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Emerging Trade Battlefield with China

EXPORT COMPETITION AND FIRM'S COPING STRATEGIES

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Abstract

This paper analyzes how intensified Chinese export competition affects the exports and product ranges of firms from Finland. Using a novel identification strategy that exploits changes in Chinese export policies, we find that Chinese export competition reduces aggregate product-level exports. Firm-level analysis further shows that Chinese competition leads to substantial price cuts to retain market shares, especially for homogeneous products. In addition, we also discover that firms respond to the increased level of Chinese export competition by dropping their marginal products. Taken together, these results highlight the importance of export competition with China for developed countries.

Tiivistelmä

Kehittyvä kauppataistelukenttä Kiinan kanssa: vientikilpailu ja yritysten selviytymisstrategiat

Tässä tutkimuksessa selvitetään, miten lisääntynyt vientikilpailu Kiinan kanssa vaikuttaa suomalaisyritysten vientiin sekä tuotevalikoimaan. Käyttämällä uutta Kiinan vientipolitiikan muutoksia hyödyntävää tunnistamisstrategiaa havaitsemme, että Kiinan vientikilpailu vähentää suomalaisyritysten tuotteiden kokonaisvientiä. Yritystason analyysi osoittaa, että kilpailu Kiinan kanssa johtaa merkittäviin hinnanalennuksiin markkinaosuuksien ennallaan pitämiseksi, erityisesti homogeenisten tuotteiden osalta. Lisäksi tutkimuksessa havaitaan, että yritykset reagoivat Kiinan kanssa lisääntyneeseen vientikilpailuun lopettamalla niille vähemmän tärkeiden tuotteiden viennin. Tutkimuksen tulokset korostavat Kiinan kanssa käytävän vientikilpailun merkitystä kehittyville maille.

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Keywords: Trade flows, Export competition, Firm-level, Product mix, China

Asiasanat: Kauppavirrat, Vientikilpailu, Yritystaso, Tuotevalikoima, Kiina

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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 has led to substantial concerns that domestically manufactured products are 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 labor-intensive goods. However, when Chinese production climbs higher on the value chain ladder, the production of more advanced products risk being out-competed. Notably, the export bundles of developed economies and China are increasingly similar (Schott, 2008). 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 analyzing how the intensified Chinese export competition affects both aggregate-level exports, and exports and product ranges of firms from Finland, an example of a developed economy highly dependent on exports. Exports constitute a substantial 40 percent of the Finnish gross domestic produuct (GDP), a feature common in many other European countries.[1] However, during the period 1999 to 2012, the annual growth of total Finnish exports shifted from strongly positive to negative. Furthermore, as shown in Figure 1, Finland lost global export share for the 10 most important export product groups for Finland, while China's export shares for the same product groups tripled during this period.[2] This observed negative relationship suggests that Finland's exports have performed weakly, while China's exports expanded.

This paper also contributes to the literature methodologically, as we propose a novel identification strategy that exploits Chinese export policy changes to address the longstanding empirical challenge in analyzing the causal impact of Chinese competition. In the era of economic reforms, China experienced a dramatic increase in production capacity, and underwent substantial trade liberalization (see e.g. Naughton, 2006; Hsieh and Klenow, 2009; Brandt, Van Biesebroeck and Zhang, 2012). 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

[1] Source: World Development Indicators.

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

shocks can bias the ordinary least squares (OLS) estimation results. Moreover, supply-side factors, such as offshoring activities and unfavorable technology shocks in Finland, can potentially reduce Finnish exports and increase Chinese exports simultaneously, creating a spurious negative effect. To tackle these problems, we introduce an instrumental variable approach that exploits changes in the product-specific export restrictions introduced by China. In particular, we explore changes in the, Chinese product-specific export quota and licensing restrictions and the abolishment of the restriction on export rights restriction. These two policy instruments, together with the distance between China and its exporting partners, create exogenous variation in Chinese export competition at the destination-product-year level.

Our instrumental approach has an advantage over common methods used in the literature to address the endogeneity problem in assessing the impact of the Chinese trade shock. Autor, Dorn and Hanson (2013), for example, use Chinese exports to other developed countries as an instrument for Chinese exports to the United States to tease out U.S. industry import demand shocks. Similar strategies have been widely adopted in the literature to assess the impact of Chinese import/export penetration (Iacovone, Rauch and Winters, 2013; Autor et al., 2014; Balsvik, Jensen and Salvanes, 2015; Acemoglu et al., 2016; Feenstra, Ma and Xu, 2017). However, as Autor, Dorn and Hanson (2013) admit, there are several threats to this strategy, such as common demand or technology shocks in high-income countries. Utar (2014) and Bloom, Draca and Van Reenen (2016) adopt a more direct approach to address the endogeneity issue. In particular, they use the abolishment of quotas under the Agreement on Clothing and Textiles (formerly the Multi Fiber Agreement, MFA) to analyze the effect of import competition on firm and worker outcomes. A limitation of the MFA approach is its inability to capture changes in industries other than textile. In this paper, we exploit information about the trade policy changes initiated by China that affected a broader range of industries, and that were common to all destinations. This approach enables us to open the black-box of the increase in Chinese exports, and to address the endogeneity issue more generally.

Using the instrumental variable approach outlined above, we first analyze the effect of intensified Chinese export competition on aggregate Finnish product-country-level exports from 1999 to 2012. We find that a one percentage point increase in the Chinese export market share reduces the Finnish export value by 5.65 percent. We further show that the downward pressure that Chinese export competition puts on global and Finnish export prices is an important mechanism for shrinking Finnish exports.

The crowding-out effect of Chinese competition on Finnish exports is, although larger, consistent with those found by Flückiger and Ludwig (2015), which is the only study, to the best of our knowledge, that has assessed the competition effect of China on exports of developed countries. In particular, the

authors use bilateral product-level trade data for 22 European countries for the 1995-2008 period to show 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 percent. However, the aggregate data used in their study does not allow a deeper analysis of firms' adjustment to changes in the exporting firms' market environment.

We reach beyond Flückiger and Ludwig (2015) analysis by analyzing the within-firm adjustment at the intensive and extensive margins in response to Chinese export competition. Using firm-level Finnish customs trade data, we find the rising Chinese export market share increases, rather than decreases, product-country-specific export values of Finnish firms, although the effect is not statistically significant at conventional levels. To study the mechanism through which Chinese competition affects exports, we estimate the impact on prices and quantities separately. We find that Chinese export competition statistically significantly decreases the unit value but increases the quantity of Finnish firms' exports. The results suggest that the competition effect occurs primarily through price cuts to retain market shares. The opposite effects on export price and quantity are likely to explain the non-significant intensive margin adjustment, measured with the overall export values. To further analyze whether the price effect differs by product types, we divide products by Rauch (1999)'s classification based on differences in price-setting strategies, and find that Chinese competition puts greater downward pressure on the prices of homogeneous and reference-priced products than on the prices of differentiated products.

Next, we examine how Finnish firms adjust their export sales strategies on the extensive margin. The results suggest that firms are more likely to drop products in markets that experience larger increases in Chinese export market shares, but the effect is not different from zero at the conventional levels of statistical significance. However, taking into account the relative importance of a product in the export product portfolio of a firm distinguishes the effect of Chinese competition on 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. These results are robust to alternative measures of importance, and consistent with the theoretical prediction that as a response to intensified competition, firms skew their exports toward core products by dropping their marginal products.

In sum, this paper makes the following key contributions. First, this paper 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. Unlike the commonly used method that instruments Chinese exports to the country of interest with Chinese exports to other parts of the world, we no longer need to assume away common demand shocks between the country of interest and other countries used

to construct instrumental variables.

To compare the results with those obtained with conventional methods, we rerun all the firm-level estimations using an alternative instrument based on the Chinese export supply in other parts of the world. The validity of this type of widely used instrument relies on strong assumptions, such as demand shocks are not correlated between the country of interest and the choice of countries used to construct the instruments. In a simple replication exercise, we instrument Chinese export competition in a particular country using the Chinese export share to the rest of the world, that is, all destination markets except for the one being instrumented for. This comparison reveals two major differences in the present results. First, according to the results using the Chinese relative export supply instrument, the increased Chinese export competition in the destination markets leads to lower Finnish firms' export prices and export values for competing products. These results, however, contrast with those obtained from the main instrumental strategy based on policy instruments, in which we find Chinese competition reduces Finnish firms' export prices, but increases their sales volume. Second, unlike the results that firms drop marginal products in response to intensified Chinese export competition, results obtained from the Chinese relative supply instrument show that firms are more likely to drop their core products, although this effect is not statistically significant in most specifications. These differences in key outcomes indicate the existence of confounding factors, such as common demand shocks in destination markets or supply shocks in the country of study, and highlight the usefulness of the proposed policy instruments in teasing out these factors in the evaluation of the impact of China's global export expansion.

This paper also highlights the importance of export competition with China for developed countries, on which previous studies largely focused on import competition. The existing empirical studies on export competition focus on the crowding-out effect of Chinese exports for Asian countries (Eichengreen, Rhee and Tong, 2007; Xing, 2011) or on the substitution effect of Chinese products for Latin American imports in the U.S. market (Moreira, 2007; López-Córdova, Micco and Molina, 2008; Montenegro, Pereira and Soloaga, 2010; Jenkins, 2010). In a multiple-country study, Hanson and Robertson (2010) estimate that if China's export supply capacity had remained constant over the 1995–2005 period, the demand for exports would have been 0.8 percent to 1.6 percent higher in the 10 developing economies for which manufacturing represents more than 75 percent of the merchandise exports.[3] According to the results, 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

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

exports as Finland.

By extending the analysis to the extensive margin of adjustment at the product-firm level, the paper also relates to the small but fast-growing literature on the export decisions of multi-product firms under globalization. Theoretical works have focused on the changes in equilibrium under bilateral trade liberalization. Bernard, Redding and Schott (2011), for example, use a general equilibrium model to show firms drop their least-successful products in trade liberalization. Unlike the constant elasticity of substitution (CES) demand assumption, and the resulting fixed markups, adopted in Bernard, Redding and Schott (2011), Mayer, Melitz and Ottaviano (2014) allow markups to vary across destinations. Their model predicts that firms drop their marginal products and increase the export share of the firms' best-performing products in markets with tougher competition. Rigorous empirical evidence of firms' export product choices is limited, with the same focus of trade liberalization. In the context of Mexican trade integration under NAFTA, Iacovone and Javorcik (2010) document substantial changes in product mix at the firm level, and further, show that firms are more likely to drop their marginal products than their core products. To the best of our knowledge, Iacovone, Rauch and Winters (2013) are the only authors who have analyzed firms' export product choices with a unilateral trade shock. In particular, they show that Mexican firms are less likely to drop their core products with increased competition from China in the firms' main export market, the United States. Instead of focusing on a single export destination, we examine Finnish firms' product choices in all possible export destinations. The result of a lower likelihood of dropping core products confirms the heterogeneous cross-product response to trade shocks or policy changes documented in the literature.

In the section 2, we present our identification strategy. In Section 3, we describe the data and present descriptives. In Section 4 and 5, we present estimation results for the country-level and firm-level analysis, respectively. In Section 6, we compare the results with those obtained using an alternative instrument that exploits Chinese exports to other countries. In section 7, we conclude.

2 Identification Strategy

In estimating the impact of Chinese export competition on Finnish exports, several confounding factors may bias the conventional OLS estimates. 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 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 trade 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 Finnish firms relocated their production and assembly lines in China in search of lower costs, China would then export the final products to the destination markets, instead of Finland. In this case, we would observe a decline in Finnish exports and an increase in Chinese exports simultaneously. This negative association, however, cannot be interpreted as the impact of Chinese export competition on Finnish exports. Similarly, technology shocks that adversely affect Finnish firms would make them vulnerable to export Chinese competition. In this case, weakened Finnish exports drive Chinese export expansion in competing industries, rather than vice versa.

To tackle the identification challenges outlined above, we construct instruments for Chinese export competition by exploring Chinese export policy, and its changes that generate exogenous variation in China's product-specific export supply. In particular, our approach is based on 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 the relaxation of restrictions on export rights in China. These 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 China export competition on Finnish firms.[4] Next, we describe the construction of each of the three instruments used in the main analysis, and provide relevant policy backgrounds.

[4] Although one could argue that the changes in the Chinese quota and licensing restrictions affect Finnish firms' offshoring decisions, this is unlikely to be the case for the quota and licensing products that are crucial for identification. Most of the products subject to the "active" quota and licensing requirements are on the list for more than one year during the sample period. Uncertainty about being relisted in the future deters Finnish firms from offshoring products that are temporarily off the list.

Instrument 1: China's export quota and licensing system

In addition to the often-examined passive MFA quota set by other countries, China adopts an "active" quota and licensing system to control Chinese exports of certain products. 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 nonrenewable resources; and/or for certain agricultural products.[5] 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.[6] 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."

The current Chinese quota and licensing 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. 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. When first established in 1992, the list covered a large number of products, accounting for 48 percent of the total Chinese export value (World Trade Organization, 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, transportation, etc. 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.[7] Therefore, the initial included products

[5]Source: http://www.gov.cn/gongbao/content/2002/content_61506.htm.

[6]The use of export restrictions is common around the globe given the "under-regulation" of World trade Organization(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, Koscielski and Wilson, 2009). In terms of formal regulations, WTO law does not properly define the circumstances that justify quantitative restrictions on export (Karapinar, 2012). Although Article XI of General Agreement of Tariffs and Trade (GATT) states that export restrictions other than duties and taxes, such as quotas or export licenses, 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).

[7]Around 2 percent of the products on the quota and licensing list are subject to country-specific restrictions in the sample period, 1999 to 2012. We exclude them in constructing the panel data for the

and the changes in the quota list are presumably exogenous to Finnish exports to any given country, a feature that allows for potential causal analysis.

We construct a panel for quota and licensing requirement data in the period 1999 to 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 one if any of the subordinate eight-digit products are subject to a quota and zero 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.[8] As shown in 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. In Figure B.1, the number of products for each industry in 1999 and 2012 is plotted. 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 percent) are on the list for the entire period, 108 (or 22 percent) for 7 to 13 years, 181 (or 37 percent) for 2 to 6 years, and 115 (or 23 percent) for only 1 year.

Instrument 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 percent of all Chinese imports at that time, and the export plan explicitly specified export quantities for more than 3,000 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

quota and licensing instrument.

[8] Unfortunately, we are unable to construct a weighted "intensity" measure using pre-period export values as weights because exports in previous periods are themselves affected by the export restrictions.

products it was responsible for trading.[9]

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 licenses 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 license.[10] Firms without foreign trade licenses can engage in foreign trade only by hiring licensed firms as agents. Unlike the quota and licensing system discussed above, trade rights licenses are not product-specific.

The second instrument is constructed according to the amendment of the Foreign Trade Law in accordance with China's accession to the WTO. Effective on 1st of July in 2004, the new Foreign Trade Law replaced the trade rights license 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, $RightRest$, that equals one for the years before 2004 and zero for the years after. As the new Foreign Trade Law became effective on July 1, 2004, we assign a value of 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.

Instrument 3: Distance between China and its export destination countries

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, then removing fixed policy costs would lead to a *larger percent 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. To capture this variation, we interact the trade policy instruments with the distance between China and the export

[9]Lardy (2005) provides a detailed description of the history of Chinese trade policy.

[10]See http://www.people.com.cn/zixun/flfgk/item/dwjjf/falv/1/1-1-01.html for details of the China's Foreign Trade Law enacted in 1994.

destination.[11]

To validate the main instruments, we estimate the effect of the quota and licensing system and the trade rights reform on the Chinese global export supply. As shown in Table B.1a in Appendix B, both instruments have a negative and statistically significant impact on the logarithm of the total China 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 instruments 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, and the share of Chinese exports in the total global export value to OECD countries. Together, the trade policy variables explain approximately 37 percent of the variation in the Chinese product-level exports. This 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 destination countries to which Finland exports.

3 Data Sources and Descriptives

The aggregate-level analysis uses cross-country trade flow data from 1999 to 2012 obtained from the UN Comtrade database. We restrict the estimation sample to countries that imported from Finland in 1999, the base year of the study, and to country-product markets that Finland ever exported to during the entire sample period (1999–2012). As the Comtrade data records 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. According to the descriptive statistics shown in Appendix Table A.1, Finland exports to 47 percent of all relevant product-country markets in a given year. China is an active player in these export markets. The average 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 percent.

We use two additional sources of data for firm-level analysis. The firm-level export data obtained from Finnish Customs is available as annual transactions at the level of the eight-digit Combined Nomenclature (CN8) by country of destination for the 1999–2012 period.[12] Stemming from compulsory registration in Finnish Customs, data on exports to countries outside the European Union (EU) consists of all trade transactions. Data for trade transactions to other EU countries is available for all firms with annual

[11] Distance is defined as the great circular distance between capitals.

[12] The Combined Nomenclature, used by EU countries, is an extended version based on the Harmonized Commodity Description and Coding System (Harmonized System, or HS).

exports to all other EU countries of more than 100,000 euros.[13]

For firm-level analysis, we restrict the sample to manufacturing firms with at least 20 employees in the first year in the data, which is 1999 for most firms. The number of employees and the industry code variables that we use come from a register-based firm-level financial statement panel provided by Statistics Finland. Descriptive statistics of the regression panel data are reported in Appendix Table A.2.

4 Country-level Exports

4.1 Estimation Model

Before moving to firm-level analysis, we analyze the impact of Chinese export competition on the aggregate product-destination specific exports of Finnish firms. We focus on the impact of Chinese export competition on two types of exporting behavior (i.e., $FinE_{jkt}$), (1) the likelihood of export, measured by a dummy that equals one if Finland exports product k to country j in year t, and zero otherwise; and (2) the log value of the export volume conditional on exporting, i.e., $ln(FinEV_{jkt})$. We also examine whether the competition impact is realized via downward pressure on unit prices, by using the log of unit export value $ln(FinEP_{jkt})$ as an additional dependent variable.[14]

We measure the level of the Chinese export competition (CEC_{jkt}) by Chinese export market share, calculated as the 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}):

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

This relative measure of Chinese export competition neutralizes common demand shocks in country j (type 2 demand shock). In addition to this "relative" share measure, we check the robustness of the results using an alternative "absolute" measure of Chinese export competition, $ln(CEV_{jkt} + 1)$, where CEV_{jkt} is the log value of Chinese exports in product k to country j in year t. We add one to the total

[13]EU countries may set this threshold themselves. One hundred thousand euros is the threshold applied in most EU countries.

[14]The quantity used in the unit price calculation is measured in kilograms, because other quantity measures are not available for all commodities. Although, the technology change may affect the weight of a product over time, the export weight remains a valid measure of the export volume after controlling for the year fixed effect.

trade value to keep products not shocked by China in the analysis. We model the Finnish exporting behavior to country j of product k in year t as the following:

$$FinE_{jkt} = \beta_0 + \beta_1 CEC_{jkt} + \theta_{jt} + \gamma_k + \epsilon_{jkt}, \quad (2)$$

where 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 export product-destination markets, we would expect that increases in Chinese export competition crowd out Finnish exports to these markets; i.e., $\beta_1 < 0$. We expect this negative effect is more likely to be present for the value adjustment at the intensive margin, and only in extreme cases does the intensified Chinese export competition cause Finland to stop exporting a specific product to a destination country as a whole.

Although we measure Chinese export competition in relative terms to tease out common demand shocks at the destination country (type 2) in the main specification, 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 previously discussed, 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 to. In particular, we estimate the following first-stage specification:

$$\begin{aligned} CEC_{jkt} = \beta_0 + \beta_1 Q\&L_{kt} + \beta_2 RightsRes_t + \beta_3 Dist_j + \beta_4 Q\&L\_RightsRes_{kt} + \\ \beta_5 Q\&L\_Dist_{jkt} + \beta_6 RightsRes\_Dist_{jt} + \beta_7 Q\&L\_RightsRes\_Dist_{jkt} + \\ \theta_{jt} + \gamma_k + \epsilon_{jkt}, \quad (3) \end{aligned}$$

where $Q\&L_{kt}$ is a binary variable that equals one if product k was subject to the Chinese quota and licensing restrictions in year t, and zero otherwise; $RightsRes_t$ equals one if the export was subject to manual export license approval (in contrast with the auto-export license registration) in year t (1999 to 2003), 0.5 in year 2004, and zero for years from 2005 onward; and $Dist_j$ is the great circle distance between country j and China. $Q\&L\_Right_{kt}$, $Q\&L\_Dist_{jkt}$, $RightsRes\_Dist_{jt}$, and $Q\&L\_RightsRes\_Dist_{jkt}$ are a full set of interactions among $Q\&L_{kt}$, $RightsRes_t$ and $Dist_j$. θ_{jt} and γ_k represent country-year fixed effects and product fixed effects, respectively.

4.2 Results

Table 1a shows the impact of Chinese export competition on Finnish exports using the main specification outlined in equations (1) and (2). Export competition is defined in relative terms, that is, the share of Chinese exports of the total global exports to a particular product-destination market. The OLS results reported in column (1) show 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 percent. Conditional on exporting, a 1 percentage point increase in the Chinese export market share is associated with a 1.34 percent reduction in the Finnish export value (column (3)). Both effects are statistically significant at the 1 percent level.

In Table 1b, columns (1) and (3) show OLS regression results with an alternative measure of Chinese export competition in absolute terms. Interestingly, the estimated effect is the opposite sign of those obtained using relative export competition measures. In particular, we find a 1 percent increase in the Chinese export value is associated with a 0.8 percentage point increase in the likelihood that Finland exports the same product to the same destination country, and a 4.5 percent increase in the export value conditional on exporting.

The difference between the results obtained from the relative measure of Chinese export competition and this alternative absolute measure provides evidence of common demand shocks in a destination country (type 1). A positive (negative) demand shock leads to an increase (decrease) in imports from China and Finland, generating a positive correlation between Chinese and Finnish exports as documented in Table 1b, when Chinese export competition is measured in the logarithm of one plus absolute values. The main specification uses the export share to measure Chinese export competition, which enables us to tease out the common demand shocks faced by both countries. After controlling for common demand shocks, results shown in columns (1) and (3) of Table 1a reveal that Chinese exports crowd out Finnish exports in export destination markets.

Although using market share to measure Chinese export competition is helpful in teasing out common demand shocks in a certain destination market, there may still be unobserved demand shocks that are country specific within a destination or common across destinations, i.e., shock type 2 or 3, as well as other confounding factors. In this case, OLS estimates are still biased. Therefore, we resort to an instrumental variable approach to address this issue. As outlined in Section 2, the instruments are based on a series of Chinese trade policy reforms. They serve as export-supply shocks from China, and are exogenous to any unobserved country-specific demand shocks, as well as Finnish supply shocks.

Regression results using the IV approach differ from those obtained from OLS. As shown in Table 1a,

Chinese export competition, measured in relative terms, no longer affects the likelihood of Finland exporting the same product to the same country. Although the effect is still negative, the point estimate is small, and is not statistically significant. Conditional on exporting, the impact on the Finnish export value is much larger than that of OLS: A 1 percentage point increase in China's export share reduces the Finnish export value of the same product by 5.65 percent. These results show 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. In this sample, the average Chinese export market share rose from 4.3 percent in 1999 to 14.5 percent in 2012 in the relevant Finnish markets, which implies a 57.6 percent reduction in Finnish potential exports during this period.

We test the robustness of the IV results using the absolute measure of Chinese export competition, and the estimated impacts are qualitatively similar. Unlike the OLS results, the impact of Chinese export competition on Finnish exports is no longer positive according to the IV results shown in Table 1b, columns (2) and (4). Instead, although a 1 percent increase in the Chinese export value has no impact on the likelihood of Finland exporting, the increase reduces the Finnish export value by 0.13 percent. These results are in line with those found in the main specification with the relative measure of Chinese export competition.

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 global prices. To explore the importance of this price mechanism, we estimate the impact of Chinese export competition on global and Finnish export prices, proxied as unit values per kilogram, using an IV specification analogous to the one outlined above. We exclude Chinese exports from the global export values and quantities to compute product-destination-specific unit values for the rest of the world. As shown in Table 2a column (1), a 1 percentage point increase in the Chinese export share in a destination country reduces the price of the global export to this country by 2.83 percent. The magnitude of this impact of export competition is similar to those found by Auer, Degen and Fischer (2013) for import competition, who show that a 1 percentage point increase in the European market share of Chinese and other Asian low-wage countries' firms decreases European prices by about 3 percent.

The downward pressure on global export prices may or may not fully affect Finland, depending on the nature of the competition in the destination markets. For instance, if Finnish firms have established brand loyalty or export products of higher quality, the firms would be able to export at prices above the average. This seems to be the case we find. As reported in Table 2a, column (2), the downward pressure on price is only partially passed on to Finnish export: A 1 percentage point increase in Chinese

export share reduces Finnish export prices by 1.58 percent, which is statistically significantly smaller than the one found for global prices (p=0.047). Similarly, the price effect is also evident, and is smaller for Finland than for the global average using the absolute measure of Chinese export competition in logarithm terms. Nonetheless, the magnitude of the Chinese export competition effect on Finnish export prices is still large, signifying a substantial threat faced by Finnish exporting firms.

5 Firm-level Export Performance

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 exporting product mix choices and price cuts, 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.

5.1 Firm-level Intensive Margin: Estimation Model

In the firm-level analysis, we start by analyzing 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 behaviors of product k to country j in year t as the following:

$$FinE_{ijkt} = \beta_0 + \beta_1 CEC_{jkt} + \theta_{ijk} + \gamma_t + \epsilon_{ijkt}, \tag{4}$$

where the exporting behaviors of Finnish firms, $FinE_{ijkt}$, include the total export value, unit export value, and export quantity, all measured in logarithm terms. This analysis is conditional on exporting as taking the natural logarithm of the Finnish export value excludes the observations with the value of zero, and leads to an unbalanced panel.[15] Again, we measure the level of Chinese export competition, CEC_{jkt}, by the export value of product k from China to country j in year t (CEV_{jkt}) as a share of the total global export value (WEV_{jkt}). We include firm-product-country specific fixed effects, θ_{ijk}, and time dummies, γ_t. Therefore, the coefficient of interest, β_1, captures within-firm, -product and -country export adjustment in response to Chinese export competition across time. Standard errors are clustered at the firm-product-country level.

[15] A firm's export behavior is granular, as it does not need to export in consecutive years to be active in the exporting market. This measure helps avoid this granularity issue by dropping zeros.

We use the same trade policy instruments for Chinese export competition as in the aggregate country-level estimations: the quota and licensing requirement ($Q\&L_{kt}$), export rights restrictions ($RightRes_t$), the distances between China and its export destination markets ($Dist_j$), and a full set of their interactions.

5.2 Firm-level Intensive Margin: Results

Table 3 presents the estimated impact of Chinese export competition on various export indicators of Finnish firms, all conditional on continuing exporting. The OLS results reported in column (1) show 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 0.26 percent. 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), a 1 percentage point increase in the Chinese export market share lowers the Finnish firms' export prices measured by unit values by 0.08 percent and reduces the export quantities measured in terms of kilograms by 0.14 percent, both of which are statistically insignificant at the 1 percent 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.

In contrast, IV estimates show that Chinese competition does not crowd out exports from Finnish firms. Although not statistically significant, the sign of the effect is positive instead (column (2)). According to column (4), we find again that Chinese competition puts downward pressure on the unit values of Finnish firms' exports, but the magnitude of the effect is larger than those obtained from 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 1.25 percent. The price effect is smaller in the firm-level estimations than in the aggregate-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)). Unlike the negative effect documented in the OLS results, the IV results suggest that a 1 percentage point increase in the Chinese export share *increases* the exported quantities by 2.51 percent. The difference between the OLS and IV estimates likely indicates the existence of unobserved confounding factors that would bias OLS estimations. The sales expansion result shows that Finnish firms cut prices in response to intensified competition with China to retain their market

shares. The opposite effects on unit values and quantities cancel each other out, resulting in the overall non-statistically significant positive effect of increased Chinese export competition on Finnish firms' export values found earlier.

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 supply is expected to be particularly strong for commodities that are traded on organized exchanges where Finnish firms take the 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) categorized all traded commodities into three groups: homogeneous, reference-priced, and all other (i.e., heterogeneous) commodities. Homogeneous commodities are traded and priced in organized exchanges. 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 *Chemical Marketing Reporter* quotes its price per pound weekly based on surveys of suppliers. 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. 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 Rauch's (1999) the 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 Table 4 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 (panel a, column (4)). In particular, a 1 percentage point increase in the Chinese export market share decreases the unit value of Finnish exports by 1.47 percent.

For heterogeneous products, the price effect is smaller: A 1 percentage point increase in the Chinese export market share reduces Finnish export prices by 0.68 percent (Panel b, column (4)).[16] Again, these results sharply contradict those obtained from the OLS estimations, in which we find Chinese competition reduces export prices and values only for differentiated products.

In sum, these results provide evidence that firms exporting heterogeneous differentiated products are less affected by the increasing Chinese exports. These firms likely have established brand names, and the monopolistic power they possess help shield them partially from Chinese export competition. The export value of these products is not hurt by Chinese export competition: The estimated impact, although not statistically significant, is, in fact, positive. However, 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. Consistently, regardless of being not statistically significant, we also find increased Chinese export competition has a negative effect on the export value of homogeneous and reference-priced products. These products constitute a substantial share of the total commodity exports of Finland, indicating the importance of Chinese export competition for the profit margin of Finnish exporting firms.

5.3 Firm-Level Extensive Margin: Estimation model

The intensive margin adjustment analyzed above, that is, changing the value, quantity, and price of exports, is only one possible reaction of firms to intensified 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, Redding and Schott, 2011; Mayer, Melitz and Ottaviano, 2014). Rigorous empirical evidence of firms' export product choices include, for example, substantial changes in Mexican firms' export product mixes and a higher likelihood of dropping their marginal products rather than their core products after joining NAFTA (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 United States (Iacovone, Rauch and Winters, 2013).

These previous studies provide us with predictions that we explore in the empirical analysis. We turn to firms' within extensive margin adjustment by analyzing whether firms drop products in export destinations in response to Chinese export competition. Further, we analyze whether the relative importance of products in the global portfolio of multi-product firms affects the likelihood that products are

[16] However, we cannot reject the hypothesis that the estimated price effect is larger for the homogeneous and reference-priced group than for the heterogeneous group (p=0.147).

dropped.

An empirical challenge of analyzing product dropping at the firm level is the granularity of the export flows. Previous studies using transaction data, e.g., Geishecker, Schröder and Sørensen (2017), showed that granularity of the trade flows is a common feature of firm-level trade data. Figure A.1 in Appendix A 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. Nevertheless, an export flow that lasts for one year does not necessarily imply that the firm has dropped the product from the export market. The firm could re-start exporting the same product to the same destination after a break of one or more years.

To take into account the granularity of export activities in the analysis of product dropping behavior, we define firms' export engagement over five-year time intervals. We analyze whether the Chinese export competition crowds out products that were exported in the 1999–2003 period. We choose 2004 as the threshold to define pre- and post- period intervals, because this was the year when the new 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 this pre-period. A product that was exported any year in the 1999–2003 period but not in a five-year period after 2004 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, i.e., firms that exit the export market.

We have two main post-period choices, 2005–2009 and 2008–2012. The former post-period captures the immediate effect, and the latter the effect with a longer time lag so that firms have more room to make necessary adjustments. Descriptive statistics of each of the two collapsed cross-section data are reported in Appendix Table A.3. Product dropping behavior in destination markets is common for Finnish firms. Among all firm-product-destination combinations with positive export values in the period 1999–2003 period, 38 percent and 40 percent were dropped in the post-periods 2005–2009 and 2008–2012, respectively.

We define the increase in Chinese export competition, ΔCEC_{jk}, as the difference in the average yearly Chinese export market share between the pre-period and one of the post-periods, and estimate its effect

on product dropping behaviors in a cross-section analysis with a linear probability model:

$$Product\_drop_{ijk}^{dummy} = \beta_0 + \beta_1 \Delta CEC_{jk} + \theta_i + \epsilon_{ijk}, \quad (5)$$

where $Product\_drop_{ijk}^{dummy}$ is an indicator that equals one if firm i did not export product k to country j in one of the pre-defined post periods, and θ_i is a set of firm dummies. We instrument ΔCEC_{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, the distance between China and its trading partner ($Dist_j$) and their interactions. We cluster the standard errors at the firm level.

Next, we 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 the share of exports for a particular product of a firm's total global exports. The second importance measure is defined 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 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 addresses this issue, and normalizes the product shares by relating them to the share of the most important product. This relative importance measure is computed only for firms with multiple products.[17] In the estimations, we interact the measure of product importance with the measure of Chinese export competition to capture the heterogeneous product dropping behavior across products' competency levels. We use the same set of instruments for this interaction term.

5.4 Firm-Level Extensive Margin: Results

In Table 5, we report firms' extensive margin adjustment (product dropping) in response to increased Chinese export competition for the immediate post-period 2005–2009. The OLS estimation result in Table 5a column (1) suggests that a 1 percentage point increase in the Chinese export market share increases the likelihood that Finnish firms drop the same product from the corresponding export market by 0.06 percentage points. The effect is larger for products with either larger export sale shares or with larger sales relative to the best-selling product (columns (2) and (3)). The OLS result that firms are more likely to drop important products contradicts theoretical predictions in the literature.

[17] The estimation samples consist of very few single-product firms, about 0.2 percent of the observations. In the sub-sample of multiple product firms, the mean number of export products per firm is 16 (at the six-digit HS code level), and the median number is six.

Results change drastically when we instrument the change in the Chinese export market share using trade policy instruments. Although the average effect of Chinese competition on product dropping is no longer statistically significant, the effect varies by the relative importance of the product in the firm's global export portfolio. According to Table 5b, products with larger shares of the firm's global export sales are less likely to be dropped (column (2)). Results are similar when we measure product importance with relative product sales share (column (3)). The results that more important products are less likely to be dropped confirms the predications in the literature.[18]

The sharp contrast between the OLS and IV results shows the existence of the many confounding factors discussed previously that may bias OLS results. As shown in Table 6, the results for the 2008–2012 post-period are very similar to those for the 2005–2009 post-period, except that the additional likelihood of dropping core products, although still negative, is no longer statistical significant when we use firms' unnormalized export shares to measure product importance. Taken together, the results suggest that an increase in Chinese export competition raises the likelihood of dropping a marginal export product from a market where Chinese competition has intensified.

The firm-level analysis uncovers important firm adjustment strategies in response to increased Chinese export competition that are masked in the cross-country analysis. In Section 4, we showed that in aggregate, Chinese export competition crowds out Finnish exports of the same product to the same export destination measured with the log of Finnish export value. According to our micro-level 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 overall immediate effect on the export value, i.e., firm intensive margin adjustment, is negative but not statistically significant. The decisions to drop products from particular export markets completely, and the resulting changes in the export product range, are also important firms' adjustment behaviors that could help explain the aggregate findings.

6 Comparison with the Chinese Relative Export Supply Instrument

Throughout the paper, we have shown that results obtained using the policy instruments differ in a few key outcomes from those obtained from OLS. In this section, we use an alternative instrument based on

[18] We also use product rank as a measure of importance. These results confirm a similar effect of the product's relative importance.

the Chinese global export supply, and compare the firm-level results for the two instrumental variable approaches. The Chinese export supply is widely used in the literature to instrument for Chinese import or export competition. Autor et al. (2014), for instance, instrumented for growth in Chinese imports to the United States using Chinese imports in eight other developed countries. The idea is that much of the growth in Chinese imports results from changes in Chinese supply factors, including the rising competitiveness of manufacturers, as well as policy and institutional changes. Similarly, we base the alternative instrument on China's export supply, and define the relative measure $CRES_{jkt}$ as the Chinese export value to all destination markets, except for the one being instrumented for, divided by the total global export value to these same markets:

$$CRES_{jkt} = \frac{CES_{kt}^{World} - CES_{jkt}}{WES_{kt} - WES_{jkt}}, \tag{6}$$

where CES_{kt}^{World} is Chinese exports of product k in year t to the world, and CES_{jkt} is Chinese exports of product k in year t to country j. WES measures are equivalent for the sum of the world exports of product k.

The Chinese relative export supply instrument helps to tease out demand shocks in country j (type 1 and 2) from the China-specific variation in the export supply. Because the relative export supply measure generates continuous variations across the product, destination country, and year, the measure provides more power to detect the impact of increased Chinese export competition on Finnish firms' exports than the binary quota policy instrument adopted in the main specifications. However, as admitted by Autor et al. (2014), the export supply measure is unable to tease out demand shocks that are shared by country groups and domestic supply productivity shocks. We keep these limitations in mind when interpreting the results.

For intensive margin adjustment, the results reported in Appendix Table A.4 are similar to those for the OLS specifications. Increased Chinese export competition in destination markets leads to lower export prices, quantities, and export values for Finnish firms. These results, however, differ from those obtained from the main policy instruments, in which we find Chinese competition *increases* Finnish firms' export quantities, and the overall impact on export value is not statistically significant but positive. In addition, the results reported in Appendix Table A.5 show that the intensified Chinese export competition negatively affects the prices of differentiated products more than those of homogeneous products, which are similar to OLS results but are in contrast with the results obtained from the policy instruments. These differences likely reflect the existence of confounding factors that are not accounted for by the Chinese relative supply instrument.

For the average adjustment at the extensive margin, the results using the Chinese relative supply instrument are consistent with those for the main specification (Appendix Table A.6, column (1)). The intensified Chinese export competition increases the likelihood that Finnish firms drop the same export product in a particular destination market; however, this positive effect is not statistically significant in either of the post-periods. For heterogeneous product dropping behavior based on core competency, results obtained from the Chinese relative supply instrument show that firms are more likely to drop core products in both post-periods in response to Chinese export competition, regardless of the measures of importance we use, i.e., firms' export product share or the relative product share to the best-selling product. The positive effect is not statistically significant in most specifications, except for the post-period 2008–2012 specification with the relative product share measure of importance. These results differ from those obtained using the main policy instrument, and are inconsistent with predictions in the literature.

In sum, estimation results using the conventional Chinese relative supply instrument contrast with those using the proposed policy instruments for many key outcomes of firms' adjustments. These differences highlight the existence of confounding factors, such as common demand shocks in destination markets or supply shocks in the country of study. Assuming away these factors, as done with the Chinese relative export supply approach, can potentially bias the estimation results. In extreme cases, the bias is large enough to change the sign of the impact, leading to inappropriate policy recommendations. The proposed binary policy instrument, when used in applicable settings, helps overcome these issues.

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 analyze 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 within-firm coping strategies in export markets.

We find that although Chinese export competition reduces export prices, it increases export quantities for continuing exporting products of Finnish firms, on average. The overall impact on export values is positive, but not statistically different from zero. These results indicate that firms undertake price cuts to retain their market shares in response to intensified Chinese export competition. In addition to the average responses, we show the impact of Chinese export competition by product type. Chinese

competition affected export prices more for heterogeneous products (i.e., those differentiated by quality and other characteristics) than for homogeneous and reference-priced products. This difference indicates the pressure from Chinese competition is disproportionately born by certain Finnish firms. In addition to adjusting sales strategies for products being continually exported, we show firms change their exporting product mix by dropping their marginal products.

The results show the competition with China is not limited to the domestic market for developed countries, on which previous studies largely focused. 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 for the same products exported by developed countries, we find that the negative effects are, however, more substantial for export products that are relatively homogeneous and mainly compete with prices.

Unlike the instrument widely used in the literature for Chinese export competition that is based on the Chinese export market share in other parts of the world, this approach enables us to open the black-box of the rising Chinese exports, and to address the endogeneity issue in a better way. To show how results differ according to the instrument chosen, we instrument Chinese export competition in a particular country using the Chinese export share to the rest of the world, and rerun all firm-level analysis. Using this conventional method, we find increased Chinese export competition in destination markets leads to lower export prices, quantities, and export values for Finnish firms, and a higher likelihood of dropping core products. These results contrast sharply from those obtained from the policy instruments, indicating the existence of confounding factors that the conventional method mentioned above is unable to account for. Further understanding of the underlying causes of the Chinese export expansion, and how to incorporate these causes directly into empirical analysis, would help to evaluate better the resulting impact on other economies, and is an important avenue for future research.

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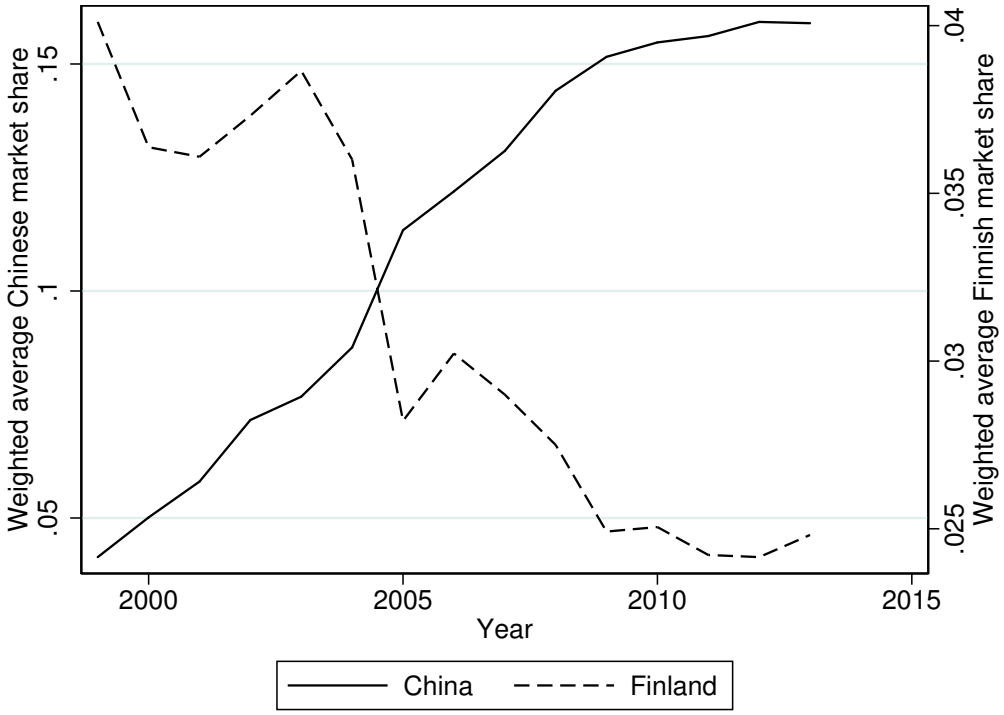

Figure 1: Finnish and Chinese Shares of World Exports for Important Finnish Export Products.

Notes: Figure is drawn based on UN Comtrade data. The weighted market shares are calculated using the ten most important 2-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).

Table 1: Aggregate Effects of Chinese Export Competition on Finnish Exports

(a) Chinese Export Competition Measure: Destination Share

Dependent Variable	Fin. Exp. Likelihood		Ln(Fin Exp. Value)	
Specification	OLS	IV	OLS	IV
	(1)	(2)	(3)	(4)
China Exp. Share	-0.072***	-0.020	-1.335***	-5.649***
	(0.005)	(0.181)	(0.049)	(1.867)
First Stage F-stat	–	23.76	–	17.93
Number of Observations	1,548,227	1,548,227	726,601	726,601

(b) Chinese Export Competition Measure: Log Value

Dependent Variable	Fin. Exp. Likelihood		Ln(Fin Exp. Value)	
Specification	OLS	IV	OLS	IV
	(1)	(2)	(3)	(4)
Ln(China Exp. Value +1)	0.008***	0.005	0.045***	-0.128*
	(0.000)	(0.006)	(0.002)	(0.074)
First Stage F-Stat	–	20.58	–	8.772
Number of Observations	1,548,227	1,548,227	726,601	726,601

Note: For Finland export value analysis, we restrict the sample to observations with positive values, i.e. conditional on exporting. Country-year fixed effects and HS six-digit product fixed effects are included in all specifications. F-stat is Kleibergen Paap rk wald F statistic. Standard errors are clustered at the product level. *, **, and, *** denote significant levels of 10%, 5%, and 1% respectively.

Table 2: Aggregate Effects of Chinese Export Competition on Export Prices

(a) Chinese Export Competition Measure: Destination Share

Dependent Variable	Ln(World Price)	Ln(Fin Price)
	(1)	(2)
China Exp. Share	-2.832**	-1.576*
	(1.181)	(0.950)
First Stage F-stat	18.27	18.27
Number of Observations	707,867	707,867

(b) Chinese Export Competition Measure: Log Value

Dependent Variable	Ln(World Price)	Ln(Fin Price)
	(1)	(2)
Ln(China Exp. Value +1)	-0.090**	-0.064*
	(0.040)	(0.034)
First Stage F-stat	7.954	7.954
Number of Observations	707,867	707,867

Note: We exclude Chinese exports in the calculation of world export prices at destination markets. Country-year fixed effects and HS six-digit product fixed effects are included in all specifications. F-stat is Kleibergen Paap rk wald F statistic. Standard errors are clustered at the product level. *, **, and, *** denote significant levels of 10%, 5%, and 1% respectively.

Table 3: Effect of Chinese Export Competition on Firm-product-country Exports

Dependent Var.	Ln(Value)		Ln(Price)		Ln(Quantity)	
Specification	OLS	IV	OLS	IV	OLS	IV
	(1)	(2)	(3)	(4)	(5)	(6)
China Exp. Share	-0.259***	1.073	-0.080***	-1.249***	-0.142***	2.509***
	(0.029)	(0.689)	(0.013)	(0.305)	(0.029)	(0.716)
First Stage F-stat	–	201.7	–	204.7	–	204.7
Number of Obs.	1,131,029	1,131,029	1,088,387	1,088,387	1,088,387	1,088,387

Note: Firm-product-country and year fixed effects are included in all specifications. F-stat is Kleibergen Paap rk wald F statistic. Standard errors are clustered at the firm-product-country level. *, **, and, *** denote significant levels of 10%, 5%, and 1% respectively.

Table 4: Effect of Chinese Export Competition on Firm-product-country Exports, by Product Types

(a) Homogeneous and Reference-priced Products

Dependent Var.	Ln(Value)		Ln(Price)		Ln(Quantity)	
Specification	OLS	IV	OLS	IV	OLS	IV
	(1)	(2)	(3)	(4)	(5)	(6)
China Exp. Share	-0.506***	-0.175	0.030	-1.474**	-0.382***	1.166
	(0.078)	(1.917)	(0.032)	(0.677)	(0.078)	(1.912)
First Stage F-stat	–	25.67	–	25.40	–	25.40
Number of Obs.	184,914	184,914	180,533	180,533	180,533	180,533

(b) Heterogenous Products

Dependent Var.	Ln(Value)		Ln(Price)		Ln(Quantity)	
Specification	OLS	IV	OLS	IV	OLS	IV
	(1)	(2)	(3)	(4)	(5)	(6)
China Exp. Share	-0.245***	0.139	-0.082***	-0.684**	-0.137***	1.225*
	(0.031)	(0.701)	(0.014)	(0.331)	(0.031)	(0.725)
First Stage F-stat	–	230.8	–	234.1	–	234.1
Number of Obs.	946,115	946,115	907,854	907,854	907,854	907,854

Note: Firm-product-country and year fixed effects are included in all specifications. F-stat is Kleibergen Paap rk wald F statistic. Standard errors are clustered at the firm-product-country level. *, **, and, *** denote significant levels of 10%, 5%, and 1% respectively.

Table 5: Effect of Chinese Export Competition on Firms' Product Dropping Behaviors in Export Destinations: Pre-period 1999-2003 and Post-period 2005-2009

(a) OLS specification

	(1)	(2)	(3)
China Exp. Share	0.057**	0.040	0.037
	(0.027)	(0.027)	(0.026)
China Exp. Share * Product Share		0.218***	
		(0.079)	
Product Share		-0.463***	
		(0.015)	
China Exp. Share * Rel. Prod. Share			0.174***
			(0.051)
Relative Product Share			-0.330***
			(0.010)
Number of Observations	216,824	216,417	216,417

(b) IV specification

	(1)	(2)	(3)
China Exp. Share	0.302	0.213	-0.021
	(0.442)	(0.466)	(0.450)
China Exp. Share * Product Share		-4.279***	
		(1.481)	
Product Share		-0.228***	
		(0.080)	
China Exp. Share * Rel. Prod. Share			-2.275**
			(1.003)
Relative Product Share			-0.198***
			(0.056)
First Stage F-stat	43.68	25.38	27.32
Number of Observations	216,824	216,417	216,417

Note: Firm fixed effects are included in all specifications. F-stat is Kleibergen Paap rk wald F statistic. Standard errors are clustered at firm level. *, **, and, *** denote significant levels of 10%, 5%, and 1% respectively.

Table 6: Effect of Chinese Export Competition on Firms' Product Dropping Behaviors in Export Destinations: Pre-period 1999-2003 and Post-period 2008-2012

(a) OLS specification

	(1)	(2)	(3)
China Exp. Share	0.034*	0.026	0.020
	(0.020)	(0.018)	(0.018)
China Exp. Share * Product share		0.078	
		(0.067)	
Product share		-0.384***	
		(0.015)	
China Exp. Share * Rel. Prod. Share			0.093**
			(0.044)
Relative Product Share			-0.277***
			(0.011)
Number of Observations	213,516	213,109	213,109

(b) IV specification

	(1)	(2)	(3)
China Exp. Share	0.419	0.277	0.014
	(0.358)	(0.320)	(0.295)
China Exp. Share * Product Share		-2.833**	
		(1.233)	
Product Share		-0.167*	
		(0.094)	
China Exp. Share * Rel. Prod. Share			-0.802
			(0.786)
Relative Product Share			-0.210***
			(0.061)
First Stage F-stat	37,19	24.66	23.64
Number of Observations	213,516	213,109	213,109

Note: Firm fixed effects are included in all specifications. F-stat is Kleibergen Paap rk wald F statistic. Standard errors are clustered at firm level. *, **, and, *** denote significant levels of 10%, 5%, and 1% respectively.

APPENDIX A: ADDITIONAL TABLES AND FIGURES

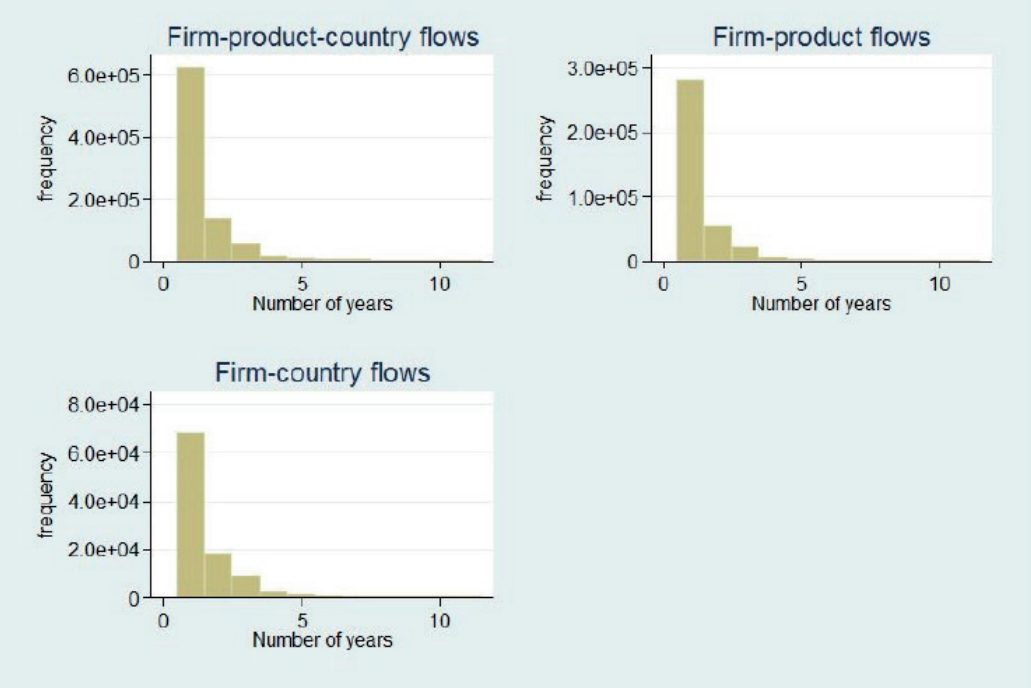

Figure A.1: Frequency of Export Flows by Duration in Years

Table A.1: Descriptive Statistics: Country-level Exports

Variables	Mean	Std. Dev	Observations
Finnish Exports			
$Finland\_Export\_Dummy$	0.469	0.499	1,548,227
$Ln(Fin\_Exp\_Value)$	9.958	2.980	726,704
Chinese Export Competition			
$China\_Exp\_Market\_Share$	0.102	0.186	1,548,227
$Ln(China\_Exp\_Value + 1)$	8.763	6.106	1,548,227

Source: UN COMTRADE database 1999-2012. Data are at the product-country-year level. We restrict the sample 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).

Table A.2: Descriptive Statistics: Firm-level Exports

Variables	Mean	Std. Dev	Observations
Ln(Value of Finnish export)	8.655	3.088	1,131,029
Ln(Price of Finnish export)	3.105	1.950	1,088,387
Ln(Quantity of Finnish export)	5.772	3.826	1,088,387
China Export Share	0.094	0.157	1,131,029

Note: Data are at the firm-product-country-year level. Singular firm-product-country observations are excluded.

Table A.3: Descriptive Statistics: Firm-level Export Product Dropping Behaviors

Variables	Mean	Std. Dev	Observations
Likelihood of Product Dropping (2005-2009)	0.381	0.486	216,824
Likelihood of Product Dropping (2008-2012)	0.400	0.490	213,516

Note: We restrict the sample to the firm-product-country observations that have positive export value in a least one year during the pre-period 1999-2003.

Table A.4: Effect of the Chinese Export Competition on Firm-Product-Country Exports: Chinese Relative Export Supply Instrument

Dependent Variable	Ln(Value)	Ln(Price)	Ln(Quantity)
	(1)	(2)	(3)
China Exp. Share	-2.012***	-0.659***	-1.156***
	(0.102)	(0.045)	(0.101)
First Stage F-stat	176.8	162	162
Number of Observations	1,131,024	1,088,382	1,088,382

Note: Firm-product-country and year fixed effects are included in all specifications. Standard errors are clustered at the firm-product-country level. *, **, and, *** denote significant levels of 10%, 5%, and 1% respectively.

Table A.5: Effect of the Chinese Export Competition on Firm-Product-Country Exports, by Product Types: Chinese Relative Export Supply Instrument

(a) Homogenous and Reference-priced Products

Specification	Ln(Value)	Ln(Price)	Ln(Quantity)
	(1)	(2)	(3)
China Exp. Share	-2.278***	-0.428***	-1.295***
	(0.347)	(0.140)	(0.345)
First Stage F-stat	10.06	9.513	9.513
Number of Obs.	184,910	180,529	180,529

(b) Heterogeneous Products

Specification	Ln(Value)	Ln(Price)	Ln(Quantity)
	(1)	(2)	(3)
China Exp. Share	-2.154***	-0.684***	-1.327***
	(0.110)	(0.050)	(0.108)
First Stage F-stat	22,206	21,063	21,063
Number of Obs.	946,114	907,853	907,853

Note: Firm-product-country and year fixed effects are included in all specifications. F-stat is Kleibergen Paap rk wald F statistic. Standard errors are clustered at the firm-product-country level. *, **, and, *** denote significant levels of 10%, 5%, and 1% respectively.

Table A.6: Effect of the Chinese Export Competition on Firms' Product Dropping Behaviors in Export Destinations: Chinese Relative Export Supply Instrument

(a) Pre-period 1999-2003 and Post-period 2005-2009

	(1)	(2)	(3)
China Exp. Share	0.110	0.119	0.123
	(0.111)	(0.102)	(0.101)
China Exp. Share * Product Share		0.153	
		(0.286)	
Product Share		-0.459***	
		(0.020)	
China Exp. Share * Rel. Prod. Share			0.259
			(0.167)
Relative Product Share			-0.335***
			(0.013)
First Stage F-stat	406.2	208.2	218.2
Number of Observations	216,824	216,417	216,417

(b) Pre-period 1999-2003 and Post-period 2008-2012

	(1)	(2)	(3)
China Exp. Share	0.117	0.116*	0.102
	(0.079)	(0.068)	(0.067)
China Exp. Share * Product Share		0.124	
		(0.244)	
Product Share		-0.387***	
		(0.022)	
China Exp. Share * Rel. Prod. Share			0.262*
			(0.144)
Relative Product Share			-0.290***
			(0.015)
First Stage F-stat	12.16	6.012	4.604
Number of Observations	213,516	213,109	213,10

Note: Standard errors are clustered at firm level. *, **, and, *** denote significant levels of 10%, 5%, and 1% respectively.

APPENDIX B: CHINA'S QUOTA AND LICENSING SYSTEM

In this appendix, we provide evidence that the two policy instruments adopted in the paper, the export quota and licensing system, and the removal of the exporting rights restriction, substantially influenced the overall Chinese export supply. To merge the policy data with trade data reported by UN Comtrade, we aggregate the quota and licensing products panel into the HS six-digit level. The primary quota and licensing requirement measure is a dummy variable at the HS six-digit level that equals one if any of the subordinate eight-digit products is subject to the quota and licensing requirements, and zero otherwise.

In addition to this binary measure, we create an intensity measure, calculated as the fraction of HS eight-digit products that are subject to the quota and licensing requirements within each HS six-digit category.[19] The denominator used in the calculation of this fraction in each HS six-digit category is the number of HS eight-digit products, rather than *exporting* products, because exporting behavior itself is affected by quota and licensing restrictions. As a result, the intensity measure is not necessarily better than the binary measure in comparing the stringency of export restriction across products.

We examine several measures of the Chinese export supply at the product-year level. The first measure is the logarithm of the export value to the world reported by China. We use statistics reported by China rather than by each individual trading partner because not all Chinese trading partners provide reliable trade statistics. In the analysis, we restrict the sample to products exported by China in 1999. The second measure of the Chinese export supply is the logarithm of the sum of each OECD country's reported import values from China. For analysis using this measure, we restrict the sample to products that OECD countries imported from China in 1999. One caveat of these two measures using logarithm values is that zeros are dropped in the analysis. This means if China no longer exported a product in year t, then this product-year observation is not included in the analysis. To include these zero observations, and form a balanced panel, we construct a relative measure of the Chinese export supply as the ratio of the OECD countries' reported import value from China to their total import value from the world of product k in year t. For each of these Chinese export supply measures, we estimate the following regression equation:

$$CES_{kt} = \beta_0 + \beta_1 Q\&L_{kt} + \beta_2 RightsRes_t + \beta_3 Q\&L_{kt} \times RightsRes_t + \gamma_k + \theta_t + \epsilon_{kt}, \tag{B.1}$$

[19] We count the number of HS eight-digit products within each HS six-digit category using the Chinese Customs' 2008 product list.

where CES_{kt} is one of the three measures of the Chinese export supply of product k in year t; $Q\&L_{kt}$ is the quota and licensing requirement for product k in year t measured either as a binary variable or as an intensity; $RightsRes_t$ is a dummy variable that equals 1 if the export was subject to manual export license approval in year t (i.e., before 2004), 0.5 in year 2004, and zero for the years from 2005 onward; and γ_k and θ_t are the product and year fixed effects. We cluster the errors at the HS six-digit product level.

Appendix Table B.1a reports the estimation results of the impact of the export policy restrictions on the Chinese export supply for the binary quota measures. As shown in column 1, the export rights restriction imposed before 2004 reduced China's export value by a substantial 228 percent. The quota restriction also statistically significantly limits export value by 31.2 percent. The positive coefficient of the interaction term shows one policy restriction's negative impact on exports is smaller if a product is also subject to the other policy restriction. To put it another way, the rise in export value resulting from the removal of the export rights restriction is 87.6 percent higher for products that are not subject to the quota and licensing requirements (hereafter referred to the non-Q&L products) than for products that are subject to these requirements (hereafter referred to the Q&L products). Overall, the specification with China's export policy measures is able to explain 36.4 percent of the within-product variation in China's export value. Results are similar when we focus on Chinese exports to OECD countries only, except that the quota's impact alone is no longer statistically significant (column 2). Column 3 shows the impact of China's export restriction policies on its market share in OECD countries. The export rights and export quota and licencing restrictions limit China's export market share by 10 and 2.3 percentage points, respectively. The increase in the export market share due to the policy change that grants universal export rights is 4.5 percentage points higher for non-Q&L products than for Q&L products. As reported in Appendix Table B.1b, the results are robust to using the intensity measure for the quota and licensing requirements. As the intensity Q&L measure provides no improvement in explanatory power for Chinese exports, we use the simple binary measure for the main analysis.

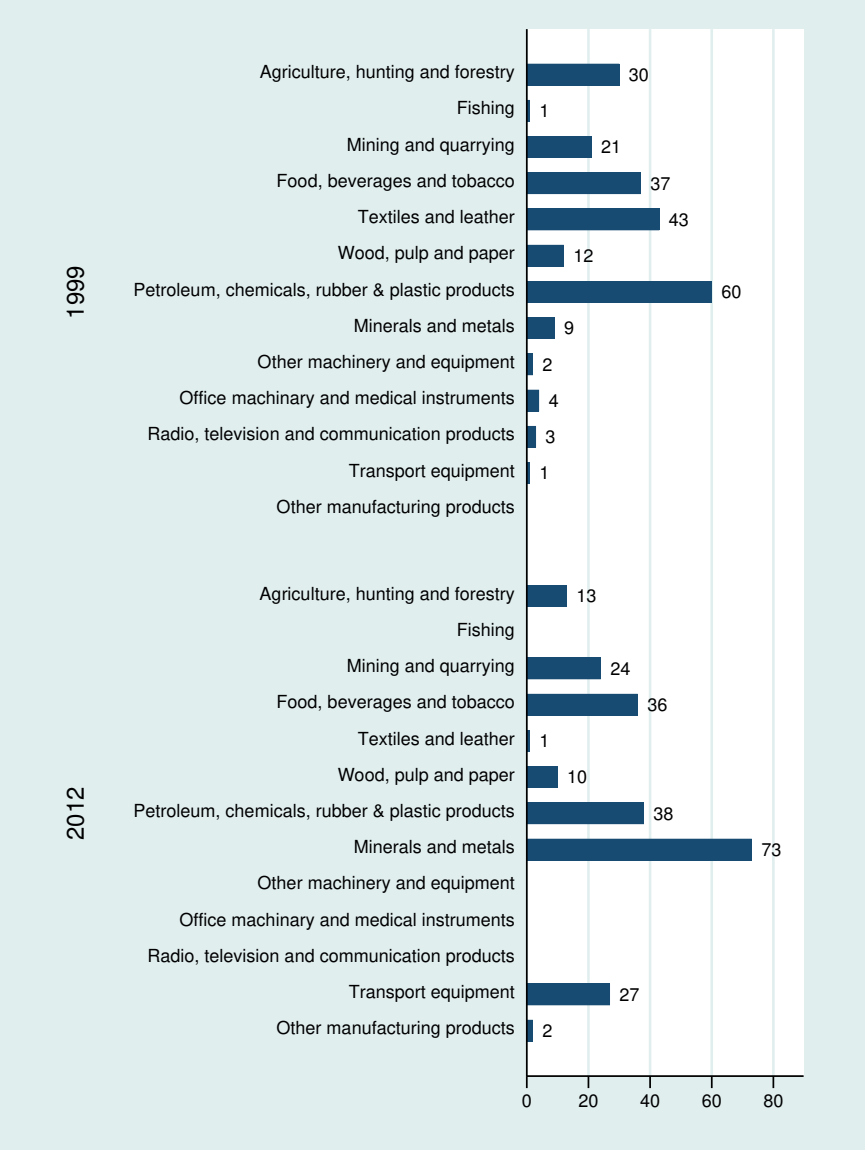

Figure B.1: Number of Products Subject to Quota and Licensing System By Industry

Table B.1: Chinese Exports Explained by Export Policies

(a) Binary Quota Measure

Dependent Variable	Total China Export (log)	China Export to OECD (log)	China Export to OECD (Share)
$RightsRes_t$	-2.280***	-2.085***	-0.100***
	(0.031)	(0.028)	(0.002)
$Q\&L\_Dummy_{kt}$	-0.312**	-0.031	-0.023***
	(0.126)	(0.095)	(0.006)
$RightsRes_t \times Q\&L\_Dummy_{kt}$	0.876***	0.843***	0.045***
	(0.146)	(0.138)	(0.008)
Number of Observation	65,350	63,702	64,362
R-squared	0.364	0.377	0.252

(b) Intensity Quota Measure

Dependent Variable	Total China Export (log)	China Export to OECD (log)	China Export to OECD (Share)
$RightsRes_t$	-2.276***	-2.082***	-0.101***
	(0.031)	(0.028)	(0.002)
$Q\&L\_Intensity_{kt}$	-0.296**	-0.043	-0.025***
	(0.139)	(0.108)	(0.006)
$RightsRes_t \times Q\&L\_Intensity_{kt}$	0.974***	1.003***	0.056***
	(0.176)	(0.159)	(0.009)
Number of Observation	65,350	63,702	64,362
R-squared	0.364	0.377	0.253

We restrict the sample for column (1) to products exported by China in 1999, and sample for column (2) and (3) to products that OECD countries imported from China in 1999. We control for year fixed effects and product fixed effects. Standard errors are clustered at the product level. *, **, and, *** denote significant levels of 10%, 5%, and 1% respectively.

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