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The Chinese Export Displacement Effect Revisited

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Abstract

China's global export share has increased dramatically over the past decades. This development has prompted an empirical literature on whether Chinese exports displace those originated from elsewhere in various destination markets. In this paper we focus on the growth of China's exports to the East African Community (EAC) countries and show how it has affected exports from the European Union (EU) to the EAC. Our main contribution to the literature on the displacement effect of Chinese exports is a set of total and relative displacement estimates based on different specifications of the gravity model where we control for country-year fixed effects so as to avoid the "gold medal mistake" of not accounting for time varying "multilateral resistance". Our findings do not support the hypothesis that Chinese exports have displaced exports from other countries in general. Nor do they support the hypothesis that Chinese exports have displaced exports from EU countries to the EAC countries or elsewhere. There has been no displacement in the sense that, although exporters from the EU and elsewhere have lost market share to China, the value of their exports to the EAC and elsewhere have still increased.

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Keywords: trade, gravity equation, export displacement, China, East African Community, European Union

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1 Introduction

China's exports and export shares have increased dramatically in the past decades at the global scale as well as in many regional and national markets, including destinations where traditional exporters have encountered great difficulties in expanding exports such as the African markets. For instance, while the European Union has managed to retain its status as one of the most important provider of exports into the African markets, its importance has diminished drastically, despite its many efforts in strengthening its long-standing trade ties with Africa. These efforts include the EU's recent push for the completion of negotiations on the region-to-region Economic Partnership Agreements (EPA) with various groups of African countries[1]. The EPAs aim at replacing the various existing one-way trade preferences granted by the EU with WTO-compatible free trade areas between the EU and its African partners (Jensen and Yu, 2012, European Parliament, 2012).

In contrast, the two-way trade linkages between China and Africa have been greatly strengthened during the same period. While it has been widely reported and analyzed that China has increased imports of resources and mineral products from Africa in recent decades (see e.g. Besada et al., 2008, Information Office of the State Council, 2013) , exports from China to Africa have also been on steady rise during a relatively short period, leading to sizable and increasing shares for China in the African import markets. For example, according to our calculations based on the reconciled import statistics BACI (Gaulier and Zignago, 2010), in the East African Community (EAC) consisting of Burundi, Kenya, Rwanda, Tanzania, and Uganda, the import share of China rose from a mere 3% in 1995-97 to 19% in 2015-17, with import values growing by a factor of 42. During the same period, the EU's import share dropped from 38% to 11% (see Appendix Table 1). In broadly defined sectors, China appears to have enjoyed particular successes in expanding exports of manufacturing, machinery and transportation products, sectors where the EU has held a dominant position traditionally (see Appendix Table 2-3). Due to these trends, China is now the single most important source of imports for the EAC countries.

This quite dramatic change in import sourcing in the EAC (and in other parts of Africa) raises a number of interesting analytical and policy related issues. For instance, from the perspectives of the EAC countries, the obvious question to ask is how increased imports from China and the relative decline of imports from the EU has affected EAC consumers and producers. From a trade policy

[1] For recent development of the EPA negotiations, see http://trade.ec.europa.eu/doclib/docs/2009/september/tradoc_144912.pdf

perspective, this shift also has implications on the EAC's external trade policy practices, especially with regards to its participations in the EPA negotiations with the EU. For the EU, the continuing rise of exports from China and other emerging economies to the EAC and other African markets would erode the leading position being enjoyed by the EU historically. It naturally calls into attention the questions on why the EU's strategy in expanding trade with Africa has so far not been successful and on why trade with China have achieved so much prominence in such a short period of time. It further casts doubts on the relevance of the EPA negotiations, as the African countries may attach more importance to their trade linkages with the emerging economies in the South, especially with China.

To address the above concerns, a valuable exercise would be to formally characterize the relative rise (and fall) of exports from China (and the EU) in the EAC market. In this paper, we use recent bilateral trade statistics spanning over the period of 1995-2015 to determine whether Chinese exports have displaced or "crowded out" EU exports to the EAC. By doing so, this paper also makes a meaningful addition to the recent literature on the "displacement" effects of Chinese exports, as Africa as the destination market has so far not being featured in that literature. To realize these objectives, we follow the relevant empirical literature (to be reviewed later in this paper) and estimate a gravity model on bilateral trade data to investigate whether or not China's exports to the EAC have displaced those sourced from other countries, particularly those originating in the EU.

The paper also contributes methodologically to the literature on the displacement effect of Chinese exports by showing how it is possible to estimate the total displacement effect in a gravity model with country-year, industry-year and country-pair fixed effects, in addition to the relative displacement effect. Moreover, we estimate the displacement effect in six broadly defined sectors in a model with country-year, commodity-year and country-pair fixed effects using disaggregated trade data. None of the existing studies, for reasons discussed below, report total displacement effects of Chinese exports based on a model with country-year fixed effects (see Kong and Kneller, 2016).

Our main findings are easily summarized. They do not support the claim that Chinese exports to the EAC countries and elsewhere have displaced exports from other sources in general and from the EU in particular. Instead what we find is that Chinese exports are positively associated with exports from other countries, including the EU. As discussed in section 2.2, this finding is at odds with the early studies on the displacement effects of Chinese exports which did not account for country-year fixed effects in their estimations. Some of the more recent studies that do account for these fixed effects do not estimate the total displacement effect, but only the displacement effect of certain countries relative to that of a control group. Unfortunately, the sign of this relative effect does not tell us anything about the sign of the total effect. For example, if the trade flow between exporter i belonging to group g and importer j involves a product that is a substitute for a similar product from China, then a negative relative effect implies that exporters from group g are more adversely affected by Chinese exports than other exporters. Conversely, if the product is a complement to Chinese goods, then a negative relative effect implies that exporters from g are less positively affected than other countries and they might even be negatively affected. However, since we do not know *a priori* whether a product is a substitute or a complement to a similar Chinese good we cannot infer from the relative effect alone, whether the total displacement effect is negative or positive. What we show in this paper is that the total effect is positive, i.e. Chinese exports do not displace or crowd out exports, in general, from other countries or the EU in particular. This is also the case for each of the broad sectors that we consider, including the manufacturing sector.

The rest of the paper is organized as follows. In the next section we introduce the gravity equation model and the data used in the estimations. We also briefly review the related literature on the displacement effects of Chinese exports. Section three contains an analysis of the estimation results and section four concludes the paper with discussions.

2 Model specification, data and related literature

2.1 The Gravity model of trade

The gravity model has proved to be a very useful tool for describing global trade flows and for quantifying the determinants of trade, including WTO membership (Rose, 2004, Subramanian and Wei, 2007, Grant and Boys, 2011, Dutt et al., 2013), free trade agreements (Baier and Bergstrand, 2007, Baier and Bergstrand, 2009, Egger et al., 2011, Baier et al., 2014, Dai et al., 2014), currency unions (Rose and Van Wincoop, 2001, Rose and Honohan, 2001, Barro and Tenreyro, 2007), colonial links (Head et al., 2010, Berthou and Ehrhart, 2017), non-tariff barriers (Disdier et al., 2008, Disdier et al., 2015), etc. As discussed below, there are also quite a few studies that use the gravity equation to estimate the displacement effect of Chinese exports on other countries' exports. The first application of the gravity equation in economics is attributed to Tinbergen (1962) who realized that large countries and countries that are located close to each other tend to trade more than countries that are small and far apart. Early studies used importer and exporter GDPs as well as geographical distance between capitals to explain trade flows and this specification fitted the trade data remarkably well (see the surveys by Anderson, 2011, Mayer, 2014).

The empirical success of the gravity equation has been followed by studies which justify the model's theoretical foundations. Anderson (1979), in an early paper, derived the gravity equation from a setup with differentiated products and a constant elasticity of substitution utility function. Other authors have derived similar gravity equations from different setups but the now standard derivation is due to Anderson and Van Wincoop (2003). As these authors pointed out, trade flows are not simply determined by bilateral trade costs but also by so called multilateral resistance which, essentially, accounts for the general equilibrium nature of trade (i.e. bilateral trade flows are also affected by trade costs with third countries). Whereas Anderson and Van Wincoop (2003) themselves estimated these multilateral resistance terms from the data, more recent studies instead control for multilateral resistance by including sets of "fixed effects" in the model, as recommended by Feenstra (2002).

Section 2.2 reviews the literature on the displacement effect of Chinese exports. The models that we use to estimate the displacement effect of Chinese exports in this paper are discussed in section 2.3-2.6. Section 2.7 and 2.8 describe the data and the estimation framework, respectively.

2.2 Literature review

In this section we review the literature on the displacement effect of Chinese exports. Starting with Eichengreen et al. (2007), a number of studies have investigated whether or not Chinese exports have displaced exports from other Asian countries (Eichengreen et al., 2007, Greenaway et al., 2008, Amann et al., 2009, Athukorala, 2009, Kong and Kneller, 2016). The models used in these papers are variants of the general model

$$\ln EXP_{ijt} = \alpha_0 + \alpha_1 \ln ChEXP_{jt} + \alpha_2 X_{ijt} + \epsilon_{ijt}, \tag{1}$$

where variable $\ln Exp_{ijt}$ denotes the log of exports from source country i to destination j in year t and $\ln ChExp_{sjt}$ denotes the log of export from China to j. X_{ijt} is a vector of additional gravity controls including importer and exporter GDP, distance between i and j etc. Due to the logarithmic formulation of the model, the coefficient α_1 can be interpreted as the elasticity of exports from country i with respect to exports from China into country *j*. A significant negative α_1 suggests that Chinese exports are displacing exports from other countries. For reasons that will become clear below, we shall refer to α_1 in equation (1) as the "level effect".

As Kong and Kneller (2016) note, results from the early studies are inconclusive. The preferred estimator in Eichengreen et al. (2007) leads to a statistically insignificant overall displacement effect. However, when they split up the trade data into Capital goods, Intermediates and Consumer goods the effect becomes significant. For consumer goods $\hat{\alpha}_1 < 1$ whereas $\hat{\alpha}_1 > 1$ for capital goods and intermediates. That is, exporters of capital goods and intermediates seem to benefit trade wise from increasing Chinese exports whereas exporters of Consumer goods suffer. This implies that China's export growth has benefitted high- and middle income Asian countries which are large exporters of capital goods and intermediates, whereas low income Asian countries, that are more dependent on consumer goods, were negatively affected. Greenaway et al. (2008) estimate a model that is similar to that of Eichengreen et al. (2007) but they arrive at a different set of conclusions. According to their results, there is a displacement effect on other Asian countries ($\hat{\alpha}_1 < 1$). When they split up their dataset according to the income level of Asian countries they find that China's export expansion has affected high income Asian exporters adversely whereas low income Asian exporters has not been affected (in a statistically significant way). They do not, however, consider trade in different types of goods but only aggregate trade flows. Athukorala (2009) analyzes trade in machinery and transport equipment and manufactures. What he finds is $\hat{\alpha}_1 > 1$ and highly significant across all estimations (based on different subsets of the data). He cannot find much evidence that East Asian countries are more adversely affected by Chinese exports than other countries but there are some differences in terms of the size of the export response, among the individual Asian countries and across sectors, to increasing Chinese exports.

The studies reviewed so far do not include country-year fixed effects in their models. As Kong and Kneller (2016) note, this omission is the "gold medal mistake" of not controlling for (time varying) multilateral resistance terms (Baldwin and Taglioni, 2006). The main model considered by Kong and Kneller (2016) is given by

$$\ln EXP_{ijt} = \beta_0 + \beta_1 \ln ChEXP_{jt} \times endow_i + \gamma_{it} + \gamma_{jt} + \gamma_{ij} + \epsilon_{ijt}, \tag{2}$$

where $endow_i$ is measure for the factor endowment of country i relative to the factor endowment of China and where γ_{it}, γ_{jt} and γ_{ij} are sets of exporter-year, importer-year and country-pair fixed effects, respectively. Kong and Kneller (2016) are not able to estimate β_1 without interacting the $ChExp$ variable with a variable that varies across the exporter dimension i, due to the country-year fixed effects γ_{it} and γ_{jt} included in the model. That is, Kong and Kneller (2016) cannot estimate the level effect, but only the relative displacement effect. What they find is that endowments play an important role in explaining the extent to which a country is affected by Chinese exports. Specifically, countries with higher capital-labor ratios and human capital levels relative to China experience more export growth or less export displacement in connection with increasing Chinese exports ($\hat{\beta}_1 > 0$). The problem with model (2) is that the relative effect is not very informative without the level effect. In fact, the total effect (level + relative effect) could either be positive or negative depending on the signs and sizes of the two effects. Kong and Kneller (2016) recognize this so they infer the sign of level effect from economic theory. In particular they argue that the level effect should be negative for final goods and positive for parts and components. Therefore, according to this reasoning, the sign of the total effect is ambiguous for final goods.

A group of related studies also estimate the effect of Chinese exports in a gravity model but without a focus on other Asian countries. Giovannetti et al. (2013) estimate the effects of rising Chinese exports on EU exports to OECD markets. What they find is that the sign and significance of the level effect vary according to the two-digit SITC sectors and exporting countries considered. They therefore do not find evidence of a general displacement effect of Chinese exports. In a recent paper Pham et al. (2017) investigate the effects of China's high-tech exports on other exporters of high-tech products. The authors conclude that Chinese exports have displaced the exports of its developing competitors in South America and South East Asia in most high-tech products. They also find that Chinese exports are associated with additional high-tech exports from developed exporters like South Korea and Japan. This suggests that Chinese high-tech exports are substitutes for other developing countries' exports of high-tech goods whereas they are complements to those of developed countries.

We have identified five studies based on the gravity model that focuses on trading relationships between African countries and China. Giovannetti and Sanfilippo (2009) and Geda and Meskel (2008) each consider the manufacturing sector and analyze whether Chinese exports have displaced exports from African countries. Both studies find evidence that Chinese exports are crowding out African exports in third country markets. Montinari and Prodi (2011) studies China's impact on intra-African trade and concludes that exports from the Sub-Saharan African (SSA) countries to China increase intra-African trade for small exporters and reduce it for large exporters. Chinese imports to SSA, on the other hand, do not have a statistically significant effect on intra-African trade. He (2013) estimates the impact of imports from the United States, France and China on Sub-Saharan African

(SSA) countries' manufactured exports. He finds a positive relationship between SSA imports from these three countries and SSA exports for each of the manufacturing sectors considered. Moreover, China's impact is the strongest among these three countries.

None of the studies reviewed above account for time varying multilateral resistance in their estimations so they all make the "gold medal mistake" of gravity analysis. Edwards and Jenkins (2014), on the other hand, include country-year-product fixed effects in their model which is given by

$$\ln EXP_{ijkt} = \beta_0 + \beta_1 \ln ChEXP_{jkt} \times SA_i + \gamma_{ikt} + \gamma_{jkt} + \gamma_{ijk} + \epsilon_{ijkt}, \tag{3}$$

where the k subscript refers to a HS4 level sector and SA_i is a dummy indicating whether or not the exporter is South Africa. Similar to Kong and Kneller (2016), Edwards and Jenkins (2014) are not able to estimate the level effect but only the relative effect of Chinese exports on the exports of South Africa relative to that of other exporters. What they find is that exports from China have a negative relative effect on exports from South Africa to other African countries for all product groups considered ($\hat{\beta}_1 < 0$). That is, South African exports are either less positively affected by Chinese exports or more negatively affected than exports from other countries. Again, the sign of the total effect is ambiguous.

In summary, the survey above is inconclusive as to whether Chinese exports are displacing exports from other countries. Moreover, none of the studies that estimate a level displacement effect account for time varying multilateral resistance. The studies that do account for time varying multilateral resistance are only able to estimate a displacement effect, relative to that of other countries.

Below we introduce the models that we use in this paper to estimate the total displacement effect of Chinese exports as well as the relative displacement effect on EU exports in general and EU exports to the EAC countries in particular. Our main contribution is a set of estimates of the total effect of Chinese exports on exports from other sources based on models that includes country-year fixed effects. As will be clear, our solution to the problem of how to include country-year dummies in the model, in order to account for multilateral resistance and still be able to estimate the level effect, involves using trade data with sectoral variation rather than aggregate trade data.

2.3 Benchmark model estimated with sectoral trade data

Our baseline gravity model for estimating the displacement effect of Chinese exports is given by

$$\ln EXP_{sijt} = \beta_0 + \beta_1 \ln ChEXP_{sjt} + \beta_2 \ln ChEXP_{sjt} \times EU15_i + \beta_3 \ln ChEXP_{sjt} \times EAC_j + \beta_4 \ln ChEXP_{sjt} \times EU15_i \times EAC_j + \gamma_{st} + \gamma_{it} + \gamma_{jt} + \gamma_{ij} + \epsilon_{sijt}, \quad (4)$$

where subscripts *s, i, j* and *t* denote sector, exporting country, importing country, and year, respectively. The variable $\ln Exp_{sijt}$ denotes the log of exports from *i* to *j* in year *t* of goods belonging to sector s, whereas $\ln ChExp_{sjt}$ denotes the log of export from China to j (see Appendix Table 5). The variables $EU15_i$ and EAC_j are dummies indicating whether the exporter is one of the EU15 countries and whether the importer is one of the EAC countries, respectively. ϵ_{sijt} is the error term containing omitted influences on bilateral trade flows and the gammas are sets of dummies defined as follows:

γ_{st} 1 if trade flow concerns sector s and year t, zero otherwise (sector-year fixed effect)

γ_{it} 1 if trade flow concerns exporter i and year t, zero otherwise (exporter-year fixed effect)

γ_{jt} 1 if trade flow concerns importer j and year t, zero otherwise (importer-year fixed effect)

γ_{ij} 1 if trade flow concerns exporter i and importer j, zero otherwise (country-pair fixed effect)

The source of the trade data and sectoral aggregation scheme is discussed in section 2.7.

The coefficient sum $\sum_{k=1}^{4} \beta_k$ in (4) can be interpreted as the elasticity of sector *s* exports from country i with respect to sector *s* exports from China into country *j*. In line with the literature reviewed in section 2.2 we shall refer to this sum as the total displacement effect. The coefficients $\beta_k, k \in (2,4)$ in front of the interaction terms we refer to as relative displacement effects whereas β_1 represent the level effect.

Specifically, if Chinese exports are displacing exports from other sources in general, then $\beta_1 < 0$. If Chinese exports are displacing exports from the EU countries to other countries in general, then $\beta_1 + \beta_2 < 0$. If Chinese exports are displacing exports from the other countries in general to the EAC countries, then $\beta_1 + \beta_3 < 0$. Finally, if Chinese exports are displacing exports from the EU countries to the EAC countries in particular, then $\sum_{k=1}^{4} \beta_k < 0$.

If the level effect and one or more of the relative effects have different signs, then the total effect can either be positive or negative depending on the relative magnitude of the two effects. For example, if $\beta_1 > 0$, $\beta_2 < 0$ and $\beta_1 + \beta_2 > 0$, then Chinese exports in general lead to additional exports from other sources but less so when the exporter is an EU country. In the opposite case (i.e. $\beta_1 < 0$, $\beta_2 > 0$ and $\beta_1 + \beta_2 < 0$), Chinese exports displace exports from other sources in general but less so when the exporter is in the EU. In each of these two cases the sign of the total effect depends on the sign of the sum $\beta_1 + \beta_2$.

As mentioned in section 2.1, the issue of which fixed effects to controls for is a somewhat contentious topic in the gravity literature in general and the literature on the Chinese export displacement in particular. In the gravity literature a fixed effect refers to a set of dummies that, when included in the model, controls for unobserved multilateral resistance. To not control for multilateral resistance is the "gold medal mistake" of gravity analysis (Baldwin and Taglioni, 2006) because it causes omitted variable bias. With aggregate panel data, these dummies indicate unique importer-year and exporter-year combinations (referred to jointly as country-year dummies). Some studies also control for bilateral trade frictions by including a set of (time invariant) country-pair dummies in the model unless the variable of interest is a time invariant bilateral (dyadic) variable. With disaggregated trade data it is possible to include a set of country-year-product dummies to control for a country's time- and product specific multilateral resistance. In our benchmark model (4) we do not this. Instead we control for country-year, country-pair and sector-year fixed effects. In effect we are assuming that the average trade costs faced by a country are the same across all sectors. This assumption is relaxed in section 2.6.

Another benefit of controlling for country-time fixed effects is that it takes care of some unobserved factors affecting Chinese exports such as country specific business cycles. Most of the studies in the literature on the displacement effect of Chinese exports do not, however, control for country-year fixed effects. Instead they use IV estimation to alleviate the omitted variable bias associated with the endogeneity of $ChExp$. One reason for this is that many of these studies use aggregate trade data and it is not possible to estimate the displacement effect in a model with country-year fixed effects, without sectoral variation in the data or, alternatively, without variation in the $ChExp$ variable across the importer-exporter and time dimension. The latter approach is discussed below

2.4 Benchmark model estimated with aggregate sectoral trade data

One potential issue with model (4) is that it leads to a loss of information and potentially sample selection bias. The problem is that those observations in the dataset where there is export from i to j but not from China to j in a specific sector and year are dropped from the regressions. Therefore, if there are systematic differences between the Chinese export flows and the export flows of other countries, then the model may suffer from selection bias. Another issue with model (4) is that a country's multilateral resistance may vary significantly across sectors. As a robustness check on the results based on model (4) we consider an aggregated version which we write

$$\begin{aligned}&\ln EXP_{ijt} = \beta_0 + \beta_1 \ln ChEXP_{ijt} + \beta_2 \ln ChEXP_{ijt} \times EU15_i + \beta_3 \ln ChEXP_{ijt} \times EAC_j + \\ &\beta_4 \ln ChEXP_{ijt} \times EU15_i \times EAC_j + \gamma_{it} + \gamma_{jt} + \gamma_{ij} + \epsilon_{ijt}.\end{aligned} \tag{5}$$

The dependent variable in model (5) is defined as $EXP_{ijt} = \sum_s EXP_{sijt}$ i.e. total exports from *i* to *j*. However, the Chinese export variable in model (5) is given by

$$ChExp_{ijt} = \sum\nolimits_{s(ij)} ChExp_{sijt}, \tag{6}$$

where the (ij) subscripts in the sum signifies that we only sum over the sectors *s* where there is exports from i to j, rather than the sectors where there is export from China to j. This aggregation scheme preserves the information contained in these Chinese export flows and, importantly, it generates variation in Chinese exports across the exporter- in addition to the importer- and time dimension which is why we include an i subscript in $ChEXP_{ijt}$. This enables us to estimate β_1 while controlling for country-year and country-pair fixed effects, even with aggregate trade data. Multilateral resistance that varies across sectors is also less of an issue, presumably, with aggregate trade flows.

2.5 A model without country-year fixed effects

As a second robustness check we analyze the ramifications of not controlling for country-year fixed effects. Although it is generally accepted that it is necessary to control for these fixed effects, it is often not done in the practice for two main reasons. The first is that it precludes us from estimating the effects of variables that only vary along the country-year dimensions. The second reason is that the standard estimators including OLS, IV and the within estimator, as programmed in standard statistical software packages, are not suitable for regressions involving a large number of dummies.

The model without country-year fixed effects that we consider is given by

$$\begin{aligned}
&\ln EXP_{sijt} = \beta_0 + \beta_1 \ln ChEXP_{sjt} + \beta_2 \ln ChEXP_{sjt} \times EU15_i + \beta_3 \ln ChEXP_{sjt} \times EAC_j + \\
&\beta_4 \ln ChEXP_{sjt} \times EU15_i \times EAC_j + \beta_5 \ln GDP_{it} + \beta_6 \ln GDP_{jt} + \\
&\beta_7 \ln Pop_{it} + \beta_8 \ln Pop_{jt} + \beta_9 \ln RER_{ijt} + \gamma_s + \gamma_i + \gamma_j + \gamma_{ij} + \gamma_t + \epsilon_{ijt}.
\end{aligned} \tag{7}$$

where the additional explanatory variables are the GDPs and population sizes of the trading partners and their bilateral real exchange rate (see Appendix Table 2). The fixed effect dummies are defined as:

γ_s 1 if trade flow concerns sector s, zero otherwise (sector fixed effect)

γ_i 1 if trade flow concerns exporter i, zero otherwise (exporter fixed effect)

γ_j 1 if trade flow concerns importer j, zero otherwise (importer fixed effect)

γ_t 1 if trade flow concerns year t, zero otherwise (year fixed effect).

We follow Rose (2000) and Vandenbussche and Zanardi (2010) and include the bilateral real exchange rate, RER_{ijt} in order to control for time varying bilateral trade frictions. We do not include the traditional trade friction proxies; instead we control for country-pair fixed effects. For completeness we also estimate the aggregated model

$$\begin{aligned}
&\ln EXP_{ijt} = \beta_0 + \beta_1 \ln ChEXP_{ijt} + \beta_2 \ln ChEXP_{ijt} \times EU15_i + \beta_3 \ln ChEXP_{ijt} \times EAC_j + \\
&\beta_4 \ln ChEXP_{ijt} \times EU15_i \times EAC_j + \beta_5 \ln GDP_{it} + \beta_6 \ln GDP_{jt} + \\
&\beta_7 \ln Pop_{it} + \beta_8 \ln Pop_{jt} + \beta_9 \ln RER_{ijt} + \gamma_s + \gamma_i + \gamma_j + \gamma_{ij} + \gamma_t + \epsilon_{ijt},
\end{aligned} \tag{8}$$

where the two export variables are the same as in (5).

As mentioned above, a concern in the literature is that exports from China are likely to be correlated with those from other countries, due to some common unobserved factors exerting influences on exports from both China and other exporting countries. In this case, the error term in the model will be correlated with the $ChExp$ variable and the OLS estimator will be biased. The typical solution to this problem is to use IV estimation where the distance to China and the Chinese GDP are the two most commonly used instruments. There are, however, some issues with these instruments which make them unsuitable. First, the distance to China varies only across the importer dimension and therefore it is redundant once a full set of importer or importer-year dummies is included. Second, Chinese GDP only varies across the time dimensions and therefore it is redundant once a full set of year or country-year dummies is included. Following the Eichengreen et al. (2007), we instead use (the log of) time-varying "economic distances" between China and its export destinations as an instrument (denoted $\ln ChDist_{jt}$). These distances are weighted averages of the distance to j from Beijing, Shanghai, and Guangdong where the weights are the export shares of these cities in total Chinese exports sourced from the China Statistical Yearbook.[2]

It should, however, be immediately clear that including a full set of importer-year dummies controls for the same factors as does the economic distance instrument. This is exactly why we cannot use economic distance as an instrument in model (4) or (5), since we do not have data on Chinese sectoral exports at the provincial level.

2.6 Benchmark model estimated with product level trade data

As a third and final robustness check we run a set of regressions for each sectoral separately. We cannot estimate model (4) and (5) with trade data aggregated to the sectoral level. Instead we must base the sectoral regressions on model (7) or, alternatively, we can estimate model (4) with product level trade data. That is, for each sector *s* we estimate the model

$$\begin{aligned}\ln EXP_{g\in s,ijt} &= \beta_0 + \beta_1 \ln ChEXP_{g\in s,jt} + \beta_2 \ln ChEXP_{g\in s,jt} \times EU15_i + \beta_3 \ln ChEXP_{g\in s,jt} \times EAC_j + \\ &\beta_4 \ln ChEXP_{g\in s,jt} \times EU15_i \times EAC_j + \gamma_{gt} + \gamma_{it} + \gamma_{jt} + \gamma_{ij} + \epsilon_{gijt},\end{aligned} \tag{9}$$

where the $g \in s$ subscript refers to a specific good or product belonging to sector s. The country-year fixed effects in these sectoral regressions are not specific to the particular good in question since this would make it impossible to estimate the level effect β_1. However, they are specific to the sector s that the good belongs to. In effect we assume that average trade frictions are the same for each of the goods belonging to a given sector. Finally, to account for the many missing Chinese export flows at the goods level we also estimate the aggregated model

[2] China Statistical Yearbook is available from National Bureau of Statistics of China (http://www.stats.gov.cn/english/statisticaldata/yearlydata/).

$$\begin{aligned}\ln EXP_{(s)ijt} = \beta_0 + \beta_1 \ln ChEXP_{(s)ijt} + \beta_2 \ln ChEXP_{(s)jt} \times EU15_i + \beta_3 \ln ChEXP_{(s)jt} \times EAC_j + \\ \beta_4 \ln ChEXP_{(s)jt} \times EU15_i \times EAC_j + \gamma_{it} + \gamma_{jt} + \gamma_{ij} + \epsilon_{(s)ijt},\end{aligned} \tag{10}$$

with product level data, for each sector separately, where the aggregation is similar to the one in (5) except that, for each s we sum over $g \in s$ rather than s.

2.7 Data

The dependent variable $\ln EXP_{gijt}$ in model (9), defined as the log of bilateral exports of good g, produced in country i and sold in country j, is sourced from the CEPII-BACI database (Gaulier and Zignago, 2010). The BACI database, which is based on the UN COMTRADE database, improves upon its source in several ways and has been used in place of the COMTRADE database by a number of recent studies (e.g. Bensidoun et al., 2009, Disdier et al., 2010, Fontagné et al., 2009). First, it reconciles import and export reports of the same trade flows; second, it harmonizes quantities for all trade flows to allow for consistent computing of unit values and; lastly, it has a much wider country coverage, as data for missing reporters in the COMTRADE database can be inferred from data reported by missing reporters' trading partners. These improvements are particularly important when investigating bilateral trade flows concerning African countries, as data for these countries have been known for large discrepancies and inconsistencies.[3]

A good g is defined as a six digit Harmonized System (HS) product code. In order to aggregate individual goods g into sectors s we use a concordance between the HS classification and the Standard International Trade Classification (SITC) classification, to convert the BACI data classified in the HS6 nomenclature into the Standard International Trade Classification Rev 3 classification (SITC-3). Then we group the disaggregated trade flows into six main product groups: "Food", "Resource based products", "Manufacturing products", "Chemicals", "Machinery and transportation equipment" and "Other goods" (see Appendix Table 4).

Our disaggregated dataset contains 131,374,814 observations and covers bilateral trade between 211 countries over the 21 year period 1995-2015. When we aggregate the trade data into 6 sectors the

[3] These issues have long been recognized in the literature. For instance, an early study by Yeats (1990) suggests that statistics on trade between African countries are almost useless for empirical and policy studies, partly because of smuggling and false invoicing. Another study by Ng and Yeats (2000) points out that Sub-Saharan African countries are among the most deficient in reporting timely and accurate trade data to the United Nations Statistical Office, which compiles the COMTRADE database.

number of observations drops to a more manageable 1.8 million. We do not include zero-trade flows in our estimations for reasons laid out below.

2.8 Estimation

The large number of observations in the dataset and the many country-year dummies included in models (4), (5) and (9) it is not feasible to estimate these models with standard estimators. Therefore, we use the generalized within estimator developed by Gaure (2013b) which allows us to project out multiple group effects prior to estimation.[4] In this way we do not actually estimate the many dummies (fixed effects) in the model but, instead, we transform the model variables in order to wipe out the fixed effects prior to estimation. Standard errors are clustered by country-pairs as is the tradition on gravity analysis.

The generalized within estimation method described above only works with linear models, which is why we do not include zero-trade flows in the dataset. The now standard estimator in the presence of zero-trade flows, the Poisson Pseudo Maximum Likelihood estimator promoted by Silva and Tenreyro (2006), is based on a nonlinear model, so we cannot transform it in a way to get rid of the multilateral resistance terms prior to estimation. However, explicit inclusion of country-year dummies in the model makes estimation very computationally demanding unless we limit the number of observations to a small subset. We therefore leave this issue for future work.

3 Estimation Results

In this section we first present the results obtained from the benchmark models (4) and (5). Next, we discuss the effects of disregarding country-year fixed effects based on models (7) and (8). Finally, we discuss whether the results are sensitive to the assumption that multilateral resistance is the same for all sectors by estimating the sector specific models (9) and (10) with disaggregated trade data.

3.1 Results based on the benchmark model

Table 1 summarizes our estimated benchmark model. The table is divided into two panels, A and B, where panel A contains results from model (1) based on data pooled over the broad sectors and panel B contains results from the aggregated model (2). In the first column we report results based on data spanning the entire 21 year period 1995-2015. The second and third columns contain results based on the two sub periods 1995-2001 and 2002-2015, respectively. The motivation behind this is that

[4] The method is implemented in the R package lfe described in Gaure (2013a).

China became a WTO member in late 2001 so trade frictions were presumably lower in the latter period.

Because we control for country-pair fixed effects it does not make sense to include any of the traditional bilateral (dyadic) variables related to trade friction in the model as these do not vary over time (common border/language, colonial history etc.). Nor do we include importer and exporter GDP as the economic forces represented by these variables are accounted for by the country-year fixed effects. There are, however, two country dummies included in the model: $EU15_i$ and EAC_j. The former indicates whether or not the exporter is among the EU15 countries and the latter whether or not the importer is among the EAC countries. Each of these is interacted with the $ChExp$ variable individually as is their product. The coefficient to $ChExp$ represents the level effect of Chinese exports on exporting countries not in EU15 and importing countries not in EAC. The coefficients to the interaction terms represent the effects of Chinese exports on EU exports and EAC imports relative to this reference group.

We can derive the following conclusions from the 6 regressions summarized in Table 1. Focusing on panel A, the first thing we note is that the estimated level effects are positive and well below 1. The largest of these is 0.223 and it is from the regression based on the 2002-2015 period. It suggests that a ten percent increase in Chinese exports leads to a 2.2 percent increase in exports, on average, from countries that are not in EU15 to countries that are not in EAC. The estimated level effect is approximately half as large in early period. Second, the EU15 relative effect is large and statistically significant. In fact, the total effect, based on estimates from the full sample, of a ten percent increase in Chinese exports, is an increase of 4.7 percent in EU exports to non-EAC countries. This relative effect is very similar for both sub-periods. Third, the EAC and EU15-EAC relative effects are small and statistically insignificant. The estimates in panel B are similar to those in panel A with two exceptions: The EU15 relative effect is smaller in both sub-periods and the EU15-EAC relative effect is fairly large and statistically significant in the early period. In that period, an increase in Chinese exports did not lead to additional EU exports to the EAC, according to the estimates in panel B. In summary, these regressions provide little evidence that Chinese exports have displaced exports from the EU15 or any other countries for that matter, whether destined for the EAC markets or elsewhere. In fact, our results suggest that rather than displacing exports from other countries, Exports from China generate additional exports from other countries, including the EU15 countries.

3.2 Results based on the model without country-year fixed effects

In this section we assess the sensitivity of the results to changes in model specification and estimation technique. The model that we consider is similar to the one used by Eichengreen et al. (2007), Greenaway et al. (2008) and many other authors to quantify the displacement effect of Chinese exports (see section 2.2). It is characterized by a lack of country-year fixed effects. This, however, means we can include the traditional monadic gravity variables such as GDP and population size. We do not include any of the constant dyadic gravity variables such as distance or colonial history. Instead we include a set of country-pair fixed effects.

Table 2 reports the estimates from model (7) based on the sectoral trade data. Panel A contains results based on OLS whereas panel B contain results based on IV estimation. What we see is that OLS leads to a level effect that is positive whereas IV estimation leads to a negative level effect. Note, however, that the IV level effect is only significant when based on the sample containing data from all the years, 1995-2015. Apart from this, the results in Table 2 are similar to those in Table 1.

Table 3 reports regression results based on model (8) and the aggregated trade data. As can be seen, the results are qualitatively similar to the ones in Table 2 although the displacement level effect is larger in the IV case.

It was results similar to these which led Eichengreen et al. (2007), Greenaway et al. (2008) and other authors to conclude that there was a displacement effect of Chinese exports. However, as pointed out by Kong and Kneller (2016), this conclusion is based on a mis-specified model. As discussed in section 2.5, the instrument variable, economic distance to China, does not vary across the sector dimension so the first-stage regression would suffer from perfect multicollinearity if we included a set of importer-year fixed effects. This clearly shows that the IV approach without country-year fixed effects controls for fewer omitted variables than does OLS with country-year fixed effects (or generalized within estimation). The former approach is therefore inferior to the latter and the negative displacement effects reported in this section should not be taken at face value.

3.3 Results based on the disaggregated model

Table 4-7 report results based on models (9) and (10). In both cases we estimate a separate regression for each of the six broad sectors except for the "Other goods" sector because the EAC countries do not import any such goods. The difference between the two models is that the former is based on disaggregated (HS6 level) trade data whereas the latter is based on aggregated trade data so as to keep the observations where there is export from i to j but not from China to j.

What the tables show is that the level effect are all positive and highly significant. They are also remarkably stable across time and sectors. There is also not a big difference between the results based on the two models except that the effects based on model (10) are slightly larger in magnitude. These results thus support the ones reported in Table 1 based on the benchmark model. That is, the evidence clearly suggests that Chinese exports have not displaced exports from other countries in general. As to whether EU exports have increased less than exports from other countries, the evidence is a little more mixed depending on the sector and model considered. The same can be said for exports to the EAC in general and EU exports to the EAC in particular. However, the total estimated effect is always positive except for the Resources sector based on model (10).

4 Conclusion

China's exports have grown dramatically during the past couple of decades. In this paper we reexamine the question of whether Chinese exports have displaced exports from other countries in general and exports from the EU countries to the EAC countries in particular. The choice of the EAC countries as the focused destination market is partly due to the observation that the African market has received little attention in the empirical literature on the displacement effect of Chinese exports. Methodologically, what sets this paper apart from other similar studies is that we estimate the total displacement effect of Chinese exports in a model that includes (time varying) country-year fixed effects. Other studies that have estimated the total displacement effect only control for (time invariant) country fixed effects. The few studies that do include country-year fixed effects, on the other hand, are only able to estimate the displacement effect relative to that of other countries, not the level or total effect. It is important to include country-year fixed effects in a gravity model of trade because their omission leads to the "gold medal mistake" of not controlling for a country's general level of trade frictions, i.e. multilateral resistance (Baldwin and Taglioni, 2006, Anderson and Van Wincoop, 2003, Kong and Kneller, 2016).

We use several different specifications of the gravity model to quantify the extent of Chinese export displacement. Our benchmark model is estimated with trade data aggregated into six broad sectors and includes country-pair- and sector-year-, in addition to country-year fixed effects. An alternative version of the benchmark model uses aggregated trade data where we only sum the Chinese export flows across sectors where there is trade between the exporter- importer pair (i, j). In this way we are able to keep the observations where there is export from i to j but not from China to j that would otherwise drop out of the regression. This aggregate specification also represents a robustness check on the assumption that multilateral resistance does not vary across sectors in the benchmark model estimated with sectoral data. Regression results from both model specifications suggest that, rather than displacing exports, the large increase in Chinese exports have led to additional exports from other countries in general and even more exports from the EU. On average, across the entire 1995-2015 period considered, a one percent increase in Chinese exports have led to around 0.2 percent additional exports from non-EU countries and an additional 0.07-0.3 percent exports from the EU countries, depending on the model. The relative effect for the EAC countries is not significant.

To gauge the importance of including country-year fixed effects we estimate a second set of models with (time invariant) country fixed effects instead. Similar to other studies we obtain a large negative and significant level effect, when the regression is based on IV estimation. However, this result is not robust to the time period considered nor does this specification properly control for multilateral resistance so the model suffers from omitted variable bias. Therefore we do not give much credence to this result.

In a final set of regressions based on disaggregated we analyze differences across sectors in the displacement effect. In the underlying disaggregated model we assume that multilateral resistance varies across sectors, countries and years but not across the individual six digit HS tariff lines included in each of the sectors. Results from these sectoral regressions are similar to the ones from the benchmark model with a significant level effect of around 0.2 in most cases and relative effects that are smaller and whose sign and significance depend on the sector.

We conclude that there is strong evidence that the growth of Chinese exports has actually been associated with additional exports from other countries including the ones from the EU. Our results do not support the notion that the large increase in Chinese exports to the EAC countries has displaced EU exports to the EAC, although for some sectors the growth in EU exports to the EAC has been smaller than the one for other export destinations. These results are not as strange as they might sound. EAC imports from China as well as from the EU went up over the 1995-2015 period so it is not surprising that we do not find a displacement effect. Given that the gravity model explains the magnitude of trade flows between two markets rather than trade shares, the inability of the EU to scale up its exports to the EAC market cannot be explained by rising Chinese exports to the same market in a gravity model framework. Moreover, it also seems to be totally rational that the EAC member countries are not particularly attracted to the EPA negotiations with the EU, given the growing importance of imports sourced from China.

Some caveats regarding our methodological contributions remain. While we contribute to the literature by estimating the total displacement effect of Chinese exports with models that include (time varying) country-year fixed effects, we are not at the same time able to account for zero-trade flows nor do we distinguish between the intensive and extensive margin of trade. These important issues we leave for future work.

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Tables

Table 1. Estimation results: Models (4) and (5)

	1995-2015	1995-2001	2002-2015
	Panel A. Dependent variable: $\ln EXP_{sijt}$		
$\ln ChEXP_{sjt}$	0.187***	0.125***	0.223***
	(0.006)	(0.007)	(0.007)
$\ln ChEXP_{sjt} \times EU15_i$	0.284***	0.250***	0.300***
	(0.006)	(0.009)	(0.007)
$\ln ChEXP_{sjt} \times EAC_j$	0.025	0.007	0.026
	(0.019)	(0.025)	(0.020)
$\ln ChEXP_{sjt} \times EU15_i \times EAC_j$	-0.011	0.011	0.041
	(0.025)	(0.039)	(0.031)
Observations	1,690,651	481,020	1,209,631
R^2	0.701	0.714	0.709
Fixed effects:	exporter-year, importer-year, industry-year, country-pair		
	Panel B. Dependent variable: $\ln EXP_{ijt}$		
$\ln ChEXP_{ijt}$	0.178***	0.184***	0.164***
	(0.005)	(0.008)	(0.005)
$\ln ChEXP_{ijt} \times EU15_i$	0.066***	0.044**	0.058***
	(0.012)	(0.020)	(0.015)
$\ln ChEXP_{ijt} \times EAC_j$	0.022	0.017	-0.002
	(0.023)	(0.040)	(0.030)
$\ln ChEXP_{ijt} \times EU15_i \times EAC_j$	-0.047	-0.197***	-0.017
	(0.033)	(0.070)	(0.041)
Observations	485,424	142,815	342,609
R^2	0.895	0.929	0.909
Fixed effects:	exporter-year, importer-year, country-pair		

Note: Standard errors clustered by country-pair in parenthesis. *p<0.1; **p<0.05; ***p<0.01

Table 2. Estimation results: Model (7)

	Dependent variable: $\ln EXP_{sijt}$		
	1995-2015	1995-2001	2002-2015
	Panel A. OLS estimation		
$\ln ChEXP_{sjt}$	0.205***	0.142***	0.267***
	(0.007)	(0.008)	(0.009)
$\ln ChEXP_{sjt} \times EU15_i$	0.212***	0.226***	0.275***
	(0.010)	(0.011)	(0.015)
$\ln ChEXP_{sjt} \times EAC_j$	0.002	-0.019	0.002
	(0.016)	(0.026)	(0.018)
$\ln ChEXP_{sjt} \times EU15_i \times EAC_j$	0.055	0.057	0.164**
	(0.047)	(0.044)	(0.074)
Observations	978,626	301,208	677,418
R^2	0.675	0.711	0.678
Fixed effects:	exporter, importer, year, industry, country-pair		
Control variables:	$\ln GDP_{it}$, $\ln GDP_{jt}$, $\ln Pop_{it}$, $\ln Pop_{jt}$, $\ln RER_{ijt}$		
	Panel B. IV estimation		
$\ln ChEXP_{ijt}$	-0.296**	-0.231	-0.378
	(0.118)	(0.348)	(0.327)
$\ln ChEXP_{ijt} \times EU15_i$	0.336***	0.371***	0.403***
	(0.031)	(0.136)	(0.067)
$\ln ChEXP_{ijt} \times EAC_j$	0.133***	0.160	0.156*
	(0.035)	(0.170)	(0.081)
$\ln ChEXP_{ijt} \times EU15_i \times EAC_j$	-0.055	-0.087	0.044
	(0.054)	(0.141)	(0.096)
Observations	978,626	301,208	677,418
R^2	0.659	0.702	0.657
Fixed effects:	exporter, importer, year, industry, country-pair		
Control variables:	$\ln GDP_{it}$, $\ln GDP_{jt}$, $\ln Pop_{it}$, $\ln Pop_{jt}$, $\ln RER_{ijt}$		

Note: Standard errors clustered by country-pair in parenthesis. *p<0.1; **p<0.05; ***p<0.01

Table 3. Estimation results: Model (8)

	Dependent variable: $\ln EXP_{ijt}$		
	1995-2015	1995-2001	2002-2015
	Panel A. OLS estimation		
$\ln ChEXP_{ijt}$	0.199***	0.199***	0.195***
	(0.006)	(0.010)	(0.007)
$\ln ChEXP_{ijt} \times EU15_i$	-0.099***	-0.020	-0.100***
	(0.014)	(0.029)	(0.020)
$\ln ChEXP_{ijt} \times EAC_j$	-0.017	0.009	-0.031
	(0.017)	(0.043)	(0.021)
$\ln ChEXP_{ijt} \times EU15_i \times EAC_j$	0.036	-0.015	0.073
	(0.072)	(0.082)	(0.068)
Observations	276,876	85,779	191,097
R^2	0.886	0.930	0.897
Fixed effects:	exporter, importer, year, country-pair		
Control variables:	$\ln GDP_{it}$, $\ln GDP_{jt}$, $\ln Pop_{it}$, $\ln Pop_{jt}$, $\ln RER_{ijt}$		
	Panel B. IV estimation		
$\ln ChEXP_{ijt}$	-0.724**	0.677	-12.107
	(0.330)	(0.709)	(85.585)
$\ln ChEXP_{ijt} \times EU15_i$	0.066	-0.365	2.468
	(0.063)	(0.512)	(17.870)
$\ln ChEXP_{ijt} \times EAC_j$	0.338***	-0.438	6.343
	(0.128)	(0.664)	(44.343)
$\ln ChEXP_{ijt} \times EU15_i \times EAC_j$	-0.319**	0.330	-6.704
	(0.159)	(0.518)	(47.143)
Observations	276,876	85,779	191,097
R^2	0.838	0.922	-6.254
Fixed effects:	exporter, importer, year, country-pair		
Control variables:	$\ln GDP_{it}$, $\ln GDP_{jt}$, $\ln Pop_{it}$, $\ln Pop_{jt}$, $\ln RER_{ijt}$		

Note: Standard errors clustered by country-pair in parenthesis. *p<0.1; **p<0.05; ***p<0.01

Table 4. Estimation results: Model (9), Chemicals, Food and Resources sectors

	Dependent variable: $\ln EXP_{gijt}$		
Chemicals	1995-2015	1995-2001	2002-2015
$\ln ChEXP_{gjt}$	0.138***	0.141***	0.138***
	(0.004)	(0.005)	(0.004)
$\ln ChEXP_{gjt} \times EU15_i$	0.005	-0.042***	0.017***
	(0.005)	(0.007)	(0.005)
$\ln ChEXP_{gjt} \times EAC_j$	0.001	0.055***	-0.004
	(0.011)	(0.020)	(0.011)
$\ln ChEXP_{gjt} \times EU15_i \times EAC_j$	-0.036**	0.008	-0.045***
	(0.014)	(0.030)	(0.015)
Observations	8,640,712	1,684,815	6,955,897
R^2	0.339	0.351	0.340
Food			
$\ln ChEXP_{gjt}$	0.138***	0.151***	0.134***
	(0.003)	(0.004)	(0.003)
$\ln ChEXP_{gjt} \times EU15_i$	-0.033***	-0.063***	-0.025***
	(0.004)	(0.006)	(0.004)
$\ln ChEXP_{gjt} \times EAC_j$	-0.012	0.109***	-0.028
	(0.017)	(0.039)	(0.017)
$\ln ChEXP_{gjt} \times EU15_i \times EAC_j$	0.045*	-0.011	0.052**
	(0.024)	(0.072)	(0.024)
Observations	4,277,615	870,836	3,406,779
R^2	0.303	0.314	0.306
Resources			
$\ln ChEXP_{gjt}$	0.143***	0.148***	0.141***
	(0.004)	(0.005)	(0.004)
$\ln ChEXP_{gjt} \times EU15_i$	-0.017***	-0.052***	-0.007
	(0.005)	(0.006)	(0.005)
$\ln ChEXP_{gjt} \times EAC_j$	0.038	-0.044	0.041
	(0.025)	(0.053)	(0.027)
$\ln ChEXP_{gjt} \times EU15_i \times EAC_j$	0.083**	0.302***	0.089**
	(0.034)	(0.078)	(0.035)
Observations	2,163,360	458,055	1,705,305
R2	0.323	0.348	0.324
Fixed effects:	exporter-year, importer-year, country-pair		

Note: Standard errors clustered by country-pair in parenthesis. *p<0.1; **p<0.05; ***p<0.01

Table 5. Estimation results: Model (9), Manufactures and Machinery sectors

	Dependent variable: $\ln EXP_{gijt}$		
Manufactures	1995-2015	1995-2001	2002-2015
$\ln ChEXP_{gjt}$	0.171^{***}	0.160^{***}	0.175^{***}
	(0.003)	(0.004)	(0.003)
$\ln ChEXP_{gjt} \times EU15_i$	0.024^{***}	-0.030^{***}	0.039^{***}
	(0.005)	(0.006)	(0.005)
$\ln ChEXP_{gjt} \times EAC_j$	-0.044^{***}	-0.038^{**}	-0.045^{***}
	(0.014)	(0.015)	(0.015)
$\ln ChEXP_{gjt} \times EU15_i \times EAC_j$	-0.078^{***}	-0.042^{**}	-0.089^{***}
	(0.014)	(0.018)	(0.015)
Observations	50,747,253	11,044,794	39,702,459
R^2	0.368	0.376	0.368
Machinery			
$\ln ChEXP_{gjt}$	0.183^{***}	0.163^{***}	0.190^{***}
	(0.004)	(0.005)	(0.004)
$\ln ChEXP_{gjt} \times EU15_i$	0.008	-0.037^{***}	0.018^{***}
	(0.005)	(0.006)	(0.005)
$\ln ChEXP_{gjt} \times EAC_j$	-0.048^{***}	-0.036^{**}	-0.050^{***}
	(0.012)	(0.015)	(0.012)
$\ln ChEXP_{gjt} \times EU15_i \times EAC_j$	-0.014	-0.031	-0.016
	(0.014)	(0.019)	(0.015)
Observations	23,153,950	4,546,641	18,607,309
R^2	0.437	0.455	0.435
Fixed effects	exporter-year, importer-year, country-pair		

Note: Standard errors clustered by country-pair in parenthesis. $^{*}p<0.1$; $^{**}p<0.05$; $^{***}p<0.01$

Table 6. Estimation results: Model (10), Chemicals, Food and Resources sectors

	Dependent variable: $\ln EXP_{ijt}$		
Chemicals	1995-2015	1995-2001	2002-2015
$\ln ChEXP_{ijt}$	0.220***	0.163***	0.218***
	(0.004)	(0.007)	(0.005)
$\ln ChEXP_{ijt} \times EU15_i$	-0.012	-0.049***	0.0001
	(0.008)	(0.014)	(0.011)
$\ln ChEXP_{ijt} \times EAC_j$	0.068***	-0.001	0.090***
	(0.021)	(0.038)	(0.025)
$\ln ChEXP_{ijt} \times EU15_i \times EAC_j$	-0.089***	-0.053	-0.085**
	(0.031)	(0.052)	(0.039)
Observations	235,647	59,438	176,209
R^2	0.907	0.943	0.918
Food			
$\ln ChEXP_{ijt}$	0.158***	0.111***	0.150***
	(0.003)	(0.006)	(0.003)
$\ln ChEXP_{ijt} \times EU15_i$	-0.056***	-0.037***	-0.051***
	(0.007)	(0.010)	(0.008)
$\ln ChEXP_{ijt} \times EAC_j$	0.006	-0.062*	0.038
	(0.023)	(0.035)	(0.030)
$\ln ChEXP_{ijt} \times EU15_i \times EAC_j$	-0.077**	0.052	-0.110***
	(0.034)	(0.054)	(0.042)
Observations	241,707	60,448	181,259
R^2	0.903	0.944	0.919
Resources			
$\ln ChEXP_{ijt}$	0.177***	0.130***	0.177***
	(0.004)	(0.007)	(0.005)
$\ln ChEXP_{ijt} \times EU15_i$	-0.052***	-0.064***	-0.034***
	(0.008)	(0.013)	(0.010)
$\ln ChEXP_{ijt} \times EAC_j$	-0.101***	-0.047	-0.103***
	(0.026)	(0.060)	(0.029)
$\ln ChEXP_{ijt} \times EU15_i \times EAC_j$	-0.155***	-0.120	-0.072*
	(0.035)	(0.097)	(0.040)
Observations	216,954	52,651	164,303
R2	0.859	0.921	0.873
Fixed effects	exporter-year, importer-year, country-pair		

Note: Standard errors clustered by country-pair in parenthesis. *p<0.1; **p<0.05; ***p<0.01

Table 7. Estimation results: Model (10), Manufactures and Machinery sectors

	Dependent variable: $\ln EXP_{ijt}$		
Manufactures	1995-2015	1995-2001	2002-2015
$\ln ChEXP_{ijt}$	0.280^{***}	0.234^{***}	0.267^{***}
	(0.003)	(0.005)	(0.003)
$\ln ChEXP_{ijt} \times EU15_i$	-0.019^{***}	-0.079^{***}	-0.005
	(0.007)	(0.013)	(0.009)
$\ln ChEXP_{ijt} \times EAC_j$	0.005	-0.034	0.024
	(0.014)	(0.030)	(0.016)
$\ln ChEXP_{ijt} \times EU15_i \times EAC_j$	-0.026	-0.015	-0.010
	(0.020)	(0.050)	(0.031)
Observations	373,997	102,036	271,961
R^2	0.920	0.949	0.929
Machinery			
$\ln ChEXP_{ijt}$	0.241^{***}	0.204^{***}	0.226^{***}
	(0.003)	(0.006)	(0.004)
$\ln ChEXP_{ijt} \times EU15_i$	0.025^{***}	-0.048^{***}	0.034^{***}
	(0.008)	(0.013)	(0.010)
$\ln ChEXP_{ijt} \times EAC_j$	0.066^{***}	0.059^{*}	0.073^{***}
	(0.015)	(0.031)	(0.018)
$\ln ChEXP_{ijt} \times EU15_i \times EAC_j$	-0.022	-0.096	-0.026
	(0.027)	(0.064)	(0.029)
Observations	327,725	84,565	243,160
R^2	0.900	0.937	0.908
Fixed effects	exporter-year, importer-year, country-pair		

Note: Standard errors clustered by country-pair in parenthesis. *p<0.1; **p<0.05; ***p<0.01

Appendix

Appendix Table 1. EAC imports from major exporters 1995-2015

	China	EU15	US	Japan	BRIC	EAC
			Import values (million US dollars)			
1995-1997	181.1	2099.6	272.7	414.4	584.3	465.0
1998-2000	209.2	1866.4	393.9	442.4	611.4	605.6
2001-2003	315.1	1871.3	516.1	452.4	827.3	680.0
2004-2006	798.2	2757.7	686.5	726.9	1866.1	1087.2
2007-2009	2033.6	4301.7	955.2	1270.6	4774.9	1602.9
2010-2012	4120.7	4803.0	826.0	1527.9	9414.8	2342.8
2013-2015	7616.9	4549.8	911.8	1837.1	15260.8	2821.2
Change (ratio)	42.1	2.2	3.3	4.4	26.1	6.1
			Import shares			
1995-1997	0.03	0.38	0.05	0.07	0.11	0.08
1998-2000	0.03	0.29	0.06	0.07	0.09	0.09
2001-2003	0.04	0.25	0.07	0.06	0.11	0.09
2004-2006	0.06	0.21	0.05	0.05	0.14	0.08
2007-2009	0.09	0.18	0.04	0.05	0.20	0.07
2010-2012	0.13	0.16	0.03	0.05	0.30	0.08
2013-2015	0.19	0.11	0.02	0.05	0.38	0.07
Change (difference)	0.16	-0.27	-0.03	-0.03	0.28	-0.01

Source: own calculations based on BACI data

Appendix Table 2. EAC's imports from China 1995-2015

	Chemical	Food	Machinery	Manufactures	Resource	Total
	Values of import from china (million US dollars)					
1995-1997	10.6	10.3	57.0	101.9	1.3	181.1
1998-2000	19.0	9.6	63.0	111.3	6.3	209.2
2001-2003	32.3	5.4	90.2	185.2	2.0	315.1
2004-2006	72.1	9.9	267.0	437.1	12.1	798.2
2007-2009	200.9	14.1	894.4	908.8	15.4	2033.6
2010-2012	380.7	30.8	1687.6	1993.9	27.6	4120.7
2013-2015	648.9	55.3	2770.7	4012.1	130.0	7616.9
Change (ratio)	61.24	5.35	48.64	39.36	102.50	42.06
	China's shares in EAC imports					
1995-1997	0.01	0.01	0.03	0.07	0.00	0.03
1998-2000	0.02	0.01	0.03	0.07	0.01	0.03
2001-2003	0.03	0.00	0.04	0.10	0.00	0.04
2004-2006	0.04	0.01	0.07	0.14	0.00	0.06
2007-2009	0.06	0.01	0.12	0.18	0.00	0.09
2010-2012	0.09	0.01	0.18	0.28	0.00	0.13
2013-2015	0.13	0.01	0.26	0.41	0.01	0.19
Change (difference)	0.11	0.00	0.23	0.35	0.01	0.16
	Shares of imports from China to EAC by sectors					
1995-1997	0.06	0.06	0.32	0.56	0.01	1.00
1998-2000	0.09	0.04	0.30	0.54	0.03	1.00
2001-2003	0.11	0.01	0.28	0.59	0.01	1.00
2004-2006	0.09	0.01	0.33	0.55	0.02	1.00
2007-2009	0.10	0.01	0.43	0.45	0.01	1.00
2010-2012	0.09	0.01	0.42	0.47	0.01	1.00
2013-2015	0.09	0.01	0.37	0.52	0.02	1.00
Change (difference)	0.03	-0.05	0.05	-0.04	0.01	0.00

Source: own calculations based on BACI data

Appendix Table 3. EAC's imports from EU15, 1995-2015

	Chemical	Food	Machinery	Manufactures	Resource	Total
	Values of import from EU15 (million US dollars)					
1995-1997	402.6	167.5	878.4	527.3	120.3	2099.6
1998-2000	333.0	158.0	851.8	415.0	108.4	1866.4
2001-2003	357.2	131.8	877.8	389.0	113.6	1871.3
2004-2006	528.1	196.8	1326.4	565.2	136.2	2757.7
2007-2009	741.0	251.3	2324.8	717.2	263.3	4301.7
2010-2012	801.9	303.1	2620.0	790.9	284.2	4803.0
2013-2015	1022.0	336.8	2139.2	779.8	269.7	4549.8
Change (ratio)	2.54	2.01	2.44	1.48	2.24	2.17
	EU15's shares in EAC imports					
1995-1997	0.54	0.20	0.45	0.36	0.29	0.38
1998-2000	0.39	0.16	0.40	0.27	0.11	0.29
2001-2003	0.34	0.13	0.37	0.22	0.10	0.25
2004-2006	0.29	0.13	0.34	0.18	0.05	0.21
2007-2009	0.24	0.09	0.32	0.14	0.05	0.18
2010-2012	0.20	0.08	0.28	0.11	0.04	0.16
2013-2015	0.20	0.08	0.20	0.08	0.03	0.11
Change (difference)	-0.34	-0.11	-0.24	-0.27	-0.26	-0.27
	Shares of imports from EU15 to EAC by sectors					
1995-1997	0.19	0.08	0.42	0.25	0.06	1.00
1998-2000	0.18	0.08	0.46	0.22	0.06	1.00
2001-2003	0.19	0.07	0.47	0.21	0.06	1.00
2004-2006	0.19	0.07	0.48	0.21	0.05	1.00
2007-2009	0.17	0.06	0.54	0.17	0.06	1.00
2010-2012	0.17	0.06	0.55	0.16	0.06	1.00
2013-2015	0.23	0.07	0.47	0.17	0.06	1.00
Change (difference)	0.03	-0.01	0.05	-0.08	0.00	0.00

Source: own calculations based on BACI data

Appendix table 4. Classification of sectors

SITC 3 (Standard International Trade Classification, Rev.3)	Industry classification
Food and Animals (0) Beverages and tobacco (1) Animal and vegetable oils, fats and waxes (4)	Food sector
Crude materials, inedible, except fuels (2) Mineral fuels, lubricants and related materials (3)	Resource sector
Chemicals and related products, n.e.s(5)	Chemical sector
Manufactured goods classified chiefly by material (6) Miscellaneous manufactured articles (8)	Manufacture sector
Machinery and transport equipment (7)	Machinery sector
Commodities and transactions not classified elsewhere in the SITC (9)	Other sectors

Appendix Table 5. Description of variables

Variable	**Model**	**Description**	**Source**
Dependent variables			
$\ln EXP_{sijt}$	(4), (7)	Log of exports from country i to country j in year t of goods belonging to sector s (Current US dollars)	BACI-CEPII and own calculations
$\ln EXP_{ijt}$	(5), (8)	Log of aggregate exports from country i to country j in year t (Current US dollars)	BACI-CEPII and own calculations
$\ln EXP_{g\in s,ijt}$	(9)	Log of exports from country i to country j in year t of a HS6 tariff line belonging to sector s (Current US dollars)	BACI-CEPII
$\ln EXP_{(s)ijt}$	(10)	Log of exports from country i to country j in year t of goods belonging to sector s (Current US dollars). Separate regression for each sector s.	BACI-CEPII and own calculations
China export regressors			
$\ln ChEXP_{sjt}$	(4), (7)	Log of exports from China to importer j in year t of goods belonging to sector s (Current US dollars)	BACI-CEPII and own calculations
$\ln ChEXP_{ijt}$	(5), (8)	Log of aggregate exports from China to country j in year t (Current US dollars).	BACI-CEPII and own calculations

		Aggregation is over the sectors s where there is export from i to j in year t.	
$\ln ChEXP_{g\in s,jt}$	(9)	Log of exports from China to country j in year t of a HS6 tariff line belonging to sector s (Current US dollars)	BACI-CEPII
$\ln ChEXP_{(s)ijt}$	(10)	Log of exports from China to country j in year t of goods belonging to sector s (Current US dollars). Separate regression for each sector s. Aggregation is over the goods g where there is export from i to j in year t.	BACI-CEPII and own calculations
Country group indicator variables			
$EU15_i$	All	Dummy indicating whether the exporter is an EU15 country	Own construction
EAC_j	All	Dummy indicating whether the importer is an EAC country	Own construction
Traditional gravity control variables			
$\ln GDP_{it}$	(7), (8)	Log of GDP of exporting country i in year t (current US dollars)	World Bank, World Development Indicators
$\ln GDP_{jt}$	(7), (8)	Log of GDP of importing country j in year t (current US dollars)	World Bank, World Development Indicators
$\ln pop_{it}$	(7), (8)	Log of population of exporting country i in year t	World Bank, World Development Indicators
$\ln GDP_{jt}$	(7), (8)	Log of population of importing country j in year t	World Bank, World

			Development Indicators
$\ln RER_{ijt}$	(7), (8)	Log of real exchange rate between i and j in year t. It is defined as $\frac{E_{i,US,t}}{E_{j,US,t}}\frac{CPI_{i,t}}{CPI_{j,t}}$	World Bank, World Development Indicators, own calculations
$\ln ChDist_{jt}$	(7), (8), First stage regression	Log of "economic distance" between China and importing country j in year t	China Statistical Yearbook, CEPII, own calculations