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Eckel, Carsten; Jäkel, Ina Charlotte; Macedoni, Luca; Riezman, Raymond

# Working Paper Testing the Waters: How Firms Enter New Markets

CESifo Working Paper, No. 11340

**Provided in Cooperation with:** Ifo Institute – Leibniz Institute for Economic Research at the University of Munich

*Suggested Citation:* Eckel, Carsten; Jäkel, Ina Charlotte; Macedoni, Luca; Riezman, Raymond (2024) : Testing the Waters: How Firms Enter New Markets, CESifo Working Paper, No. 11340, CESifo GmbH, Munich

This Version is available at: https://hdl.handle.net/10419/305582

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Carsten Eckel, Ina Charlotte Jäkel, Luca Macedoni, Raymond Riezman



# Impressum:

CESifo Working Papers ISSN 2364-1428 (electronic version) Publisher and distributor: Munich Society for the Promotion of Economic Research - CESifo GmbH The international platform of Ludwigs-Maximilians University's Center for Economic Studies and the ifo Institute Poschingerstr. 5, 81679 Munich, Germany Telephone +49 (0)89 2180-2740, Telefax +49 (0)89 2180-17845, email office@cesifo.de Editor: Clemens Fuest https://www.cesifo.org/en/wp An electronic version of the paper may be downloaded • from the SSRN website: www.SSRN.com

- from the RePEc website: <u>www.RePEc.org</u>
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# Testing the Waters: How Firms Enter New Markets

# Abstract

Using firm-level data on production and trade from Denmark, we document that firms frequently employ a strategy of entering new export markets with Carry-Along Trade (CAT), i.e., with products manufactured by other firms. This strategy is surprising because, empirically, CAT products have below average market shares and mark-ups, and trade models predict firms to focus on core products with large sales in export markets with additional fixed and variable costs. To rationalize this new stylized fact, we propose a model where CAT plays a pivotal role in enabling firms to learn about market conditions and assess market viability. In our framework, exporting own-produced core products requires upfront sunk entry investments that create a benefit of knowing the exact market conditions. Firms can learn these market conditions by either investing first based on expected market conditions, or by exporting CAT products that do not require additional investments. We provide empirical evidence in support of our mechanism by showing that entering with CAT is particularly prevalent (i) among small firms, (ii) in distant markets, and (iii) among firms with no prior exporting experience.

JEL-Codes: F140, F120.

Keywords: market entry, carry-along trade, delivery of own goods, learning.

Carsten Eckel LMU Munich / Germany carsten.eckel@econ.lmu.de

Luca Macedoni\* Aarhus University / Denmark Imacedoni@econ.au.dk Ina Charlotte Jäkel\* Aarhus University / Denmark inaj@econ.au.dk

Raymond Riezman Aarhus University / Denmark rriezman@econ.au.dk

September 2024

We thank Kristian Maretty Hojen for excellent research assistance. We thank Costas Arkolakis, Andrew Bernard, Ken Kikkawa, Gianmarco Ottaviano, and seminar participants at Aarhus University, ETSG, the Aarhus-Kiel Workshop, the Göttingen International Economics Workshop, and the Danish International Economics Workshop for helpful comments and suggestions.

\* Financial support from the Carlsberg Foundation is gratefully acknowledged.

## 1 Introduction

Entering a new market presents a challenging scenario for firms, characterized by uncertain profits and certain upfront costs. This uncertainty often leads to a high likelihood of market exit for newly entering firms (Jovanovic, 1982). Typically, these firms start small in the new market due to limited information about consumer demand or the need to establish a customer base (Dunne et al., 1988; Gourio and Rudanko, 2014). In dealing with the trade-off between uncertain market demand and certain costs of entry, firms aim to minimize the costs associated with this uncertainty. This paper demonstrates that one common strategy employed by firms is to initially enter a market by distributing goods produced by other companies, a practice known as Carry-Along Trade (CAT).

In our empirical analysis, we focus on the entry of firms into new export markets. Our data allow us to distinguish firm entry in foreign markets with CAT, i.e., with products that they do not produce themselves, or by Delivery of Own Goods (DOG), i.e., by exporting own-produced products. While most studies in international trade focus on the case of DOG, the prevalence of CAT among exporting firms is significant: the majority of manufacturing exporters practice both CAT and DOG (Bernard et al., 2019). Here, we document a new stylized fact: firms show a greater reliance on CAT when they first enter a new destination, compared to subsequent years. In fact, over half of the firms initiating exports do so exclusively through CAT. Moreover, we find that a product is more likely to be exported via CAT in a firm's first year of exporting to a destination, even after controlling for product and firm characteristics.

This is a puzzling finding when confronted with existing empirical evidence and theoretical predictions. Empirically, CAT products are typically peripheral products within a firm's product portfolio, with smaller market shares and lower mark-ups than core DOG products (Bernard et al., 2019). Given these characteristics, static trade models would predict firms to focus on their large core DOG products in environments with higher fixed and variable costs, such as distant export markets. Furthermore, Bernard et al. (2019) find a positive correlation between a firm's productivity and the number of CAT products it exports. This correlation can be attributed to potential complementarities between CAT and DOG in both demand or supply. According to their model, firms with a smaller scope – characteristic of new market entrants – are less inclined to rely on CAT compared to larger, more established firms. While the model of Bernard et al. (2019) effectively explains firm behavior in a steady-state scenario, it cannot explain the pronounced reliance on CAT by firms new to exporting. Similarly, Eckel and Riezman (2020) show that CAT can be triggered by strategic considerations of large firms with market power, but again, this cannot explain why CAT becomes less prevalent as firms grow in new markets. Therefore, we propose a new theory for understanding export market entry. In our model, firms lack comprehensive knowledge about new market conditions, and this uncertainty is only resolved through the act of exporting. We argue that, under certain conditions, CAT provides a more cost-effective way for firms to learn about new market conditions, compared to using DOG.<sup>1</sup>

In our theoretical model, we assume that firms have to make a sunk decision which depends on market characteristics when entering a new market with an own-produced good (e.g., investment in marketing activities). This decision is contingent on either the expected characteristics of the market, if these are unknown, or on the actual, known characteristics. Our approach does not specify the exact nature of these market characteristics, as they can encompass a variety of factors unique to each market or product, such as market size, language barriers, and other hidden costs.<sup>2</sup> In our framework, gaining knowledge about market characteristics is only possible through prior export experience, which can be achieved via either DOG or CAT.<sup>3</sup> The primary role of CAT is to facilitate market screening, and it is assumed to offer no other benefits aside from enabling the firm to learn about the market. When the potential losses incurred from making investment decisions for DOG based on expected, rather than actual, market characteristics are significant, beginning to export with CAT becomes the optimal strategy.

We provide a microfoundation for our model by incorporating the concept of endogenous marketing costs, as outlined by Arkolakis (2010). In this model, firms must incur proportional fixed costs to reach a certain percentage of customers with their own products. These costs are dependent on the expected or actual market size of the destination. However, in the case of CAT products, no such fixed costs are required. Employing CAT as a tool for market screening becomes an optimal strategy when the learning benefits about the market outweigh the costs.

Our model generates several predictions with respect to the conditions under which entry by CAT is profitable, and we present empirical evidence that supports the mechanisms of our model. First, we observe that CAT exports typically have lower values and experience higher sales volatility compared to the export of own goods. These patterns are consistent with the idea that CAT generally entails lower fixed costs of exporting than DOG. Second, we find that smaller exporters (with higher marginal costs and lower productivity) that face

 $<sup>^{1}</sup>$ In our model, we focus exclusively on this channel and, thus, ignore the reasons why firms engage in CAT in the steady state.

<sup>&</sup>lt;sup>2</sup>This perspective aligns with the general approach in international trade models that focus on firm learning about profitability in various destinations, regardless of the specific channels through which this profitability is achieved (Albornoz et al., 2012, 2023).

<sup>&</sup>lt;sup>3</sup>CAT may also involve sunk costs, but these costs do not depend on market characteristics.

a higher risk of export failure tend to rely more on CAT when entering new markets. Third, to support the hypothesis that CAT allows firms to learn about market conditions, we find that firms that enter exclusively with CAT favor exporting CAT goods in the same narrowly defined sector of their best-selling own good. Finally, we explore the aspect of learning and its impact on export strategy. We find that the reliance on CAT in new destinations is more pronounced in situations of higher uncertainty. We measure this uncertainty by factors such as the geographical distance from Denmark. In addition, we show that firms' reliance on CAT decreases as they gain experience in a specific market through repeated entries and exits. This trend suggests that as firms become more familiar with a market, their need for CAT as a learning and risk mitigation tool diminishes.

The paper is organized as follows. Section 2 reviews the related literature. Section 3 describes the data used in our analysis and Section 4 documents the new stylized fact on exporters' entry and use of CAT. Section 5 builds a model of firm entry in export markets with CAT and DOG. Section 6 provides additional evidence in support of the model. Section 7 concludes.

# 2 Related Literature

A growing literature has underscored the importance of new firms learning about their demand in order to grow. Previous literature documents that young firms tend to be smaller (Dunne et al., 1988; Caves, 1998; Cabral and Mata, 2003) and, if they survive, they tend to grow faster (Eaton et al., 2007; Albornoz et al., 2012; Ruhl and Willis, 2017; Arkolakis et al., 2018). Learning about demand is a key determinant of these two patterns (Foster et al., 2016). Theoretical models in this literature posit that firms must actively sell goods in a given market to gain insights into demand. In the models by Abbring and Campbell (2003) and Arkolakis et al. (2018), firms learn their product appeal over time by observing the quantity sold or the prevailing price of their products in the market. In Eaton et al. (2021), firms learn about their product appeal by successfully matching with new buyers. In our paper, we show that by using CAT, firms can learn about market demand even without having to directly sell their products. This finding indicates that while some features about demand are product-specific, others carry over across products.<sup>4</sup> The works by Gourio and Rudanko (2014), Foster et al. (2016), and Eaton et al. (2022) indicate that building a customer base is a key driver for firms to grow. Using CAT, firms can begin to grow their customer base and then introduce their own products.

<sup>&</sup>lt;sup>4</sup>Exploiting firm-to-firm transaction data for Belgium, Connell et al. (2019) show that manufacturing firms may also learn about destination markets by indirectly exporting through wholesalers. In their set-up, learning happens across firms, while we consider learning across CAT and DOG products within a firm.

A parallel literature has examined the role of firm learning about its efficiency for firm growth and entry in export markets (Jovanovic, 1982; Dunne et al., 1988). Although often it is difficult to distinguish between changes in production efficiency and changes in demand without detailed data, arguably, the use of CAT may only allow the firm to learn about demand and not its own supply.

One of the puzzles in the trade literature is the contrast between the presence of small new exporters and the prevailing consensus of high fixed costs associated with exporting. Arkolakis (2010) reconciles this puzzle by assuming that the fixed cost is a function of the share of the market a firm reaches with its marketing activities, and Arkolakis (2016) uses this specification for fixed costs to explain why small entrants tend to grow faster. Albornoz et al. (2012) build a model in which firms learn about profitability in export markets and first experiment with small quantities. Export profitability is uncertain upon entry and positively correlated over time and across destinations. In a similar spirit, Eaton et al. (2021) build a model with costly customer search, network effects, and learning about product appeal. Using a different approach not based on market learning, Kohn et al. (2016) rationalizes the growth rates of new exporters by modeling financial constraints, which become less and less binding as a firm continues to export. Our findings reveal an alternative approach that firms might follow: entering a market with the products of other firms and, thus, avoiding the payment of any export costs associated with their own products.

The paper closely relates to Albornoz et al. (2023), who examine the sequential entry of firms and their products in export markets. In particular, the authors find that firms tend to enter a destination with the same core product and that such a product tends to be resilient. We should note that we do not view our findings as contradicting theirs but rather as complementing theirs. In fact, we show that the results of Albornoz et al. (2023) mainly apply to DOG and less so to CAT. Hence, if a firm enters with an own good, it is more likely that the firm will enter other destinations with the same own good. However, our paper shows that the firm may not enter with DOG and instead opt for CAT in the initial year. The first goods exported via CAT may also be used in subsequent entry in other destinations, but this probability is half that associated with DOG.<sup>5</sup>

<sup>&</sup>lt;sup>5</sup>In particular, we replicate the analysis of Albornoz et al. (2023) with the Danish data. We restrict the sample to only new exporters and identify which products they export in the first year – what Albornoz et al. (2023) label "first products". Notice that in our study products are defined at the eight-digit level and in theirs at the six-digit level. We find that within three years after beginning to export, first products are present in 43% of all entries in new destinations, which is similar to the number reported by Albornoz et al. (2023) (51%). This means that if a firm begins to export with a certain product, this product will also be exported in a new destination in the first year 43% of the times. This result is mainly driven by DOG: when we restrict the sample to firms' own products (and hence drop firms that enter as exporting only via CAT), about 49% of first products that are DOG are exported in the first year of export to new destinations. When we restrict the sample to products exported by CAT (and hence drop firms that enter only with DOG), the

Instead of exporting through CAT, firms can gain insights into market conditions in a destination by analyzing the performance of other exporters. In the presence of such "export spillovers", firms are more inclined to export to locations where other firms have already established a significant export presence (Choquette and Meinen, 2015).<sup>6</sup> Our findings indicate that the two strategies to enter are imperfect substitutes: firms rely more on CAT in destinations with fewer Danish exporters. However, there is a significant distinction between export spillovers and learning through CAT. The success of exports in a specific market depends not only on the market conditions but also on the exporting firm's marginal costs. Since firms cannot fully know the marginal costs of their competitors, the export performance of other firms serves as an imperfect method for gauging market conditions. In contrast, a firm engaging in CAT knows its marginal cost because this is essentially the price it pays for the CAT product, thereby allowing for a more accurate analysis of market conditions.

The paper also relates to the broad literature on exporters learning about their customers and about market conditions. Rauch and Watson (2003) show how the quantities exchanged between a buyer from a developed country and a seller from a developing country can begin small and grow over time as the buyer learns about the seller's quality. Aeberhardt et al. (2014) and Araujo et al. (2016) consider firms that learn about the type of their buyers and link buyer-seller relationships to the quality of institutions. Timoshenko (2015) shows that firms switch their product mix frequently as they learn about market demand. Conconi et al. (2016) find that firms engaging in FDI in a destination and tend to have exported in that destination in previous years. The authors rationalize the finding with a model in which firms learn about market demand.

Our research, along with prior studies, suggests that direct export experience holds significant learning potential. However, there are alternative methods for acquiring knowledge about market characteristics, such as marketing research, fairs, etc. Importantly, engaging in direct exports does not necessarily preclude these alternative avenues. The literature has well-documented that managers' previous experience in a market is a crucial factor for the internationalization strategies of firms.<sup>7</sup> In fact, hiring managers with prior export experience not only enhances a firm's presence in export markets (Meinen et al., 2022) but also increases the likelihood of firms entering new markets when they become profitable (Mion

number drops to 23%.

<sup>&</sup>lt;sup>6</sup>Early work found mixed evidence for the presence of export spillovers with some studies rejecting it (Aitken et al., 1997; Bernard and Jensen, 2004; Lawless, 2010) and others finding support (Barrios et al., 2003; Greenaway et al., 2004). However, more recent studies, using transaction-level data, have provided support for this phenomenon (Silvente and Giménez, 2007; Koenig, 2009; Koenig et al., 2010; Cassey and Schmeiser, 2013; Fernandes and Tang, 2014; Choquette and Meinen, 2015; Wagner and Zahler, 2015).

<sup>&</sup>lt;sup>7</sup>The process by which firms gather information via labor mobility is referred to as *learning by hiring* (Parrotta and Pozzoli, 2012).

et al., 2022). Additionally, firms have been observed to actively recruit managers with previous export experience in response to improved export opportunities (Labanca et al., 2024).

The empirical literature has provided robust evidence for the widespread use of CAT by exporters across several countries: Amador and Opromolla (2013) for Portugal, Damijan et al. (2013) for Slovenia, Di Nino (2015) for Italy, Lo Turco and Maggioni (2014, 2015) and Erbahar and Rebeyrol (2023) for Turkey, Bernard et al. (2019) for Belgium, van den Berg et al. (2019) for the Netherlands, Abreha et al. (2020) for Denmark, and Arnarson (2020) for Sweden. To our knowledge, we are the first to investigate the use of CAT by exporters in a dynamic setting. Bernard et al. (2019) and Eckel and Riezman (2020) provide the theoretical framework to rationalize the use of CAT by firms, which is based on complementarities, transportation synergies, and strategic interaction. Our paper contributes to the theoretical literature on CAT by providing a new rationale based on learning about market conditions.

# 3 Data

The goal of our empirical analysis is to evaluate the use of CAT and DOG by exporters upon entry in a destination market, and in subsequent years. Our starting point is the Manufacturers' Sales of Goods survey (VARS), which we combine with information from the International Trade in Goods statistics (UHDI). In the following, we discuss each dataset in turn, and explain how we match these data in order to distinguish exports (or Delivery) of Own-produced Goods (DOG) from products exported via Carry-Along Trade (CAT). All data is provided by Statistics Denmark, unless indicated otherwise.

#### 3.1 Manufacturing and Trade Data

In the *Manufacturers' Sales of Goods survey* (VARS; "sales survey" henceforth), firms are asked to report their sales in quantities and values for each product they produce. Sales are recorded independently of the market in which the product is sold and, therefore, include both domestic and export sales. Importantly, only sales of own-produced goods are reported at the product-level.<sup>8</sup> The data contain a firm identifier (CVRNR) and an eight-digit Combined Nomenclature (CN) product code, and thereby can be linked to other firm and firm-product-level data sources (such as the trade statistics).

Firms with some manufacturing activity and with a minimum of 10 employees participate in the survey.<sup>9</sup> Via the firm identifier, we can link these firms to the general firm statistics

<sup>&</sup>lt;sup>8</sup>The data also contain information on other sources of revenue, such as sales of traded goods and revenue from contract work, but this information is not disaggregated by product.

<sup>&</sup>lt;sup>9</sup>More precisely, the reporting unit in the sales survey is the Kind of Activity Unit (KAU), which is the sum of a firm's workplaces engaged in the same economic activity (industry). The majority of firms in our

(FIRM) to extract information on firms' main industry of activity (and other variables of interest, such as employment, revenue, and value added).

In the International Trade in Goods statistics (UHDI; "trade statistics" henceforth), firms report their exports and imports by product and destination. Products are reported according to the eight-digit level of the CN code. The reporting unit is the firm (CVRNR). The data is derived from two different sources: Intrastat and Extrastat. Intrastat covers trade with other EU countries and is based on data reported by Danish enterprises with total annual exports of goods over DKK 6 million (ca. EUR 0.8 million) in 2015. This reporting threshold varies across years and is fixed each year to cover 97% of total exports. Extrastat covers trade with non-EU member countries and is based on data reports concerning customs and supplies collected from the Danish tax authorities.

Our starting point is the panel of firms in the sales survey for the period 2000–2015. We only keep firms with a main activity within manufacturing in the sample. Firms that are dropped due to this restriction could be, e.g., wholesalers with some manufacturing activity. We also drop firms that do not report own-produced goods (e.g., these could be firms that only do contracting work for others); and firms with non-positive revenue or value added. In addition, since our focus is on the use of CAT in export markets, firms are only included for those years in which they report positive exports to at least one destination market. After these restrictions, our final sample covers 4713 firms.

Via the firm identifier and the CN code, we link these firms and their products to information from the trade statistics. Large part of our empirical analysis proceeds at the firm-product-destination level. To this aim, we consider all firms in the sample, and their products exported and destinations reached.

#### 3.2 Measuring CAT, DOG, and Export Entry

We define CAT and DOG as follows. For each firm, a product that is reported both in the sales survey and the trade statistics is defined as a DOG product: these are own-produced goods that are exported by the firm itself. Product codes that (for a given firm) are included only in the trade statistics but not included in the sales survey are defined as CAT products. Thus, products that are exported but not recorded in the sales survey are assumed to be produced by other firms.<sup>10</sup>

sample has only one workplace. The survey comprises all manufacturing and mining/quarrying KAUs with at least 10 employees. Typically, only firms with a main activity within manufacturing are therefore included in the survey.

<sup>&</sup>lt;sup>10</sup>We define an exported good as a CAT good if it is not produced by the firm, regardless of whether the firm also exports own goods or not. We should note that Erbahar and Rebeyrol (2023) use the term "pure intermediation" for exporting that involves CAT only.

Our definition of CAT corresponds to the "pure CAT" definition of Bernard et al. (2019). Specifically, within a firm-year, an exported product can only be either DOG or CAT. Thereby, we abstract from "mixed CAT", i.e., situations where exports of a given CN code are a mixture of CAT and DOG. For example, some firms might be producing one variety of a CN eight-digit code as well as exporting a different variety of the same product code which is produced by another firm.<sup>11</sup> Importantly, our definition of CAT is conservative, and will tend to understate the importance of CAT.

Note that outsourced products are not counted as CAT. Specifically, in the sales survey, firms are asked to report sales of outsourced goods as own-produced goods if the reporting firm owns the material used in their production. Thus, the CAT products exported by a given firm have typically been produced by another independent producer, who does not export the product itself. For an example of this, consider Viking, a Danish multinational specializing in life-saving equipment (Macedoni and Mattana, 2024). Viking produces and exports highly customized and differentiated products, such as life-rafts and evacuation systems tailored for ships and offshore platforms. Alongside these items, Viking also engages in CAT by selling more standardized products like fire extinguishers and lifebuoys. These products are not outsourced or produced under the management of Viking, but rather are independently produced by other manufacturers; Viking simply purchases these goods and re-sells them to their customers.

The measurement of CAT and DOG relies on the comparison of information from two different data sources, and as such is subject to certain issues and caveats (Bernard et al., 2019). We provide a detailed discussion of these in our data appendix, and explain how we address them in our robustness analysis.

As a baseline, we construct indicator variables for export entry as follows: at the firm level, we discard firms that exported in the first year of our sample (2000), and for all remaining firms we define the year of export entry as the first year with positive exports thereafter. At the firm-destination level, we exclude firm-destination combinations with positive exports in 2000, and define export entry into a specific destination market as the first year with positive exports to that destination. These definitions of export entry are conservative, in that firms re-entering the export market after a break in their export activity are not counted as entrants. In our robustness analysis, we consider alternative strategies employed in previous literature.

<sup>&</sup>lt;sup>11</sup>Bernard et al. (2019) identify "mixed CAT" as those instances where the value of exports of a product exceeds the value of production, which indicates some reliance on CAT along with DOG. Arguably, unless domestic sales are zero, such a definition is only partly able to capture "mixed CAT". Here, we abstract from these cases and classify them as DOG.

# 4 Export Entry and CAT

Using the data described in the previous section, in this section, we document a new stylized fact: firms rely more on CAT upon entry in a new destination market than in subsequent years. First, we show descriptive evidence: a surprisingly large share of firms starts exporting by exclusively selling goods produced by others; and this share of firms that engages only in CAT is much higher in the entry year compared to the typical year. Second, we rely on regression analysis using data at the firm-product-destination level to show that products are more likely exported via CAT in the entry year.

#### 4.1 Descriptive Evidence

In Table 1, we distinguish three types of exporting firms according to which combination of the two export modalities (DOG and CAT) they are involved in: (i) "DOG & CAT blended" exporters are firms exporting both types of goods; while (ii) "Exclusively CAT" or (iii) "Exclusively DOG" exporters are firms involved in only one of the two export modalities. In the upper part of the table, firms are classified into the three types according to their aggregate export portfolio. In the lower part of the table, we consider the destination-level, and classify firms according to their destination-specific export portfolios.

The first column of Table 1 shows that a majority (55.6%) of firms start exporting by exclusively exporting CAT goods. This share remains strikingly high if we consider the first year of exporting to a destination market. In fact, we see a larger share of firms venturing into a new destination market only with CAT goods (46.5%) than only with DOG goods (40.2%). These numbers are puzzling because they are at odds with the common view that carry-along trade is used as a strategy of complementing (or bundling) own-produced goods with products sourced from others.

For comparison, the second column of Table 1 reports the same statistics, but for the average year of exporting. Importantly, here we see a large decline in the fraction of firms only engaging in CAT: it falls from 55.6% to 25% at the firm level, and from 46.5% to 28.7% at the firm-destination level. This is an indication that most firms which start exporting exclusively with CAT add own-produced goods to their export portfolios in subsequent years (or stop exporting entirely, and therefore drop out of the statistics). On a general note, the fraction of firms falling in the "DOG & CAT blended" category is much higher in the average year than in the entry year, independent of whether we consider the firm or firm-destination level. This pattern should not be surprising as we would expect that the number of products exported by a firm increases with export experience – as firms expand their export portfolio, we also see a higher probability of observing firms engaging in a mixture

of the two export modalities. In our regression analysis, we will account for this statistical artefact by conditioning on the number of exported products.

In the third and forth column of Table 1, we consider the share of sales in the three export modalities. As expected, the majority of sales come from firms exporting a mixture of DOG and CAT goods, which are – by construction – multi-product firms. In the average year, 95.1% of export values are generated by firms exporting a mixture of both types of goods, while firms only engaged in carry-along trade account for 4%, and those solely exporting their own goods account for 0.9%. Combined with the results on the number of firms in the three different export categories, this indicates that firms that only engage in CAT or only in DOG are smaller than the typical firm that exports both via CAT and DOG. However, in the entry year, the reliance on CAT is larger: the share of sales of firms engaging exclusively in CAT is 6.2% at the firm level, and 28.5% at the firm-destination level.

Importantly, we do not claim that all firms make use of CAT products in order to test new export markets. In fact, Table 1 shows that a significant share of firms enter with "DOG & CAT blended" at the firm level (33.3%) and with "Exclusively DOG" at the firmdestination level (40.2%). However, in this paper, we focus on explaining the large prevalence of "Exclusively CAT" entrants, which contradicts previous literature. Moreover, below we demonstrate that smaller exporters rely more on CAT when entering a market, whereas larger exporters, with a wider range of products, are more likely to enter with their own goods, either exclusively or alongside CAT. This heterogeneity across firms also accounts for the higher incidence of "Exclusively DOG" entry at the firm-destination level. In fact, there is a composition effect where larger, multi-destination firms that rely less on CAT are over-represented at the firm-destination level compared to the firm-level.

We confirm that these findings broadly hold when we consider different sectors individually. Table A.1 in the appendix shows the share of firms that engages exclusively in CAT in the average year and in the entry year, by sector. For all sectors, the share of firms that engages exclusively in CAT is higher in the entry year than in subsequent years, though it varies substantially across sectors. In the average year, the share of Exclusively-CAT firms ranges from 12.8% (Food Products) to 54.2% (Reparation and Installation of Machinery). In the entry year, the share of firms that only engage in CAT ranges from 36.7% (Food Products) to 76.3% (Reparation and Installation of Machinery). For most sectors, the same pattern occurs when looking at sales, with a few exceptions.

To supplement the results in Table 1, we also consider the dynamics of firms that enter a given destination market exclusively with CAT. In 25% of all such firm-destination cases, we observe that the firm introduces a DOG good in the destination market in subsequent years. Thus, in many cases entry exclusively with CAT leads to entry with own goods in

	Share of Firms							
	Nu	mber	S	ales				
	Entry Year	Average Year	Entry Year	Average Year				
DOG & CAT blended Exclusively CAT Exclusively DOG	$33.3 \\ 55.6 \\ 11.1$	70.4 25.0 4.6	93.0 6.2 0.8	$95.1 \\ 4.0 \\ 0.9$				

#### Table 1: Share of CAT and DOG by Year

	Share of Firm-Destinations						
	Number			S	ales		
	Entry Year	Average Year	Eı	ntry Year	Average Year		
DOG & CAT blended	13.2	36.5		41.5	72.1		
Exclusively CAT	46.5	28.7		30.0	10.2		
Exclusively DOG	40.2	34.7		28.5	17.7		

The columns Number report the share of the number firms by type of exports (DOG & CAT blended, Exclusively CAT, or Exclusively DOG) in the average year or in the entry year. For the average year, we compute the three shares in each year and take an average between 2000 and 2015. For the entry year, we compute the three shares in each year restricting the sample to new entrants, and then take the average between 2001 and 2015 (we drop the year 2000 which is the initial year of our sample for the entrants). The columns Sales report the share of sales of firms by type of exports (DOG & CAT blended, Exclusively CAT, or Exclusively DOG) in the average year or in the entry year. In the top part of the table, the unit of observation is the firm, i.e., we consider the share of the number of firms and the share of sales of firms. In this case, a new entrant is a new exporter. In the bottom part of the table, the unit of observation, i.e., we consider the share of firm-destinations and the share of sales of firm-destinations. In this case, a new entrant is a new exporter in a destination.

subsequent years.<sup>12</sup> However, among these firm-destination cases where subsequent DOG exports are observed, entry with DOG often involves a considerable time lag: on average, in approximately 30% of cases we observe firms introducing their first own good immediately in the year after entry; in roughly 40% of cases does entry with DOG first happen after more than 3 years (cf. Figure A.1 in the appendix).<sup>13</sup> Among firm-destination observations where export entry is exclusively with CAT, the average number of years until the first export of a DOG good is recorded is 3.6 years, with a standard deviation of 3.

We also consider whether firms that enter exclusively with CAT continue exporting their initial CAT goods throughout their export experience. On average, firm-destinations where entry is exclusively with CAT remain in a market for 6.5 years (with a standard deviation of 3.7 years). However, the initial CAT products tend to have a shorter lifespan, lasting only

<sup>&</sup>lt;sup>12</sup>Notably, cases in which we do not observe subsequent exports of DOG includes cases where the firm exits the destination market quickly after entry. Thus, this is also an indication of export entry via Exclusively CAT being a way of export experimentation (and potential failure).

<sup>&</sup>lt;sup>13</sup>Confirming these results, in Table A.15 of the appendix, we examine the relationship between exports in the second year and the likelihood of a product being exported as CAT in our product-level regressions. We find that the likelihood of a product being exported as CAT in the second year is lower than in the first year but higher than in subsequent years.

2.5 years on average (with a standard deviation of 2.5 years).<sup>14</sup> This pattern suggests that, while firms may enter with CAT products initially, these products are often dropped from export markets over time.

**Examples.** While we are unable to disclose specific product information from individual firms due to confidentiality constraints, we can analyze prevalent product trends among firms that initiate their export activities as exclusively-CAT exporters. Our focus will be on the top-30 products exported as CAT in the initial year or as DOG in any year, measured by the number of firms exporting them, but restricting the analysis to firms that began their export activities exclusively with CAT. This allows us to discern significant patterns in the transition from CAT to DOG.

Three main patterns are observed in this context. First, there is a recurrent theme of firms exporting different varieties of a product both under CAT and DOG, with the only difference between the two export modalities being the material with which the product is made. For example, a multitude of firms export wooden doors and windows under CAT, whereas different wood varieties of the same items often appear in DOG exports.

Firms often export a subset of product varieties within a sector as CAT and a broader array of goods from the same sector as DOG. A common scenario includes iron or steel screws, bolts, and nuts exported as CAT products, while items such as iron or steel structures and parts thereof appear in DOG exports. The same pattern applies to products such as plastic items, with certain firms exporting plastic goods excluding plastic film under CAT and goods including plastic film under DOG.

Machine parts for various applications are frequently represented in the CAT exports, including components for dairy machines and engine parts. In contrast, DOG exports often include more complete items, such as milking machines, or different parts, like heat exchange units. This suggests a potential discrepancy in reporting, as firms might produce both final goods and parts, while only recording the final goods in their sales data. Nonetheless, it should be noted that these parts and components are also popular items in DOG exports, and that the pattern persists if we aggregate the observations at the six-digit level, which should reduce misreporting. This implies a likely export as CAT of parts and components that firms purchase from other suppliers, which could subsequently be incorporated into their final goods.

 $<sup>^{14}</sup>$ For each firm-destination, we also compute the ratio of the average export spell for initial CAT products to the firm-destination spell. On average, this ratio equals 0.43, indicating that the typical CAT product is exported only for 43% of the firm-destination spell.

#### 4.2 **Results from Regression Analysis**

Table 1 reveals that a strikingly large share of firms ventures into new export markets by exclusively relying on CAT exports, and that there are remarkable differences in the extent to which firms rely on CAT in the year of export entry vs. subsequent years. Next, we turn to a regression analysis, which allows us to control for various confounding factors. Specifically, we consider the probability that any product in a firm's product portfolio is a CAT product, and investigate whether this probability is higher in the entry year compared to subsequent years.

We denote by  $Prob(CAT_{fpdt} = 1)$  the likelihood that a product p in firm f's product portfolio in destination d at time t is a CAT product, and estimate the following linear probability model:

$$Prob(CAT_{fpdt} = 1) = \beta_1 \text{Entry Year}_{fdt} + \beta_2 \text{Log(Number of Products)}_{fdt} + FE_{dt} + FE_{ft} (+FE_{pt} + FE_{fd}) + \epsilon_{fpdt}$$
(1)

The binary variable Entry  $\operatorname{Year}_{fdt}$  equals one if firm f starts exporting to destination d in year t. A positive coefficient estimate for  $\beta_1$  would be consistent with the idea that the probability of a product being CAT is higher in the entry year, implying a higher share of CAT products in the firm's portfolio upon entry.

We introduce the log of the number of products from a firm in a destination as a control variable, since the export scope of a firm is correlated with the number of products exported via CAT (Bernard et al., 2019) and firms typically start exporting with a limited range of products.

We provide a number of alternative specifications, where we increasingly control for a more demanding set of fixed effects. Our most parsimonious model includes firm-year fixed effects to account for common firm-wide shocks (like productivity changes) and destinationyear fixed effects to handle any shocks to the destination (such as shifts in income or trade costs). Importantly, firm-year fixed effects also account for the firm's overall portfolio composition in terms of CAT and DOG products, and thus  $\beta_1$  is identified solely based on the within-firm-year variation in the portfolio across destinations (i.e., the firm selling different bundles of products across markets). Next, we add product-year fixed effects to control for any product-specific shocks that could influence a firm's decision to export a particular good, irrespective of their production status. Finally, we add firm-destination fixed effects, thereby only exploiting the within-firm-destination variation in the dependent variable. Standard errors are clustered at the firm level.

Importantly, none of our estimated models includes firm-product fixed effects. Our inter-

est lies in how the probability of any product in a firm's portfolio being a CAT good changes from the entry year to subsequent years, rather than the within-firm-product-destination change in CAT vs. DOG status. Not surprisingly, such within-firm-product changes in CAT status are, in fact, extremely rare in our data.

	Dependent Variable: Probability of Being CAT							
	All Firm-Dest.			Firm-Des	Firm-Dest. $> 3$ Years of Obs.			
	(1)	(2)	(3)	(4)	(5)	(6)		
Year of Entry	0.041***	0.025***	0.008***	0.026***	0.016***	0.009***		
	(0.004)	(0.002)	(0.002)	(0.005)	(0.003)	(0.002)		
Log(# of Products)	$0.130^{***}$	$0.080^{***}$	$0.082^{***}$	$0.133^{***}$	$0.081^{***}$	$0.082^{***}$		
	(0.005)	(0.003)	(0.004)	(0.005)	(0.003)	(0.004)		
Destination-Year FE	Yes	Yes	Yes	Yes	Yes	Yes		
Firm-Year FE	Yes	Yes	Yes	Yes	Yes	Yes		
Product-Year FE	No	Yes	Yes	No	Yes	Yes		
Firm-Destination FE	No	No	Yes	No	No	Yes		
$R^2$	0.40	0.65	0.69	0.40	0.65	0.68		
# Obs.	2234349	2216676	2193139	2121227	2103393	2103393		

Table 2: Probability of Being CAT and Entry

Results from OLS of equation (1). Robust std. error in parenthesis. Cluster: firm. \*\*\*: significant at 99%, \*\* at 95%, \* at 90%. Destination-Year and Firm-Year fixed effects in all columns. Product-Year fixed effects in columns (2), (3), (5), and (6). Firm-Destination fixed effects in columns (3) and (6). The first three columns include all firm-destinations. The last three columns restrict the sample to firms that have exported to a destination for at least three years.

Results, shown in Table 2, confirm a higher likelihood of a product within a firm's portfolio being a CAT product upon initial entry into a destination. In the first column, we control for firm-year and destination-year fixed effects. The result of this specification indicates that, if we consider products in a firm's portfolio, the probability that a product is a CAT product is 4.1 percentage points higher in the entry year.

In column 2, we turn to a specification including product-year fixed effects. These fixed effects account for a range of product characteristics which could affect both the mode of exporting (CAT or DOG) as well as the speed with which firms typically introduce them to a market (upon entry or only as export experience has been gained). In the model we present below, this could be driven by low marginal costs or low fixed marketing costs. While this model allows us to rule out certain confounding factors, two caveats should be kept in mind. First, this specification is considerably more demanding, since it exploits only variation in CAT status within a product across firms. In particular, certain products are almost exclusively exported as CAT, and these products will no longer contribute to the identification of  $\beta_1$ . Second, and relatedly, there may be certain products that are more easily exported in the initial year because of their idiosyncratic characteristics (such as low sunk investments required to begin exporting these products). Interpreted through the lens

of our model in Section 5, these could be the products that firms might choose to export as CAT (if they do not produce them). In essence, one of the channels through which CAT can help firms as a market screening device is ruled out in this specification.

The coefficient estimate of  $\beta_1$  in column 2 remains positive and significant, albeit with a smaller magnitude of 2.5 percentage points. The decrease in the coefficient estimate is consistent with the idea that firms enter new markets with CAT partly because their CAT products have some characteristics that make them the optimal choice to enter the market. Yet, this mechanism does not capture the full effect of the entry year. Thus, the benefits of entering a new market with CAT appear to be both firm- and product-specific. For example, whether market screening with a particular CAT product is the optimal entry strategy may depend on the characteristics of this given CAT good relative to the characteristics of firms' own goods.

To further validate our findings, we introduce firm-destination fixed effects in the third column. These control for both observed and unobserved characteristics of firm-destination pairs, offering a robust assessment of the impact of entry on the use of CAT. However, this method, by design, excludes firms that appear in a destination for only a year, i.e., unsuccessful exporters. Considering our argument that CAT is employed to screen markets, this specification could lead to an underestimation of reliance on CAT and, thus, it is not our preferred specification. Indeed, as expected, we observe a notable drop in the coefficient estimate of  $\beta_1$ , which, however, remains statistically significant.

To illustrate the point further, we restrict the sample to "successful" export entries, defined as firms that have exported to a destination for at least three years. If entry exclusively with CAT involves market screening, such entry should more often involve export failure. Therefore, we expect to find the importance of CAT upon entry to be lower in this sample. Results, reported in the final three columns of Table 2, confirm this hypothesis: our results persist, albeit at reduced magnitudes. The coefficients in columns (4) and (5) are statistically smaller than those in columns (1) and (2), while the results in column (6), where we control for firm-destination fixed effects, are similar to those in column (3). These findings strengthen the core premise of our model: CAT serves as a market screening mechanism.

#### 4.3 Robustness

#### 4.3.1 Different Definitions of Entry

In our baseline regressions, we define the entry year as the first year a firm reports positive sales in a specific destination market (excluding the first year of the sample). Since our sample commences in 2000, this approach presents a potential limitation: companies that were active on an export market before 2000 but inactive in 2000 are included as new exporters. In the following, we therefore explore two alternative methods to establish the year of export entry.

Our first alternative strategy is to disregard the years immediately following 2000 as potential entry years. Specifically, we redefine our independent variable such that if the entry year is 2001 (or either 2001 or 2002), the firm is not recorded as an entrant at the location. Utilizing these two alternative definitions of entry in a destination market barely affects our baseline findings, as demonstrated in Table A.9.

Our second alternative strategy departs from the observation that the entry year definition employed in Table 2 is relatively conservative. For example, Albornoz et al. (2012) classify the entry year as the year when positive export sales occur, provided there were no export sales the previous year (thus, allowing for re-entry in an export destination). To validate our approach, we apply the entry year definition from Albornoz et al. (2012) and find our results remain consistent. Additionally, we experiment with a case where the entry year is defined as the year with positive export sales, given there were no export sales in the preceding three or five years, based on the methodology by Araujo et al. (2016). As Table A.10 illustrates, these adjustments do not affect our results.

#### 4.3.2 Partial-Year Effects

In yearly data, a firm's export growth upon entry will be overestimated (and the size of new entrants underestimated) for firms that do not start exporting in January (Bernard et al., 2017). This "partial year" effect should not pose a problem for our analysis since we are not primarily interested in export growth upon entry. Still, one might be concerned that the partial year effect could interact with CAT. In particular, if CAT exports are more frequently dispatched than DOG products, the partial year effect may lead to an overestimation of firms' dependence on CAT in the initial year.<sup>15</sup>

We leverage a dataset encompassing information on firm-product-destination-level exports by month to investigate this concern. We calculate the number of monthly transactions for each exported product, firm, destination, and year. Interestingly, we find that DOG products typically have a much greater number of transactions per year compared to CAT products (cf. Figure A.2 in the appendix). Consequently, CAT products are significantly less frequently exported than DOG products, and should therefore *ceteris paribus* be less likely to be recorded as a firm's first transaction. This finding confirms that the partial year

<sup>&</sup>lt;sup>15</sup>For example, consider a firm that exports via CAT every month and only exports its own goods once a year. If this firm begins exporting in the latter part of a year, it is more likely that it will export only CAT, rather than both CAT and DOG.

effect is unlikely to be a concern in our empirical set-up.

#### 4.3.3 Further Robustness

**Product-Destination-Year Fixed Effects.** Firms may enter a destination with a product because of shocks which are product-destination-year specific. To verify whether entry with CAT is in part driven by these shocks, we repeat our baseline regression and replace the destination-year and product-year fixed effects with product-destination-year fixed effects. Including these fixed effects greatly reduces the number of observations, as there are several cases in which a single firm supplies a certain product in a destination in a year. With this in mind, our results are robust to this specification and the coefficient on the entry year is larger than our baseline specification with product-year fixed effects.

Imported CAT. Firms may import certain CAT product codes they export. The presence of such imported CAT products might raise concerns if they are tied to offshoring decisions or the multinational activities of the firms. For example, a foreign subsidiary could re-export products manufactured by other subsidiaries of the same multinational corporation. While this does not invalidate our theory, it necessitates an adaptation of our theoretical framework. To ensure our results are not influenced by imported CAT goods, we replicate our core findings, excluding all imported CAT products. Table A.2 confirms the robustness of our results to this sample modification. When we exclude imported CAT goods, the sales share of firms exclusively exporting CAT (mechanically) decreases, but notably it still remains higher in the entry year compared to the average year. Conversely, the share of firms solely engaged in DOG activity increases significantly, as many firm-destinations only deal with DOG and imported CAT. The regression analysis results shown in Table A.11 reveal minimal changes when we remove imported CAT goods from consideration.

Foreign-Owned Firms. The previous sample modification also addresses the potential issue of results being skewed by foreign-owned firms merely exporting goods produced by their foreign affiliates. To further reinforce our findings, we eliminate foreign-owned firms from our sample, and our results, shown in Tables A.3 and A.12, are robust to this specification.<sup>16</sup>

**Product Misclassification.** A further potential concern is the possibility of misclassification of a product as CAT due to errors in a firm's reporting. Since reporting to the sales survey is independent of the customs data, a specific eight-digit product code that is both produced and exported could be recorded differently in the trade data versus the sales data.

<sup>&</sup>lt;sup>16</sup>To determine a firm's foreign ownership status, we cross-reference our data with the data on foreignowned enterprises (FATI), which is available from 2002. As such, we omit the first two years from our sample, defining the entry years of firms using the complete sample.

To address this concern, we conduct a robustness test wherein we aggregate products at the six-digit level. Our results, as presented in Tables A.4 and A.13, prove to be robust to this product code aggregation at the six-digit level.<sup>17</sup>

Changes in the Product Classification. To further ensure the robustness of our findings, we execute another check to correct for changes over time in the product classification. Indeed, some CN eight-digit codes are occasionally discontinued, merged with other codes, or new codes are introduced. Given that our measures are calculated at the firm-year and firm-destination-year levels, these classification changes are likely to have only a minor effect. Yet, to dispel any lingering concerns about potential measurement error, we adopt the correction procedure delineated in Van Beveren et al. (2012). This process results in the merging of some products, leading to a slightly reduced number of observations. Despite these alterations, our results, as shown in Tables A.5 and A.14, remain largely consistent with our baseline findings.

# 5 Model

This section presents a theory explaining why firms might choose to enter a destination with CAT instead of DOG. To keep the model straightforward, we consider a firm that can export either a single CAT product, a single DOG product, or both. Consistent with the empirical evidence, the firm may decide to enter exclusively with CAT, exclusively with DOG, or with a combination of CAT and DOG. Once entered, the firm decides whether to remain in the market or exit. Additionally, if the firm has entered with only one product (either CAT or DOG), it can decide whether to introduce the product not yet exported.

This simple setup leads to several alternative entry and exit scenarios. Therefore, we further limit the set of possibilities to focus on explaining the novel stylized fact documented above. First, we restrict our analysis to a scenario where exporting the firm's own good is profitable under perfect information. In other words, in the steady state, the firm will always export its own good.

Second, in the main text, we only discuss two possible entry cases: 1) the firm enters exclusively with CAT and then introduce its own good and 2) the firm enters directly with DOG. To illustrate the main point of the paper as simply as possible, we make a few restric-

<sup>&</sup>lt;sup>17</sup>We adapt the CN six-digit codes from different classification years using the RAMON conversion tables, generously provided by Chan et al. (2022). Note that this six-digit level aggregation does not affect the share of firms that exclusively engage in CAT in terms of number and sales. The only difference is that some firms previously classified as engaging in DOG & CAT blended are now solely categorized as delivering their own goods. For instance, if a firm exports two distinct eight-digit products within a single six-digit code, one as DOG and the other as CAT, the six-digit code is designated as DOG because it contains some domestically-produced goods.

tive assumptions in the following sections, leaving the more general model to Appendices B.1 and B.2.

Section 5.1 provides a framework that illustrates the main economic mechanism: firms decide to enter with CAT to learn about market conditions. This can be profitable when exporting own goods is associated with some sunk decision, for instance, on investment in marketing, that is based on market characteristics, either known or expected. Under some conditions, it is optimal for the firm to enter with CAT first, learn about market characteristics, and enter with DOG based on actual information about the market instead of first entering with DOG based on expectations about market conditions.

We also provide an additional microfoundation for the general model. In particular, we assume that the sunk decisions a firm makes when entering a new market is the engagement in marketing activities to reach directly its own new customers. This is the framework we analyze in Section 5.2, where we apply the model of Arkolakis (2010) with fixed marketing costs that are proportional to the share of customers that a firm wants to reach. Lack of knowledge about market size can lead to sub-optimal level of investment in marketing activities and firms might find it profitable to enter with CAT first.

#### 5.1 Baseline Framework

We consider the problem of a firm that wants to enter a market and can do so with CAT or DOG. Entering with CAT can be done at any moment without prior investments and yields profits  $\pi_{CAT}$ . To highlight the use of CAT as a market screening device, we make the stark assumption that the profits from CAT are negative ( $\pi_{CAT} < 0$ ).<sup>18</sup> This could be driven by low operating profits relative to the fixed cost of exporting and is in line with the evidence that firms that enter only with CAT tend to outlive their initial exported CAT products. Entering with CAT allows the firm to learn about market conditions, which we label M. We assume that profits are increasing in M. These market conditions can be general, i.e., the firm can learn about market size, competition, etc.<sup>19</sup>

Entering the market with an own good is subject to delay.<sup>20</sup> In period 1, the firm decides

<sup>&</sup>lt;sup>18</sup>If the profits from CAT are positive, firms will export CAT in every year.

<sup>&</sup>lt;sup>19</sup>In the data, we have shown that a consistent fraction of firms enters both with DOG and CAT. Through the lenses of our model, this suggests that the CAT good is used to learn about the market conditions for a different own good which has yet to be exported. We should also note that in our model entering with CAT is not always optimal and, thus, firms that enter both with DOG and CAT may not find it optimal to learn about market conditions and start directly exporting DOG along with some complementary good that is exported via CAT.

<sup>&</sup>lt;sup>20</sup>Although assuming a delay in the export of own goods could be an ad hoc explanation for why firms enter with CAT first, we should note that having only a delay in DOG without a role for learning would imply that either all firms begin exporting with CAT (if it is profitable) or no firms do that (if CAT is not profitable). The possibility of learning about market characteristics with CAT is required to avoid these

whether or not to enter with its own product. If it decides to enter, the firm earns sales and profits in period 2. However, in period 1, the firm makes the sunk decision over some investment D, which is based on the actual market conditions M or on the expected market conditions  $\mathbb{E}[M]$ . In the next section, we provide a specific example for the type of sunk decisions the firm is involved in. Let  $D^*(\tilde{M})$  denote the optimal level of investments chosen by the firm given a specific realization of the market conditions  $\tilde{M}$ . It follows that the profits the firm obtains from the sales of the own product are higher if the firm has full information on market conditions, i.e.,

$$\pi_{DOG}(\tilde{M}, D^*(\tilde{M})) \ge \pi_{DOG}(\tilde{M}, D^*(\mathbb{E}[M])) \tag{2}$$

with equality if the realization of M equals its expected value ( $\tilde{M} = \mathbb{E}[M]$ ). The firm only knows the market conditions if it is active in such a market. In what follows, we focus on a firm whose marginal costs are low enough to make a positive profit with an own good in both scenarios, so that in period 1 the firm always decides to enter with DOG in period 2.

The model is dynamic: the firm accrues profits every period it is present in the market. We assume away the discount factor for simplicity. In period 1, the firm decides whether to enter with CAT or DOG. If it enters with CAT, the firm obtains  $\pi_{CAT}$  in period 1 and learns about the specific market conditions  $\tilde{M}$ . In period 2, the firm obtains  $\pi_{DOG}(\tilde{M}, D^*(\tilde{M}))$ .<sup>21</sup> In the following periods, the firm obtains the same profits as period 2. If a firm enters with CAT, it obtains the following profits in the first two periods:

$$\pi_{EntCat} = \pi_{CAT} + \pi_{DOG}(M, D^*(M)) \tag{3}$$

Let us now consider the case in which a firm enters with DOG. In period 1, the firm makes zero profits and decides prices and investments for period 2 based on the expected market conditions  $\mathbb{E}[M]$ . In period 2, the firm obtains profits  $\pi_{DOG}(\tilde{M}, D^*(\mathbb{E}[M]))$  and learns the true market conditions  $\tilde{M}$ . From period 3, the firm earns profits  $\pi_{DOG}(\tilde{M}, D^*(\tilde{M}))$ . Hence, from period 3 onward the firm obtains the same profits regardless of whether it entered with CAT or DOG goods. If a firm enters with DOG, it obtains the following profits in the first two periods:

$$\pi_{EntDog} = \pi_{DOG}(\tilde{M}, D^*(\mathbb{E}[M])) \tag{4}$$

Denote with  $\Delta \pi \equiv \pi_{EntCat} - \pi_{EntDog}$  the difference between (3) and (4). The firm enters

extreme outcomes.

<sup>&</sup>lt;sup>21</sup>Since the profits from CAT are negative, the firm stops engaging in CAT in the second year, having reached the objective of learning about market characteristics.

the market with CAT first if the expected difference in profits is positive. Namely,

$$\mathbb{E}[\Delta \pi] = \mathbb{E}[\pi_{EntCat}] - \mathbb{E}[\pi_{EntDog}] > 0$$
$$\mathbb{E}[\pi_{DOG}(M, D^*(M))] - \mathbb{E}[\pi_{DOG}(M, D^*(\mathbb{E}[M]))] > -\pi_{CAT}$$
(5)

If the left hand side of (5) is positive, there is a value in knowing the actual market conditions. This is never the case if profits are just a linear function of market conditions M. But if profits are convex in M (because of the endogenous investment), expected profits based on actual market conditions are higher than profits based on expected market conditions. Importantly, if (2) holds with inequality, the left hand side of (5) is positive. In this case, firms may decide to enter with a CAT good even if exporting a CAT good generates losses because knowing the exact market conditions is valuable.

In this model, we assume that firms achieve positive profits from selling their own good after making optimal decisions, leading them to remain in the market beyond the first year. Consequently, our model does not address the likelihood of a firm's continued market presence after its initial entry. It is important to note that the impact of market entry using CAT on a firm's survival prospects is ambiguous. While CAT can offer firms a cost-effective way to learn about market conditions, enhancing their survival chances, the actual outcome heavily depends on the discovered market conditions. Specifically, employing CAT for exploring multiple markets may inadvertently lower survival chances if it reveals numerous markets with unfavorable conditions that preclude positive profits. This observation aligns with existing literature, which has noted a generally low survival rate for new exporters in their first year (Eaton et al., 2007; Albornoz et al., 2023).

We consider two extensions to the baseline model. In Appendix B.1, we allow for a sunk decision for CAT as well. In this case, when firms enter with CAT, they face an additional loss in the first year of engaging in CAT based on some expected market condition. In Appendix B.2, we also allow for a delayed entrance for CAT. This appendix is useful in that it shows that without a difference in the delay required to export CAT or DOG, the decisions on whether to enter with CAT or DOG becomes mostly trivial and depends on whether the firm expects positive or negative profits from entering with either good.<sup>22</sup>

 $<sup>^{22}</sup>$ In our data, firms are often multi-product, i.e., they have a portfolio of both CAT and DOG goods that they can export. In this scenario, firms not only have to choose whether to enter with CAT or DOG, but also with which CAT product or DOG product to enter. Let us assume that all CAT and DOG products of the firm face the same market conditions M. If the CAT products can be ranked by their profits in the initial year, firms will chose to enter with the product that yields the smallest loss. If the DOG products can be ranked by their expected profitability, firms will chose to enter with the product with the highest profitability.

#### 5.2 Microfoundation: Investment in Reaching Customers

In this section, we consider a version of the general model with specific functional form assumptions, where firms directly find new customers with marketing investments.

We assume that there is a single destination with L consumers, who have a Constant Elasticity of Substitution (CES) utility function that generates the following demand function for a DOG good:

$$q = Ap^{-\sigma} \tag{6}$$

where A is a constant demand shifter that captures aggregate variables (income, price index) and  $\sigma > 1$  is the demand elasticity. The firm incurs fixed costs to reach consumers (marketing expenditures), and following Arkolakis (2010), we assume the following specific functional relationship between marketing expenditures F and the share of consumers reached n:

$$F(n) = f\left(\frac{1 - (1 - n)^{1 - \beta}}{1 - \beta}\right)$$
(7)

where f is a constant and  $\beta \in [0, \infty)$ . A larger  $\beta$  is associated with greater diminishing returns in marketing activities: to reach the same share of customers, the firm must pay a higher fixed cost the larger  $\beta$  is.

Let c denote the unit cost of the firm. Prices are set by the standard CES rule:

$$p = \frac{\sigma}{\sigma - 1}c\tag{8}$$

Define  $M \equiv LA(\sigma - 1)^{\sigma-1}\sigma^{-\sigma}$  as our measure for market conditions or size. Given (8) and the share of consumers reached *n*, profits from exporting the own good equal:

$$\pi(M,n) = nMc^{1-\sigma} - f\left(\frac{1 - (1-n)^{1-\beta}}{1-\beta}\right)$$
(9)

We assume that the firm knows its own costs parameters c, f, and  $\beta$ , and that it knows the demand elasticity  $\sigma$ . Since the firm decides the share of customers reached by its marketing activities n, the remaining variable that the firm needs to know to make the optimal decision over n is M, our measure of market size. Given n, if the firm exports and earns profits  $\pi$ , it can back out the value of M.

Firms decide how much to invest in marketing and how many consumers to reach by choosing the profit maximizing n. Since operating profits (the first term on the right hand side of equation (9)) are linear in n and marketing costs (7) are convex in n a profit maximized maximized

mizing n exists. The first order condition with respect to n yields:

$$n(M) = 1 - \left(\frac{Mc^{1-\sigma}}{f}\right)^{-\frac{1}{\beta}}$$
(10)

which is the share n of consumers reached as a function of the market size M. If the firms knows the specific market conditions  $\tilde{M}$ , (10) yields the optimal share of consumers for  $M = \tilde{M}$ . Instead, if the firm does not know the market size, the share of targeted customers is based on the expected market size:

$$n(\mathbb{E}[M]) = 1 - \left(\frac{\mathbb{E}[M]c^{1-\sigma}}{f}\right)^{-\frac{1}{\beta}}$$
(11)

By combining (9) and (10), we can express profits as a function of  $\tilde{M}$  when the firm knows the size of the market:

$$\pi(\tilde{M}, n(\tilde{M})) = \tilde{M}c^{1-\sigma} + \frac{\beta}{1-\beta}\tilde{M}^{1-\frac{1}{\beta}}c^{(1-\sigma)\left(1-\frac{1}{\beta}\right)}f^{\frac{1}{\beta}} - \frac{f}{1-\beta}$$
(12)

In expectations, i.e., before the specific realization of M is learnt, these profits can be expressed as<sup>23</sup>:

$$\mathbb{E}[\pi(M, n(M))] = \mathbb{E}[M]c^{1-\sigma} + \frac{\beta}{1-\beta}\mathbb{E}[M^{1-\frac{1}{\beta}}]c^{(1-\sigma)\left(1-\frac{1}{\beta}\right)}f^{\frac{1}{\beta}} - \frac{f}{1-\beta}$$
(13)

Similarly, by combining (9) and (11), and taking expectations, we can express expected profits when marketing investments are based on expected market size as:

$$\mathbb{E}[\pi(M, n(\mathbb{E}[M]))] = \mathbb{E}[M]c^{1-\sigma} + \frac{\beta}{1-\beta}\mathbb{E}[M]^{1-\frac{1}{\beta}}c^{(1-\sigma)\left(1-\frac{1}{\beta}\right)}f^{\frac{1}{\beta}} - \frac{f}{1-\beta}$$
(14)

Define  $\Delta \pi_{DOG} \equiv \pi(M, n(M)) - \pi(M, n(\mathbb{E}[M]))$ . By subtracting (14) from (13), the first and the last terms on the right hand sides cancel, and we obtain:

$$\mathbb{E}[\Delta \pi_{DOG}] = \frac{\beta}{1-\beta} \left( \mathbb{E}[M^{1-\frac{1}{\beta}}] - \mathbb{E}[M]^{1-\frac{1}{\beta}} \right) c^{(1-\sigma)\left(1-\frac{1}{\beta}\right)} f^{\frac{1}{\beta}} > 0$$
(15)

**Lemma 1** (Jensen's Inequality). By Jensen's inequality it holds that  $\mathbb{E}[\Delta \pi_{DOG}] > 0$ .

*Proof.* Define  $\varphi(M) \equiv M^{1-\frac{1}{\beta}}/(1-\beta)$ . By Jensen's inequality  $\mathbb{E}[\varphi(M)] - \varphi(\mathbb{E}[M]) > 0$  if  $\varphi$  is strictly convex. Since  $\varphi''(M) > 0 \forall \beta > 0$ , it follows that  $\mathbb{E}[\Delta \pi_{DOG}] > 0$ .

<sup>&</sup>lt;sup>23</sup>Note that  $\mathbb{E}[\tilde{M}] = \mathbb{E}[M]$ .

Lemma 1 states that there is a value of knowing the exact size of the market. This value is coming from the investment decision about marketing that creates a wedge between the expected profits when the investment is tailored to the specific market conditions relative to when the investment is based on expected market conditions. Without this investment decision, profits are simply a linear function in market size, and the expected profits are identical in the two scenarios. But because firms reach a higher share of consumers in larger markets, profits are convex in market size, making it valuable to learn the exact size of the market before investing.

Another way to see the value of learning the exact size of the market is by comparing marketing investments in the two scenarios. An inspection of (10) reveals that n(M) is strictly concave for all  $\beta > 0$ . Consequently, Jensen's inequality implies that:

$$\mathbb{E}[n(M)] < n\left(\mathbb{E}[M]\right) \tag{16}$$

Hence, the share of consumers reached when making marketing decisions based on expected market sizes is larger than the expected share when the exact size is known. This implies that not knowing the exact market conditions leads to costly over-investment in marketing.

We can now state the following proposition:

**Proposition 1** (Condition CAT Entry). A firm enters with CAT if  $\mathbb{E}[\Delta \pi_{DOG}] > -\pi_{CAT}$ , *i.e.*, *if*:

$$\frac{\beta}{1-\beta} \left( \mathbb{E}[M^{1-\frac{1}{\beta}}] - \mathbb{E}[M]^{1-\frac{1}{\beta}} \right) c^{(1-\sigma)\left(1-\frac{1}{\beta}\right)} f^{\frac{1}{\beta}} > -\pi_{CAT}$$
(17)

Proposition 1 highlights three key insights: First, since  $\mathbb{E}[\Delta \pi_{DOG}] > 0$ , entry with CAT is always profitable if  $\pi_{CAT} > 0$ . In this case, there is a double premium: profits from selling the CAT product and extra profits from tailoring the investment for the DOG product. But this scenario is not very likely. CAT products are products with small market shares that were bought from other firms at a price that already includes a markup. Hence, they are not likely to generate high profit contributions. But even if these profit contributions are negative, firms may still find it profitable to enter a market with CAT products if the gains from learning are sufficiently large. This is our second insight. Even if the sales from CAT products generate direct losses ( $\pi_{CAT} < 0$ ), they still generate value for the firm by disclosing the conditions of the market ( $\mathbb{E}[\Delta \pi_{DOG}]$ ) > 0. And if this value is large enough, it still pays off to accept the operating losses from selling the CAT products to learn about the market conditions for their own products. Finally, and this is our third insight, condition (17) is a firm-product-destination-specific condition that depends on firm-product-specific marginal costs, firm-product-specific marketing costs, destination-profits of specific CAT products and destination-specific market conditions. Hence, it may hold only for some products of some firms in some markets.

Equation (17) allows us to take a closer look at the decision to enter with CAT and derive two additional propositions.

**Proposition 2** (Marketing Costs). The benefit of entering with CAT increases with the cost of marketing activities f.

*Proof.* From (15) we obtain  $d \ln \mathbb{E}[\Delta \pi_{DOG}]/d \ln f = 1/\beta > 0$ . Hence, a higher f makes entry with CAT more profitable.

Proposition 2 follows immediately from equation (16). Firms over-invest in reaching consumers when they do not know the exact market conditions, and this over-investment is even more costly when f is higher. Hence, a higher fixed cost increases the value of learning about the market conditions using CAT.

**Proposition 3** (Marginal Costs). The benefit of entering with CAT increases with marginal costs c if  $\beta < 1$ , and it decreases with c if  $\beta > 1$ .

*Proof.* From (15) we obtain  $d \ln \mathbb{E}[\Delta \pi_{DOG}]/d \ln c = (1 - \sigma) \left(1 - \frac{1}{\beta}\right)$ . Since  $\sigma > 1$ , this is positive if  $\beta < 1$  and negative if  $\beta > 1$ .

Proposition 3 states that it depends on the value of  $\beta$  whether small firms (with high marginal costs) or large firms (with low marginal costs) find it more profitable to enter via CAT. This question depends ultimately on whether the response of firms' marketing expenditures to changes in market size is more volatile for large or small firms. This volatility determines the costs of uncertainty, and, thus, of the value of learning. Using (7) and (10), we can express this volatility as:

$$\frac{dF(M)}{dM} = \frac{f}{\beta M} \left(\frac{M}{f} c^{1-\sigma}\right)^{1-\frac{1}{\beta}} > 0$$
(18)

and the derivative of this volatility with respect to c as:

$$\frac{d^2 F(M)}{dMdc} = (1-\sigma) \left(1-\frac{1}{\beta}\right) \frac{f}{\beta Mc} \left(\frac{M}{f} c^{1-\sigma}\right)^{1-\frac{1}{\beta}}$$
(19)

Therefore, if  $\beta < 1$ ,  $d^2F(M)/dMdc > 0$ , and the volatility of marketing expenditures is increasing in c. This implies that small firms (with high marginal costs) experience a larger volatility in their marketing expenditures, and, thus, have a larger benefit from learning the true size of the market. If  $\beta > 1$ , it is the larger firms (with low marginal costs) that respond more volatilely and, thus, have a larger benefit from learning.

Interestingly, Arkolakis (2010) estimate an average value for  $\beta$  across products and destinations and finds it equal to 0.915, which is consistent with our empirical finding (reported below) that smaller firms, who tend to have higher marginal costs, rely more on CAT to enter a new market. By contrast, Eaton et al. (2011) find that  $\beta = 1.1$ , which would imply that larger firms rely more on CAT than smaller firms.

# 6 Additional Evidence in Support of the Model

In this section, we provide additional evidence in support of the model. First, we show that goods exported via CAT and via DOG have systematically different properties which are in line with our assumptions that DOG features higher fixed export costs (Section 5.2). Second, we document that small firms rely more on CAT upon entry than large firms. Third, firms that enter exclusively with CAT are more likely to export CAT products that are in the same narrowly defined sector of their core produced goods, thus, likely sharing some demand characteristics. Fourth, we find that CAT upon entry is more likely in farther destinations and countries outside of the EU, where, presumably, Danish firms have less knowledge of market conditions. Moreover, CAT upon entry is less common in destinations with a large number of Danish exporters. Finally, consistent with Albornoz et al. (2012) who postulate that market characteristics learned by a firm are correlated across destinations, we find that exporters with more experience rely less on CAT upon entry.

#### 6.1 Differences Between CAT Goods and Own Goods

In our model, the goods exported via CAT and the goods exported via DOG are systematically different. In this section, we provide suggestive evidence which is consistent with a model in which own goods are exported with higher fixed costs and CAT has lower fixed costs (in our model, there are no explicit fixed costs with CAT). This is in line with the specific model of Section 5.2.

First, if a product has higher fixed costs, we observe higher revenues. In fact, higher fixed costs select out low-sales items and only high-sales products survive. Hence, we expect the export sales of CAT goods to be lower than the export sales of own goods. To show this, we consider the following regression equation:

$$\ln(\text{Export value})_{pft} = \beta_1 CAT_{pft} + FE_{pt} + FE_{ft} + \epsilon_{pft}$$
(20)

where  $CAT_{pft} = 1$  if a product p is CAT for a firm f in year t. Results in Table 3 indicate that CAT goods tend to have lower export value, both across firms and across products. The value of the coefficient between -3.1 and -3.6 indicates that the export value of a CAT good is between  $e^{-3.6} = 2.7\%$  and  $e^{-3.1} = 4.5\%$  of the export value of an own good. Notice that the inclusion of product fixed effects barely changes the coefficient, indicating that differences in export value are due to differences in export modes and not differences in products.

In addition, higher fixed costs are associated with lower sales volatility. Suppose that the unconditional distributions of sales for CAT goods and an own goods are identical. If own goods have higher fixed costs, their distribution of sales conditional on survival will exhibit a lower variance. Indeed, we show in Table 4, that the sales volatility of CAT goods, measured as the coefficient of variation, is higher than the sales volatility of own goods.

	Dependent	Variable:	Log Export Value
	(1)	(2)	(3)
CAT	-3.629***	-3.113***	<b>-</b> 3.394***
	(0.011)	(0.011)	(0.012)
Firm-Year FE	Yes	No	No
Product-Year FE	No	Yes	Yes
$R^2$	0.30	0.34	0.44
# Obs.	568814	568814	568814

Table 3: Firm-Product Sales and CAT

Results from OLS of equation (20). Std. error in parenthesis. \*\*\*: significant at 99%, \*\* at 95%, \* at 90%. Firm-Year fixed effects in the first and last columns, Product-Year fixed effects in the second and last columns.

	Sales-Weighted					Bins				
	Average	1	5	10	25	50	75	90	95	99
DOG	0.34	0.02	0.10	0.16	0.32	0.60	0.94	1.28	1.42	1.79
CAT	0.52	0.01	0.12	0.23	0.50	0.81	1.15	1.39	1.55	1.90

Table 4: Coefficient of Variation: CAT vs DOG

In the first column, we report the sales-weighted average coefficient of variation of firm-products sales. For the remaining columns, we divide the coefficient of variation in 100 bins (quantiles), and report the average coefficient of variation for the bins: 1, 5, 25, 50, 75, 90, 95, 99.

#### 6.2 Firm Size and Use of CAT Upon Entry

In this section, we investigate whether the use of CAT as a market screening mechanism is contingent on firm size. As stated in Proposition 3, the expected difference in profits from entering with CAT compared to DOG depends on the firm's marginal costs c, which is tied to the parameter  $\beta$ . If  $\beta < 1$ , the expected difference in profits increases with c, implying that firms with higher marginal costs are more likely to enter with CAT. Conversely, if  $\beta > 1$ , the expected difference in profits decreases with c, suggesting that firms with lower marginal costs are more inclined to initiate exports with CAT.

To test this hypothesis and gain insight on the value of  $\beta$ , we propose the following firm-product-destination-level regression:

$$Prob(CAT_{fpdt} = 1) = \beta_1 \text{Entry Year}_{fdt} + \beta_2 \text{Log(Number of Products)}_{fdt} + \beta_3(\text{Entry Year}_{fdt}) \times \text{Firm Size}_{fdt} + FE_{dt} + FE_{ft} + FE_{pt} + \epsilon_{fpdt}$$
(21)

where we use three different metrics of firm size (Firm  $\text{Size}_{fdt}$ ): 1) the log of a firm's scope in the destination, 2) the log of a firm's total sales across all destinations, and 3) the log number of destinations that a firm exports to. These measures are positively correlated with each other.

The results are presented in Table 5 and indicate that small firms are more likely to enter with CAT. In fact, the coefficient on the interaction term between year of entry and the measures of firm size is negative and statistically significant: the dependency on CAT upon entry diminishes as the firm's size expands. Hence, our results indicate that  $\beta < 1$ , in line with the results from Arkolakis (2010).<sup>24</sup>

#### 6.3 Sector of CAT Goods

In this section, we examine whether the sector of the CAT product influences firms' learning processes in export markets. For each firm f and year t, we identify the core product as the eight-digit CN code with the highest production value. We then analyze whether, upon market entry, firms tend to rely more on CAT products within the same sector as their core goods. If firms use CAT products to gain insights into market conditions for their own goods, we would expect them to rely predominantly on CAT products within the same sector as their core as their core products.

<sup>&</sup>lt;sup>24</sup>These results find support in the analysis by Dickstein and Morales (2018), who find that larger firms possess better knowledge of market conditions in foreign countries, which is independent of their previous export experience.

	Dependent	Variable:	Probability	of Being CAT
	(1)	(2)	(3)	(4)
Year of Entry	0.025***	0.029***	0.052***	$0.035^{***}$
	(0.002)	(0.003)	(0.011)	(0.004)
(Year of Entry)x $Log(\# of Products)$		-0.004*		
		(0.002)		
(Year of Entry) Log(Total Export Value)		· · · ·	-0.002**	
			(0.001)	
(Year of Entry)x(Multiple Destinations)			· · · ·	-0.011**
				(0.004)
Log(# of Products)	0.080***	0.080***	0.080***	0.080***
	(0.003)	(0.003)	(0.003)	(0.003)
Destination-Year FE	Yes	Yes	Yes	Yes
Firm-Year FE	Yes	Yes	Yes	Yes
Product-Year FE	Yes	Yes	Yes	Yes
Firm-Destination FE	No	No	No	No
$R^2$	0.65	0.65	0.65	0.65
# Obs.	2216676	2216676	2216676	2216676

Table 5: Probability of Being CAT and Entry: The Role of Firm Size

Results from OLS of Equation (21). Robust std. error in parenthesis. Cluster: firm. \*\*\*: significant at 99%, \*\* at 95%, \* at 90%. Destination-Year, Firm-Year, and Product-Year fixed effects in all columns.

We consider the following regression:

$$Prob(CAT_{fpdt} = 1) = \beta_{1} \text{Entry Year}_{fdt} + \beta_{2} \text{Log(Number of Products)}_{fdt} + \sum_{k=2,4,6} \gamma_{k} \text{Same CNk as Core}_{fpt} + \sum_{k=2,4,6} \delta_{k}(\text{Same CNk as Core}_{fpt}) * \text{Entry Year}_{fdt} + FE_{dt} + FE_{ft} (+FE_{pt} + FE_{fd}) + \epsilon_{fpdt}$$
(22)

where Same CNk as  $\operatorname{Core}_{fpt}$  is a dummy variable equal to one if product p is in the same kdigit product code as the core product of firm f in year t. Notice that Same CN4 as  $\operatorname{Core}_{fpt}$ equals one if product p is in the same four-digit code as the core product, but not the same six-digit code. Similarly, Same CN2 as  $\operatorname{Core}_{fpt}$  equals one if product p is in the same two-digit code as the core product, but not the same six-digit or four-digit code.

Results from this regression, reported in Table 6, reveal that, in a typical year, exported CAT products are generally in different sectors from the firms' core goods. This is evidenced by the negative and significant coefficients for  $\gamma_k$  across all specifications. These findings suggest that the typical CAT product may be complementary to the firms' core goods, aligning with the arguments made by Bernard et al. (2019).

Our main interest in Table 6 is in the coefficients on the interaction terms,  $\delta_k$ . A positive

 $\delta_k$  suggests that firms are more reliant on CAT products within the same k-digit code as their core product. The first three columns in Table 6 indicate that firms are less likely to use CAT products within the same six-digit code as their core product upon entry. However, they are equally likely to enter with CAT products within or outside the four-digit or two-digit sector of their core product.

Results differ significantly when we restrict the sample to firms entering exclusively with CAT products. In this scenario, firms tend to enter with CAT products in the same sector as their core product. These findings support our hypothesis that firms use CAT products to learn about market conditions. Specifically, firms entering exclusively with CAT products tend to use CAT products within the same sectors as their core goods, which likely share similar demand characteristics. This is further supported by the fact that the highest probability of exporting a CAT product upon entry is observed for products within the same six-digit code of the core good of a firm, and then have a likely high relatedness relative to goods in different six-digit codes.

	Dependent Variable: Probability of Being CAT					
	(All)	(All)	(All)	(Excl. CAT)	(Excl. CAT)	(Excl. CAT)
Entry Year	0.040***	0.026***	0.008**	0.039***	0.023***	0.010***
	(0.005)	(0.003)	(0.003)	(0.004)	(0.003)	(0.003)
Same CN2 as Core	-0.121***	-0.072***	-0.068***	-0.048***	-0.041***	-0.041***
	(0.013)	(0.010)	(0.010)	(0.011)	(0.008)	(0.008)
Same CN4 as Core	-0.291***	-0.224***	-0.219***	$-0.166^{***}$	-0.161***	-0.163***
	(0.019)	(0.015)	(0.015)	(0.022)	(0.017)	(0.017)
Same CN6 as Core	-0.697***	-0.640***	-0.623***	-0.735***	-0.732***	$-0.716^{***}$
	(0.014)	(0.014)	(0.014)	(0.017)	(0.014)	(0.014)
(Entry Year)x(Same CN2 as Core)	-0.014	-0.006	-0.006	$0.047^{***}$	$0.034^{***}$	$0.029^{***}$
	(0.012)	(0.007)	(0.009)	(0.009)	(0.006)	(0.006)
(Entry Year)x(Same CN4 as Core)	0.001	0.002	0.008	$0.131^{***}$	$0.092^{***}$	$0.095^{***}$
	(0.014)	(0.008)	(0.009)	(0.017)	(0.010)	(0.011)
(Entry Year)x(Same CN6 as Core)	-0.052***	-0.033***	-0.009	$0.583^{***}$	$0.376^{***}$	$0.362^{***}$
	(0.009)	(0.005)	(0.006)	(0.021)	(0.029)	(0.033)
Log(# of Products)	$0.054^{***}$	$0.035^{***}$	$0.035^{***}$	$0.007^{***}$	$0.006^{***}$	$0.010^{***}$
	(0.004)	(0.002)	(0.002)	(0.002)	(0.001)	(0.002)
Destination-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Product-Year FE	No	Yes	Yes	No	Yes	Yes
Firm-Destination FE	No	No	Yes	No	No	Yes
$R^2$	0.58	0.74	0.76	0.66	0.81	0.83
# Obs.	2234349	2216676	2193139	238242	221714	210545

Table 6: Probability of Being CAT and Entry: Sector of CAT Goods

Results from OLS of equation (1). Robust std. error in parenthesis. Cluster: firm. \*\*\*: significant at 99%, \*\* at 95%, \* at 90%. Destination-Year and Firm-Year fixed effects in all columns. Product-Year fixed effects in columns (2), (3), (5), and (6). Firm-Destination fixed effects in columns (3) and (6). The first three columns include all firm-destinations. The last three columns restrict the sample to firm-destinations where entry is exclusively with CAT.

#### 6.4 Heterogeneity in CAT across Destinations

A necessary condition for the use of CAT as a market testing tool is the existence of uncertainty surrounding market conditions. In the following, we exploit various destination characteristics (labeled  $X_{dt}$ ) that are plausibly related to the knowledge firms possess about markets prior to entry or the uncertainty they face. We then augment equation (1) by introducing an interaction term that combines the year of entry with  $X_{dt}$ :

$$Prob(CAT_{fpdt} = 1) = \beta_1 \text{Entry Year}_{fdt} + \beta_2 \text{Log(Number of Products)}_{fdt} + \beta_3(\text{Entry Year}_{fdt}) \times (X_{dt}) + FE_{dt} + FE_{ft} + FE_{pt} + \epsilon_{fpdt}$$
(23)

The results can be found in Table 7.

We hypothesize that firms face larger uncertainty regarding market conditions in destinations that are further away from Denmark (as measured by log distance to the destination) while such uncertainty should be lower in destinations that are more similar to the home market. We proxy similarity with linguistic proximity as sourced from Melitz and Toubal (2014). Consistent with the first hypothesis, the role of CAT upon entry is significantly larger in more distant destinations, while linguistic proximity does not seem to play a role (cf. columns (1) and (2) of Table 7).

The EU single market provides firms with common rules and regulations, and we therefore may expect that Danish firms have better information about market conditions prior to entry in EU markets. Indeed, results in column (3) suggest that CAT does not play a role for market screening in EU destinations.

Next, we note that there might be other channels of learning, such as observing the behaviour of other firms. Therefore, we test whether the role of CAT for market screening is reduced in more popular destinations. Specifically, we interact the entry dummy with the lagged log number of Danish firms selling the core product of firm f in destination d, where the core product of a firm is the eight-digit product with the largest production value in a year. We find evidence that the use of CAT upon entry is less likely in the presence of "export spillovers" (cf. column (4)). This result further supports our hypothesis that firms use CAT to learn about market conditions, as it is less often used when firms can learn by observing the success of other firms that produce their same products.

Finally, we use information on country risk as classified by the OECD (OECD, 2024) as a concrete measure of market uncertainty. Column (5) of Table 7 shows that the interaction of destination risk and the entry year is indeed positive. Moreover, given that risk is measured on a scale from 0 to 7, the implied differences across destinations are also quantitatively important.

	Dopondont	Variable	Probability o	f Boing CA	Г
		variable.	i iobability c	Dellig CA	L
	(1)	(3)	(2)	(4)	(5)
Year of Entry	-0.050***	0.022***	0.036***	0.030***	0.020***
	(0.017)	(0.003)	(0.003)	(0.003)	(0.003)
(Entry Year)*Log(Distance)	$0.010^{***}$				
	(0.002)				
(Entry Year)*(Ling. Prox Tree)		0.001			
		(0.002)			
(Entry Year)*EU			-0.036***		
			(0.005)		
Entry year * Lagged $Log(\# Firms)$			× /	-0.011***	
				(0.002)	
(Entry Year)*OECD-risk				· · · ·	$0.002^{**}$
					(0.001)
Log(# of Products)	0.080***	$0.082^{***}$	0.080***	0.080***	0.080***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Destination-Year FE	Yes	Yes	Yes	Yes	Yes
Firm-Year FE	Yes	Yes	Yes	Yes	Yes
Product-Year FE	Yes	Yes	Yes	Yes	Yes
Firm-Destination FE	No	No	No	No	No
$R^2$	0.65	0.65	0.65	0.65	0.66
# Obs.	2208145	1675271	2208145	2208145	1634001

Table 7: Probability of Being CAT and Entry: Destination Heterogeneity

Results from OLS of equation (23). Robust std. error in parenthesis. Cluster: firm. \*\*\*: significant at 99%, \*\* at 95%, \* at 90%. Destination-Year, Firm-Year, and Product-Year fixed effects in all columns.

#### 6.5 Export Experience and Entry with CAT

As we argue that firms use CAT as a market screening tool upon their initial entry, we expect the reliance on CAT to diminish over time. Specifically, if a firm exits a market only to re-enter it later, we anticipate that the firm's dependence on CAT will have lessened. This is based on the assumption that some of the knowledge acquired during the previous export experience still resides within the firm. To verify this hypothesis, we conduct the following regression:

$$Prob(CAT_{fpdt} = 1) = \beta_1 \text{Entry Year}_{fdt} + \beta_2 \text{Re-Entry Year}_{fdt} + \beta_3 \text{Log(Number of Products)}_{fdt} + FE_{dt} + FE_{ft} + FE_{pt} + \epsilon_{fpdt}$$
(24)

where Re-Entry Year<sub>fdt</sub> = 1 if firm f has re-entered destination d in year t. This implies the firm recorded no exports to j in year t - 1 but had positive exports in year t - k for some k > 1. If the knowledge gained from previous export experience remains within the firm, we would expect  $\beta_2 < \beta_1$ . Indeed, Table 8 shows that, in general,  $\beta_2 < \beta_1$ . The difference in the two coefficients is statistically significantly different from zero in the first and second column of Table 8. In the third column, when we include firm-destination fixed effects, the difference between  $\beta_2$  and  $\beta_1$  is not statistically significant. Given our earlier findings, this is hardly surprising. When we incorporate fixed effects for each firm-destination, we effectively omit any firms that do not maintain a presence in a particular market for a minimum of two years. As we have argued before, based on our theory that CAT is employed for market screening, this modeling approach might underestimate the extent to which firms rely on CAT.

	Dependen	t Variable:	Probability of Being CAT
	(1)	(2)	(3)
Year of Entry	$0.046^{***}$	0.029***	0.010***
	(0.005)	(0.003)	(0.002)
Year of Re-Entry	$0.033^{***}$	$0.019^{***}$	$0.007^{***}$
	(0.003)	(0.002)	(0.001)
Log(# of Products)	$0.132^{***}$	$0.081^{***}$	0.082***
	(0.005)	(0.003)	(0.004)
Destination-Year FE	Yes	Yes	Yes
Firm-Year FE	Yes	Yes	Yes
Product-Year FE	Yes	Yes	Yes
Firm-Destination FE	No	No	Yes
$R^2$	0.40	0.65	0.69
# Obs.	2234349	2216676	2193139

Table 8: Probability of Being CAT, Entry, and Re-Entry

Results from OLS of Equation (24). Robust std. errors in parenthesis. Cluster: firm. \*\*\*: significant at 99%, \*\* at 95%, \* at 90%. Destination-Year, Firm-Year, and Product-Year fixed effects in all columns.

# 7 Conclusions

We have documented a new stylized fact for export entry: when firms begin their export experience in a new destination, they frequently tend to use CAT. We rationalize this finding in a model in which firms learn about market characteristics and, given that, update their sunk investments for their own goods. Entering with CAT can be profit maximizing when the value of knowing market characteristics is large enough. We provide a microfoundation for this mechanism, which relies on marketing costs to reach new customers.

Additional evidence supports our model. In particular, CAT goods tend to have lower sales and higher volatility of sales, which suggests lower fixed export costs for CAT. Furthermore, we show that small firms rely more on CAT than bigger firms. Finally, we show that the use of CAT is reduced in markets that are plausibly better known by Danish firms and that the larger the experience of an exporter, the lower the reliance on CAT.

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# A Data Appendix

#### A.1 Additional Details on Data Sources and Handling

In the following, we discuss further details regarding our data sources and measurement of key variables.

The sales survey. The population of firms for the sales survey is selected once a year based on information on employment in the 3rd quarter of the previous year and industry information in Statistics Denmark's Business Statistics Register (ESR) at the start of the reference year. Information on firms' sales is collected each quarter, and we aggregate the data up the to firm-product-year level.

In the survey, firms report sales for each of their own-produced goods. Own-produced goods are defined as goods for which the firm itself has purchased the raw materials and intermediate inputs, and which it has either (i) manufactured itself or for which it has (ii)

outsourced production to others. Thus, when a company produces products on behalf of another company which owns the raw materials and intermediate inputs, this will enter the statistics as a product produced by the latter firm rather than the former. Instead, the former firm will record their sales under "paid work for others".

**Defining export entry.** It is worth noting that, due to firm size thresholds for participation in the sales survey, firms that are close to the threshold may drop in and out of the sample. We carefully construct our indicators for export entry (at the firm or firm-destination level) to circumvent any issues arising from such changes: specifically, we construct a list of firms that appear in our sample (in at least some years), and merge this list to the trade statistics. This approach allows us to capture export entry even if it appeared in a year in which the firm did not participate in the sales survey.

#### A.2 Measuring CAT: Issues and Caveats

Since our identification of CAT and DOG hinges on the mismatch between the sales survey and the trade statistics in terms of the products reported by firms, it is important to highlight possible issues and caveats.

**Product classification (and misclassification).** In the sales survey, own-produced products are reported according to the eight-digit level of the CN code, which is also the product classification used in the trade data. This is different from many other EU countries, where the PRODCOM classification is used for reporting production, and it implies that there should be less measurement error of CAT in the Danish data than e.g., in the Belgian data. According to Statistics Denmark, there could be some issues related to firms not always reporting the production values in the correct product codes. To address this caveat, in Section 4.3, we aggregate the data at the six-digit level of the CN classification.

Differences in number of product codes across data sources. Comparing the sales survey and the trade statistics, there is a broad range of product codes which only show up in the trade data but not in the sales data. In fact, almost 50% of all product codes in the trade statistics never show up in the sales survey. However, these product codes are less important in terms of total export transactions (they account for only 10% of transactions). There could be several explanations for this. First, these products could be imported by Danish firms and re-exported without further processing (apart from, e.g., quality checks etc.). Second, these products might be produced in Denmark by smaller manufacturing firms that do not report in the sales survey (note the employment threshold). Given these plausible explanations, we keep these products in the sample for our main analysis. However, in our robustness analysis of Section 4.3, we address the specific issue of firms importing and re-exporting the same product by excluding all such products from the sample. Differences in reporting units. In the trade data, the firm (CVRNR) is the reporting unit. In the sales survey, however, it is the Kind of Activity Unit (KAU). KAUs consist of all local units within an enterprise that have the same industrial classification. In most cases the enterprise is the same as the KAU, but for especially large enterprises with activities in several industries the KAU will be a subdivision of the enterprise. One issue is that we might misclassify DOG as CAT at multi-KAU firms if not all KAUs that pertain to the firm report into the sales survey (e.g., because these KAUs are below the reporting threshold of 10 employees). To address this concern, we have used workplace information (IDAS) to gauge the importance multi-KAU firms: 81% of firms in the sample are single-establishment firms (and, thus, single-KAU firms). Aggregating establishments into KAUs, 91% of firms are single-KAU firms. Considering only manufacturing KAUs, the number of single-KAU firms further increases to 94%. Looking at multiple-KAU firms, 93% of KAUs at these firms have more than 10 employees in November of the previous year, and thus should be included in the sales survey. In sum, we believe the concern to be minor.

# A.3 Export Entry and CAT: Descriptive Results

		Share	of Firms	Share of Sales		
	Sector	Entry Year	Average Year	Entry Year	Average Year	
10	Food Products	36.7	12.8	0.4	1.3	
13	Textile	71.4	18.7	1.5	3.4	
16	Wood	64.8	38.8	42.7	6.1	
17	Paper	53.6	29.2	67.4	14.2	
18	Printing	57.8	32.9	11.0	8.4	
22	Rubber and Plastic	44.9	21.6	7.6	11.9	
23	Non-Metals Minerals	48.3	28.7	8.0	7.5	
24	Metals	40.0	18.8	0.1	12.2	
25	Iron and Metal Goods	71.9	43.7	26.7	13.0	
26	Electronics	58.0	18.2	52.8	4.9	
27	Electrical Equipment	63.6	31.1	7.0	3.8	
28	Machinery	53.8	21.9	5.0	3.8	
29	Motor Vehicles	59.3	27.0	3.8	4.9	
31	Furniture	37.2	15.8	2.2	2.3	
32	Miscellaneous	43.5	14.9	36.9	2.2	
33	Repar. and Install. Of Machinery	76.3	54.2	28.8	20.3	
	Average	55.1	26.8	18.9	7.5	

Table A.1: Share of Exclusively CAT Firms in Average Year and in Entry Year by Sector

Share of number of firms that engage only in CAT in average year and entry year. The share is computed as the share of the number of firms that engage only in CAT relative to the total, or the share of sales of firms that engage only in CAT relative to the total. Sectors are defined at the two-digit NACE level, reported for each firm by the dataset FIRM. For confidentiality reasons, we drop from the table sectors for which the number of firms or entrants is too small.

	Share of Firms							
	Nu	mber		Sales				
	Entry Year	Average Year	Entry Year	Average Year				
DOG & CAT blended	33.2	69.8	93.7	96.2				
Exclusively CAT	54.2	24.3	2.5	2.0				
Exclusively DOG	12.5	5.8	3.8	1.8				

#### Table A.2: Share of CAT and DOG by Year - Drop Imported CAT

	Share of Firm-Destinations					
	Nu	ımber	S	ales		
	Entry Year	Average Year	Entry Year	Average Year		
DOG & CAT blended	10.0	27.1	30.0	58.0		
Exclusively CAT	35.8	19.4	18.9	4.6		
Exclusively DOG	54.2	53.5	51.1	37.4		

The columns Number report the share of the number firms by type of exports (DOG & CAT blended, Exclusively CAT, or Exclusively DOG) in the average year or in the entry year. For the average year, we compute the three shares in each year and take an average between 2000 and 2015. For the entry year, we compute the three shares in each year restricting the sample to new entrants, and then take the average between 2001 and 2015 (we drop the year 2000 which is the initial year of our sample for the entrants). The columns Sales report the share of sales of firms by type of exports (DOG & CAT blended, Exclusively CAT, or Exclusively DOG) in the average year or in the entry year. In the top part of the table, the unit of observation is the firm, i.e., we consider the share of the number of firms and the share of sales of firms. In this case, a new entrant is a new exporter. In the bottom part of the table, the unit of observation, i.e., we consider the share of firm-destinations and the share of sales of firm-destinations. In this case, a new entrant is a new exporter in a destination. We drop all imported CAT products, defined as CN eight-digit product codes which a firm reports as both imported and exported in the customs data, but that the firm does not report in the production data.

	Share of Firms					
	Nu	umber	S	ales		
	Entry Year Average Year		Entry Year	Average Year		
DOG & CAT blended	44.0	67.8	96.9	94.9		
Exclusively CAT	55.4	27.5	2.0	3.4		
Exclusively DOG	11.5	4.7	1.1	1.0		

Table A.3: Share of CAT and DOG by Year - Drop Foreign Owned Firms

	Share of Firm-Destinations						
	Nu	mber	S	ales			
	Entry Year Average Year		Entry Year	Average Year			
DOG & CAT blended	13.1	35.6	37.8	72.1			
Exclusively CAT	46.8	29.2	29.5	9.3			
Exclusively DOG	40.1	35.2	32.6	18.5			

Channel Finne Dentinetions

The columns Number report the share of the number firms by type of exports (DOG & CAT blended, Exclusively CAT, or Exclusively DOG) in the average year or in the entry year. For the average year, we compute the three shares in each year and take an average between 2000 and 2015. For the entry year, we compute the three shares in each year restricting the sample to new entrants, and then take the average between 2001 and 2015 (we drop the year 2000 which is the initial year of our sample for the entrants). The columns Sales report the share of sales of firms by type of exports (DOG & CAT blended, Exclusively CAT, or Exclusively DOG) in the average year or in the entry year. In the top part of the table, the unit of observation is the firm, i.e., we consider the share of the number of firms and the share of sales of firm-destination, i.e., we consider the share of the number of the table, the unit of observation is a new exporter. In the bottom part of the table, the unit of sales of the share of the number of firm-destinations and the share of sales of firm-destinations. In this case, a new entrant is a new exporter in a destination. We drop all firms that are foreign owned.

	Share of Firms						
	Nu	umber	S	ales			
	Entry Year Average Year		Entry Year	Average Year			
DOG & CAT blended	32.3	69.8	90.0	94.9			
Exclusively CAT	55.6	25.0	6.2	4.0			
Exclusively DOG	12.1	5.3	3.8	1.1			

Table A.4: Share of CAT and DOG by Year - Aggregating Products at the Six-digit Level

	Share of Firm-Destinations					
	Nu	umber	S	ales		
	Entry Year Average Year		Entry Year	Average Year		
DOG & CAT blended	12.7	35.5	38.3	70.3		
Exclusively CAT	46.5	28.7	30.0	10.2		
Exclusively DOG	40.8	35.8	31.6	19.5		

Channel Finne Dentinetions

The columns Number report the share of the number firms by type of exports (DOG & CAT blended, Exclusively CAT, or Exclusively DOG) in the average year or in the entry year. For the average year, we compute the three shares in each year and take an average between 2000 and 2015. For the entry year, we compute the three shares in each year restricting the sample to new entrants, and then take the average between 2001 and 2015 (we drop the year 2000 which is the initial year of our sample for the entrants). The columns Sales report the share of sales of firms by type of exports (DOG & CAT blended, Exclusively CAT, or Exclusively DOG) in the average year or in the entry year. In the top part of the table, the unit of observation is the firm, i.e., we consider the share of the number of firms and the share of sales of firm-destination, i.e., we consider the share of the number of the table, the unit of observation is a new exporter. In the bottom part of the table, the share of sales of firm-destinations. In this case, a new entrant is a new exporter in a destination. A product is defined as a CN six-digit code.

Share of Firms							
	Nu	ımber	S	ales			
	Entry Year Average Year		Entry Year	Average Year			
DOG & CAT blended	39.5	75.2	94.2	96.2			
Exclusively CAT	43.6	18.1	1.7	2.5			
Exclusively DOG	16.9	6.7	4.1	1.3			

**Table A.5:** Share of CAT and DOG by Year – Correcting for Changes in Product Classification

	Share of Firm-Destinations						
	Nu	mber	S	ales			
	Entry Year	Entry Year Average Year		Average Year			
DOG & CAT blended	13.1	35.4	38.9	68.7			
Exclusively CAT	38.9	22.1	20.4	7.4			
Exclusively DOG	48.0	42.5	40.7	23.9			

The columns Number report the share of the number firms by type of exports (DOG & CAT blended, Exclusively CAT, or Exclusively DOG) in the average year or in the entry year. For the average year, we compute the three shares in each year and take an average between 2000 and 2015. For the entry year, we compute the three shares in each year restricting the sample to new entrants, and then take the average between 2001 and 2015 (we drop the year 2000 which is the initial year of our sample for the entrants). The columns Sales report the share of sales of firms by type of exports (DOG & CAT blended, Exclusively CAT, or Exclusively DOG) in the average year or in the entry year. In the top part of the table, the unit of observation is the firm, i.e., we consider the share of the number of firms and the share of sales of firms. In this case, a new entrant is a new exporter. In the bottom part of the table, the unit of observation is the firm-destination, i.e., we consider the share of the number of firm-destinations and the share of sales of firm-destinations. In this case, a new entrant is a new exporter in a destination. Products are defined at the eight-digit code, and we apply the correction procedure described in Van Beveren et al. (2012).

	Share of Firms (Number)					
	Entry	Year 2	Year 3	Year 4	Year 5	
DOG & CAT blended	33.3	49.0	50.7	53.5	55.4	
Exclusively CAT	55.6	44.3	44.0	40.0	38.9	
Exclusively DOG	11.1	6.7	5.3	6.6	5.6	

 Table A.6: Share of CAT and DOG by Year After Entry – Number of Firms and-Firm Destinations

Share of Firm-Destinations (Number) Entry Year 2 Year 3Year 4 Year 5 DOG & CAT blended 13.223.025.527.328.5Exclusively CAT 46.538.836.8 34.633.7Exclusively DOG 40.2 38.038.337.737.8

The columns report the share of the number firms by type of exports (DOG & CAT blended, Exclusively CAT, or Exclusively DOG) in the entry year and in the subsequent years. We compute the three shares in each year restricting the sample to entrants, entrants in their second year, etc. and then take the average between 2001 and 2015 (we drop the year 2000 which is the initial year of our sample for the entrants). In the top part of the table, the unit of observation is the firm, i.e., we consider the share of the number of firms. In this case, a new entrant is a new exporter. In the bottom part of the table, the unit of observation is the firm-destination, i.e., we consider the share of the number of the number of firm-destination.

	Share of Firms (Sales)					
	Entry	Year 2	Year 3	Year 4	Year 5	
DOG & CAT blended	93.0	94.0	98.0	97.8	96.3	
Exclusively CAT	6.2	5.6	1.7	1.8	3.1	
Exclusively DOG	0.8	0.4	0.3	0.4	0.6	

Table A.7: Share of CAT and DOG by Year After Entry – Sales of Firms and Firm-Destinations

	Share of Firm-Destinations (Sales)					
	Entry	Year 2	Year 3	Year 4	Year 5	
DOG & CAT blended	41.5	50.1	57.1	58.8	55.5	
Exclusively CAT	30.0	26.4	22.8	19.4	20.4	
Exclusively DOG	28.5	23.6	20.1	21.8	24.2	

The columns report the share of the sales of firms by type of exports (DOG & CAT blended, Exclusively CAT, or Exclusively DOG) in the entry year and in the subsequent years. We compute the three shares in each year restricting the sample to entrants, entrants in their second year, etc. and then take the average between 2001 and 2015 (we drop the year 2000 which is the initial year of our sample for the entrants). In the top part of the table, the unit of observation is the firm, i.e., we consider the share of the sales of firms. In this case, a new entrant is a new exporter. In the bottom part of the table, the unit of observation is the firm-destination, i.e., we consider the share of the sales of firm-destination.

## A.4 Export Entry and CAT: Results from Regression Analysis

	Dependent Variable: Probability of Being CAT							
	A	ll Firm-Des	st.	Firm-Des	Firm-Dest. $> 3$ Years of Obs.			
	(1)	(2)	(3)	(4)	(5)	(6)		
Entry Year	$0.041^{***}$	0.035***	0.011***	0.026***	0.021***	0.011***		
	(0.004)	(0.003)	(0.003)	(0.005)	(0.004)	(0.003)		
Log(# of Products)	$0.130^{***}$	$0.099^{***}$	$0.098^{***}$	$0.133^{***}$	$0.101^{***}$	$0.098^{***}$		
	(0.005)	(0.004)	(0.004)	(0.005)	(0.004)	(0.004)		
Destination-Year FE	Yes	No	No	Yes	No	No		
Firm-Year FE	Yes	Yes	Yes	Yes	Yes	Yes		
Product-Destination-Year FE	No	Yes	Yes	No	Yes	Yes		
Firm-Destination FE	No	No	Yes	No	No	Yes		
$R^2$	0.40	0.66	0.70	0.40	0.66	0.70		
# Obs.	2234349	1488481	1462815	2121227	1402099	1402099		

Table A.8: Probability of Being CAT and Entry

Results from OLS of equation (1). Robust std. error in parenthesis. Cluster: firm. \*\*\*: significant at 99%, \*\* at 95%, \* at 90%. Firm-Year fixed effects in all columns. Product-Destination-Year fixed effects in columns (2), (3), (5), and (6). Firm-Destination fixed effects in columns (3) and (6). The first three columns include all firm-destinations. The last three columns restrict the sample to firms that have exported to a destination for at least three years.

	Dependent Variable: Probability of Being CAT							
	No	Entry in 2	001		No Ent	ry in 2001 o	or 2002	
	(1)	(2)		(3)	(1)	(2)	(3)	
Year of Entry	0.041***	0.025***	0.007***		0.040***	0.025***	0.006***	
	(0.004)	(0.003)	(0.002)		(0.004)	(0.003)	(0.002)	
Log(# of Products)	0.130***	0.080***	0.082***		0.130***	0.080***	0.082***	
	(0.005)	(0.003)	(0.004)		(0.005)	(0.003)	(0.004)	
Destination-Year FE	Yes	Yes	Yes		Yes	Yes	Yes	
Firm-Year FE	Yes	Yes	Yes		Yes	Yes	Yes	
Product-Year FE	No	Yes	Yes		No	Yes	Yes	
Firm-Destination FE	No	No	Yes		No	No	Yes	
$R^2$	0.40	0.65	0.69		0.40	0.65	0.69	
# Obs.	2234349	2216676	2193139		2234349	2216676	2193139	

Table A.9: Probability of Being CAT and Entry - Different Entry Year

Results from OLS of equation (1). Robust std. error in parenthesis. Cluster: firm. \*\*\*: significant at 99%, \*\* at 95%, \* at 90%. Destination-Year and Firm-Year fixed effects in all columns. Product-Year fixed effects in columns (2) and (3). Firm-Destination fixed effects in column (3). In the first three columns, if the entry year is 2001 the firm-destination is not recorded as an entrant. In the last three columns, if the entry year is 2001 or 2002, the firm-destination is not recorded as an entrant.

Dependent Variable: Probability of Being CAT No Export in t-1No Export in t - 3 - t - 1No Export in t - 5 - t - 1(3)(3)(3)(1)(2)(1)(2)(1)(2)0.040\*\*\* 0.024\*\*\* 0.008\*\*\* 0.040\*\*\* 0.025\*\*\* 0.008\*\*\* 0.042\*\*\* 0.026\*\*\* 0.008\*\*\* Year of Entry (0.004)(0.001)(0.004)(0.002)(0.002)(0.004)(0.002)(0.002)(0.002) $0.132^{***}$ 0.081\*\*\*  $0.082^{***}$ 0.131\*\*\* 0.080\*\*\* 0.082\*\*\* 0.130\*\*\* 0.080\*\*\* 0.082\*\*\* Log(# of Products)(0.005)(0.003)(0.004)(0.005)(0.003)(0.004)(0.005)(0.003)(0.004)Destination-Year FE Yes Yes Yes Yes Yes Yes Yes Yes Yes Firm-Year FE Yes Yes Yes Yes Yes Yes Yes Yes Yes Product-Year FE No Yes Yes No Yes Yes No Yes Yes Firm-Destination FE No No No Yes No  $\operatorname{No}$ Yes No Yes  $\mathbb{R}^2$ 0.400.650.690.400.650.690.400.650.69

Table A.10: Probability of Being CAT and Entry - Different Entry Year

Results from OLS of equation (1). Robust std. error in parenthesis. Cluster: firm. \*\*\*: significant at 99%, \*\* at 95%, \* at 90%. Destination-Year and Firm-Year fixed effects in all columns. Product-Year fixed effects in columns (2) and (3). Firm-Destination fixed effects in column (3). (No Export in t-1): we define the entry year as the year t with positive firm-destination exports, conditional on no exports in t-3, t-2, and t-1. (No Export in t-5-t-1): we define the entry year as the year t with positive firm-destination exports, conditional on no exports in t-3, t-2, and t-1. (No Export in t-5-t-1): we define the entry year as the year t with positive firm-destination exports, conditional on no exports in t-5, t-4, t-3, t-2, and t-1.

2234349

2216676

2193139

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# Obs.

2234349

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	Dependen	t Variable:	Probability of Being CAT
	(1)	(2)	(3)
Year of Entry	0.052***	0.029***	0.010***
	(0.004)	(0.002)	(0.002)
Log(# of Products)	$0.170^{***}$	$0.095^{***}$	0.101***
	(0.006)	(0.003)	(0.004)
Destination-Year FE	Yes	Yes	Yes
Firm-Year FE	Yes	Yes	Yes
Product-Year FE	No	Yes	Yes
Firm-Destination FE	No	No	Yes
$R^2$	0.45	0.70	0.74
# Obs.	1424246	1405599	1381847

**Table A.11:** Probability of Being CAT and Entry - DropImported CAT

Results from OLS of equation (1). Robust std. error in parenthesis. Cluster: firm. \*\*\*: significant at 99%, \*\* at 95%, \* at 90%. Destination-Year and Firm-Year fixed effects in all columns, Product-Year fixed effects in the last two columns, and Firm-Destination fixed effects in the last column. We drop all imported CAT products, defined as CN eight-digit product codes which a firm reports as both imported and exported in the customs data, but that the firm does not report in the production data.

 Table A.12: Probability of Being CAT and Entry - Drop Foreign

 Owned Firms

	Dependen	t Variable:	Probability of Being CAT
	(1)	(2)	(3)
Year of Entry	0.040***	0.022***	0.006***
	(0.005)	(0.003)	(0.002)
Log(# of Products)	$0.134^{***}$	$0.074^{***}$	0.075***
	(0.006)	(0.003)	(0.003)
Destination-Year FE	Yes	Yes	Yes
Firm-Year FE	Yes	Yes	Yes
Product-Year FE	No	Yes	Yes
Firm-Destination FE	No	No	Yes
$R^2$	0.40	0.69	0.72
# Obs.	1503648	1487083	1467651

Results from OLS of equation (1). Robust std. error in parenthesis. Cluster: firm. \*\*\*: significant at 99%, \*\* at 95%, \* at 90%. Destination-Year and Firm-Year fixed effects in all columns, Product-Year fixed effects in the last two columns, and Firm-Destination fixed effects in the last column. We drop all firms that are foreign owned.

	Dependent Variable: Probability of Being CAT		
	(1)	(2)	(3)
Year of Entry	$0.042^{***}$	0.030***	0.008***
	(0.004)	(0.003)	(0.002)
Log(# of Products)	$0.149^{***}$	0.101***	$0.103^{***}$
	(0.005)	(0.004)	(0.004)
Destination-Year FE	Yes	Yes	Yes
Firm-Year FE	Yes	Yes	Yes
Product-Year FE	No	Yes	Yes
Firm-Destination FE	No	No	Yes
$R^2$	0.40	0.61	0.65
# Obs.	2035999	1993627	1970102

**Table A.13:** Probability of Being CAT and Entry - AggregatingProducts at the Six-digit Level

Results from OLS of equation (1). Robust std. error in parenthesis. Cluster: firm. \*\*\*: significant at 99%, \*\* at 95%, \* at 90%. Destination-Year and Firm-Year fixed effects in all columns, Product-Year fixed effects in the last two columns, and Firm-Destination fixed effects in the last column. A product is defined as a CN six-digit code.

 
 Table A.14: Probability of Being CAT and Entry - Correcting for Change in Product Classification

	Dependen	Probability of Being CAT	
	(1)	(2)	(3)
Year of Entry	0.043***	0.028***	0.009***
	(0.004)	(0.003)	(0.002)
Log(# of Products)	$0.155^{***}$	0.097***	$0.103^{***}$
	(0.006)	(0.004)	(0.004)
Destination-Year FE	Yes	Yes	Yes
Firm-Year FE	Yes	Yes	Yes
Product-Year FE	No	Yes	Yes
Firm-Destination FE	No	No	Yes
$R^2$	0.41	0.62	0.66
# Obs.	1976424	1964400	1940777

Results from OLS of equation (1). Robust std. error in parenthesis. Cluster: firm. \*\*\*: significant at 99%, \*\* at 95%, \* at 90%. Destination-Year and Firm-Year fixed effects in all columns, Product-Year fixed effects in the last two columns, and Firm-Destination fixed effects in the last column. Products are defined at the eight-digit code, and we apply the correction procedure described in Van Beveren et al. (2012).

	Dependent Variable: Probability of Being CAT		
	(1)	(2)	(3)
Second Year of Export	0.014***	0.009***	0.003
	(0.004)	(0.002)	(0.002)
Log(# of Products)	0.133***	0.081***	$0.084^{***}$
	(0.005)	(0.003)	(0.004)
Destination-Year FE	Yes	Yes	Yes
Firm-Year FE	Yes	Yes	Yes
Product-Year FE	No	Yes	Yes
Firm-Destination FE	No	No	Yes
$R^2$	0.40	0.65	0.68
# Obs.	2118924	2101165	2090166

Table A.15: Probability of Being CAT and Second Year of Exports

Results from OLS of equation (1). Robust std. error in parenthesis. Cluster: firm. \*\*\*: significant at 99%, \*\* at 95%, \* at 90%. Destination-Year and Firm-Year fixed effects in all columns, Product-Year fixed effects in the last two columns, and Firm-Destination fixed effects in the last column.

## A.5 Additional Figures





In the figure, we plot the share of firm-destinations that introduce their first own good in the year after entry, two years after entry, and so on. On the horizontal axis, we report the number of years after entry until the firm in a destination introduces its first own good. We also report the average and standard deviation of the number of years it takes to export the first own good by a firm in a destination. We restrict the sample to firm-destinations that enter only with CAT and that introduce at least an own good in the subsequent years.



#### Figure A.2: Number Of Transactions: DOG vs. CAT products

(a) Number of Monthly Transactions: DOG

(b) Number of Monthly Transactions: CAT

The figure shows the fraction of of firm-product-destination-year observations for which the number of monthly transactions within a year is equal to 1, 2, ... 12 months, for DOG and CAT products, respectively.

# **B** Theory Appendix

#### B.1 Sunk Decision for Both CAT and DOG

Consider an extension to the baseline model in which we maintain the assumption that there is a delay for a firm to enter the market with its own product while there is no delay in exporting another firm's goods. Moreover, we maintain the assumption that the firm makes positive profits selling its own good under perfect information. In this model extension, we assume that for a firm to engage in CAT, it must also make some sunk decisions based on the expected market conditions ( $\mathbb{E}[M]$ ) if these are unknown or on the actual market conditions ( $\tilde{M}$ ) if they are available. This scenario can be categorized into two distinct cases:

- 1. Case 1:  $\mathbb{E}[\pi_{CAT}(M, D^*(\mathbb{E}[M]))] > 0.$
- 2. Case 2:  $\mathbb{E}[\pi_{CAT}(M, D^*(\mathbb{E}[M]))] < 0.$

which we examine below.

**Case 1:**  $\mathbb{E}[\pi_{CAT}(M, D^*(\mathbb{E}[M]))] > 0$ . If the expected profits from CAT given the expected market conditions are positive, and there is no delay in exporting, the firm will always enter using CAT and enter with DOG the following year.

**Case 2:**  $\mathbb{E}[\pi_{CAT}(M, D^*(\mathbb{E}[M]))] < 0$ . If a firm chooses to enter the market using CAT, it earns  $\pi_{CAT}(\tilde{M}, D^*(\mathbb{E}[M]))$  in the first period while gaining knowledge about the market conditions. In the subsequent period, the firm enters with its own product (referred

to as DOG) and continues to engage in CAT, with updated sunk decision, if the profits from this activity is positive. The profits of the firm in the second period are equal to  $\pi_{CAT}(\tilde{M}, D^*(\tilde{M})) + \pi_{DOG}(\tilde{M}, D^*(\tilde{M}))$ , assuming that  $\pi_{CAT}(\tilde{M}, D^*(\tilde{M})) > 0$ . From the third period onward, the firm consistently earns the same profits as in the second period.

On the other hand, if the firm decides to enter the market with DOG, it makes zero profit in the first period. In the second period, it earns a profit of  $\pi_{DOG}(\tilde{M}, D^*(\mathbb{E}[M]))$  while learning the true market conditions. From the third period onwards, the firm's earnings are equal to  $\pi_{CAT}(\tilde{M}, D^*(\tilde{M})) + \pi_{DOG}(\tilde{M}, D^*(\tilde{M}))$ . Therefore, similar to the baseline model, the decision of whether to enter the market with CAT or DOG depends on the profits generated in the first two periods.

If a firm enters the market using CAT, it earns the following profits in the first two periods:

$$\pi_{EntCat} = \pi_{CAT}(\tilde{M}, D^*(\mathbb{E}[M])) + \pi_{CAT}(\tilde{M}, D^*(\tilde{M})) + \pi_{DOG}(\tilde{M}, D^*(\tilde{M}))$$
(B.1)

If a firm enters the market with DOG, it earns the following profits in the first two periods:

$$\pi_{EntDog} = \pi_{DOG}(\tilde{M}, D^*(\mathbb{E}[M])) \tag{B.2}$$

Let  $\Delta \pi = \pi_{EntCat} - \pi_{EntDog}$  represent the difference between profits in equations (B.1) and (B.2). The firm will enter the market with CAT first if the expected difference in profits is positive. Specifically,

$$\mathbb{E}[\Delta \pi] = \mathbb{E}[\pi_{EntCat}] - \mathbb{E}[\pi_{EntDog}] > 0$$
$$\mathbb{E}[\pi_{DOG}(M, D^*(M))] - \mathbb{E}[\pi_{DOG}(M, D^*(\mathbb{E}[M]))] > -\mathbb{E}[\pi_{CAT}(M, D^*(\mathbb{E}[M]))] - \mathbb{E}[\pi_{CAT}(M, D^*(M))]$$

which is a condition similar to our baseline model: a firm enters with CAT first, if the expected gain from knowing the market conditions for DOG is larger than the expected losses from entering with CAT. In this case, the expected losses from CAT include two terms: the expected CAT losses when the firm does not know the market conditions and the expected (negative) CAT losses under perfect information.

#### B.2 Delayed Entry for both CAT and DOG

Consider now an extension to the baseline model in which to export both DOG and CAT requires a delay, in addition to a sunk decision. In this scenario, if a firm wishes to enter a new market, it will make sunk decisions and earn no profits in the first period. In the second period, the firm will generate profits from either the DOG or CAT product or both,

depending on the sunk decision based on the expected market conditions. By the third period, the firm will earn profits from either DOG or CAT products or both, with a sunk decision based on the actual market conditions. This implies that the profits from the third period onward are not influenced by the firm's initial market entry method. Consequently, the distinction between strategies hinges on the profits during the second period, which will be the focus of our analysis.

The firm has now three options: 1) enter with CAT, 2) enter with DOG, and 3) enter with both CAT and DOG. The profits in period 2 in the three options equal:

$$\pi_{EntCat} = \pi_{CAT}(\tilde{M}, D^*(\mathbb{E}[M])) \tag{B.3}$$

$$\pi_{EntDog} = \pi_{DOG}(\tilde{M}, D^*(\mathbb{E}[M])) \tag{B.4}$$

$$\pi_{EntBoth} = \pi_{CAT}(\tilde{M}, D^*(\mathbb{E}[M])) + \pi_{DOG}(\tilde{M}, D^*(\mathbb{E}[M]))$$
(B.5)

If the expected profits from any good given the expected market conditions are positive, the firm will introduce such a good. Trivially,

Enter with CAT if 
$$\mathbb{E}[\pi_{CAT}(M, D^*(\mathbb{E}[M]))] > 0$$
 and  $\mathbb{E}[\pi_{DOG}(M, D^*(\mathbb{E}[M]))] < 0$   
Enter with DOG if  $\mathbb{E}[\pi_{CAT}(M, D^*(\mathbb{E}[M]))] < 0$  and  $\mathbb{E}[\pi_{DOG}(M, D^*(\mathbb{E}[M]))] > 0$   
Enter with both if  $\mathbb{E}[\pi_{CAT}(M, D^*(\mathbb{E}[M]))] > 0$  and  $\mathbb{E}[\pi_{DOG}(M, D^*(\mathbb{E}[M]))] > 0$ 

A more interesting case occurs if both  $\mathbb{E}[\pi_{CAT}(M, D^*(\mathbb{E}[M]))] < 0$  and  $\mathbb{E}[\pi_{DOG}(M, D^*(\mathbb{E}[M]))] < 0$ , but  $\mathbb{E}[\pi_{DOG}(M, D^*(M))] > 0$ , namely the firm expects negative profits when entering without knowledge of market conditions, but positive profits for the own good when entering with full information. Here, if a firm decides to enter the market, it enters with CAT if the following condition holds:

$$\mathbb{E}[\pi_{CAT}(M, D^*(\mathbb{E}[M]))] > \mathbb{E}[\pi_{DOG}(M, D^*(\mathbb{E}[M]))]$$

The condition implies that the firm enters with CAT the losses from using CAT as a market screening device are smaller than using DOG.