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Export competition with China and firms' coping strategies

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Abstract

This paper analyses how intensified Chinese competition in export markets affects firms' coping strategies. Using a novel identification approach that exploits changes in China's product-specific export policies across industries, we find that Chinese export competition reduces the aggregate value of product- and destination-specific exports of Finland, primarily by putting a downward pressure on export prices. The firm-level analysis using Finnish administrative data shows that firms undertake larger price cuts for homogeneous products than for differentiated export products. We analyse further export firms' coping strategies on product range margin, and find that firms drop their marginal products as the Chinese export competition intensifies. Our results highlight the increasing importance of competition with China for exporters from developed countries.

1 | INTRODUCTION

The deep integration of China in the global economy is one of the central forces shaping the structure of the international market in the last 25 years. China's global economic expansion led to substantial concerns that domestically manufactured products were displaced by Chinese imports in local markets. The competition with China in export markets has received less attention, and worried primarily middle-income or developing countries specializing in the production of labour-intensive goods. However, over the past two decades, China has climbed higher on the value chain ladder and emerged as a major competitor of developed countries in many technology-intensive industries where their production of more advanced products risks being out-competed. Regardless of the extensive literature on the impacts of increased Chinese competition in general, our understanding of the consequences of the Chinese export competition for developed economies is still limited.

This paper aims to fill this gap by analysing how the intensified Chinese competition in export markets affects both aggregate and firm-level product–destination-specific exports, and the ranges of export products of firms. We unveil the mechanism by which increased competition

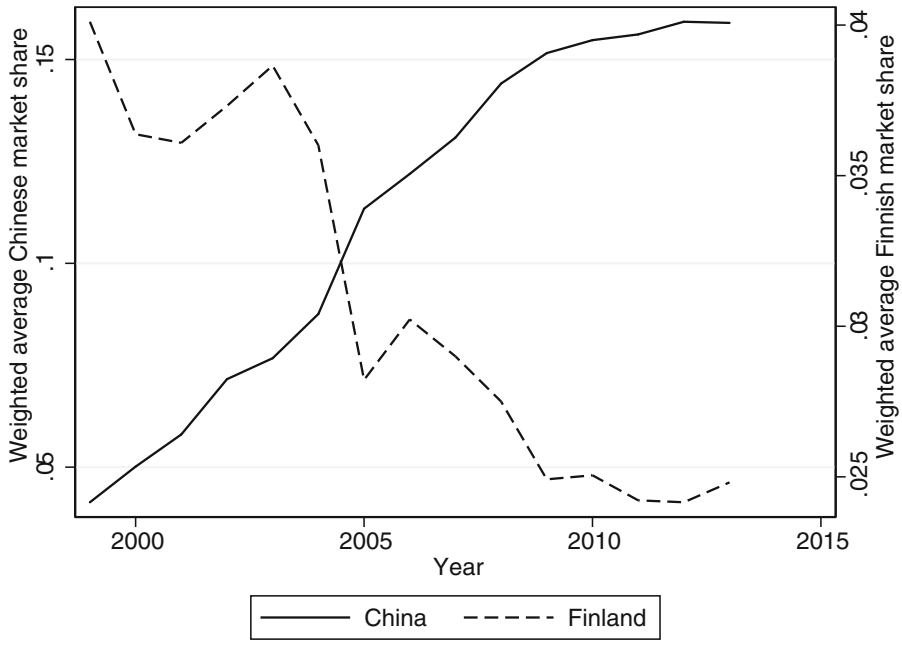

FIGURE 1 Finnish and Chinese shares of world exports for important Finnish export products. *Notes*: This figure is drawn based on UN Comtrade data. The weighted market shares are calculated using the ten most important two-digit (HS2002) export products for Finland in 1999, with weights based on their export values in 1999. These products include 39 Plastics and articles thereof, 44 Wood and articles of wood, 47 Pulp of wood or of other fibrous cellulosic material, 48 Paper and paperboard, 72 Iron and steel, 73 Articles of iron or steel, 84 Machinery and mechanical appliances, 85 Electrical machinery and equipment and parts thereof, 87 Vehicles other than railway and 90 Optical, photographic, cinematographic, measuring, checking, precision, medical or surgical instruments and apparatus. The sample is restricted to countries that imported from Finland in 1999, and to country–product markets that Finland ever exported to in the entire study period (1999–2012).

impacts export values by distinguishing between the effects on export prices and quantities. Furthermore, the firm-level analysis uncovers important firm adjustment strategies in response to increased Chinese export competition that could be masked in the aggregate-level analysis. For the purpose, we use firm–product–destination-specific export data from Finland, an example of a developed economy that is highly dependent on exports: exports constitute a substantial 40% of the Finnish gross domestic product (GDP), a feature common in many other European countries.[1] However, during the period from 1999 to 2012, the annual growth of total Finnish goods exports shifted from strongly positive to negative. Furthermore, as shown in Figure 1, while Finland lost global export shares for its ten most important export product groups, China tripled its export shares for the same product groups during the period.[2] The observed negative relationship suggests that China's exports expanded in the product markets of Finnish exporters, and as a consequence, the export bundles of Finland and China became increasingly similar. The same development of an increasing correlation with the Chinese export bundle[3] could be observed in several other European countries.[4]

This paper also contributes to the literature methodologically, as we propose a novel identification strategy that exploits Chinese export policy changes to address the long-standing empirical challenge in analysing the causal impact of Chinese competition. In particular, we explore changes in product-specific Chinese export quota and licensing restrictions, and the abolition of the restriction on export rights. These two policy instruments, together with the distance between China and its exporting partners, create exogenous variations in Chinese export competition at the destination–product–year level across a broad range of industries. This

approach enables us to open the black box of the increase in Chinese exports, and to address the endogeneity issue more generally.

In the era of economic reforms, China experienced a dramatic increase in production capacity and underwent substantial trade liberalization, which culminated in the accession to the World Trade Organization (WTO) in 2001 (see, for example, Naughton 2006; Hsieh and Klenow 2009; Brandt *et al.* 2012; Handley and Limao 2010). Although these exogenous factors are believed to drive the rapid increase in Chinese exports, the share of Chinese imports of total imports, the common measure for Chinese competition in the literature, could be the outcome of many other confounding factors. For instance, there may exist unobservable demand shocks in the destination markets that affect the growth of Chinese exports, and when not controlled for, these shocks can bias the ordinary least squares (OLS) estimation results. Moreover, supply-side factors, such as offshoring activities and unfavourable technology shocks in Finland, can potentially reduce Finnish exports and increase Chinese exports simultaneously, creating a spurious negative effect.

Using an instrumental approach based on product-specific Chinese export restrictions across industries, we provide a new set of tools to address the endogeneity problem in assessing the impact of the Chinese trade shock. Previously, Autor *et al.* (2013) used Chinese exports to other developed countries as an instrument for Chinese exports to the USA to tease out US industry import demand shocks (i.e. an export supply instrument). Similar strategies have been adopted widely in the literature to assess the impact of Chinese import/export penetration (Iacovone *et al.* 2013; Autor *et al.* 2014; Balsvik *et al.* 2015; Acemoglu *et al.* 2016; Feenstra *et al.* 2017). However, as Autor *et al.* (2013) admit, there are several threats to this strategy, such as common demand or technology shocks in high-income countries. Utar (2014) and Bloom *et al.* (2016) adopt a more direct approach to address the endogeneity issue. In particular, they use the abolition of quotas under the Agreement on Clothing and Textiles (formerly the Multi-Fibre Arrangement, MFA) to analyse the effect of import competition on firm and worker outcomes. A limitation of the previously used MFA approach is its inability to capture changes in industries other than textiles.

We first analyse how the increased Chinese export competition impacted aggregate Finnish product–destination-level exports from 1999 to 2012. We find that a 1 percentage point increase in the Chinese export market share reduces the Finnish export value by 5.81%. We further discover that the downward pressure that Chinese export competition puts on Finnish export prices is an important mechanism for shrinking Finnish exports. In contrast, Chinese export competition *increases* Finnish export quantity, which partially offsets the effect of falling prices on the export value. These results suggest that Finnish firms may have strategically reduced prices to expand their sales volumes and to maximize their profits (or to minimize losses). Besides the price and quantity decomposition, we also decompose the overall impact on Finnish export value into changes in the average export value per firm and the number of exporting firms, and find that the former type of adjustment dominates.

The crowding-out effect of Chinese competition on Finnish exports is, although larger, consistent with the findings of Flückiger and Ludwig (2015), who use bilateral product-level trade data for 22 European countries for the 1995–2008 period to assess the competition effect of China on exports of developed countries. They find that an increase of 1 percentage point in Chinese export competition leads to a decline in the home country's export volume of between 0.30% and 0.55%. However, the use of Chinese export market share as a measure of Chinese export competition is prone to identification threats. For example, a demand shock towards or against Chinese goods in destination markets would bias the results. Moreover, the aggregate data used in their study do not allow for a deeper analysis of firms' adjustment strategies to changes in their export markets.

Next, we analyse firms' intensive margin adjustments in the exports of products that firms continue exporting to a particular destination market. According to our findings, the firms' surviving strategy is to lower selling prices to expand the sales volume as a response to the increased

Chinese export competition. As a result, the net effect on the export value is small and statistically insignificant for the pooled sample of exported products of Finnish firms.[5] We also distinguish the effects of the Chinese export competition by product types, and divide the sample into two groups: homogeneous or reference-priced products, and heterogeneous or differentiated products according to the classification of Rauch (1999), which is based on differences in price-setting strategies. We find that firms selling homogeneous or reference-priced products deviate from the pattern for the pooled sample. For them, both export prices and quantities are impacted negatively by Chinese competition, leading to a dramatic 10.44% decline in export values. For heterogeneous or differentiated products, the overall effect on export values is small and statistically insignificant. In sum, our results provide evidence that firms exporting homogeneous or reference-priced products are more affected by the increasing Chinese export competition.

In addition to these intensive margin adjustments, we examine how Finnish firms adjust their export sales strategies at the extensive margin. According to our estimates, firms do not seem to drop products in markets that experience larger increases in Chinese export market shares in general. However, taking into account the relative importance of a product in the export product portfolio of a firm distinguishes the effect of Chinese competition at the extensive margin adjustment. The estimations indicate that products representing a larger share of the firm's global export sales in the initial period are less likely to be dropped. The result is consistent with the theoretical prediction that as a response to increased competition, firms skew their exports towards core products by dropping their marginal products. Thus our firm-level extensive margin analysis suggests that the decisions to drop products from particular export markets completely, and the resulting changes in the export product range, are also important adjustment behaviours for firms facing increased Chinese export competition.

In sum, this paper makes the following key contributions.

First, it contributes methodologically to the large literature on consequences of increased Chinese competition. We propose a new set of instruments based on Chinese export policy changes to generate exogenous variation in the level of competition with China in the international market.

Second, this paper also highlights the importance of export competition with China for developed countries. In the early phases of integration to the world markets, China's competitors were other developing countries exporting commodities from labour-intensive industries. The first empirical studies on export competition thus focused on the crowding-out effect of Chinese exports for Asian countries (Eichengreen *et al.* 2007; Xing 2011) or on the substitution effect of Chinese products for Latin American imports in the US market (Moreira 2007; López-Córdova *et al.* 2008; Montenegro *et al.* 2010; Jenkins 2010). In a multiple-country study including the ten developing and middle-income economies for which manufacturing represents more than 75% of the merchandise exports, Hanson and Robertson (2010) estimate that if China's export supply capacity had remained constant over the 1995–2005 period, then the demand for the exports of the countries would have been 0.8–1.6% higher.[6] More recently, the literature has shifted focus from developing to developed countries, which reflects the fact that technological advancement over the past two decades has helped China to catch up with developed countries and become their competitor in advanced technology-intensive industries. For instance, Benkovskis *et al.* (2013), Flückiger and Ludwig (2015), Giovannetti *et al.* (2012), Módolo and Hiratuka (2017), Silgoner *et al.* (2015) and Stanojevic *et al.* (2020) study crowding-out effects for European countries by using country-specific trade flows at the aggregate or product level. By analysing the within-firm adjustment at the intensive and extensive margins of response to Chinese export competition, we reach beyond the previous studies using aggregate data. Our findings confirm that competition with China in the export market is not limited to developing countries. Recognizing the importance of export competition with China for developed countries is crucial for effective policy-making in response to China's integration in the global market, especially for countries as highly dependent on exports as Finland.

Third, by extending the analysis to the extensive margin of adjustment at the product–firm level, the paper also contributes to the fast-growing literature on the product choices of multi-product firms under globalization. To the best of our knowledge, this paper is the first to causally test the impact of increased export competition on firms' export product choices in a cross-market setting. Most other empirical works have focused on product choices under trade liberalization, affecting firms' product scope via both a competition effect and a demand effect (Iacovone and Javorcik 2010; Goldberg *et al.* 2010; Bernard *et al.* 2011). The only exception is Iacovone *et al.* (2013), who studied the effect of Chinese competition in Mexican firms' main export market, the USA, and showed that Mexican firms were less likely to drop their core products with the increased competition. In contrast to the studies focusing on a single export destination, we examine Finnish firms' product choices in all their export markets, and directly test and confirm the cross-market theoretical prediction of Mayer *et al.* (2014) that firms drop their marginal products in markets with tougher competition.

The rest of this paper is organized as follows. In Section 2, we present our identification strategy. In Section 3, we describe the data and present descriptives. In Section 4, we validate our identification strategy. In Section 5, we present the estimation model and the results for the aggregate product–destination-level exports of Finland, and in Section 6, the estimation model and the results for the firm-level intensive and extensive margin analysis. Section 7 concludes.

2 | EMPIRICAL CHALLENGES AND IDENTIFICATION STRATEGY

In this section, we first outline challenges in causal identification of the impact of changes in Chinese export competition on the exports of other countries. We then move on to describe our instruments derived from China's export policies.

Previous studies identify a mix of demand- and supply-side factors explaining Chinese export growth since the early 2000s. For instance, Handley and Limao (2010) emphasize the role of China's WTO accession in boosting export growth by reducing policy uncertainty, and particularly the risk of a trade war with the USA; Brandt and Lim (2024) find that rising foreign demand, improvements in access to imported intermediates, and factor productivity growth within China were the three key drivers of Chinese export growth overall; and Huang *et al.* (2024) demonstrate that changes in factor endowments, technology and trade costs jointly accounted for the underlying evolution of China's production and exports; some, but not all, of these demand and supply factors are exogenous to Finnish exports.

In estimating the impact of Chinese competition on the exports of other countries, several confounding factors may bias the conventional OLS estimates. For instance, there may exist unobservable demand shocks in the destination markets that affect the growth of Chinese exports, and when not controlled for, these shocks can bias the OLS estimation results. In particular, unobservable demand shocks in export destination markets could potentially affect Chinese exports. There are at least three different types of demand shocks. First, common demand shocks may exist in a particular export market, affecting all trading partners' exports to this country. Fluctuations in economic conditions, for example, can lead to this type of common demand shock. Second, in a particular export market, there may also be unobserved demand shocks that are country-specific (for its trade partners). For instance, consumers in a destination market may consider that goods in China are produced in an environmentally unfriendly manners, and therefore switch to products from other countries, including Finland. Third, demand shocks could also be correlated across destination countries, such as within customs unions (countries share common trade policies), and for countries with similar social and cultural backgrounds (consumers have similar preferences). The first two demand shocks are often identification

challenges for import competition studies, but the third type of demand shock is unique in this study of export competition.

In addition to demand shocks, supply-side changes, such as offshoring activities or technology shocks, act as additional confounding factors in identification and interpretation of the OLS estimates. If foreign firms relocated their production and assembly lines in China in search of lower costs, then China would export the final products to the destination markets, instead of back to the foreign country. In this case, we would observe a decline in the exports of the foreign country—Finland in our case—and an increase in Chinese exports simultaneously. This negative association, however, cannot be interpreted as the impact of Chinese export competition on the exports of the foreign country. Similarly, technology shocks that adversely affect foreign firms would make them vulnerable to Chinese export competition. In this case, weakened foreign exports drive Chinese export expansion in competing industries, rather than vice versa.

To tackle the identification challenges outlined above, and to address the endogeneity problem in assessing the impact of the Chinese trade shock, we construct instruments for Chinese export competition by exploring Chinese export policies, and their changes that generate exogenous variations in China's product-specific export supply. Our strategy is similar to the more direct approach adopted by Utar (2014) and Bloom *et al.* (2016), who use the abolition of quotas under the Agreement on Clothing and Textiles (formerly the MFA) to analyse the effect of import competition on firm and worker outcomes. However, in contrast to the MFA approach, which captures policy changes only in textile industries and was imposed by the USA and the European Union (EU) to restrict imports from developing countries in an effort to protect their domestic textile industries, we exploit changes in the Chinese export policies introduced by China across a broad range of industries.

In particular, our approach is based on (i) the 'active' quota and licensing system that China uses to control the exports of certain products for national interest as part of the country's industrial policy, and (ii) the relaxation of restrictions on export rights in China. These (country-neutral) policy changes, combined with the distance between China and its trading partners, create exogenous variation in Chinese export competition at the product–country–year level. As our identification relies on changes in China-specific supply-side factors that are unlikely to be correlated with Finnish exports, we are able to tease out the effect of all three types of demand shocks, as well as the endogenous Chinese supply changes outlined above, and provide causal inferences regarding the impact of Chinese export competition on Finnish firms.[7] Next, we describe the measure of each of the three exogenous Chinese export supply factors listed above, provide relevant policy backgrounds, and present the construction of instruments used in the main analysis based on these factors.

2.1 | Export factor 1: China's export quota and licensing system

In addition to the often-examined 'passive' MFA quotas,[8] Chinese exports of certain products have been restricted by an 'active' quota and licensing system. The system was formally established in 1992 in line with the Provisional Measures on the Administration of Export Products, promulgated by the Ministry of Foreign Trade and Economic Cooperation. Based on the Provisions on the Export License Administration enacted by the Ministry of Foreign Trade and Economic Cooperation of the People's Republic of China in 2001, this 'active' export restriction is imposed in one of the following situations: for national security and public interest; for commodities in domestic shortage or preservation of non-renewable resources; and/or for certain agricultural products.[9] All products under the quota and licensing system are subject to export licensing requirements, and around half of these products are also subject to specific export quantity restrictions.[10] According to Kim (2010), the size of the quota, if imposed, depends on

'national security, availability of domestic resources for downstream processing, development plans for certain domestic industries, and international and domestic demand'.

Each year, the Ministry of Commerce and the General Administration of Customs announce a list of products subject to the export quota and licensing requirements at the HS eight-digit level. Initially, the list covered a large number of products, accounting for 48% of the total Chinese export value (WTO 2001). Although the list has been shortened over time, it still covers a large variety of products during the sample period, including certain animals and animal products, vegetables, minerals, chemicals, wood products, textiles, stones, metals, machinery and transportation. This coverage is much broader than the MFA quotas, which apply only to the textile industry, and allows us to examine the impact of Chinese trade shocks more generally. In addition, unlike the MFA quotas that are established by a few countries to which China exports, the products subject to the quota and licensing restrictions are set by the Chinese government, and these restrictions usually apply to all exporting countries.[11] Therefore, as we will demonstrate in Section 4, the initial inclusion and subsequent changes in the quota list are exogenous to Finnish exports, a feature that allows for potential causal analysis.

We construct a panel for quota and licensing requirement data in the period 1999–2012 according to these official lists. To be consistent with cross-country trade data reported by UN Comtrade, we aggregate the quota and licensing panel into the HS six-digit level. In particular, we create a dummy variables at the HS six-digit level that equals 1 if any of the subordinate eight-digit products are subject to a quota, and 0 otherwise. Alternatively, we could use an 'intensity' measure of export restrictions, calculated as the fraction of HS eight-digit products that are subject to the quota and licensing system within each HS six-digit category.[12] As shown in Table B.1 of Online Appendix B, this intensity measure has almost identical explanatory power for Chinese exports compared with the binary measure. Therefore, we base the following analysis solely on the binary measure.

Joining the WTO did not affect the export quota and licensing system. Although the number of products under the active quota and licensing system varies slightly across years, there is no obvious decline in the export control. In the data, the number of HS six-digit products subject to the quota and licensing requirements was 246 and 242 for years 1999 and 2012, respectively. Although certain products always stay on the list, the overall product combination often changes across years. Figure B.1 of Online Appendix B plots the number of products for each industry in 1999 and 2012. The list of HS six-digit products that are subject to the active quota and licensing system spans various industries, and the coverage changes over time. During the 14-year period for which we have data, 483 products are subject to this export restriction for at least one year. Among these products, 79 (or 16%) are on the list for the entire period, 108 (or 22%) for 7–13 years, 181 (or 37%) for 2–6 years, and 115 (or 23%) for only one year.

2.2 | Export factor 2: changes in China's export rights

China's trade was fully controlled by the central government via import and export planning until the late 1970s. According to Lardy (2005), the import plan covered more than 90% of all Chinese imports at that time, and the export plan explicitly specified export quantities for more than 3000 individual products. These plans were fulfilled by a limited number of foreign trade corporations owned and controlled by the Ministry of Foreign Trade. Each foreign trade corporation had exclusive rights for products it was responsible for trading.[13]

The economic reform in 1979 shifted the trade administration rights from the central government to provincial governments. Although state-owned foreign trade corporations had become decentralized, the central government maintained its power in regulating trade composition and

flows by issuing firms foreign trade export licences and subsidizing their activities via its agency, the Ministry of Foreign Economics Relations and Trade (Zeng 2007). The Foreign Trade Law enacted in 1994 formalized the procedure and requirements for obtaining a trade rights licence.[14] Firms without foreign trade licences can engage in foreign trade only by hiring licensed firms as agents. Unlike the quota and licensing system discussed above, trade rights licences are not product-specific.

We construct a measure of export right restriction according to the amendment of the Foreign Trade Law in accordance with China's accession to the WTO. Effective on 1 July 2004, the new Foreign Trade Law replaced the trade rights licence system, and its associated administrative approval requirement, with a new automatic licensing system. Under the new system, firms interested in engaging in foreign trade activities then only needed to register with the Administration of Industry and Commerce and the Ministry of Commerce, or their authorized agencies. The registration served only for recording purposes, and no longer required administrative approval. Based on this export rights reform, we construct an export rights restriction variable, $RightRes_t$, that equals 1 for the years before 2004, and 0 for the years after.[15] As the new Foreign Trade Law became effective on 1 July 2004, we assign a value 0.5 for this variable in 2004. After the liberalization of exporting rights, we would expect a larger increase in exports for products that are not subject to the export quota and licensing restrictions.

2.3 | Export factor 3: distance between China and its export destinations

According to the gravity model, trade flows between two countries negatively correlate to their distance as a result of the increasing transportation costs. Assuming that the total trade costs are the sum of fixed policy costs due to trade restrictions and transportation costs that increase with the distance between trading partners, removing fixed policy costs would lead to a *larger percentage reduction* in total trade costs for countries closer to each other, that is, with lower transportation costs. Therefore the changes in the Chinese (country-neutral) export policies discussed above are expected to have a larger impact on exports to nearby countries than on exports to countries farther away. We capture this variation by interacting the trade policy variables with the distance between China and the export destination.[16]

3 | DATA AND DESCRIPTIVES

We use trade data from two main sources. The aggregate-level part of the analysis uses cross-country trade flow data from 1999 to 2012 obtained from the UN Comtrade database. As the Comtrade data record only positive trade flows, the constructed panel does not include products that a country did not import from the world in a given year by construction. The firm-level part of the analysis uses export data obtained from Finnish Customs that are available as annual transactions at the level of the eight-digit Combined Nomenclature (CN8) by country of destination for the 1999–2012 period.[17] The number of employees and the industry code variables that we use in the firm-level analysis come from a register-based firm-level financial statement panel provided by Statistics Finland. Finally, the distance variable, defined as the great circle distance between the most populated cities, is obtained from the gravity database of the CEPII. Definitions and data sources of all the variables are listed in Appendix Table A1, and descriptive statistics of the regression panel data are reported in Appendix Table A2.

Our sample of destination countries is restricted by the availability of firm-level data as follows. Stemming from the compulsory registration in the Finnish Customs, data on exports to countries outside the EU are collected for all trade transactions.[18] However, the Finnish Customs

provides firm- and product-level (HS8) export data for all destination countries separately from 2003 onwards. Before 2003, data for exports are available for all the main export destinations of Finland—which include all European countries, Canada, the USA, Mexico, Turkey, Japan, South Korea, Australia, New Zealand, Brazil, India, China, Taiwan, Hong Kong, Indonesia and Singapore—and data for exports to the rest of the destinations outside Europe are available as sums: other Americas, other Asia, Africa, other Oceania, and other possible countries. Due to this data limitation, we restrict our sample to the destinations for which data are available in 1999 and all the products that Finland ever exported to these countries during the entire period 1999–2012. This leaves us with a sample of exports that is consistent over time, but excludes exports to markets that are less important or new to the Finnish exporters. We apply the same sample restriction in both aggregate-level and firm-level analysis.[19] For firm-level analysis, we also restrict the sample to manufacturing firms with at least 20 employees in the first year in the data, which is 1999 for most firms.[20]

According to the descriptive statistics shown in panel A of Appendix Table A2, Finland exports to 47% of all relevant product–country markets in a given year. China is an active player in these export markets. It exports to 79% of these product–country markets. The average (unconditional) market share of Chinese exports, calculated as the Chinese export value as the share of the global export value to a market, is 10.2%. Conditional on exporting, the average market share of Chinese exports reaches 14.2%. Many products exported by Finland are subject to export restrictions imposed by China. For instance, among all products that Finland exported in 2012, 8% were ever subject to the Chinese export quota and licensing requirement in the sample period. These products represented a significant 21% of Finnish total export value in 2012.

The fact that Finland exports to only 47% of the product–country markets per year on average could be explained by the granularity of trade flows, and the fact that the number of firms that sell a given product in a given destination is small (the median is one firm, and in the 90th percentile, there are 4–5 sellers). The feature that only a very small number of firms export a given product to a given market gives more weight to our within-firm analysis. It also explains why the sample size of the firm-level analysis is not much larger than that of the aggregate binary product-level analysis. A similar characteristic of exports (and imports) has been documented by Hummels *et al.* (2014) for Denmark.

Previous studies using both aggregate bilateral country–product-level and firm–product-level trade data suggest that the granularity of trade is universal and that trade flows are in general very short-lived, often with a median duration of exports of merely one year.[21] In other words, the typical scenario for firms that begin to export is to exit the market within the first year. Gullstrand and Persson (2015) analyse the firm's decision to continue to export or to exit the market for a given product in a given market, and find that firms will tend to stay longer in their core markets, while export decisions regarding peripheral markets are much less long term.[22] Thus the observed durations reflect different kinds of decisions, and survival rates depend on the core–periphery dimension. Even if a firm decides to exit one market, it might continue to export the same product to other markets, or to export other products to the same or other markets. Furthermore, in the case of capital goods, it is plausible that a short-lived export is reflecting a larger one-off transaction to a specific customer in a country where the firm has no other customers.

Appendix Figure A2 plots the frequency of Finnish firm-level export flows by their durations for three different levels of aggregation: firm–product–country, firm–product and firm–country. Note that most firm-level export flows last for only one year, even when aggregated at the product level across countries or at the country level across products. Export flows that last five years or longer are rare. The granularity of the export flows has implications for the design of our extensive margin analysis, which we discuss further in Subsection 6.

4 | VALIDATION OF THE IDENTIFICATION STRATEGY

Before proceeding to the main empirical analysis, we perform three empirical exercises to validate the instrumental variables presented in Section 2. First, we focus only on the export policy variables, and estimate the effect of the quota and licensing system and the trade rights reform on the Chinese global export supply.

As shown in panel (a) of Table B.1 in Online Appendix B, both variables have a negative and statistically significant impact on the logarithm of the total Chinese export value (column (1)). The positive coefficient of the interaction term suggests that the effect of the quota and licensing system became more restrictive after the liberalization of export rights in 2004. The variables have sufficient explanatory power in the estimations for the two alternative measures of the Chinese export supply, the logarithm of the Chinese export value to OECD countries (column (2)), and the share of Chinese exports in the total global export value to OECD countries (column (3)). Together, the trade policy variables explain approximately 37% of the variation in the Chinese product-level exports.

Next, to ensure that the inclusion of products in the quota and licensing list is not influenced by Finnish exports, we examine whether being subject to the quota and licensing requirement in a given year can be explained by Finnish exports in the previous year. We find no supporting evidence for this hypothetical effect in a regression of product–year-level binary measure described above on the logarithm of lagged Finnish export value, controlling for lagged quota and licensing status, product fixed effects and year fixed effects.[23] This result demonstrates that Finnish exports do not contribute to changes in product-specific export quota and licensing requirement over time, supporting the exogeneity of the instrument.

As a final test, to demonstrate the ability of the trade policy variables together with the distance between China and the export destination in explaining Chinese export supply at the product–country–year level, we first define our Chinese export competition measure as the share of export value of HS six-digit product k from China to country j in year t (CEV_{jkt}) as a share of the total global export value to this country (WEV_{jkt}):

$$CES_{jkt} = \frac{CEV_{jkt}}{WEV_{jkt}}. \tag{1}$$

We model CES_{jkt} as

$$\begin{aligned} CES_{jkt} = {} & \beta_0 + \beta_1\ Quota_{kt} + \beta_2\ Quota_{kt} \times RightsRes_t + \beta_3\ Quota_{kt} \times Dist_j \\ & + \beta_4\ Quota_{kt} \times RightsRes_t \times Dist_j + \theta_{jt} + \gamma_k + \varepsilon_{jkt}, \end{aligned} \tag{2}$$

where $Quota_{kt}$ is a binary variable that equals 1 if product k was subject to the Chinese quota and licensing restrictions in year t, and 0 otherwise; $RightsRes_t$ equals 1 if the export was subject to manual export licence approval in year t (1999–2003), 0.5 in year 2004, and 0 for years from 2005 onwards; $Dist_j$ is the great circle distance between country j and China; and θ_{jt} and γ_k represent country–year fixed effects and product fixed effects, respectively. Although in total we are able to construct seven potential regressors using the three export factors and their interactions, we exclude $RightsRes_t$, $Dist_j$ and $RightsRes_t \times Dist_j$ from the regression because they are collinear with the fixed effects. We cluster the standard errors at the product level. In the estimation of equation (2), we focus on potential Chinese export markets by restricting the estimation sample to countries that imported from China in 1999, the base year of the study, and to product–country markets that China ever exported to during the entire sample period (1999–2012).

As shown in panel A of Appendix Table A3, the explanatory variables in equation (2) have a strong predictive power for product–country–year level of Chinese export share, a potential measure for the level of Chinese export competition in these markets. These variables are highly

significant at the 0.05 or 0.01 level, except for the term $Quota_{kt} \times Dist_j$ (p-value 0.106).[24] This result suggests that the quota and licensing system and the trade rights reform, interacted with the distance between China and the export destination, can be used as instruments to generate exogenous within-product variation in Chinese export competition across different destination countries.

5 | AGGREGATE-LEVEL EXPORT ADJUSTMENTS

We begin by analysing the impact of Chinese export competition on the aggregate product–destination-specific exports of Finland. We focus on the impact of Chinese export competition on two types of exporting behaviour (i.e. $FinExport_{jkt}$): (i) the likelihood of export, measured by a dummy that equals 1 if Finland exports product k to country j in year t, and 0 otherwise; and (ii) the log value of the export volume conditional on exporting.

To further investigate how the competition impact is realized, we also estimate the impact of Chinese export competition on Finnish export prices and quantities separately. In the short term, while we expect that Chinese export competition reduces export prices, the direction of its impact on export quantities is ambiguous, depending on factors such as the elasticity of demand and brand loyalty. On one hand, if the Chinese exporters compete with lower prices, then it would lead to losses in market shares and sales volumes for Finnish firms when demand shifts to cheaper Chinese products. These negative effects on export quantities would be mitigated for the Finnish products and brands that have loyal customers. This could refer to a situation where consumers face a search cost in order to learn the price of a new seller or product, and they will tend to favour the one that they have bought before. On the other hand, if Finnish firms react to the tougher competition by lowering their prices, then they might be able to retain their sales volumes and markets shares.[25] Therefore the net effect on export quantities is uncertain, and could be positive for products with high price elasticity of demand.

In addition to these short-run changes in prices and quantities, Chinese competition could trigger quality upgrading of export products, leading to price increases in the medium to long run.[26] As we focus on the short-run effect of Chinese competition on Finnish exports, we do not expect to observe price or quantity changes associated with quality upgrading in our analysis.

5.1 | Aggregate product–destination exports: estimation model

We measure of the level of the Chinese export competition by the relative measure defined in equation (1). This relative measure of Chinese export competition neutralizes common demand shocks in country j (type 2 demand shock).[27]

We model the Finnish exporting behaviour to country j of product k in year t as

$$FinExport_{jkt} = \beta_0 + \beta_1 \, CES_{jkt} + \theta_{jt} + \gamma_k + \varepsilon_{jkt}, \tag{3}$$

where CES_{jkt} is defined as in equation (1), and θ_{jt} and γ_k represent country–year fixed effects and product fixed effects, respectively. We cluster the standard errors at the product level to allow for within-product correlation of exports across years. If export competition between China and Finland exists in common export product–destination markets, then we would expect that increases in Chinese export competition crowd out Finnish exports to these markets; that is, $\beta_1 < 0$. We expect this negative effect to be more distinct as a value adjustment at the intensive margin than

TABLE 1 Aggregate effects of Chinese export competition on Finnish exports.

	Export likelihood		ln(Export value)	
Dependent variable	OLS	IV	OLS	IV
Specification	(1)	(2)	(3)	(4)
CES_{jkt}	−0.072***	−0.122	−1.335***	−5.805***
	(0.005)	(0.180)	(0.049)	(1.905)
First-stage F-statistic		23.31		17.45
Hansen J-statistic		0.114		0.653
Observations	1,548,227	1,548,227	726,601	726,601

Notes: The dependent variable is 1 for positive exports, and 0 otherwise, in columns (1) and (2), and log of export value in columns (3) and (4), including only the observations with positive export values, i.e. conditional on exporting. Country–year and product fixed effects are included in all the estimations. The F-statistic is the Kleibergen–Paap rk Wald F-statistic. Standard errors are clustered at the product level.
*, **, *** denote significant levels of 10%, 5%, 1%, respectively.

as an adjustment at the extensive margin where Finland stops exporting a specific product to a destination country completely.

Although we measure Chinese export competition in relative terms to tease out common demand shocks at the destination country (type 2), China's exports may still be related to other unobserved shocks, captured by ε_{jkt}. Therefore we resort to the instrumental variable approach to address the potential endogeneity issue. As discussed previously, changes in Chinese (country-neutral) trade policies, combined with the geographic distance between China and its exporting destinations, can be used as instruments to generate within-product variation in Chinese export competition across destination countries to which Finland exports. In particular, we use equation (2) as the first-stage specification, and re-estimate it with the sample of Finnish export markets defined in Section 3. As shown in panel B of Appendix Table A3, the instruments retain strong explanatory power for Chinese export shares in Finnish export markets.

5.2 | Aggregate product–destination exports: empirical results

Table 1 shows the impact of Chinese export competition on Finnish exports using the main specification outlined in equation (3). The OLS results reported in column (1) show that a 1 percentage point increase in the Chinese export market share decreases the likelihood of Finland exporting the same product to the same country by 0.07 percentage points. Conditional on exporting, a 1 percentage point increase in the Chinese export market share is associated with a 1.34% reduction in the Finnish export value (column (3)). Both effects are statistically significant at the 1% level.

Regression results using the IV approach differ slightly from those obtained from OLS. As shown in column (2) of Table 1, although the point estimate is still negative, Chinese export competition no longer affects the likelihood of Finland exporting the same product to the same country in a statistically significant way. Conditional on exporting, the impact on the Finnish export value is much larger than that of the OLS specification: a 1 percentage point increase in China's export share reduces the Finnish export value of the same product by 5.81% (column (4)). These results show that the total Finnish trade adjustment in response to export competition from China is more through the intensive margin (export value) rather than through the extensive margin (product drop) at the aggregate level. The magnitude of the estimated intensive adjustment is substantial.

TABLE 2 Margins of aggregate Finnish export adjustment.

Specifications	OLS (1)	IV (2)	OLS (3)	IV (4)
Panel A: Export price versus Export quantity				
Dependent variable	ln(Export price)		ln(Export quantity)	
CES_{jkt}	−0.247***	−13.654**	−1.087***	8.112**
	(0.028)	(3.291)	(0.057)	(3.492)
First-stage *F*-statistic		17.2		17.2
Observations	717,220	717,220	717,220	717,220
Panel B: Number of exporting firms versus average export value per firm				
Dependent variable	ln(Number of firms)		ln(Export value per firm)	
CES_{jkt}	−0.169***	0.792	−0.565***	−5.791**
	(0.015)	(0.697)	(0.046)	(2.730)
First-stage *F*-statistic		13.58		13.58
Observations	733,391	733,391	733,391	733,391

Notes: In panel A, the dependent variable is the log of unit value in columns (1) and (2), and the log of export quantity in columns (3) and (4). In panel B, the dependent variable is the log of number of firms exporting in columns (1) and (2), and the log of average export value per firm in columns (3) and (4) by product–destination, including only the observations with positive export values. Country–year and product fixed effects are included in all the estimations. The *F*-statistic is the Kleibergen–Paap rk Wald *F*-statistic. Standard errors are clustered at the product level.
*, **, *** denote significant levels of 10%, 5%, 1%, respectively.

5.3 | The margins of adjustment at the aggregate level

The documented negative impact of Chinese competition on the Finnish export value could be a result of the downward pressure that the increasing supply of Chinese products puts on export prices, quantities or both. We estimate the impact of Chinese export competition on Finnish export prices and quantities separately, using an IV specification analogous to the one outlined above. As shown in column (2) of panel A in Table 2, a 1 percentage point increase in the Chinese export share in a destination country reduces the price of Finnish export to this country by a massive 13.7%.[28] More interestingly, we find that a 1 percentage point increase in the Chinese export share *increases* Finnish export quantity by 8.1% (column (4)). These results are in sharp contrast to those obtained from OLS, which show that Chinese export competition leads to declines in both Finnish export prices and quantities. The sharp difference in results between the OLS and IV specifications suggests the existence of confounding factors that are not taken into account in the OLS specification.[29]

According to the IV results, Finnish firms seem to have reduced prices in order to expand their sales volumes. As a result, the increase in export quantities partially offsets the drop in prices, leading to a smaller impact on export values than on export prices. This result is consistent with the strategic behaviour of responding to tougher price competition by lowering prices to retain market shares.[30]

Before proceeding to firm-level analysis, we investigate additional margins of adjustment across firms. More specifically, we aggregate the firm-level data to the product–country–year level, and use the same IV approach to examine whether the impact of Chinese export competition on aggregate Finnish export is realized via changes in the average export value per firm or the number of exporting firms. According to results presented in columns (2) and (4) of panel B in Table 2, the former type of adjustment seems to dominate: while an increasing Chinese export competition in product–country markets reduces the average export value of Finnish firms, it does not affect the number of firms exporting to these markets. Again, our results differ from

those obtained from the OLS regressions, which show a decline in both the number of exporting firms and the average export value per firm.

6 | FIRM-LEVEL EXPORT ADJUSTMENTS

Although the aggregate impacts of increased Chinese competition on Finnish export presented above are substantial and interesting, the ultimate adjustments are taken by firms, which have various possible coping strategies, such as changing export product mixes and cutting prices, to retain their market shares. In this section, we move on to examine firms' responses to increased Chinese competition at the intensive and extensive margins.

6.1 | Firm–product–destination exports: estimation model

In the firm-level analysis, we start by analysing firms' intensive margin adjustments in response to Chinese export competition in a similar way as in the aggregate product–country-level analysis. In particular, we model firm i's exporting behaviours of product k to country j in year t as

$$FinExport_{ijkt} = \beta_0 + \beta_1 \, CES_{jkt} + \theta_{ijk} + \gamma_{jt} + \varepsilon_{ijkt}, \tag{4}$$

where the exporting behaviours of Finnish firms, $FinExport_{ijkt}$, include the total export value, unit export value, and export quantity, all measured in logs. This analysis is conditional on exporting, as taking the natural logarithm of the Finnish export value excludes the observations with value 0, which leads to an unbalanced panel. Again, we measure the level of Chinese export competition by Chinese export share, CES_{jkt}, defined as in equation (1). We include firm–product–country-specific fixed effects θ_{ijk}, and country–year fixed effects γ_{jt}. Therefore the coefficient of interest, β_1, captures within-firm–product–country export adjustment in response to Chinese export competition across time. Standard errors are clustered at the firm–product–country level. We use the same set of instruments for Chinese export competition as in the aggregate country-level estimations.

6.2 | Firm–product–destination exports: empirical results

Table 3 presents the estimated impact of Chinese export competition on various export indicators of Finnish firms, all conditional on continuing exporting. Panel A reports the estimation results for the total sample of products. The OLS results reported in column (1) of panel A show that a 1 percentage point increase in the Chinese export market share decreases Finnish firms' export value of the same product to the same country by 0.33%. To check how Finnish firms adjust their export sales strategies, we estimate the impact of Chinese export competition on firms' prices and quantities separately. According to the results shown in columns (3) and (5) in panel A, a 1 percentage point increase in the Chinese export market share lowers the Finnish firms' export prices (unit values) by 0.05%, and reduces the export quantities by 0.26%, both of which are statistically significant at the 1% level. According to these results obtained from the OLS specifications, Finnish firms' price and quantity adjustments are in the same direction, and both contribute to the overall negative impact of Chinese export competition on their export values.

The IV estimates show, in contrast to the OLS estimates, that Chinese competition does not reduce the total value of exports of Finnish firms. Although not statistically significant, the sign of the effect is positive instead (column (2) of panel A in Table 3). According to column (4) in panel A, Chinese competition imposes downward pressure on the prices of Finnish firms' exports,

TABLE 3 Effect of Chinese export competition on firm–product–country exports.

	ln(Value)		ln(Price)		ln(Quantity)	
Dependent variable	OLS	IV	OLS	IV	OLS	IV
Specification	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: All products						
CES_{jkt}	−0.331***	0.055	−0.054***	−2.055***	−0.264***	2.111**
	(0.037)	(0.971)	(0.015)	(0.404)	(0.038)	(1.009)
First-stage *F*-statistic		92.27		93.17		93.17
Observations	1,131,028	1,131,028	1,081,834	1,081,834	1,081,834	1,081,834
Panel B: Homogeneous and reference-priced products						
CES_{jkt}	−0.531***	−10.44***	−0.006	−3.980**	−0.462***	−6.873*
	(0.094)	(4.036)	(0.038)	(1.749)	(0.096)	(3.914)
First-stage *F*-statistic		6.50		6.18		6.18
Observations	184,900	184,900	179,794	179,794	179,794	179,794
Panel C: Heterogeneous products						
CES_{jkt}	−0.317***	−0.752	−0.055***	−1.393**	−0.260***	0.858
	(0.041)	(1.016)	(0.017)	(0.441)	(0.041)	(1.046)
First-stage *F*-statistic		93.66		95.12		95.12
Observations	946,114	946,114	902,026	902,026	902,026	902,026

Notes: The dependent variable is the log of export value in columns (1) and (2), the log of export unit value in columns (3) and (4), and the log of export quantity in columns (5) and (6). Country–year and firm–product–country fixed effects are included in all the estimations. The *F*-statistic is the Kleibergen–Paap rk Wald *F*-statistic. Standard errors are clustered at the firm–product–country level. *, **, *** denote significant levels of 10%, 5%, 1%, respectively.

and the magnitude of the effect is larger in the IV estimation than in the OLS estimation. In particular, a 1 percentage point increase in the Chinese export market share decreases the unit value of Finnish exports by a substantial 2.06%. The negative effect on export prices is consistent with the aggregate-level estimations, but smaller in magnitude in the firm-level estimations. One explanation for the difference is that aggregate product-level data also incorporates firm-level extensive margin adjustments for products that some firms stop exporting while others continue to export.

A noteworthy result is that the estimated effect on export quantities is of a different sign than that obtained from OLS (column (6) of panel A in Table 3). The IV results suggest that a 1 percentage point increase in the Chinese export share *increases* the exported quantities by 2.11%. The difference between the OLS and IV estimates likely indicates the existence of unobserved confounding factors that would bias OLS estimations.[31] The positive quantity effect is consistent with our aggregate-level results, and suggests that Finnish firms cut prices in response to intensified competition with China to retain their sales volumes and market shares. The opposite effects on prices and quantities cancel each other out, resulting in the overall statistically insignificant effect of increased Chinese export competition on Finnish firms' export values.

6.3 | Heterogeneous effects by products' price-setting strategies

The aggregate- and firm-level results show that the mechanism through which Chinese competition affects Finnish exports is primarily through pushing down the prices of export goods. The magnitude of the resulting price cuts is likely to vary depending on the nature of the competition

for different products. For instance, the price effect in response to the increased Chinese export competition is expected to be particularly strong for the commodities for which Finnish firms take prices as given.

To further explore the heterogeneity of the price effect of Chinese competition, we divide export commodities into different groups based on price-setting strategies. Rauch (1999) categorizes all traded commodities into three groups: homogeneous, reference-priced, and all other (i.e. heterogeneous or differentiated) commodities. Homogeneous commodities are traded and priced in organized exchanges. These are typically agricultural products, raw materials and non-ferrous metals, such as sugar, coffee, soya beans, pulp, wood, petroleum products, aluminum, copper, zinc and inorganic chemical elements. Reference-priced commodities are not traded in organized exchanges, but nevertheless possess reference prices. As an example given by Rauch (1999), polyoxyethylene sorbitan monostearate is not listed on any organized exchange, but the *Chemical Marketing Reporter* quotes its price per pound weekly based on surveys of suppliers. Other examples are foods, chemicals and metals that have required some work or preparation. Unlike the other two types, heterogeneous commodities possess some degree of product differentiation in quality or other characteristics, and their pricing is based on uniqueness and monopolistic power. The heterogeneous goods include typically manufactured products but also different natural products or materials that have been worked, processed or prepared.

In the base year of the sample period (1999), the value shares of the homogeneous, reference-priced and heterogeneous commodities in the total Finnish commodity exports are 4.3%, 34.5% and 61.2%, respectively. To simplify the comparison across products, we estimate the effect of Chinese competition on two commodity groups separately, one with homogeneous and reference-priced products, and one with heterogeneous products, according to the Rauch (1999) classifications. We group homogeneous and reference-priced products together as both types of products are not differentiated, both possess reference prices either quoted on organized exchange markets or in trade publications, and their suppliers are largely price-takers. These features are in sharp contrast with heterogeneous products, the prices of which reflect differences in characteristics and consumer preference.

The results reported in panels B and C of Table 3 show that the effect of Chinese competition varies by product type. For homogeneous and reference-priced products, Chinese competition has substantial negative and statistically significant effects on export prices (column (4) of panel B). In particular, a 1 percentage point increase in the Chinese export market share decreases the price of Finnish exports by 3.98%. In addition to the price reduction, Chinese competition also significantly decreases Finnish export quantity (column (6) of panel B). The combined effect is substantial: a 1 percentage point increase in Chinese export market share reduces the Finnish firm export value by a dramatic 10.44%.[32] For heterogeneous products, the price effect is smaller: a 1 percentage point increase in the Chinese export market share reduces Finnish export prices by 1.39% (column (4) of panel C). The export quantity of these products is not hurt by Chinese export competition: the estimated impact, although not statistically significant, is in fact positive. As a result, the overall effect on export values of heterogeneous products is small and statistically insignificant. Again, these results sharply contradict those obtained from the OLS estimations, in which we find that Chinese competition reduces export prices only for differentiated products, and decreases export values for both types of products.

Our results provide evidence that firms exporting heterogeneous differentiated products are less affected by the increasing Chinese exports. These firms are likely to have established brand names, and the monopolistic power that they possess helps to shield them partially from Chinese export competition. Consequently, the export value of these products is not hurt by Chinese export competition. In contrast, Chinese competition puts greater pressure on the Finnish export prices of products that are relatively homogeneous, as firms in these industries are price-takers, with no other coping strategies but to reduce price. Even so, Chinese exports still largely crowd out Finnish export quantity of products in this category, a likely result of the high level of

cross-provider substitutability of relatively homogeneous products. Consistently, we also find that increased Chinese export competition has a negative effect on the export value of homogeneous and reference-priced products. These products constitute a sizeable share of the total commodity exports of Finland, indicating the importance of Chinese export competition for the profit margin of Finnish exporting firms. The substantial decline in export values of homogeneous and reference-priced products potentially drives the reduction in average export value per firm documented earlier in the aggregate-level analysis (panel B of Table 2).

In sum, the firm-level results for the pooled sample of firms suggest that Chinese competition does not have a significant impact on export values, while the aggregate results show that Chinese competition reduces the average export value per firm. These results are seemingly inconsistent. However, the difference between the results could be explained simply by the fact that the number of exporting firms varies substantially across products, leading to different weighting of the products in the aggregate- and firm-level regressions. More specifically, homogeneous and reference products account for 24% of observations in the aggregate analysis, but only 16% in the pooled firm-level analysis.[33] Thus firm-level results reflect behaviours of firms exporting heterogeneous products to a larger extent, resulting in an insignificant effect on firm export values.

6.4 | Firm-level extensive margin adjustment

The intensive margin adjustment analysed above—that is, changing the value, quantity and price of exports—is only one possible reaction of firms to the increased Chinese competition in the export market. An emerging theoretical literature has shown that changing the product range is another form of adjustment in response to globalization (Eckel and Neary 2010; Bernard *et al.* 2011; Mayer *et al.* 2014). Rigorous empirical evidence of firms' export product choices includes, for example, substantial changes in Mexican firms' export product mixes, a higher likelihood of dropping their marginal products rather than their core products after joining the North American Free Trade Agreement (Iacovone and Javorcik 2010), and a lower likelihood that Mexican firms will drop their core products with increased competition from China in Mexico's main export market, the USA (Iacovone *et al.* 2013). These previous studies provide us with predictions to explore in our empirical analysis.

We approach firms' extensive margin adjustment by analysing whether firms drop products in export destinations in response to the Chinese export competition. Further, we analyse whether multi-product firms are more likely to continue exporting their core products and drop their marginal products as the Chinese export competition intensifies.

As discussed in Section 3, the spells of firm-level export flows are typically short. To take into account the granularity of export activities in the analysis of product dropping behaviour, we define firms' export engagement over five-year time intervals. We analyse whether products that were exported in the 1999–2003 period were crowded out by the Chinese export competition in the 2005–9 period. We choose 2004 as the threshold to define pre- and post- period intervals, because this was the year when the new Chinese Foreign Trade Law became effective, which granted trade rights to all firms. For the purpose of the study, we restrict the sample for the analysis of export product dropping activities to the firm–product–country observations that have positive export values in at least one year during the pre-period. A product that was exported any year in the 1999–2003 period but not in 2005–9 to a destination is defined as a dropped product. We base the empirical analysis of product dropping on the resulting collapsed cross-sectional data. Note that the sample includes firms that stop exporting all of their products after 2004, that is, firms that exit the export market. According to descriptive statistics reported in panel C of Appendix Table A2, product dropping behaviour in destination markets is common for Finnish firms. Among all firm–product–destination combinations with positive export values in the 1999–2003 period, 38% were dropped in the post-period 2005–9.

6.5 | Firm-level product dropping behaviour: estimation model

We define the increase in Chinese export competition, ΔCES_{jk}, as the difference in the average yearly Chinese export market share between the pre-period and the post-period, and estimate its effect on product dropping behaviours in a cross-section analysis with a linear probability model

$$ProductDrop_{ijk}^{dummy} = \beta_0 + \beta_1 \Delta CES_{jk} + \theta_{ij} + \gamma_k + \varepsilon_{ijk}, \quad (5)$$

where $ProductDrop_{ijk}^{dummy}$ is an indicator that equals 1 if firm i did not export product k to country j in 2005–9. Here, θ_{ij} and γ_k are firm–country and product fixed effects, respectively. We instrument ΔCES_{jk} by the change in the likelihood of a product being under the Chinese quota and licensing system ($\Delta Quota_k$), calculated as the average within the five-year interval, and its interaction with the distance between China and its trading partner ($\Delta Quota_k \times Dist_j$). We cluster the standard errors at the firm–country level.

To test whether firms are less likely to drop their core products, we define the importance of a product to a firm in the pre-period in two ways. The first measure is defined as the share of exports for a particular product of a firm's total global exports, and the second as the ratio of a particular product's export share to the best-selling product's export share in the firm's global sales. As product shares of core products can vary largely depending on the total number of products that firms export, even the most important products may represent relatively small shares of the total global sales for firms with a large number of products compared to firms with only a few products. The second measure, which normalizes the product shares by relating them to the share of the most important product, addresses this issue. The importance measures are computed only for firms with multiple products.[34] In the estimations, we interact the measure of product importance with the measure of Chinese export competition to capture the heterogeneous product dropping behaviour across products' level of importance in the export portfolios of the firms. The instruments used here include those used for equation (5) and their interactions with the product importance measure.

6.6 | Firm-level product dropping behaviour: empirical results

In Table 4, we report firms' extensive margin adjustment (product dropping) in response to increased Chinese export competition. We report results for estimations with different sets of fixed effects: firm fixed effects, firm–country fixed effects, and firm–country and product fixed effects.[35] The results from the three specifications indicate that although the Chinese competition does not significantly affect product dropping on average (columns (1), (4) and (7)), there is an effect that varies by the relative importance of the product in the firm's global export portfolio. According to Table 4, products with larger shares of the firm's global export sales are less likely to be dropped (columns (2), (5) and (8)). Results are similar when we measure product importance with the relative product sales share (columns (3), (6) and (9)). It is worth noting that the specifications in Table 4 are demanding. After collapsing the data into a cross-sectional format, the sample is smaller than in Table 3. Moreover, the main instrument used here (i.e. the change in the likelihood of a product being under the Chinese quota and licensing system) no longer captures yearly changes in quota restrictions, an important part of variations in the original quota instrument used in previous panel settings. As a result, the first stages are weaker for the last specification (columns (7), (8) and (9)). Nevertheless, the overall qualitative similarity of the results across different fixed effect specifications is reassuring.

We have focused on core products in our analysis of extensive margin of adjustment. To further analyse the importance of destinations, we defined measures of core destinations in a

TABLE 4 Effect of Chinese export competition on firms' product dropping behaviour in export destinations.

		Product share	Relative product share		Product share	Relative product share		Product share	Relative product share
Product importance	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
ΔCES_{jkt}	0.302	0.213	−0.020	0.364	0.129	0.028	−0.667	−0.520	−0.544
	(0.261)	(0.249)	(0.241)	(0.252)	(0.247)	(0.240)	(0.818)	(0.790)	(0.790)
ΔCES_{jkt} × Product importance		−4.285***	−2.277***		−7.242***	−3.492***		−3.320**	−1.332
		(0.956)	(0.671)		(1.457)	(0.964)		(1.405)	(0.932)
Product importance		−0.228***	−0.198***		−0.138***	−0.171***		−0.387***	−0.316***
		(0.050)	(0.036)		(0.077)	(0.053)		(0.075)	(0.052)
Fixed effects	Firm	Firm	Firm	Firm–country	Firm–country	Firm–country	Firm–country, product	Firm–country, product	Firm–country, product
First-stage F-statistic	83.34	43.54	44.21	101.2	44.56	24.37	5.459	2.360	2.299
Observations	216,824	216,417	216,417	207,218	207,218	207,218	206,781	206,781	206,781

Notes: The dependent variable is a firm–product–destination observation with a positive export value in at least one year during the 1999–2003 pre-period, but not in 2005–9. The F-statistic is the Kleibergen–Paap rk Wald F-statistic. Standard errors are clustered at the firm–country level.
*, **, *** denote significant levels of 10%, 5%, 1%, respectively.

similar way as for the core products (as a destination share in total firm-level exports or as a destination share relative to the share of the largest destination), and estimated the product drop regressions with these measures. We find that the interaction terms between the core destination variable and Chinese export shock variable are not statistically significant.[36] Thus according to our results, Chinese export shocks induce firms to drop their peripheral products but have no effect on their decisions regarding peripheral and core destinations. This suggests that peripheral products might have lower fixed costs of exporting than core products, and are therefore easily dropped, but we cannot conclude anything definite about the destination-specific fixed costs based on these results.[37]

Taken together, the results suggest that firms are more likely to drop their marginal products in the markets where the Chinese export competition intensifies. The finding that firms are less likely to drop their more important products is consistent with the results of the previous empirical literature discussed above, and confirms the theoretical prediction of Mayer *et al.* (2014) that firms drop their marginal products in markets with tougher competition.

The firm-level analysis uncovers important firm adjustment strategies in response to increased Chinese export competition that are masked in the aggregate-level analysis. According to our findings, for products that a firm chooses to continue exporting to a particular market, the surviving strategy adopted is to lower selling prices to expand the sales volume. As a result, the net effect on the export value is small and statistically significant for most Finnish firms. The only exceptions are firms selling homogeneous products. For them, both export prices and quantities are impacted negatively by Chinese competition, leading to reductions in their export values. In addition to these intensive margin adjustments, our firm-level extensive margin analysis further shows that the decision to drop products from particular export markets completely, and the resulting changes in the export product range, are also important adjustment behaviours for firms facing intensified Chinese export competition.[38]

7 | CONCLUSION

This paper uses a novel policy-based instrumental variable approach that generates exogenous product–country–year variation in the level of Chinese export competition to analyse the impact of such competition on Finnish exports. The exogenous Chinese export policy changes and the detailed firm-level Finnish customs trade data allow us to make causal inferences about the impact of Chinese export competition, and to uncover coping strategies of firms in export markets.

On the intensive margin of adjustment, we find that although Chinese export competition reduces export prices, it increases export quantities for products that Finnish firms continue exporting, on average. The overall impact on export values is positive, but not statistically different from zero. The results indicate that firms cut prices on their export products to retain their market shares in response to increased Chinese export competition.

In addition to the average responses, we distinguish the impact of Chinese export competition on product groups defined by different price-setting strategies. We find that Chinese competition has a greater negative impact on the export prices of homogeneous and reference-priced products than those of heterogeneous products, and it affects adversely only the quantity of homogeneous and reference-priced products. The findings provide evidence that the firms exporting heterogeneous differentiated products are less affected by the increasing Chinese competition. The firms are likely to have established brand names, and the monopolistic power that they possess helps to shield them partially from Chinese export competition. In contrast, Chinese competition puts greater pressure on the Finnish export prices of products that are relatively homogeneous, as firms in these industries are price-takers with no other coping strategies but to reduce price. Even

so, Chinese exports still largely crowd out Finnish export quantity of products in this category. This difference suggests that the pressure from Chinese competition is disproportionately born by certain Finnish export products and firms.

We analyse further the extensive level of adjustment, and find that firms change their export product portfolio as Chinese competition gets tougher. Our finding that firms drop their marginal products as an adjustment to an intensified Chinese export competition is in line with the more recent literature confirming firm-level extensive margin adjustments to globalization in general, and in particular to increased competition from China in export markets (Iacovone *et al.* 2013).

Our results provide evidence that competition with China is not limited to the domestic market for developed countries, which previous studies have largely focused on. Recognizing the importance of export competition with China for developed countries is crucial for effective policy-making in response to China's integration in the global market, especially for countries as highly dependent on exporting as Finland. Although China is increasingly competing with the same products as developed countries, we find that the negative effects are more substantial for export products that are relatively homogeneous and compete mainly with prices. In addition, our instrumental approach enables us to open the black box of rising Chinese exports. Understanding of both the underlying causes of the Chinese export expansion and how to incorporate these causes directly into empirical analysis is an important avenue for future research.

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ENDNOTES

[1] The value varied between 36.1% and 44.9% during 1999–2012. Source: World Development Indicators.

[2] The comparison is based on weighted market shares of the ten most important two-digit export product categories of the Harmonized Standard 2002 (HS2002) classification for Finland, with weights calculated based on their export values in 1999. Together, these products constitute 82% of the total Finnish goods exports in 1999.

[3] For instance, the correlations between the export bundles of China and Finland, Sweden, Germany and France, respectively, increased from 0.52, 0.62, 0.59 and 0.48 in 1999 to 0.64, 0.79, 0.72 and 0.53 in 2012. The export bundles were defined as the value shares of the eight top manufacturing industry groups (of the total of 16 groups) using the World Bank World Integrated Trade Solution data.

[4] Schott (2008) also documents an increasing similarity of the export bundles of developed economies and China.

[5] The difference between aggregate- and firm-level results for the export value could be explained simply by the fact that the numbers of exporting firms vary substantially across products, leading to different product weights used between the aggregate- and firm-level regressions. See detailed discussions in Subsection 6.

[6] These countries are Hungary, Malaysia, Mexico, Pakistan, the Philippines, Poland, Romania, Sri Lanka, Thailand and Turkey.

[7] The removal of the Chinese quota and licensing restrictions could arguably induce Finnish firms to offshore production of these products to China. However, since most of the products risk being relisted after a removal, we argue that this not an issue for the quota and licensing products that are crucial for identification.

[8] The MFA quotas were imposed by the USA and the EU to restrict imports from developing countries in an effort to protect their domestic textile industries from 1974 until 2004.

[9] Source: http://www.gov.cn/gongbao/content/2002/content_61506.htm (accessed 21 June 2024).

[10] The use of export restrictions is common around the globe given the 'under-regulation' of the WTO law on this issue. The WTO monitors barriers to trade through its Trade Policy Review (TPR) country reports. For countries that have undergone a TPR, almost all have some form of quantitative restriction in place on the export of specific goods (Bonarriva *et al.* 2009). In terms of formal regulations, the WTO law does not properly define the circumstances that justify quantitative restrictions on export (Karapinar 2012). Although Article XI of the General Agreement of Tariffs and Trade states that export restrictions other than duties and taxes, such as quotas or export licences, are forbidden, 'export prohibitions or restrictions temporarily applied to prevent or relieve critical shortages of foodstuffs or other products essential to the exporting contracting party' are allowed. In fact, China imposed export quota and licensing requirements for hundreds of HS eight-digit-level products in 2007, six years after China's accession to the WTO (Kim 2010).

[11] Around 2% of the products on the quota and licensing list are subject to country-specific restrictions in the sample period, 1999–2012. We exclude them in constructing the panel data for the quota and licensing instrument.
[12] We refrain from constructing a weighted 'intensity' measure using pre-period export values as weights because exports in previous periods are themselves affected by the export restrictions.
[13] Lardy (2005) provides a detailed description of the history of Chinese trade policy.
[14] See http://www.npc.gov.cn/zgrdw/englishnpc/Law/2007-12/12/content_1383624.htm (accessed 24 June 2024) for details of China's Foreign Trade Law enacted in 1994.
[15] Although the direct exporting right was fully granted to all firms in 2004, the government had already started to grant this right to some firms in early 2000, such as those with registered capital above certain thresholds (Bai *et al.* 2017). Nevertheless, constructing a finer measure of the exporting right restriction to capture these early changes is not feasible without micro-level data on the universe of Chinese firms. As a result, we construct the export rights restriction variable simply based on the official law change in 2004. As shown in Appendix Figure A1, the growth rate of the number of exporting firms in China peaked in year 2004, indicating the significance of the law change in affecting Chinese export supply.
[16] Distance is defined as the great circular distance between the most populated cities.
[17] The Combined Nomenclature, used by EU countries, is an extended version based on the Harmonized Commodity Description and Coding System (Harmonized System, or HS).
[18] Data for trade transactions to the EU countries within the customs union are available for all firms with annual exports to all other EU countries of more than one hundred thousand euros. The EU countries may set this threshold themselves. One hundred thousand euros is the threshold applied in most EU countries.
[19] Using the aggregate Comtrade data that include aggregate exports to the excluded destinations, we find that the exports to the excluded destinations account for 4.3% of the total value of the Finnish exports in 1999.
[20] We exclude the smaller firms (with fewer than 20 employees in the first year) since their transactions are likely to be small but potentially add noise to the estimations. To check whether the estimations are affected by this restriction, we re-run all the estimations including firms with 10–19 employees. All our results remain robust.
[21] See Hess and Persson (2011) for evidence and a detailed overview of other related studies using country-level data, and see Geishecker *et al.* (2019), Gullstrand and Persson (2015), Ilmakunnas and Nurmi (2010), Sabuhoro *et al.* (2006), Cadot *et al.* (2013), Békés and Muraközy (2012), and Esteve-Pérez *et al.* (2012) for firm-level studies confirming short export duration for a range of samples.
[22] Core markets are defined by firms' most important export products and destinations, and peripheral markets correspondingly refer to the firms' least important markets.
[23] The estimate (p-value) is 0.000 (0.552).
[24] The positive coefficient of the interaction term shows that being subject to the quota and licensing requirements reduces more Chinese export to nearby countries than to countries away from China.
[25] Market share has been long recognized as one of the main determinants of business profitability, and has been widely adopted by firms as an important organizational goal (Buzzell *et al.* 1975; O'Regan 2002). Finnish firms could also use cheaper inputs from China and elsewhere to keep production costs and prices competitive.
[26] In line with the predictions of distance-to-the-frontier models by Aghion and Howitt (2006) and Aghion *et al.* (2009) and Amiti and Khandelwal (2013) provide empirical evidence that firms use quality upgrading as a survival strategy in the face of increased import competition for products close to the world quality frontier.
[27] Using a relative export competition measure instead of log values of Chinese exports allows us to include also the observations for which Chinese exports are equal to zero.
[28] Due to missing data, the number of observations for the export price and quantity regressions in Table 2 is lower than for the export value regressions in Table 1.
[29] We split the sample into products restricted by quotas and those never restricted by quotas to provide additional evidence that the difference between the OLS and IV results is not only due to a difference between an average treatment effect (ATE) and a local average treatment effect (LATE). We find that the OLS results of Finnish export quantity for the subsample of products restricted by the Chinese quotas are still of opposite sign to the IV results, suggesting that the difference is likely due to confounding factors. The results are available on request.
[30] We also estimate the effects for high- and low-income countries separately to analyse if the income level of the destination country impacts the firm responses. Since the results are similar for the two subsamples, we do not report them, but they are available on request.
[31] Again, we split the sample into products restricted by quotas and products never restricted by quotas to show that the difference between the OLS and IV results is not due solely to the difference between an ATE and an LATE. We find that the OLS results for export quantity for the subsample of products restricted by the Chinese quotas are still of opposite sign to the IV results, suggesting that the difference is likely due to confounding factors. The results are available on request.
[32] The first-stage F-statistics (Appendix Table A4) suggest that the instruments are weaker for the subsample of homogeneous and reference-priced goods than for heterogeneous goods, which may bias the estimates.
[33] Export spells lasting for only one year are more frequent at the firm–product–destination level than at the aggregate product–destination level, which also impacts the number of observations in fixed effect regressions.

[34] Firm selling only a single product, which account for about 0.2% of the observations, are excluded from the estimations. In the subsample of multi-product firms, the mean number of export products per firm is 16, and the median number is 6, at the six-digit HS code level.
[35] The first-stage estimation results are reported in Appendix Table A5.
[36] The estimation results are not reported but are available on request.
[37] Gullstrand and Persson (2015) illustrate both theoretically and empirically that if the importance of sunk costs of exporting and expected future returns are lower in peripheral markets, defined by firms' least important export products and destinations, then firms will more easily exit these markets after an entry.
[38] We analysed firm heterogeneity by firm size in split samples. The estimated coefficients of the Chinese competition were larger for large firms (>249 employees) than for small and medium-sized firms (<250 employees) both in the intensive and extensive margin estimations. Since the results did not differ qualitatively, they are not reported.

REFERENCES

Acemoglu, D., Autor, D., Dorn, D., Hanson, G. H. and Price, B. (2016). Import competition and the great US employment sag of the 2000s. *Journal of Labor Economics*, **34**(S1), S141–S198.

Aghion, P., Blundell, R., Griffith, R., Howitt, P. and Prantl, S. (2009). The effects of entry on incumbent innovation and productivity. *Review of Economics and Statistics*, **91**(1), 20–32.

———, and Howitt, P. (2006). Appropriate growth policy: a unifying framework. *Journal of the European Economic Association*, **4**(2–3), 269–314.

Amiti, M. and Khandelwal, A. K. (2013). Import competition and quality upgrading. *Review of Economics and Statistics*, **95**(2), 476–90.

Autor, D., Dorn, D. and Hanson, G. H. (2013). The China syndrome: local labor market effects of import competition in the US. *American Economic Review*, **103**(6), 2121–68.

———, ———, ——— and Song, J. (2014). Trade adjustment: worker-level evidence. *Quarterly Journal of Economics*, **129**(4), 1799–860.

Bai, X., Krishna, K. and Ma, H. (2017). How you export matters: export mode, learning and productivity in China. *Journal of International Economics*, **104**, 122–37.

Balsvik, R., Jensen, S. and Salvanes, K. G. (2015). Made in China, sold in Norway: local labor market effects of an import shock. *Journal of Public Economics*, **127**, 137–44.

Békés, G. and Muraközy, B. (2012). Temporary trade and heterogeneous firms. *Journal of International Economics*, **87**(2), 232–46.

Benkovskis, K., Silgoner, M., Steiner, K. and Wörz, J. (2013). Crowding-out or co-existence? The competitive position of EU members and China in global merchandise trade. *European Central Bank Working Paper* **no. 1617**.

Bernard, A. B., Redding, S. J. and Schott, P. K. (2011). Multiproduct firms and trade liberalization. *Quarterly Journal of Economics*, **126**(3), 1271–318.

Bloom, N., Draca, M. and Van Reenen, J. (2016). Trade induced technical change? The impact of Chinese imports on innovation, IT and productivity. *Review of Economic Studies*, **83**(1), 87–117.

Bonarriva, J., Koscielski, M. and Wilson, E. (2009). Export controls: an overview of their use, economic effects, and treatment in the global trading system. *Office of Industries Working Paper no. ID-23*, US International Trade Commission.

Brandt, L. and Lim, K. (2024). Opening up in the 21st century: a quantitative accounting of Chinese export growth. *Journal of Development Economics*, **150**, 103895.

———, Van Biesebroeck, J. and Zhang, Y. (2012). Creative accounting or creative destruction? Firm-level productivity growth in Chinese manufacturing. *Journal of Development Economics*, **97**(2), 339–51.

Buzzell, R. D., Gale, B. T. and Sultan, R. G. M. (1975). Market share—a key to profitability. *Harvard Business Review*, **53**(1), 97–106.

Cadot, O., Iacovone, L., Denisse Pierola, M. and Rauch, F. (2013). Success and failure of African exporters. *Ferdinand*, **101**, 284–96.

Eckel, C. and Neary, J. P. (2010). Multi-product firms and flexible manufacturing in the global economy. *Review of Economic Studies*, **77**(1), 188–217.

Eichengreen, B., Rhee, Y. and Tong, H. (2007). China and the exports of other Asian countries. *Review of World Economics*, **143**(2), 201–26.

Esteve-Pérez, S., Reguena-Silvente, F. and Pallardó-López, V. (2012). The duration of firm–destination export relationships: evidence from Spain, 1997–2006. *Economic Inquiry*, **51**(1), 159–80.

Feenstra, R. C., Ma, H. and Xu, Y. (2017). US exports and employment. *NBER Working Paper* **no. 24056**.

Flückiger, M. and Ludwig, M. (2015). Chinese export competition, declining exports and adjustments at the industry and regional level in Europe. *Canadian Journal of Economics*, **48**(3), 1120–51.

Geishecker, I., Schröder, P. J. H. and Sørensen, A. (2019). One-off export events. *Canadian Journal of Economics*, **52**(1), 93–131.
Giovannetti, G., Sanfilippo, M. and Velucchi, M. (2012). The 'China effect' on EU exports to OECD markets: a focus on Italy. In G. Gomel, D. Marconi, I. Musu and B. Quintieri (eds), *The Chinese Economy: Recent Trends and Policy Issues*. Berlin: Springer, pp. 163–80.
Goldberg, P. K., Khandelwal, A. K., Pavcnik, N. and Topalova, P. (2010). Multiproduct firms and product turnover in the developing world: evidence from India. *Review of Economics and Statistics*, **92**(4), 1042–9.
Gullstrand, J. and Persson, M. (2015). How to combine high sunk costs of exporting and low export survival. *Review of World Economics*, **151**, 23–51.
Handley, K. and Limao, N. (2010). Policy uncertainty, trade, and welfare: theory and evidence for China and the United States. *American Economic Review*, **107**(9), 2731–83.
Hanson, G. H. and Robertson, R. (2010). China and the manufacturing exports of other developing countries. In R. C. Feenstra and S.-J. Wei (eds), *China's Growing Role in World Trade*. Cambridge, MA: NBER, pp. 137–59.
Hess, W. and Persson, M. (2011). Exploring the duration of EU imports. *Review of World Economics*, **147**, 665–92.
Hsieh, C.-T. and Klenow, P. J. (2009). Misallocation and manufacturing TFP in China and India. *Quarterly Journal of Economics*, **124**(4), 1403–48.
Huang, H., Ju, J. and Yue, V. Z. (2024). *Accounting for the evolution of China's production and trade patterns*. Discussion Paper, Centre for Economic Performance, London School of Economic and Political Science.
Hummels, D., Jørgensen, R., Munch, J. and Xiang, C. (2014). The wage effects of offshoring: evidence from Danish matched worker–firm data. *American Economic Review*, **104**(6), 1597–629.
Iacovone, L. and Javorcik, B. S. (2010). Multi-product exporters: product churning, uncertainty and export discoveries. *Economic Journal*, **120**(544), 481–99.
———, Rauch, F. and Winters, L. A. (2013). Trade as an engine of creative destruction: Mexican experience with Chinese competition. *Journal of International Economics*, **89**(2), 379–92.
Ilmakunnas, P. and Nurmi, S. (2010). Dynamics of export market entry and exit. *Scandinavian Journal of Economics*, **112**(1), 101–26.
Jenkins, R. (2010). China's global growth and Latin American exports. In A. U. Santos-Paulino and G. Wan (eds), *The Rise of China and India*. Berlin: Springer, pp. 220–40.
Karapinar, B. (2012). Defining the legal boundaries of export restrictions: a case law analysis. *Journal of International Economic Law*, **15**(2), 443–79.
Kim, J. (2010). Recent trends in export restrictions. *OECD Trade Policy Working Paper* **no. 101**.
Lardy, N. R. (2005). Trade liberalization and its role in Chinese economic growth. In W. Tseng and D. Cowen (eds), *India's and China's Recent Experience with Reform and Growth*. London: Palgrave Macmillan, pp. 158–69.
López-Córdova, J., Micco, A. and Molina, D. (2008). How sensitive are Latin American exports to Chinese competition in the US Market? *Economía*, **8**(2), 117–53.
Mayer, T., Melitz, M. J. and Ottaviano, G. I. P. (2014). Market size, competition, and the product mix of exporters. *American Economic Review*, **104**(2), 495–536.
Módolo, B. D. and Hiratuka, C. (2017). The impact of Chinese competition on third markets: an analysis by region and technological category. *Development Policy Review*, **35**, 797–821.
Montenegro, C. E., Pereira, M. and Soloaga, I. (2010). *China's effect on Latin America's international trade*. El Colegio de México, Centro de Estudios Económicos.
Moreira, M. M. (2007). Fear of China: is there a future for manufacturing in Latin America? *World Development*, **35**(3), 355–76.
Naughton, B. J. (2006). *The Chinese Economy: Transitions and Growth*. Cambridge, MA: MIT Press.
O'Regan, N. (2002). Market share: the conduit to future success? *European Business Review*, **14**(4), 287–93.
Rauch, J. E. (1999). Networks versus markets in international trade. *Journal of International Economics*, **48**(1), 7–35.
Sabuhoro, J. B., Larue, B. and Gervais, Y. (2006). Factors determining the success or failure of Canadian establishments on foreign markets: a survival analysis approach. *International Trade Journal*, **20**(1), 33–73.
Schott, P. K. (2008). The relative sophistication of Chinese exports. *Economic Policy*, **23**(53), 6–49.
Silgoner, M., Steiner, K., Wörz, J. and Schitter, C. (2015). Fishing in the same pool: export strengths and competitiveness of China and central, eastern and southeastern Europe at the EU-15 market. *China Economic Review*, **32**, 68–82.
Stanojevic, S., Bin, Q. and Jian, C. (2020). Sino-EU15 export competition in central and eastern Europe: is China crowding out exports from the E15? *Eastern European Economics*, **53**(3), 264–82.
Utar, H. (2014). When the floodgates open: 'northern' firms' response to removal of trade quotas on Chinese goods. *American Economic Journal: Applied Economics*, **6**(4), 226–50.

World Trade Organization (WTO) (2001). Report of the working party on the accession of China; available online at https://docs.wto.org/dol2fe/Pages/FE_Search/FE_S_S006.aspx?FullTextHash=1&MetaCollection=WTO&SymbolList=%22WT/ACC/CHN/49%22+OR+%22WT/ACC/CHN/49*%22&languageUIChanged=true# (accessed 24 June 2024).

Xing, Y. (2011). China's exports in information communication technology and its impact on Asian countries. *Economic Change and Restructuring*, **44**(1–2), 135–47.

Zeng, K. (2007). *China's Foreign Trade Policy: The New Constituencies*. Abingdon: Routledge.

SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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APPENDIX A. ADDITIONAL FIGURES AND TABLES

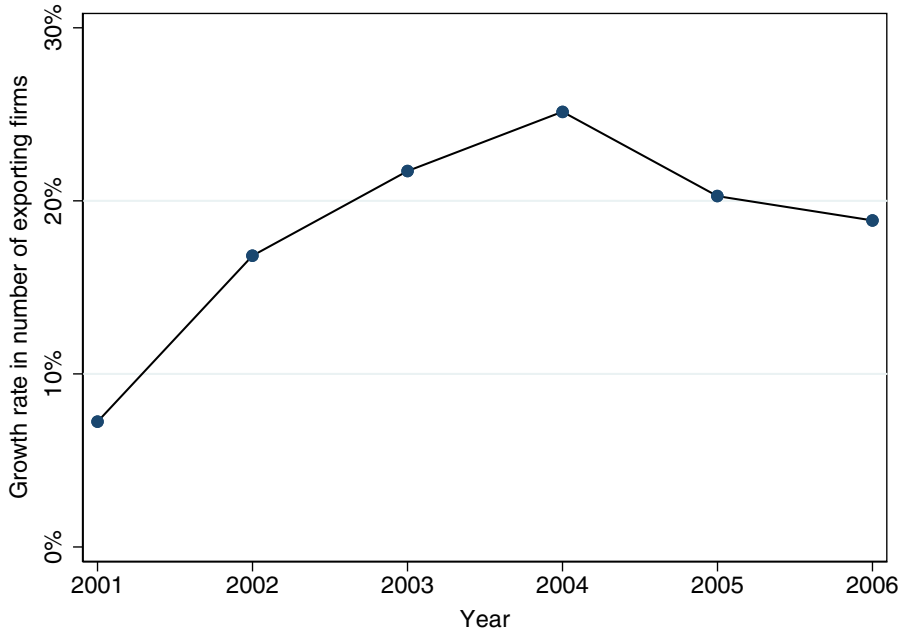

FIGURE A1 Growth rate of number of exporting firms in China. Source: Chinese customs statistics, the People's Republic of China (PRC).

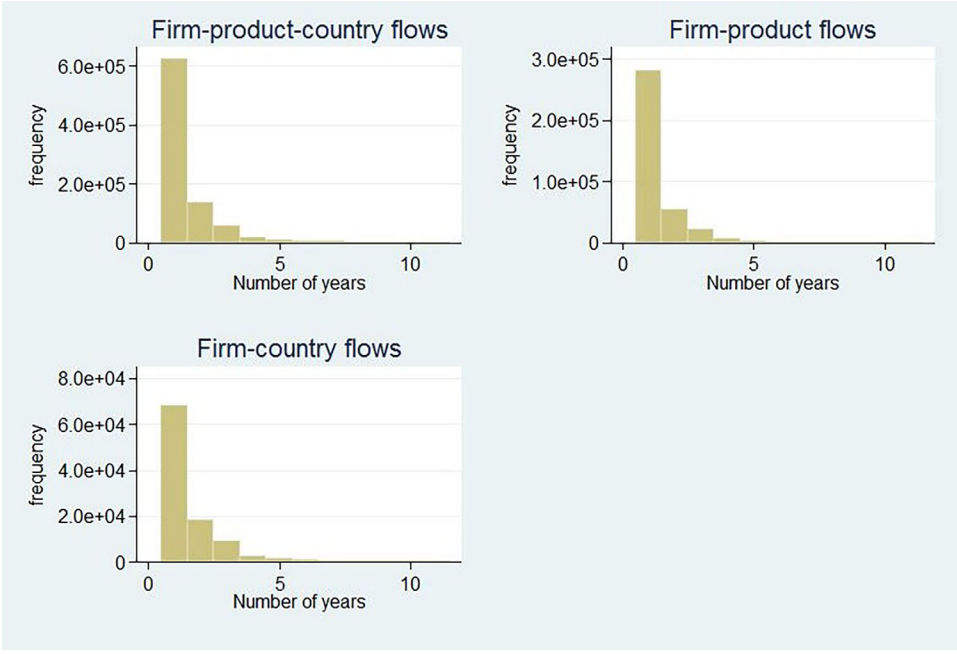

FIGURE A2 Frequency of export flows by duration in years. Source: Customs Finland.

TABLE A1 Variables and sources.

Variable name	Definition	Data source
FinExport (value)	Euro	Finnish Customs
FinExport (quantity)	Pieces (m, m^2, m^3, kg	Finnish Customs
FinExport (price)	Value/quantity	Finnish Customs
Firm size	Number of employees	Statistics Finland
Industry code	TOL 2002/NACE 2002	Statistics Finland
Chinese export share (CES)	Chinese imports as a share in total imports to a country (HS6)	Comtrade, the UN
RightRes	Indicator of the export right requirement	Ministry of Foreign Trade, the PRC
Quota	Indicator of quota or export licence requirement (HS6)	Ministry of Commerce and the General Administration of Customs, the PRC
Distance	Great circular distance between the main cities (km)	Gravity Database, CEPII

TABLE A2 Descriptive statistics.

Variables	Mean	S.D.	Observations
Panel A: Country-level exports			
Finnish exports			
Export_Dummy	0.469	0.499	1,548,227
ln(Export_Value)	9.958	2.980	726,704
Chinese export share (CES_{jkt})	0.102	0.186	1,548,227
Panel B: Firm-level exports			
ln(Value of Finnish export)	8.655	3.088	1,131,029
ln(Price of Finnish export)	3.173	2.016	1,081,834
ln(Quantity of Finnish export)	5.652	3.768	1,081,834
Chinese export share (CES_{jkt})	0.094	0.157	1,131,029
Panel C: Firm-level export product dropping (2005–9)			
Likelihood of product dropping	0.381	0.486	216,824

Notes: In panel A, country-level exports data are at the product–country–year level and restricted to the sample of countries that imported from Finland in 1999, and to country–product markets that Finland ever exported to in the entire study period (1999–2012). Source: UN Comtrade database 1999–2012. In panel B, firm-level exports data are at the firm–product–country–year level. Singular firm–product–country observations are excluded. Source: Statistics Finland and Finnish Customs. In panel C, the estimation sample includes the firm–product–country observations that have a positive export value in at least one year during the pre-period 1999–2003.

TABLE A3 First-stage regressions: aggregate analysis.

Dependent variable	Chinese export share (CES_{kt})	
Panel A: Chinese exports in global export markets		
$Quota_{kt}$	−0.085**	(0.042)
$Quota_{kt} \times RightsRes_t$	0.383***	(0.051)
$Quota_{kt} \times Dist_j$	0.008	(0.005)
$Quota_{kt} \times RightsRes_t \times Dist_j$	−0.038***	(0.006)
Observations	6,357,881	
F-statistic	26.74	
Panel B: Chinese exports in Finnish export markets		
$Quota_{kt}$	−0.157*	(0.091)
$Quota_{kt} \times RightsRes_t$	0.402***	(0.094)
$Quota_{kt} \times Dist_j$	0.015	(0.010)
$Quota_{kt} \times RightsRes_t \times Dist_j$	−0.041***	(0.010)
Observations	1,548,227	
F-statistic	23.31	

Notes: In panel A, the sample is restricted to countries that imported from China in 1999 and to country–product markets that China ever exported to during the entire sample period (1999–2012). In panel B, the sample is countries that imported from Finland in 1999 and country–product markets that Finland ever exported to during the entire sample period (1999–2012). Country–year and product fixed effects are included in all the estimations. The F-statistic is the Kleibergen–Paap rk Wald F-statistic. Standard errors are clustered at the product level.
*, **, *** denote significant levels of 10%, 5%, 1%, respectively.

TABLE A4 First-stage regression for Chinese exports in Finnish export markets: firm-level analysis.

	Chinese export share (CES_{jkt})		
Dependent variable	All	Homogeneous and reference-priced	Heterogeneous
Products	(1)	(2)	(3)
$Quota_{kt}$	−0.028**	0.002	−0.059***
	(0.011)	(0.015)	(0.016)
$Quota_{kt} \times RightsRes_t$	0.075***	0.051***	0.087***
	(0.009)	(0.019)	(0.011)
$Quota_{kt} \times Dist_j$	5.74e-08	−1.08e-06	3.09e-06
	(1.49e-06)	(1.97e-06)	(2.12e-06)
$RightsRes_t \times Dist_j$	−0.0004	0.033	0.0003
	(78.810)	(884.24)	(104.09)
$Quota_{kt} \times RightsRes_t \times Dist_j$	−6.43e-06*	−4.52e-06	−7.63e-06***
	(1.25e-06)	(2.57e-06)	(1.44e-06)
Observations	1,131,028	184,900	946,114
F-statistic	53.64	8.53	39.72

Notes: The sample is restricted to countries that imported from Finland in 1999 and to country–product markets that Finland ever exported to during the entire sample period (1999–2012). Country–year and firm–product–country fixed effects are included in all the estimations. Standard errors are clustered at the firm–product–country level.
*, **, *** denote significant levels of 10%, 5%, 1%, respectively.

TABLE A5 First-stage regression for Chinese exports in Finnish export markets: product drop analysis.

	Chinese export share (CES_{jkt})		
Dependent variable		Product share	Relative product share
Product importance measure	(1)	(2)	(3)
$\Delta Quota_k$	0.022	0.028	0.028
	(0.019)	(0.021)	(0.022)
$\Delta Quota_k \times Dist_j$	−9.78e-06***	−0.00001***	−0.00001***
	(2.54e-06)	(2.84e-06)	(2.88e-06)
$Dist_j$	−1.01e-06***	−7.74e-07**	−7.68e-07*
	(3.50e-07)	(3.98e-07)	(4.09e-07)
$Dist_j \times ProductImp_k$		−2.27e-06***	−1.42e-06***
		(7.06e-07)	(5.22e-07)
$\Delta Quota_k \times ProductImp_k$		−0.079**	−0.043
		(0.040)	(0.043)
$\Delta Quota_k \times Dist_j \times ProductImp_k$		0.00002***	0.00001**
		(4.98e-06)	(5.41e-06)
$ProductImp_k$		0.017***	0.012***
		(0.005)	(0.004)
Observations	216,824	216,417	216,417
F-statistic	83.34	43.54	44.21

Notes: Firm-level fixed effects are included in all the estimations. The F-statistic is the Kleibergen–Paap rk Wald F-statistic. Standard errors are clustered at the firm–country level.
*, **, *** denote significant levels of 10%, 5%, 1%, respectively.