms and not for SMEs. The interaction effect of trade marks on the relationship between export diversity and the real exchange rate is marginally significant for large firms and non-significant for SMEs.

Diversity robustness

Rejected/cancelled trade mark applications have no discernible effect in shaping diversity responses to tariffs or the real exchange rate

As for entry and revenue, we conducted a series of additional analyses to check the robustness of our diversification estimates. In Table 16, we report a model which includes a measure of rejected/cancelled applications, in addition to the measures of trade mark activity based on annual filing activity (Model 20). The coefficient on the trade mark variable is non-significant irrespective of whether trade mark activity is measured using accepted/registered applications or rejected/cancelled applications. Rejected/cancelled trade mark applications have no significant interaction effect on the relationship between diversity and tariffs, unlike accepted/registered applications.

Table 16. Export diversity responses: robustness to measurement of independent variables

	(20) Diversification – Rejected/cancelled applications		(21) Diversification – Trade mark variables as stocks	
	Coeff.	Std error	Coeff.	Std error
	Long export history		*Long export history*	
$ln\ tariff_t^{jk}$	0.136	(0.054)*	0.185	(0.070)*
$ln\ RER_t^k$	0.466	(0.098)**	0.436	(0.104)**
$ln\ demand_t^k$	0.061	(0.083)	0.082	(0.085)
$ln\ tmarks_{t-1}^k$	0.027	(0.039)	0.015	(0.038)
$ln\ tmarks\_uk_{t-1}^k$	–0.014	(0.064)	0.032	(0.043)
$ln\ tmarks_{t-1}^{jk} \times ln\ tariff_t^{jk}$	–0.087	(0.059)	–0.167	(0.028)***
$ln\ tmarks_{t-1}^{jk} \times ln\ RER_t^k$	0.083	(0.090)	0.176	(0.173)
$ln\ tmarks\_rejected_{t-1}^{jk}$	–0.015	(0.052)		
$ln\ tmarks\_rejected_{t-1}^{jk} \times ln\ tariff_t^{jk}$	–0.169	(0.119)		
$ln\ tmarks\_rejected_{t-1}^{jk} \times ln\ RER_t^k$	0.288	(0.341)		
	Short export history		*Short export history*	
$ln\ tariff_t^{jk}$	0.191	(0.061)*	0.218	(0.071)*
$ln\ RER_t^k$	0.341	(0.091)**	0.325	(0.093)**
$ln\ demand_t^k$	–0.003	(0.087)	0.016	(0.089)
$ln\ tmarks_{t-1}^k$	0.027	(0.037)	–0.010	(0.039)
$ln\ tmarks\_uk_{t-1}^k$	0.158	(0.155)	0.065	(0.097)
$ln\ tmarks_{t-1}^{jk} \times ln\ tariff_t^{jk}$	0.158	(0.047)**	0.008	(0.034)
$ln\ tmarks_{t-1}^{jk} \times ln\ RER_t^k$	–0.492	(0.169)*	–0.209	(0.164)
$ln\ tmarks\_rejected_{t-1}^{jk}$	0.044	(0.063)		
$ln\ tmarks\_rejected_{t-1}^{jk} \times ln\ tariff_t^{jk}$	–0.040	(0.108)		
$ln\ tmarks\_rejected_{t-1}^{jk} \times ln\ RER_t^k$	0.123	(0.303)		
Export history controls	Yes		Yes	
Firm-prod-yr f.e.	No		No	
Firm-yr f.e.	Yes		Yes	
Prod-mkt f.e.	No		No	
Mkt f.e.	Yes		Yes	
N	39,412		39,412	
R^2	0.62		0.62	
R^2–adjusted	0.47		0.47	

Notes: Export entry is estimated using a linear probability regression model. In-sample destination markets include the US, Canada and the UK. . Export history controls included but not reported. Robust standard errors, clustered by firm-product-year and product-market, are in parentheses. † $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Source: BLADE (ABS. 2019); *International Merchandise Exports* (ABS, 2019); *TM-LINK* (IP Australia, 2020); *World Trade Organization Tariff Download Facility* (WTO, 2019); *International Financial Statistics* (IMF, 2019); *National Accounts Statistics* (OECD, 2019).

Earlier trade mark activity predicts export diversity responses to tariffs

In Table 16, results in Model 21 are similar to our baseline analysis using a depreciated trade mark stock variable in place of the measure of annual filing activity. Further, as reported in Table 17 below, results are similar to the baseline in a model using 2-year lags of all independent variables (Model 22). These findings reduce concerns that our main results are a product of reverse causality (e.g., that anticipating greater competition induced tariff reductions firms both narrow their product range and increase their filing activity to protect core intellectual property).

Table 17. Export diversity responses: specification robustness

	(22) Diversification – independent variables lagged 2 years		(23) Diversification - dependent and independent variables in differences	
	Coeff.	Std error	Coeff.	Std error
	Long export history		*Long export history*	
$ln\ tariff_t^{jk}$	0.125	(0.043)*	0.283	(0.124)*
$ln\ RER_t^k$	0.380	(0.059)***	0.188	(0.139)
$ln\ demand_t^k$	0.037	(0.078)	0.327	(0.274)
$ln\ tmarks_{t-1}^k$	0.013	(0.043)	0.042	(0.017)*
$ln\ tmarks\_uk_{t-1}^k$	0.025	(0.040)	–0.079	(0.032)*
$ln\ tmarks_{t-1}^{jk} \times ln\ tariff_t^{jk}$	–0.156	(0.046)**	1.172	(0.296)**
$ln\ tmarks_{t-1}^{jk} \times ln\ RER_t^k$	0.193	(0.151)	–0.195	(0.325)
	Short export history		*Short export history*	
$ln\ tariff_t^{jk}$	0.142	(0.048)*	0.137	(0.117)
$ln\ RER_t^k$	0.323	(0.112)*	0.082	(0.191)
$ln\ demand_t^k$	–0.031	(0.078)	0.310	(0.238)
$ln\ tmarks_{t-1}^k$	0.015	(0.046)	0.025	(0.035)
$ln\ tmarks\_uk_{t-1}^k$	–0.039	(0.128)	0.189	(0.119)
$ln\ tmarks_{t-1}^{jk} \times ln\ tariff_t^{jk}$	0.004	(0.052)	1.172	(0.296)**
$ln\ tmarks_{t-1}^{jk} \times ln\ RER_t^k$	0.010	(0.183)	0.661	(0.642)
Export history controls	Yes		Yes	
Firm-prod-yr f.e.	No		No	
Firm-yr f.e.	Yes		Yes	
Prod-mkt f.e.	No		No	
Mkt f.e.	Yes		Yes	
N	38,152		23,874	
R^2	0.62		0.37	
R^2–adjusted	0.47		0.10	

Notes: Export entry is estimated using a linear probability regression model. In-sample destination markets include the US, Canada and the UK. . Export history controls included but not reported. Robust standard errors, clustered by firm-product-year and product-market, are in parentheses. † $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Source: BLADE (ABS. 2019); *International Merchandise Exports* (ABS, 2019); *TM-LINK* (IP Australia, 2020); *World Trade Organization Tariff Download Facility* (WTO, 2019); *International Financial Statistics* (IMF, 2019); *National Accounts Statistics* (OECD, 2019).

In Table 17 we present a differenced version of the baseline analysis in which the dependent and independent variables are included in differences rather than levels (Model 23). In this specification, diversity responses to shocks are consistent in direction with our baseline diversity analysis. Diversity responses to the real exchange rate are not significantly different from zero, unlike in our baseline specification, but tariff responses remain positive and significant at the 5 per cent level. Change in a firm's trade mark filing activity is positively related to change in product export diversity. The result is consistent with a view that trade marks create opportunity for brand extension and diversification. The differenced version reports a perverse (positive) interaction effect of trade marks on the relationship between diversity and tariffs. There is relatively little year-on-year time-series variation in tariffs compared to real exchange rates which could lead to perverse results in the differenced version.

Robustness to varying the estimation sample

Table 18 presents our results from varying the estimation sample. First, we restrict the sample to export markets for which we have complete trade mark data (Model 24). In this specification, none of the main variables or their interaction terms are significant. In Model 25, results are very similar to our baseline analysis after dropping observations in the top 1 per cent for export value. In Model 26, results are similar to our baseline after dropping observations with export values less than $2,000.

Table 18. Export diversity responses: sample robustness

	(24) Diversification – Restricted set of country markets		(25) Diversification – Largest exporters dropped		(26) Diversification – Smallest exporters dropped	
	Coeff.	Std error	Coeff.	Std error	Coeff.	Std error
	Long export history		*Long export history*		*Long export history*	
$ln\ tariff_t^{jk}$	0.265	(0.107)	0.216	(0.078)*	0.272	(0.093)*
$ln\ RER_t^k$	0.425	(0.106)†	0.573	(0.122)**	0.572	(0.135)**
$ln\ demand_t^k$	0.576	(0.231)	0.085	(0.117)	0.168	(0.132)
$ln\ tmarks_{t-1}^k$	-0.034	(0.031)	–0.019	(0.037)	–0.009	(0.050)
$ln\ tmarks\_uk_{t-1}^k$	0.031	(0.037)	–0.027	(0.035)	0.005	(0.039)
$ln\ tmarks_{t-1}^{jk} \times ln\ tariff_t^{jk}$	-0.129	(0.060)	–0.132	(0.047)*	–0.161	(0.053)*
$ln\ tmarks_{t-1}^{jk} \times ln\ RER_t^k$	0.137	(0.188)	0.148	(0.122)	0.153	(0.138)
	Short export history		*Short export history*		*Short export history*	
$ln\ tariff_t^{jk}$	0.166	(0.182)	0.218	(0.074)*	0.265	(0.089)*
$ln\ RER_t^k$	0.423	(0.170)	0.506	(0.129)**	0.505	(0.134)**
$ln\ demand_t^k$	0.482	(0.264)	0.024	(0.123)	0.103	(0.137)
$ln\ tmarks_{t-1}^k$	0.046	(0.035)	0.001	(0.048)	0.005	(0.052)
$ln\ tmarks\_uk_{t-1}^k$	0.101	(0.177)	0.629	(0.383)	0.686	(0.321)†
$ln\ tmarks_{t-1}^{jk} \times ln\ tariff_t^{jk}$	0.056	(0.073)	0.125	(0.082)	0.116	(0.082)
$ln\ tmarks_{t-1}^{jk} \times ln\ RER_t^k$	-0.238	(0.244)	–0.481	(0.256)†	–0.428	(0.283)
Export history controls	Yes		Yes		Yes	
Firm-prod-yr f.e.	No		No		No	
Firm-yr f.e.	Yes		Yes		Yes	
Prod-mkt f.e.	No		No		No	
Mkt f.e.	Yes		Yes		Yes	
N	18,263		25,935		26,335	
R^2	0.74		0.65		0.65	
R^2–adjusted	0.55		0.49		0.50	

Notes: Export entry is estimated using a linear probability regression model. In-sample destination market include US, Canada and the UK. Export revenue and export diversification is estimated using a log-linear OLS regression model. In-sample destination markets include US, Canada, the UK and Eurozone countries (Austria, Belgium, Finland, France, Italy, Netherlands, Portugal and Spain). . Export history controls included but not reported. Robust standard errors are in parentheses. † $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Source: BLADE (ABS. 2019); *International Merchandise Exports* (ABS, 2019); *TM-LINK* (IP Australia, 2020); *World Trade Organization Tariff Download Facility* (WTO, 2019); *International Financial Statistics* (IMF, 2019); *National Accounts Statistics* (OECD, 2019).

Diversifying entry responses

To further explore the barriers and drivers of export diversification, we test for the effects of trade marks and shocks on diversifying entry, that is, entry by a firm into exporting a product to a market when the firm exports other products to the same market. To analyse diversifying entry, we adapted our baseline entry specification which identifies export entry at the firm-product-country-year level. We interact all independent variables in the entry equation with an indicator variable that equals 1 if, in the year of potential entry into exporting a focal product to a market, an observation exports other products to the same market, and which equals zero otherwise.

In the analysis that follows we report separate entry elasticities with respect to trade marks and shocks for two groups of observations. *Potential diversifying entrants* include all firm-product-country-year observations that exported to the focal country at least one product other than the focal product in the year of analysis. *Potential focused entrants* include all firm-product-country-year observations that did not export to the focal country at least one product other than the focal product in the year of analysis.

After a firm has filed trade marks, it is more likely to diversify in response to exchange rate appreciations

In Table 19 (Model 27), the results for potential diversifying entrants are similar in direction to our baseline diversity analysis. Interestingly, real aggregate demand is positively related to entry for potential diversifying entrants and is negatively associated with entry for potential focused entrants without a broader position in the market. Trade mark activity is positively related to entry for potential diversifying entrants: an increase in trade mark filings from one to

two in the destination market is associated with a 50% increase in the likelihood of a firm diversifying its products (from 0.6% to 0.9%). Trade mark activity is not a significant predictor of focused entry. Trade marks may be become relatively more important to exporters as they establish themselves in a market, overcome the 'liability of foreignness' – e.g., the costs of building brand recognition and legitimacy in a foreign market (Hymer, 1976) – and seek opportunities for brand expansion and diversification.

Table 19. Export entry responses: marginal effects for potential diversifying and focused entrants

	(27) Entry	
	Coeff.	Std error
	Potential diversifying entrants	
$ln\ tariff_t^{jk}$	0.011	(0.010)
$ln\ RER_t^k$	0.008	(0.001)***
$ln\ demand_t^k$	0.001	(0.000)***
$ln\ tmarks_{t-1}^k$	0.003	(0.000)***
$ln\ tmarks\_uk_{t-1}^k$	–0.001	(0.001)†
$ln\ tmarks_{t-1}^{jk} \times ln\ tariff_t^{jk}$	0.006	(0.009)
$ln\ tmarks_{t-1}^{jk} \times ln\ RER_t^k$	–0.006	(0.001)***
	Potential focused entrants	
$ln\ tariff_t^{jk}$	–0.003	(0.002)
$ln\ RER_t^k$	0.001	(0.000)*
$ln\ demand_t^k$	–0.002	(0.000)***
$ln\ tmarks_{t-1}^k$	0.000	(0.000)
$ln\ tmarks\_uk_{t-1}^k$	0.000	(0.000)
$ln\ tmarks_{t-1}^{jk} \times ln\ tariff_t^{jk}$	–0.011	(0.007)
$ln\ tmarks_{t-1}^{jk} \times ln\ RER_t^k$	0.001	(0.001)
Export history controls		
last part. 2 years prior	–0.168	(0.004)***
last part. 3+ years prior	–0.076	(0.003)***
Average in-sample entry rate	0.06%	
Firm–prod–yr f.e.	Yes	
Prod–mkt f.e.	Yes	
N	25,913,264	
R^2	0.44	
R^2–adjusted	0.16	

Notes: Export entry is estimated using a linear probability regression model. In-sample destination markets include the US, Canada and the UK. Robust standard errors, clustered by firm-product-year and product-market, are in parentheses. † $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Source: BLADE (ABS. 2019); *International Merchandise Exports* (ABS, 2019); *TM-LINK* (IP Australia, 2020); *World Trade Organization Tariff Download Facility* (WTO, 2019); *International Financial Statistics* (IMF, 2019); *National Accounts Statistics* (OECD, 2019).

For potential diversifying entrants, the coefficient on the real exchange rate variable is positive and significant. Further, after a firm has filed trade marks, it is more likely to diversify its products in response to exchange rate appreciations, compared to before filing: the interaction effect of trade marks on the relationship between diversification and the real exchange rate is negative and significant at the 0.1% level. For potential diversifying entrants, the tariff variable is not significant. Neither is the interaction term between trade marks and tariffs. In direction the results are consistent with our earlier finding that tariff reductions promote export concentration.

In Model 27, the results for potential focused entrants are more similar to our baseline entry analysis. For these potential entrants, their likelihood of entry into exporting a focal product decreases with appreciations of the home real exchange rate against the market. In direction, tariff reductions are also associated with increased entry likelihood, consistent with the main entry analysis. However, the tariff variable is not significant for these observations, and neither are the interaction terms between trade marks and our key shock variables.

Trade mark activity predicts export diversification for advanced manufacturers, defence manufacturers and resource technology producers

In 2020, the Australian Government announced investment of around $1.5 billion over 4 years to help Australian manufacturers scale-up, become more competitive and build resilience in trade. A focus of the *Modern Manufacturing Strategy* is to support export market diversification including by helping Australian businesses to integrate into international value chains and bring their goods and services into new markets. The strategy focuses on growth opportunities in 6 manufacturing priority areas. In Table 20, we present entry estimates for firms operating in 3 of these priority areas – Defence, Medical products, and Resources technology – as well as Advanced manufacturing.[11]

Table 20. Export entry responses: marginal effects for potential diversified and focused entrants in different areas of manufacturing

	(28) Entry – Advanced manufacturing		(29) Entry – Defence		(30) Entry – Medical products		(31) Entry – Resources technology	
	Coeff.	Std error	Coeff.	Std error	Coeff.	Std error	Coeff.	Std error
	Potential diversifying entrants		*Potential diversifying entrants*		*Potential diversifying entrants*		*Potential diversifying entrants*	
$ln\ tariff_t^{jk}$	0.012	(0.015)	0.022	(0.018)	–0.002	(0.015)	–0.010	(0.039)
$ln\ RER_t^k$	0.012	(0.001)***	0.013	(0.002)***	0.008	(0.002)***	0.010	(0.003)**
$ln\ demand_t^k$	0.001	(0.001)	0.002	(0.001)*	0.001	(0.001)	–0.002	(0.002)
$ln\ tmarks_{t-1}^k$	0.004	(0.001)***	0.007	(0.002)**	0.003	(0.001)***	0.004	(0.002)†
$ln\ tmarks\_uk_{t-1}^k$	–0.002	(0.001)	0.012	(0.009)	–0.002	(0.002)	0.000	(0.000)
$ln\ tmarks_{t-1}^{jk} \times ln\ tariff_t^{jk}$	0.006	(0.011)	–0.183	(0.106)†	–0.003	(0.010)	0.262	(0.129)*
$ln\ tmarks_{t-1}^{jk} \times ln\ RER_t^k$	–0.007	(0.001)***	–0.040	(0.007)***	–0.001	(0.002)	–0.026	(0.008)**
	Potential focused entrants		*Potential focused entrants*		*Potential focused entrants*		*Potential focused entrants*	
$ln\ tariff_t^{jk}$	–0.003	(0.004)	–0.008	(0.004)†	0.001	(0.006)	0.001	(0.012)
$ln\ RER_t^k$	0.001	(0.000)*	0.001	(0.001)	0.000	(0.001)	0.005	(0.002)**
$ln\ demand_t^k$	–0.004	(0.001)***	–0.004	(0.001)***	–0.002	(0.001)	–0.005	(0.002)*
$ln\ tmarks_{t-1}^k$	0.000	(0.000)	–0.001	(0.001)†	0.001	(0.001)	0.000	(0.001)
$ln\ tmarks\_uk_{t-1}^k$	0.001	(0.000)	0.002	(0.002)**	0.000	(0.001)	0.004	(0.006)
$ln\ tmarks_{t-1}^{jk} \times ln\ tariff_t^{jk}$	–0.020	(0.009)*	0.007	(0.021)	–0.028	(0.032)	0.000	(0.002)
$ln\ tmarks_{t-1}^{jk} \times ln\ RER_t^k$	0.001	(0.001)*	–0.006	(0.001)***	0.001	(0.001)	–0.068	(0.103)
Export history controls								
last part. 2 years prior	–0.170	(0.005)***	–0.181	(0.008)***	–0.166	(0.011)***	–0.164	(0.012)***
last part. 3+ years prior	–0.079	(0.003)***	–0.090	(0.005)***	–0.078	(0.005)***	–0.084	(0.007)***
Firm-prod-yr f.e.	No		No		No		No	
Firm-yr f.e.	Yes		Yes		Yes		Yes	
N	9,336,751		3,201,041		1,127,056		606,797	
R^2	0.44		0.44		0.45		0.45	
R^2–adjusted	0.16		0.16		0.17		0.17	

Notes: Export entry is estimated using a linear probability regression model. In-sample destination market include US, Canada and the UK. Robust standard errors are in parentheses. † $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Source: BLADE (ABS. 2019); *International Merchandise Exports* (ABS, 2019); *TM-LINK* (IP Australia, 2020); *World Trade Organization Tariff Download Facility* (WTO, 2019); *International Financial Statistics* (IMF, 2019); *National Accounts Statistics* (OECD, 2019).

[11] Businesses are classified into manufacturing growth areas based on their primary activity as denoted by their ANZIC (2006) class at the 4-digit level. The set of ANZSIC classes attributed to a growth area is defined by the Australian Bureau of Statistics in its publication, *Characteristics of Businesses in Selected Growth Sectors, Australia* (ABS, 2015) and were selected by the Department of Industry and Science in the context of its *Industry Innovation and Competitiveness Agenda*. The ANZSIC (2006) classes deemed to be defence-related are defined in the Defence Industry Policy Statement, *Building Defence Capability: A Policy for a Smarter and More Agile Defence Industry Base* (Australian Government Department of Defence, 2010) and include: 1351 – Clothing manufacturing; 1352 – Footwear manufacturing; 2299 – Other fabricated metal product manufacturing n.e.c.; 231 – Motor vehicle and motor vehicle part manufacturing; 2391 – Shipbuilding and repair services; 2394 – Aircraft manufacturing and repair services; 2419 – Other professional and scientific equipment manufacturing; 242 – Computer and electronic equipment manufacturing; and 243 – Electrical equipment manufacturing.

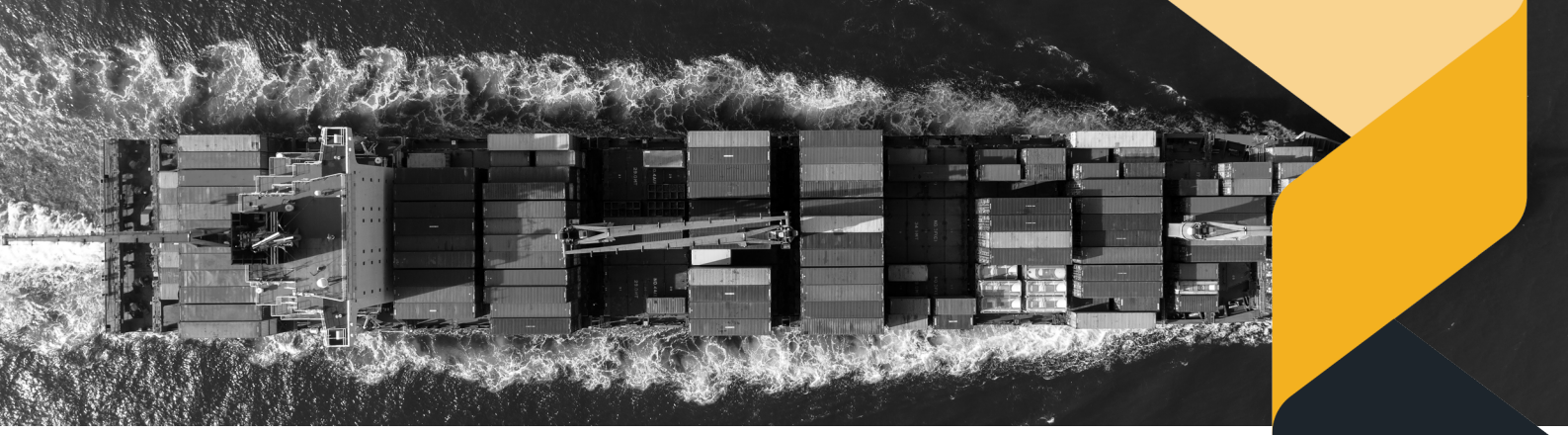
Table 20 presents separate estimates for advanced manufacturers (Model 28) and defence manufacturers (Model 29). For firms in these sample groups, results are similar to our baseline analysis of diversified entry. The likelihood of these firms diversifying increases with depreciations of the home real exchange rate and with trade mark activity in the export market. The coefficients on the tariff variables are positive – consistent with the baseline, the likelihood of export diversification decreases with tariff reductions – but the coefficients are non-significant. The interaction term between trade marks and the real exchange rate is negative and significant. After a firm files trade marks in a market, domestic exchange rate appreciations have a less negative effect on the firm's likelihood of diversifying its products.

In Model 29, focused on defence manufacturers, the interaction term between trade marks and tariffs is negative and significant at the 10% level: after filing trade marks, firms are more likely to diversify their products in response to tariff reductions. This finding accords with our earlier result that trade mark activity attenuates the impact of tariff reductions in promoting export concentration. The same is not found for advanced manufacturers (Model 28).

Table 20 also presents estimates for manufacturers of medical products (Model 30) and for resource technology producers (Model 31). For firms in these sample groups, their likelihood of diversifying the products they export to a market increases with trade mark activity in the market. A firm's likelihood of diversifying its products increases also with depreciations of the home real exchange rate against the market.

In Models 30 and 31, the coefficient on the tariff variable is not significantly different to zero. For producers of medical products, there is no significant interaction effect of trade marks on the relationship between diversification and tariffs. For resource technology producers, the interaction term between trade marks and tariffs is contrary to our expectations.

Resource technology producers are relatively more likely to diversify their products in response to exchange rate appreciations after they have filed trade marks in a market, compared to before they filing. For both medical product and resource technology producers, the interaction term between trade marks and the real exchange rate is negative. However, the result is significant only for resource technology producers and not for producers of medical products.



7. DISCUSSION AND CONCLUSION

A key challenge for Government in building a more secure and resilient Australia is understanding how best to assist businesses to diversify their exports and navigate fragile export markets. This study presents new evidence on how exporters respond to different types of shocks and the role of intellectual property in shaping their responses. The study finds that, after filing trade marks in an export market, exporters are more likely to enter that market, tend to perform better after entry, become more resilient to changes in the real exchange rate, and will expand exports more in response to tariff reductions. Compared to the average exporter, firms are more likely to diversify their exports in response to tariff reductions and exchange rate appreciations after filing trade marks in an export market.

The estimated responses of export behaviour to trade marks and shocks are significant: after a firm has increased its recent trade marks in a destination market from zero to one, a 10% tariff reduction will induce a 71% increase in export revenue, more than double the 32% increase in revenue for the firm with no recent trade mark activity. While in standard models of international trade, tariff and exchange rate elasticities are assumed to be identical, our estimates suggest this is far from the case. We present evidence that an exporter's trade mark activity abroad is associated with both muted responses to the real exchange rate and amplified responses to tariffs. We join several recent studies that have analysed heterogenous reactions of firms to shocks and linked these to firm characteristics. Ours is the first to examine the role of intellectual property in shaping how exporters respond to shocks and to link this source of heterogeneity in export behaviour to the international elasticity puzzle.

Our findings have implications for a variety of policy issues. Several important policy debates centre around the question of how exporters respond to changes in the real exchange rate, relative to other shocks (e.g., tariffs). For example, how exporters respond to exchange rate changes bears upon whether currency manipulation affects trade in a manner equivalent to trade protection. This provides evidence that Australian manufactures are relatively muted in their responses to real exchange rate changes. Further, we find that trade mark activity in export markets may contribute to this muted response. The evidence supports a view that exporters can take advantage of depreciations of the foreign exchange rate against the home market to build their foreign customer base if they have relevant marketing capabilities and assets – including brand protections – which allow them to capitalise on advertising and marketing investments. Support for exporters to acquire such capabilities and assets may assist exporters to build resilience against exchange rate shocks.

We find that after firms have filed destination-country trade marks, they will increase and diversify their exports more in response to reductions in tariffs. Lower tariffs can open access to export markets for Australian businesses. To the extent that trade marks shape how exporters respond to tariff changes, enhancing access to brand protections overseas for our exporters may complement such lower trade barriers.

This study presents evidence that a firm's trade mark activity helps to characterise how it will respond to different types of shocks. To support policy analysis, workhorse models of international trade may be improved on by incorporating micro-level indicators of IP activity, while such indicators may also prove useful for targeting export assistance.

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