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ECONOMIC RESEARCH

Working Paper 2020.05

How Does Development Aid Impact Trade Performance and Margins? Evidence from China

by

Camelia Turcu

(University of Orleans - LEO)

Yunzhi Zhang

(Jinan University and University of Orleans - LEO)

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Camelia TURCU[†] Yunzhi ZHANG[‡]

December 2020

Abstract

We study the impact of China's foreign aid on exports at the product level. To do this, we use a sample of 159 countries and a trade decomposition on 1366 HS4 products over the period 2000-2014. We employ a PPML methodology in a gravity framework. We find that the return on Chinese exports of every dollar spent on foreign aid is rather small, on average, at the HS4 product level, for the whole period. Moreover, we disentangle between different categories of international aid and find that the aid related to infrastructure, productive capacity, and other aid categories has positive effects on trade. Our results also indicate that the Chinese foreign aid enhances, at product level, the trade in new varieties but does not help the country to export more of the already traded products. In other words, at product level, the trade extensive margins are strengthened, while the intensive margins are not. We also find that, at geographical level, aid helps China exporting more towards the countries that are already its trade partners (the geographical trade intensive margins are boosted), but does not promote trade relations with new partners (no effect on the geographical trade extensive margins).

Keywords: Emerging donor, aid-trade nexus, trade margin

JEL classification: F35, P33

*We thank Dimitrios Asteriou, Matthieu Bussière, Jarko Fidrmuc, Scott Hegerty, Hendrik Kruse, Inmaculada Martinez-Zarzoso, Mihai Mutascu, Isabelle Rabaud, Kiril Tochkov and Marcel Voia for their helpful comments and suggestions on previous versions of this paper. All remaining errors are ours.

[†]University of Orléans - LEO and INFER, Email: camelia.turcu@univ-orleans.fr

[‡]Jinan University and University of Orléans - LEO, Email: yunzhi.zhang@hotmail.com

1 Introduction

The link between development aid and trade has been addressed in the literature, especially from the perspective of traditional donors. Additionally, this linkage is proved to be positive in the case of traditional donors (e.g. Hühne et al., 2014; Nowak et al., 2009; Martínez-Zarzoso et al., 2017; Hansen et al., 2014). However, this positive relationship has been recently addressed in the case of “new donors” as well (e.g. Fuchs et al., 2013; Liu et al., 2017; Turcu and Zhang 2019).¹

From the perspectives of both the donor and the recipient, the link between international aid and trade can be explained through different channels. We focus on two channels in particular that are the most relevant for this research study. First, development aid transfers income from the donor to recipients, and this will increase the level of local income. This triggers higher consumption and increased demand for foreign products (both in terms of volume and the number of varieties). Second, aid can also take the form of direct financial assistance (debt and loan), or it can also be provided in order to enhance the recipient countries’ infrastructure and productive capacity building. This kind of aid can support trade openness, improve the trade environment, and overall generate more trade: this is the second channel.

In recent years, emerging countries have started to play a proactive role in providing foreign aid. This can be translated into a new South-South relation. For this reason, more and more attention has been paid to the case of these new donors, as in Neumayer (2003), Liu et al. (2017); Turcu and Zhang (2019). These studies confirm the positive impact of new donors’ foreign aid on countries’ economic performance at the aggregate level.

The aid-trade nexus can however be examined in more details: (i) it is interesting to analyze the impact of different categories of aid on trade. By buttressing the case of aid for trade, Calí and te Velde (2011) find that aid provided for infrastructure can enhance trade by reducing trade cost and transport time; (ii) as mentioned before, aid could help to develop further donor-recipient relations: this effect can be partially found by analyzing the impact of aid on trade margins. The analysis of Wang and Xu (2018) confirms that the different categories of aid can affect the quality of exports for the recipient countries; (iii) the impact of aid flow on different commodity groups of products can also reflect to some extent the motive/behaviour of donors; (iv) it would be interesting to assess the effects of aid on trade margins, both at the product and geographical levels.

In this paper, we study the trade-aid nexus, with a focus on the case of China. We take a further step toward the understanding of Chinese foreign aid’s impact on trade by splitting different categories of aid and dividing trade flows into different types. Moreover, this study aims to investigate the impact of aid not only on exports at the four-digit Harmonized Commodity Description and Coding Systems (HS4) product level but also on the Chinese trade margin. A question that emerges within this framework is the following: does China gain from trade, following its aid strategy; and in particular, could China expand and diversify HS exports after providing the international aid? To answer this question, we employ a Poisson Pseudo Maximum Likelihood (PPML) methodology in a gravity model using a sample of 159 trading partners and 1366 HS4 products, throughout the period 2000-2014. We first follow the information of the Creditor Reporting System to

¹Developed countries, especially those listed as OECD members, are considered to be the traditional donors; new donors are usually associated with emerging countries: these countries used to be recipient countries but have begun to provide foreign aid since the late nineties.

identify the different aid categories (relative to infrastructure, productive capacity, public welfare and other). We then investigate the details of the trade-aid nexus by underlining the impact of different aid categories on four commodity groups: capital goods, intermediate goods, consumer goods, and raw materials. Lastly, we compute and analyze the trade margins. Our results for the trade margins strengthen our findings related to South-South relations and highlight that aid can help to increase China’s intensive product and geographical trade margins.

The contribution of our work is threefold: (i) it complements the scarce literature on emerging donors and analyzes aid’s impact on trade, at the product level; (ii) it reveals that the effects of different aid categories vary across the various groups of products that we consider; (iii) it augments the literature on the positive impact of aid on trade, for China’s case, by putting a specific focus on the product and geographical trade margins.

The remainder of the paper is organised as follows. In Section 2, we review the literature. The methodology and data are presented in Section 3. The results regarding the impact of aid on the exports of HS4 products are reported in Section 4. Section 5 provides in-depth evidence on the results regarding trade margins. Several robustness checks are developed in Section 6. Section 7 concludes.

2 Literature Review

Several theoretical models are developed in the literature (by Brecher et al., 1982, Djajic et al., 2004 , among others) to investigate the link between aid and trade performance. Based on the paradox of immiserizing-transfer by Leontieff (1936), Brecher et al. (1982) expand the model to include domestic distortions. The model suggests that foreign aid can impact the welfare of both the donor and the recipient through the terms of trade. But this results in a paradox, as the donor becomes more richer, immiserizing the recipient. By taking the example of food aid, they provide evidence that an “import subsidy” is more efficient than a “consumption subsidy” through terms of trade, and this “import subsidy” finally benefits both the donor and the recipient. An intertemporal aid model is developed by Djajic et al. (2004). He finds that, in a first stage, foreign aid transfers welfare from the donor to the recipient; however, in the second stage, both the donor and the recipient can benefit from increased welfare.

At the empirical level, the bulk of literature on the aid-trade nexus investigates the cases of both traditional donors and emerging donors. Arvin and Baum (1997) use a sample of 17 OECD countries for the period from 1972 to 1990 and analyze the impact of tied and untied aid on trade. They employ an intertemporal optimising model, and estimate its parameters using a nonlinear least squares systems estimator to find that tied aid has a stronger effect on exports than the untied aid.

To analyse the effect of aid on trade over the short run and the long run, Martinez-Zarzoso et al. (2014) use a Feasible GLS methodology with both within and between-within effects. Their findings show that the short-run return is lower than the long-run one: the former is set to 0.5 USD for every aid dollar provided while the latter is equal to 2.5 USD.

Hühne et al. (2014) use pooled regression to explain the impact of foreign aid on exports and imports. They examine data from 1990 to 2010 and include all recipient and donor countries listed in the OECD-DAC’s International Development Statistics. Their findings suggest that Aid for Trade triggers a three percent raise of the recipient’s exports

to the donor, and a five percent increase of imports from the donor.

The results for traditional donors are rather heterogeneous. In this case, traditional donors have been studied at the individual level. Nowak et al. (2009) analyze the case of Germany as a donor. They show that every euro spent in international assistance can lead to an increase of exports of 1.49-1.84 euros on average. Martinez-Zarzoso et al. (2017) conclude that each dollar spent by the Dutch government on foreign assistance increases by \$0.29 USD the exports. The “return” for the case of Denmark is rather small as well: Hansen et al. (2014) find that for every dollar spent on aid by Denmark, the return on exports is about 30 cents.

This is also underlined for specific emerging donors: Fuchs et al. (2013), they show that Indian exports grow by one percent, if aid increases by four percent. The case for China is analyzed by Liu et al. (2017). They conclude that an one percent increase in China’s aid flows to Africa leads to a 0.05% rise of this country’s exports towards the African continent and this export return might be postponed to a later period. Moreover, Turcu and Zhang (2019) find that the return on Chinese exports of every dollar spent on foreign aid is around \$0.156-\$0.400, at the aggregate level.

Some specific elements are underlined by Nunnenkamp and Ohler (2011). They apply a Tobit model to understand the aims of recipients and donors for the case of German aid. The estimation is based on the trade relations between Germany and 152 countries from 2005 to 2007. One of their novel approaches is to analyze donor-recipient relations by separating the private and public channels. Their findings come from two sides: from the donor’s side, aid is allocated to those countries with more democratic institution and less corruption (e.g. Germany); from the recipient countries’ side, BMZ-funded (NGO) shows stronger financial cooperation. Finally, since the data are not available in the Creditor Reporting System, they stress that this is worth studying the impact of specific aid channels.

Few studies have focused on the link between aid and economic activities by splitting aid into different categories. This kind of research is particularly related to aid for trade, and includes information from OECD’s Creditor Reporting System (CRS).

A pioneering study of the impact of different types of aid on trade is provided by Wagner (2003). By splitting aid into different categories, he argues that aid for trade can reduce trading costs between donor and recipient countries. He finds a positive link between trade and aid: every dollar spent on aid has a direct effect on trade worth 35 cents. However, the indirect effect is even higher, amounting to 98 cents.

Calli and te Velde (2011) further proved that the aid related to specific categories can reduce trade costs and promote trade. By focusing on the impact of different types and categories of aid, they apply fixed effects and GMM methodology in a panel of 130 developing and developed countries over the time span from 2002 to 2007. They find that aid related to infrastructure has a positive effect on trade while the aid related to productive capacity has no statistically significant effect.

However, the impact of aid for trade on FDI is also underlined by splitting the aid categories. Using PPML methodology on a sample including 25 donors and 120 recipient countries from 2003 to 2013, Lee and Ries (2016) find that aid for trade related to infrastructure and building productive capacity contributes most significantly to greenfield investment. The above studies underline that the impact of aid can be divided into several channels, and that each of these channels has different effects on economic activities. This shows the need and the necessity of identifying the different aid categories.

An analysis that not only splits the aid for trade into different channels, but also divides the trade flows into different commodity groups is developed by Lemi (2017), who

compares the aid from 20 OECD countries and China to 50 African countries. His finding shows that the African countries trade more with the OECD countries when the aid from the latter is related to infrastructure and productive capacity. Besides, aid from OECD countries has a stronger effect on: Africa’s imports of raw materials, intermediate goods, consumer goods, and capital goods; and Africa’s exports of raw materials, consumer goods and capital goods. Furthermore, no statistically significant relationship between aid and trade has been found for China as a donor and African countries as recipient countries.

Moreover, trade is split into its extensive margin and intensive margin to understand trade growth. This allows us to have more insight about the factors that can trigger trade growth. Shi (2011) applies an analogue method to that of Hummels et al. (2005) to decompose China’s trade with 140 trading partners over the period from 2001 to 2007, into extensive margin, quality and quantity. He finds that China’s trade growth mainly generated an increase in quantity.

Little is said concerning the impact of aid on trade margins. To the best of our knowledge, this relation is developed solely by Wang and Xu (2018). They estimate a structurally derived equation over the period from 2002 to 2012 and find a strong positive impact of aid for trade related to specific trade policies on the quality of recipient countries’ exports. This effect is partially significant for aid related to infrastructure. But no effect is present when the aid is provided towards expanding productive capacity.

3 Methodology and Data

3.1 Methodology

In order to investigate to what extent Chinese foreign aid could promote China’s exports, a structural gravity model is employed by following Anderson and van Wincoop (2003) (also see Head and Mayer, 2014; Yotov et al., 2016; among others). We include data that cover 1366 HS4 product level data for 159 countries over the period from 2000 to 2014 to analyze the trade-aid nexus using data for China’s detailed HS4 product trade. As the product data includes a large amount of zero-value flows, we use the Poisson Pseudo Maximum Likelihood (PPML) estimator for the structural gravity model proposed by Santos Silva and Tenreyro (2006). This methodology allows us to keep the dependent variable in levels, and thus, we will not lose the information provided by zero values. Another issue regarding gravity model is the multilateral resistance (MR) terms (Anderson and van Wincoop, 2003; Baier and Berstrand 2009). Within this huge dataset, we consider the MR terms are invariant and control only the HS4-importer-year fixed effects to disentangle this problem (Liu and Tang 2018).

$$Export_{cjt} = exp[\theta_1 ln(Y_{jt}) + \theta_2 ln(Pop_{jt}) + \theta_3 ln(Aid_{cjt}) + \theta_4 ln(WTO_{cjt}) + \gamma_t + \alpha_j + \beta_{hs6}] \times \varepsilon_{cjt} \quad (1)$$

Where, $Export_{cjt}$ is China’s bilateral export value at the HS4 product level to trading partner j in year t ; we keep this in levels;

$ln(.)$ denotes the natural logarithm;

$ln(Y_{jt})$ represents GDP per capita in current US dollars, in year t for trading partner j ;

$ln(Pop_{jt})$ is the population in trading partner j in year t ;

$ln(Aid_{cjt})$ is the aid value in dollars from China to trading partner j in year t ;

WTO_{cjt} denotes a dummy that equals to 1 if a trading partner j is a WTO member, and 0 otherwise.

γ_t captures the common trends in China's exports, α_j denotes trading partner fixed effects, which are also considered to capture the multilateral resistance terms. β_{hs6} accounts for heterogeneity among the products, and ε_{cjt} is an error term.

3.2 Data

The data cover a sample of 1366 HS4 trading products between China and 159 partners from 2000 to 2014. The data for China's foreign aid are taken from the Global Chinese Official Finance Dataset (Aid_{cjt}). The aid data relative to different categories are also drawn from this database ($Infra_{cjt}$ denotes the aid relative to the infrastructure category; Pro_{cjt} represents the aid related to the productive activity category; Pub_{jt} is the aid intended for the public welfare category; $Other_{jt}$ denotes other categories). China's bilateral export value at HS6 product level in US dollars is from the BACI database, data on bilateral trade at the HS4 product level is computed by the authors based on the BACI dataset ($Exports_{cjt}$ is the export value at the HS4 product level; $XCapital_{cjt}$ captures the export value of capital goods at HS4 product level; $XConsumer_{cjt}$ denotes the export value of consumer goods at the HS4 product level; $XIntermediate_{cjt}$ is the export value of intermediate goods at the HS4 product level; $XMaterials_{cjt}$ represents the export value of raw materials at the HS4 product level). Furthermore, GDP per capita (Y_{jt}), population (Pop_{jt}), WTO members (WTO_mem_{jt}) are gravity variables drawn from the Dynamic Gravity Dataset (Gurevich and Herman, 2018). Table 1.

Table 1: Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
$Export$	4,068,240	5594.35	132352.6	0	6.37e+07
$XCapital_{cjt}$	543,720	16694.88	323438.6	0	6.37e+07
$XConsumer_{cjt}$	1,178,520	6954.2	87786.79	0	1.15e+07
$XMaterials_{cjt}$	386,400	722.5704	14117.77	0	2091739
$XIntermediate_{cjt}$	1,363,440	3627.953	61090.55	0	1.64e+07
Aid_{cjt}	4,068,240	2.38e+08	1.46e+09	0	3.63e+10
$Infra_{cjt}$	4,025,494	1.21e+08	8.52e+08	0	2.50e+10
Pro_{cjt}	4,025,494	4.42e+07	4.88e+08	0	1.84e+10
Pub_{jt}	4,025,494	6115432	5.36e+07	0	1.52e+09
$Other_{jt}$	4,025,494	6.81e+07	8.28e+08	0	2.70e+10
$ln(Aid_{cjt})$	4,068,240	6.873003	8.65613	0	24.31498
$ln(Infra_{jt})$	4,025,494	3.60434	7.292723	0	23.94214
$ln(Pro_{jt})$	4,025,494	2.211992	5.799772	0	23.63562
$ln(Pub_{jt})$	4,025,494	3.240957	6.172326	0	21.14132
$ln(Other_{jt})$	4,025,494	2.75865	6.215427	0	24.0191
$ln(Y_{jt})$	3,888,412	8.429192	1.51358	5.268729	11.42512
$ln(Pop_{jt})$	3,581,820	2.019565	1.861957	-3.089077	7.166491
WTO_mem_{jt}	4,068,240	.7641304	.4245411	0	1
Robustness					
$ln(Y_{ct})$	4,068,240	8.117588	.4026251	7.479718	8.717394
$ln(Pop_{ct})$	4,068,240	7.184934	.0232491	7.146752	7.222154
$ln(DIS_{cj})$	4,068,240	8.975956	.5619277	7.244804	9.850392
CON_{cj}	4,068,240	0.0869565	0.2817714	0	1
$Agree_fta$	4,068,240	0.0576087	0.233002	0	1
HS6 data					
$HS6Export_{cjt}$	13,983,225	1402430	5.24e+07	0	4.27e+10
$ln(Aid_{jt})$	13,983,225	6.835852	8.647399	0	24.31498
$ln(Y_{jt})$	13,983,225	7.184934	0.0232491	7.146752	7.222154
$ln(Pop_{jt})$	13,983,225	29.11528	0.4259994	28.43619	29.75128
WTO_mem_{jt}	13,983,225	0.765045	0.4239707	0	1

4 Results

In order to conduct an in-depth study on the impact of foreign aid on trade, we use the PPML methodology by controlling for HS4-country-year fixed effects on the structural gravity model at the HS4 product level. We first study the effects of overall aid on all the exports of products and different commodity groups (capital goods, intermediate goods, consumer goods, and materials). This allows us to investigate detailed information on what type or characteristics of goods that aid could affect. Second, we will address the aid heterogeneity at the HS4 product level. To do this, we split the aid into four categories and,² in turn, assess the impact of each category on every commodity group of products.

4.1 HS4 Product Exports Level

The results of the impact of foreign aid on Chinese exports at the HS4 product level obtained by employing the PPML approach that controls for HS4-Country-Year fixed effects, are presented in Table 2.³ In order to have more detail, the product sample is also split into four commodity groups of goods. This decomposition information is included in the database of HS Standard Product Groups, which are drawn from World Integrated Trade Solution (WITS) dataset in World bank.⁴ According to this reference, products can be classified into capital goods, intermediate goods, consumer goods, and materials. For example, capital goods included tools, machinery and equipment,⁵ which represent high value-added products; intermediate goods include producer goods or semi-finished goods,⁶ which are considered to be part of the global value chain; furthermore, consumer goods cover the final products that are used in daily life (they are low-technology manufactured goods); and raw materials are materials and substances that could also be regarded as primary resources. Based on the aforementioned information, some questions can be raised for this section: does China provide aid to promote its technology? Or does it do so to integrate more into the global value chain? Can Chinese foreign aid help the country to export more consumer goods, which can be a result of income increased in recipient countries? Since China is a manufacturing hub, we expect positive signs for the exports of intermediate and consumer goods.

In Table 2, the first column translates the overall estimation: one dollar spent on foreign aid by the Chinese government increases the value of product level export by 0.00000008 dollars on average.⁷ The results for the impact of aid on the exports of four commodity groups of products are shown in columns (2), (3), (4), and (5). The positive aid coefficients in columns (2) (3) and (4) indicate that China's foreign aid increases the exports of capital, intermediate and consumer goods. But the effect on materials is not statistically significant. All the other control and gravity variables have the expected sign and are statistically significant overall. First, the GDP per capita in the trading partner posi-

²Further information on the aid category is provided in the next section.

³An investigation on the results of HS6 product level is shown in Table 12.

⁴<https://wits.worldbank.org/referencedata.html>

⁵e.g. Buckets, shovels, grabs and grips of excavating (HS6: 843141), Refrigerators (HS6: 841810, 841821, 841822, 841829) and Railway or tramway sleepers (HS6: 440610)

⁶e.g. Meat of bovine animals, salted... or smoked(HS6: 021012)

⁷The static term is calculated as followed: $\beta_{Aid} = \frac{\partial X}{\partial Aid_{cjt}} * \frac{AV(Aid_{cjt})}{AV(X)}$, thus, $\frac{\partial X}{\partial Aid_{cjt}} = \beta_{Aid} * \frac{AV(X)}{AV(Aid_{cjt})} = 0.0034 * \frac{5594.35}{238000000} = 0.0000000799$. $Av(.)$ denotes the means.

Table 2: PPML estimation at the HS4 product level

	(1)	(2)	(3)	(4)	(5)
	Export	XCapital	XIntermediate	XConsumer	XMaterials
$\ln Aid_{cjt}$	0.00340*** (0.000469)	0.00327*** (0.000872)	0.00426*** (0.000601)	0.00276*** (0.000753)	-0.000576 (0.00350)
$\ln Y_{jt}$	1.294*** (0.0453)	1.268*** (0.0948)	1.130*** (0.0541)	1.386*** (0.0644)	0.0654 (0.211)
$\ln Pop_{jt}$	2.223*** (0.0682)	2.006*** (0.176)	2.334*** (0.0492)	2.301*** (0.0799)	1.713*** (0.305)
WTO_{jt}	0.430*** (0.0204)	0.477*** (0.0455)	0.437*** (0.0254)	0.430*** (0.0296)	0.432*** (0.0779)
Country FE	yes	yes	yes	yes	yes
Year FE	yes	yes	yes	yes	yes
HS6 FE	yes	yes	yes	yes	yes
N	2607650	422653	899581	910938	173653

Notes:

(a) Robust standard errors in parentheses

(b) ***, **, and * denote significance at the 1, 5 and 10% level, respectively

(c) Dependent variable: China's bilateral exports in level at HS4 product level at time t. *Capital* means the exports of capital goods; *Intermediate* means the export of intermediate goods; *Consumer* means the export of consumer goods; *Materials* means the export of raw material.

tively affects bilateral trade. The coefficient for population the trading partner is positive, meaning that larger markets import more foreign goods. Lastly, the dummy coefficient for WTO membership shows a positive and statistically significant: this indicates that China trades more with partners in WTO.

4.2 Aid Heterogeneity at the HS4 Products Level

The studies on specific type of aid, so called “aid for trade”, investigate the impact of aid on trade for different aid categories (Cali and te Velde, 2011; Hühne et al. (2013); among others), and this channel has been little mentioned for the general case of foreign assistance. In order to have an in-depth analysis on aid heterogeneity in the general case for foreign aid, we now turn to examine deeply the impact of each aid category on different commodity groups of products. To better understand the effects of aid on donors' exports to recipient countries, Hühne et al. (2013) split the aiding sector into three (four) categories. We follow their classification and decompose China's foreign aid into four categories:⁸ (i) Economic infrastructure (the *Infrastructure* variable), including Communications, Energy generation and supply, Transport and storage, Other social infrastructure and services; (ii) Productive Capacity (the *Productive_capacity* variable) consisting of Agriculture, forestry and fishing, Banking and financial services, Business and other services, Industry, mining, construction, Trade and tourism, Action relating to debt, Emergency response and General budget support; (iii) Public welfare (the *Public_welfare*) consisting of Education, General budget support, General environment protection, Government and civil society, Health, Support to non-government organizations and Women in development; (iv) Other (the *Other* variable) multi-sector and Unallocated/ unspecified.⁹

⁸All the details about the sectors are provided by the database of Global Chinese Official Finance Dataset. The sectors are classified similarly to the Chinese Credit Reporting System.

⁹Our database does not include aid related to trade policy and regulations, but does include aid related to some sectors on public welfare. This is therefore the difference be-

The results for the impact of aid related to infrastructure on exports of different commodity groups of goods are showed in Table 3. All in all, the foreign aid provided by China on infrastructure could promote China's exports, as shown in column (1). Moreover, according to the aid coefficients in columns (2), (3) and (4), they indicate that aid in infrastructure enhances capital, intermediate, and consumer goods trade. However it does not help China to export more materials (shown in column (5)).

Table 4 reports the results for the impact of aid relative to productive capacity on

Table 3: The impact of aid related to infrastructure on Exports

	(1)	(2)	(3)	(4)	(5)
	Export	XCapital	XIntermediate	XConsumer	XMaterials
$\ln Aid_{cjt}$	0.00398*** (0.000424)	0.00382*** (0.000813)	0.00433*** (0.000538)	0.00404*** (0.000651)	-0.000410 (0.00326)
$\ln Y_{jt}$	1.285*** (0.0454)	1.262*** (0.0949)	1.118*** (0.0544)	1.372*** (0.0644)	0.0379 (0.212)
$\ln Pop_{jt}$	2.216*** (0.0685)	2.002*** (0.177)	2.327*** (0.0494)	2.281*** (0.0800)	1.738*** (0.309)
WTO_{jt}	0.428*** (0.0205)	0.473*** (0.0457)	0.435*** (0.0254)	0.432*** (0.0295)	0.442*** (0.0778)
Country FE	yes	yes	yes	yes	yes
Year FE	yes	yes	yes	yes	yes
HS6 FE	yes	yes	yes	yes	yes
N	2607650	422653	899581	910938	173653

Notes:

- (a) Robust standard errors in parentheses
- (b) ***, **, and * denote significance at the 1, 5 and 10% level, respectively
- (c) Dependent variable: China's bilateral exports at HS4 product level at time t

the exports of four commodity groups of goods. The results indicate that the aid provided by China related to productive capacity could promote the exports at the HS4 product level, as shown in column (1). When it comes to specific goods, reported in columns (2), (3), (4), and (5), the aid related to productive capacity has a positive effect on the exports of intermediate and consumer goods. The aid coefficients are not statistically significant for capital goods and raw materials, however.

The results for China's aid that is allocated to public welfare are reported in Table 5. Column (1) shows the impact of aid related to public welfare on exports at the HS4 product level. The negative sign indicates that aid related on public welfare could not promote exports at the HS4 level, but actually reduces exports. More precisely, this category of aid has a negative effect on the exports of capital, intermediate, and consumer goods. The impact of aid related to other categories is shown in Table 6. The first column reports a positive relation between an aid related to other categories and China's exports. The coefficients on aid are also positive and statistically significant for exports of all specific kinds of goods except for raw materials.

Furthermore, we simultaneously include four categories of aid in our regressions. Table 7 shows the impact of all aid categories on four commodity groups of products. All in all, this shows that aid related to infrastructure help to increase China's exports at the product level, as well as aid provided to increase productive capacity, and the other categories. However, aid related to public welfare does not help to promote China's exports at the product level (see column (1)). Columns (2), (3), (4) and (5) show the results for the impact of all aid categories on capital, intermediate, capital goods, and materials, respectively. First, aid related to infrastructure enhances Chinese exports of capital,

tween our research and previous studies on aid for trade, which align with the classification of the OECD Credit Reporting System.

Table 4: The impact of aid related to productive capacity on Exports

	(1) Export	(2) XCapital	(3) XIntermediate	(4) XConsumer	(5) XMaterials
$\ln Aid_{cjt}$	0.00178*** (0.000457)	0.000637 (0.000863)	0.00417*** (0.000678)	0.00137* (0.000724)	-0.00264 (0.00425)
$\ln Y_{jt}$	1.294*** (0.0454)	1.271*** (0.0951)	1.120*** (0.0544)	1.388*** (0.0643)	0.0524 (0.212)
$\ln Pop_{jt}$	2.247*** (0.0681)	2.035*** (0.176)	2.356*** (0.0495)	2.314*** (0.0804)	1.740*** (0.309)
WTO_{jt}	0.421*** (0.0201)	0.465*** (0.0447)	0.432*** (0.0253)	0.418*** (0.0292)	0.451*** (0.0788)
Country FE	yes	yes	yes	yes	yes
Year FE	yes	yes	yes	yes	yes
HS6 FE	yes	yes	yes	yes	yes
N	2607650	422653	899581	910938	173653

Notes:

- (a) Robust standard errors in parentheses
(b) ***, **, and * denote significance at the 1, 5 and 10% level, respectively
(c) Dependent variable: China's bilateral exports at the HS4 product level at time t

Table 5: The impact of aid related to public welfare on Exports

	(1) Export	(2) XCapital	(3) XIntermediate	(4) XConsumer	(5) XMaterials
$\ln Aid_{cjt}$	-0.00304*** (0.000577)	-0.00363** (0.00122)	-0.00333*** (0.000692)	-0.00293*** (0.000799)	0.00416 (0.00564)
$\ln Y_{jt}$	1.295*** (0.0452)	1.266*** (0.0947)	1.128*** (0.0541)	1.391*** (0.0640)	0.0475 (0.208)
$\ln Pop_{jt}$	2.248*** (0.0681)	2.034*** (0.176)	2.358*** (0.0495)	2.316*** (0.0804)	1.740*** (0.309)
WTO_{jt}	0.421*** (0.0201)	0.465*** (0.0447)	0.432*** (0.0253)	0.418*** (0.0292)	0.451*** (0.0788)
Country FE	yes	yes	yes	yes	yes
Year FE	yes	yes	yes	yes	yes
HS6 FE	yes	yes	yes	yes	yes
N	2607650	422653	899581	910938	173653

Notes:

- (a) Robust standard errors in parentheses
(b) ***, **, and * denote significance at the 1, 5 and 10% level, respectively
(c) Dependent variable: China's bilateral exports at HS4 product level at time t

Table 6: The impact of aid related to other categories on Exports

	(1) Export	(2) XCapital	(3) XIntermediate	(4) XConsumer	(5) XMaterials
$\ln Aid_{cjt}$	0.00330*** (0.000520)	0.00193* (0.00100)	0.00572*** (0.000779)	0.00280*** (0.000869)	0.00372 (0.00506)
$\ln Y_{jt}$	1.289*** (0.0454)	1.266*** (0.0951)	1.118*** (0.0542)	1.382*** (0.0642)	0.0161 (0.210)
$\ln Pop_{jt}$	2.240*** (0.0681)	2.030*** (0.176)	2.348*** (0.0494)	2.308*** (0.0803)	1.725*** (0.309)
WTO_{jt}	0.435*** (0.0205)	0.477*** (0.0454)	0.450*** (0.0259)	0.430*** (0.0297)	0.448*** (0.0773)
Country FE	yes	yes	yes	yes	yes
Year FE	yes	yes	yes	yes	yes
HS6 FE	yes	yes	yes	yes	yes
N	2607650	422653	899581	910938	173653

Notes:

- (a) Robust standard errors in parentheses
(b) ***, **, and * denote significance at the 1, 5 and 10% level, respectively
(c) Dependent variable: China's bilateral exports at HS4 product level at time t

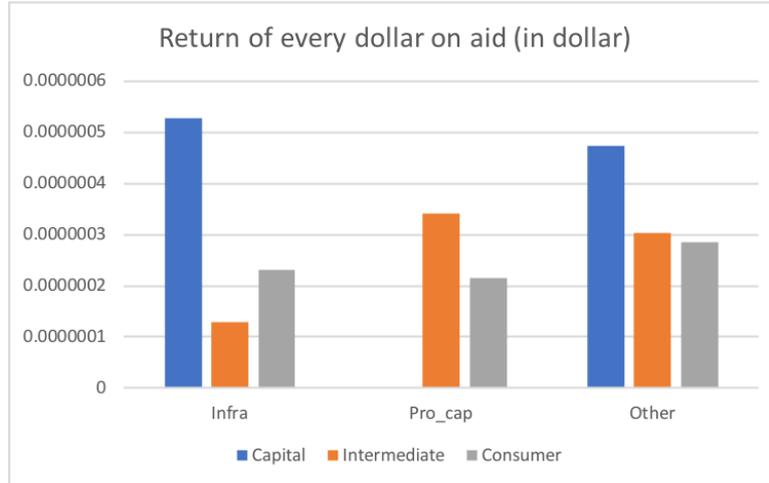


Figure 1: Infra = Infrastructure; pro_cap = productive capacity

Table 7: The impact of different types of aid on exports

	(1) Export	(2) XCapital	(3) XIntermediate	(4) XConsumer	(5) XMaterials
$\ln(\lnfra_{jt})$	0.00335*** (0.000433)	0.00355*** (0.000857)	0.00296*** (0.000486)	0.00354*** (0.000617)	-0.000702 (0.00319)
$\ln(\lnpro_{jt})$	0.000859+ (0.000453)	-0.000121 (0.000882)	0.00294*** (0.000613)	0.000535 (0.000705)	-0.00393 (0.00431)
$\ln(\lnpub_{jt})$	-0.00283*** (0.000585)	-0.00315* (0.00124)	-0.00347*** (0.0007)	-0.00279*** (0.000807)	0.00391 (0.0057)
$\ln(\lnother_{jt})$	0.00188*** (0.000519)	0.000568 (0.00104)	0.00412*** (0.000718)	0.00138+ (0.000831)	0.00462 (0.0049)
$\ln Y_{jt}$	1.282*** (0.0456)	1.262*** (0.0954)	1.113*** (0.0544)	1.371*** (0.0648)	0.0805 (0.213)
$\ln Pop_{jt}$	2.225*** (0.0681)	2.007*** (0.176)	2.347*** (0.0495)	2.296*** (0.0799)	1.716*** (0.303)
WTO_{jt}	0.425*** (0.0205)	0.469*** (0.0455)	0.429*** (0.026)	0.426*** (0.0294)	0.444*** (0.0789)
$CONS$	-9.479*** (0.546)	-7.292*** (1.205)	-8.960*** (0.601)	-11.36*** (0.69)	2.45 (2.816)
Country FE	yes	yes	yes	yes	yes
Year FE	yes	yes	yes	yes	yes
HS6 FE	yes	yes	yes	yes	yes
N	2645949	428353	912061	924633	176743

Notes:

(a) Robust standard errors in parentheses

(b) ***, **, and * denote significance at the 1, 5 and 10% level, respectively

(c) Dependent variable: China's bilateral exports at the HS4 product level at time t

intermediate, and consumer goods. Furthermore, aid related to productive capacity only increases exports of intermediate goods; and aid related to other categories help exports of intermediate and capital goods. The results mentioned above indicate that aid provided by China toward infrastructure primarily helps to exports at the product level, since the effect is stronger when comparing the aid related to any other categories. Concerning the different products, it seems that aid has a stronger positive effect on exports of intermediate goods, since the results are consistent with the different aid categories. Moreover, the estimations that include all aid categories show a weaker effect than when estimating them separately.

To conclude, the results underline an overall impact of China’s foreign aid on different commodity groups of goods: providing aid to non-profit categories does not lead to more exports; moreover, when aid flows to specific categories are meant to improve economic growth, it could promote China’s exports to some extent. We compute the static term of the magnitude of aid coefficients, to understand the “return” of every dollar spent in foreign aid to trade for China in Figure 1. Accordingly, the “return” by capital goods is higher than, for any other goods. Furthermore, exports of intermediate goods increase more when the aid is intended to increase productivity capacity or meant for other categories. The different categories of aid interested to promote the exports of consumer goods show the same return for the exports of consumer goods.

5 Trade Margin

We are turning our focus on fostering a deeper understanding of the trade-aid nexus. It is widely accepted that trade growth can be divided into extensive and intensive margins (Hummel and Klenow, 2005; Helpman et al. 2008; Besadeš and Prusa, 2011; Shi, 2011; among others). We have confirmed the positive impact of development aid on trade in the previous section. One question that can be further raised is to what extent development aid help trade growth. Moreover, is the trade-aid nexus developed through the channel of expanding trade in existing products, or initiating more varieties of goods? In this section, the results provide evidence of the impact of development aid on trade margins, by focusing particularly on the case of the emerging donor, China.

Specifically, this section aims to investigate the link between China’s foreign aid and export growth by decomposing trade margins. Several indexes can be used for trade margins, such as Theil’s, Hummels and Klenow’s, and Brenton and Newfarmer’s indices (Carrere et al., 2011). In this paper, we align with the method of Hummels and Klenow (2005) to compute the intensive and extensive margin at the detailed HS6 product level.¹⁰ This in-depth analysis could provide information as to whether China’s development aid could help China to export more value in goods that are the already traded, or could help China to export more varieties of non-traded goods.

This section aims to investigate the link between China’s foreign aid and exports by decomposing trade margins. Following Hummels et al. (2005), we compute extensive and intensive margins both for the product level and for the geographical country level.

First, the measurement of the extensive trade margins and intensive margins at the

¹⁰However, this data will be aggregated at least at the country level.

product level are as follows:

$$IM_{cw} = \frac{\sum_{i \in I_{cw}} p_{cwi} x_{cwi}}{\sum_{i \in I_{cw}} p_{kwi} x_{kwi}}$$

where IM_{cw} denotes the intensive margin; p is the dollar value of a specific product i , x is the number of units, c denotes China, w denotes the world, and k denotes the countries/regions that excluded China. Thus, $p_{cwi} x_{cwi}$ is the dollar value of China's exports of product i to the world; $p_{kwi} x_{kwi}$ is the dollar value of world exports of product i . The intensive margin translates, for a given good, how much market share China can gain at the world level through exports;

$$EM_{cw} = \frac{\sum_{i \in I_{cw}} p_{kmi} x_{kmi}}{\sum_{i \in I} p_{kmi} x_{kmi}}$$

where EM_{cw} represents the extensive margin; $p_{kmi} x_{kmi}$ is the overall amount of traded goods in the world. In other words, the extensive margin measure the market share of the products that belong to China's portfolio in the world market. Precise information in trade margin at the product level is shown in Figure 2.

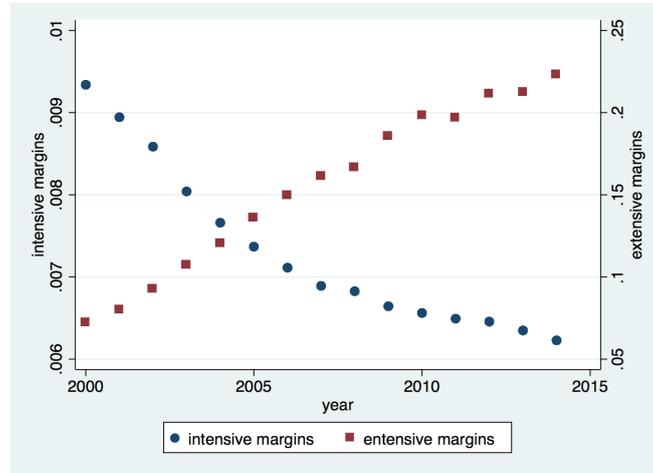


Figure 2: Product trade margins

Table 8 shows the impact of Chinese foreign aid on its trade margins, using country fixed effects as controls. The first column shows the effect on the extensive margin. The coefficients for the aid variables are positive and statistically significant. This shows that China's foreign aid could have a positive impact on increasing the country's market share in terms of the level of products. The results for the intensive margin are presented in column (2). They indicate that China's aid cannot promote country's trade in already existing goods with its trading partners.

Table 8: PPML estimation of trade margins

	(1)	(2)
	EM	IM
$\ln Y_{jt}$	0.582*** (0.0115)	-0.216*** (0.00434)
$\ln Pop_{jt}$	0.938*** (0.0592)	-0.351*** (0.0241)
$\ln Aid_{cjt}$	0.00223*** (0.000472)	-0.000929*** (0.000215)
Country FE	yes	yes
Year FE	no	no
N	2520	2520

Notes:

- (a) Robust standard errors in parentheses
- (b) ***, **, and * denote significance at the 1, 5 and 10% level, respectively
- (c) Dependent variable: China's trade margin at time t
- (d) EM is the product extensive margin; IM is the product intensive margin.
- (e) Dummy variable for WTO membership is omitted in this regression.

Moreover, the geographical trade margins are also computed, adapting the method of Hummels et al. (2005):

$$GIM_{cw} = \frac{\sum_{i \in D_{cw}} x_{cwi} n_{cwi}}{\sum_{i \in D_{cw}} x_{kwi} n_{kwi}}$$

Where, GIM_{cw} is the geographical intensive margin; $i \in D_{cw}$ is the set of destinations China exports its goods; x is the export dollar value to every country on average; n is the number of destinations. Hence, $p_{cwi} n_{cwi}$ is the dollar value of China's total exports to destination d ; and $p_{kwi} n_{kwi}$ is the dollar value exported to the same destination d by other countries. Therefore, the geographical intensive margin measures China's market share in the export destinations.

$$GEM_{cw} = \frac{\sum_{i \in D_{cw}} x_{kwi} n_{kwi}}{\sum_{i \in D_w} x_{kwi} n_{kwi}}$$

where GEM_{cw} is to which the geographical extensive margin; and $i \in D_w$ represents all the possible destinations in the world. The geographical extensive margin represents the share of China's export destinations in the world market. Figure 3 shows the evolution of geographical trade margins.

The results obtained in terms of geographical trade margins, in the presence of country fixed effects, are reported in table 9. The first column reports how Chinese foreign aid impacts geographical extensive margins. The negative and significant coefficient of the aid variable suggests that foreign assistance does not help China expand into new geographical markets by creating trade relations with new partners. Concerning the geographical intensive margin, the results are presented in column (2). The positive sign of the aid variable underlines the fact that foreign aid could help China to get more market share in already existing markets.

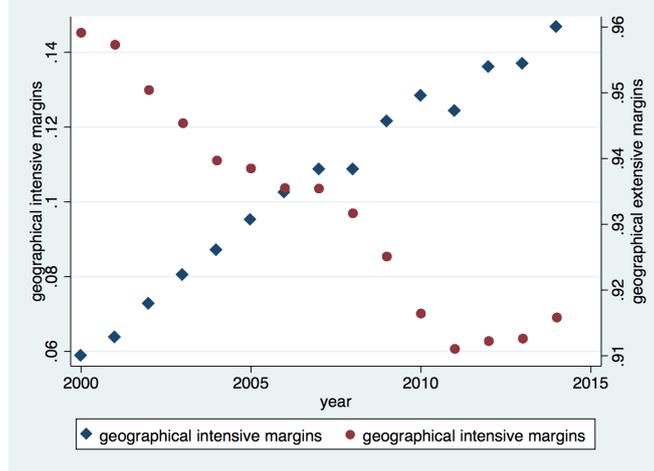


Figure 3: Geographical trade margins

Table 9: PPML estimation on geographical trade margins

	(1) GEM	(2) GIM
$\ln Y_{jt}$	-0.0272*** (0.000575)	0.450*** (0.00921)
$\ln Pop_{jt}$	-0.0502*** (0.00323)	0.778*** (0.0494)
$\ln Aid_{cjt}$	-0.000104*** (0.000028)	0.00161*** (0.000387)
Country FE	yes	yes
Year FE	no	no
N	2520	2520

Notes:

- (a) Robust standard errors in parentheses
- (b) ***, **, and * denote significance at the 1, 5 and 10% level, respectively
- (c) Dependent variable: China's trade margin at time t
- (d) GEM is the geographic extensive margin; GIM is the geographical intensive margin
- (e) Dummy variable for WTO membership is omitted in this regression.

6 Robustness

In this section, we provide a robustness check to support our results along with three lines. We check our estimation first by using OLS fixed effects by including Country-Year-HS6 fixed effect, as controls. Then we test the robustness of our results by considering aid flows that equal zero. Finally we add more variables in our estimation.

We first check our model with log-linearizing OLS fixed effects, to compare with the PPML estimations in Table 2. The results of log-log regression are reported in Table 13 in the appendix. To conclude, foreign aid provided by China has a positive effect on its exports. The magnitude of the aid coefficient in column (1) indicates that every dollar spent by the Chinese government on aid will increase, on average, its export value at the HS4 product level by 0.00000126 USD. Regarding the results for different types of products (capital, intermediate, consumer goods, and raw materials), they are all statistically significant in columns (2), (3), and (4). Moreover, the overall aid coefficients are slightly greater than the results of PPML.

One issue that should be taken into account is that of zero aid flows. This has become a particular point of attention related to the aid-trade nexus (Wagner, 2003; Cali and te Velde, 2011; Lee and Ries, 2016; among others) For China’s case, the country does not provide foreign aid all over the world, hence, zero aid flows might be included. In our second robustness check, we follow the setting of Wagner (2003) and Abeliansky and Martinez-Zarzoso (2018), including zero aid dummy in the estimation as follows:

$$BAID_{ijt} = \ln(\max BAID, 1) + D_{noaid} = \begin{cases} \ln(BAID) + 0, & \text{if}(aidvalue) > 0 \\ 0 + 1, & \text{if}(aidvalue) = 0 \end{cases} \quad (2)$$

The positive signs of $\ln Max Aid_{cjt}$ coefficients in Table 14 indicate that China’s export will increase when China provides non-zero aid to its trading partner.

The final robustness check is provided by employing additional controls. We consider whether institutional quality or natural resource rents in trading partners can have an impact on China’s exports. The results are reported in Table 15. Column (1) is the overall impact of the aid on products. The positive and statistically significant aid coefficient indicates that an additional dollar spent by Chinese government on aid can expand the trade by 0.00000062 dollars. The results for specific goods are shown in columns (2)-(4). These findings indicate that the aid provided by China enhances the exports of capital and intermediate goods. Concerning the additional controls, the coefficient of institutional variable (*polity*) does not show any significance. A higher natural resource rate in the recipient countries promotes China’s exports in general, and particularly trade in intermediate and consumer goods, which might be linked with the global value chain. These results confirm that China’s aid has a positive effect on trade when we include additional controls.

7 Conclusions

We investigate China’s trade-aid nexus at the HS4 product level. In economic terms, the return of every dollar spent on foreign aid is small at the HS4 product level, on average. This result is in line with the conclusion of Turcu and Zhang (2019) while multiplying this return by the number of HS4 products evaluated.

We take a step further and analyze various heterogeneous effects. Most of the studies focus merely on the impact of different categories of aid on trade. This paper strengthens related research to understand the impact on different trade flows, in terms of commodity groups. The results show that China's aid promotes its trade of capital, intermediate, and consumer goods.

Typically, all aid categories have a positive effect on different commodity groups of goods to some extent. First, it seems that when aid flows to specific categories meant to improve economic growth, this could promote China's exports: aid related to infrastructure could enhance the exports of capital, intermediate, consumer goods (except materials). And aid related to productive capacity promotes only the exports of intermediate and consumer goods, while aid related to other categories fosters more exports in capital, intermediate and consumer goods. Besides, the allocation of aid related to the non-profit category (i.e. public welfare) does not have positive effects on exports.

In order to understand whether and how aid can promote trade, different issues regarding trade margins have also been addressed, by following the indexes of Hummels et al. (2005). Our finding is that only extensive margins are enhanced at the product level. Hence, foreign aid can help trade in new varieties of products to existing trading partners, but does not promote more exports of the already exchanged goods with trading partners. At the geographical level, we find that foreign aid has a positive effect on the geographical intensive margin, indicating that aid could help getting more market shares in already existing markets. Furthermore, the results for geographical extensive margins show that foreign assistance does not help China expand into new markets by creating trade relations with new partners.

Finally, several policy implications can be proposed. Foreign assistance seems to enhance China's exports at the product level, and also appears to deepen international integration. Hence, foreign aid could benefit the donor. Nevertheless, if we analyze the trade-aid nexus from the perspective of self-interest and take account of the different aid categories, we find that aid related to public welfare has a negative impact on trade. A "return" in terms of trade could be received however when providing the aid towards infrastructure improving, increasing productive capacity and other categories of aid linked to economic activities that might generate economic growth.

References

- [1] ABELIANSKY, A. L., AND MARTÍNEZ-ZARZOSO, I. The relationship between the Chinese ‘going out’ strategy and international trade. economics discussion papers, no 2018-20. *Kiel Institute for the World Economy*. <http://www.economics-ejournal.org/economics/discussionpapers/2018-20> Received January 30 (2018).
- [2] ANDERSON, J. E., AND VAN WINCOOP, E. Gravity with gravitas: a solution to the border puzzle. *The American Economic Review* 93, 1 (2003), 170–192.
- [3] ARVIN, B. M., AND BAUM, C. Tied and untied foreign aid: a theoretical and empirical analysis. *Keio Economic Studies*, 2 (1997).
- [4] BAIER, S. L., AND BERGSTRAND, J. H. Bonus vetus OLS: A simple method for approximating international trade-cost effects using the gravity equation. *Journal of International Economics* 77, 1 (2009), 77–85.
- [5] BESEDEŠ, T., AND PRUSA, T. J. The role of extensive and intensive margins and export growth. *Journal of development economics* 96, 2 (2011), 371–379.
- [6] BRECHER, R. A., AND BHAGWATI, J. N. Immiserizing transfers from abroad. *Journal of International Economics* 13, 3 (1982), 353–364.
- [7] CALI, M., AND TE VELDE, D. W. Does aid for trade really improve trade performance? *World development* 39, 5 (2011), 725–740.
- [8] CARRERE, C., CADOT, O., AND VANESSA, S.-K. *Trade diversification: drivers and impacts*, m. jansen, r. peters and j. m. salazar xirinachs (eds) ed. ILO, Geneva: ILO-EC publication, 2011.
- [9] DJAJIĆ, S., LAHIRI, S., AND RAIMONDOS-MØLLER, P. Logic of aid in an intertemporal setting. *Review of International Economics* 12, 1 (2004), 151–161.
- [10] DREHER, A., FUCHS, A., PARKS, B., AND STRANGE, A. M. Aid, China, and growth: Evidence from a new global development finance dataset.
- [11] FUCHS, A., AND VADLAMANNATI, K. C. The needy donor: An empirical analysis of India’s aid motives. *World Development* 44 (2013), 110–128.
- [12] GUREVICH, T., AND HERMAN, P. The dynamic gravity dataset: 1948-2016. *USITC Working Paper 2018-02-A* (2018).
- [13] HANSEN, H., AND RAND, J. Danish exports and Danish bilateral aid.
- [14] HEAD, K., AND MAYER, T. Gravity equations: Workhorse, toolkit, and cookbook. In *Handbook of international economics*, vol. 4. Elsevier, 2014, pp. 131–195.
- [15] HELPMAN, E., MELITZ, M., AND RUBINSTEIN, Y. Estimating trade flows: Trading partners and trading volumes. *The quarterly journal of economics* 123, 2 (2008), 441–487.
- [16] HÜHNE, P., MEYER, B., AND NUNNENKAMP, P. Who benefits from aid for trade? Comparing the effects on recipient versus donor exports. *The Journal of Development Studies* 50, 9 (2014), 1275–1288.

- [17] HUMMELS, D., AND KLENOW, P. J. The variety and quality of a nation's exports. *American Economic Review* 95, 3 (2005), 704–723.
- [18] LEE, H.-H., AND RIES, J. Aid for trade and greenfield investment. *World Development* 84 (2016), 206–218.
- [19] LEMI, A. Aid for trade and Africa's trade performance: Evidence from bilateral trade flows with China and OECD countries. *Journal of African Trade* 4, 1-2 (2017), 37–60.
- [20] LEONTIEF, W. W. Quantitative input and output relations in the economic systems of the united states. *The review of economic statistics* (1936), 105–125.
- [21] LIU, A., AND TANG, B. US and China aid to Africa: Impact on the donor-recipient trade relations. *China Economic Review* 48 (2018), 46–65.
- [22] MARTÍNEZ-ZARZOSO, I., NOWAK-LEHMANN, F., AND KLASSEN, S. Aid and its impact on the donor's export industry: The Dutch case. *The European Journal of Development Research* 29, 4 (2017), 769–786.
- [23] MARTÍNEZ-ZARZOSO, I., NOWAK-LEHMANN, F., PARRA, M. D., AND KLASSEN, S. Does aid promote donor exports? Commercial interest versus instrumental philanthropy. *Kyklos* 67, 4 (2014), 559–587.
- [24] NEUMAYER, E. What factors determine the allocation of aid by Arab countries and multilateral agencies? *Journal of Development Studies* 39, 4 (2003), 134–147.
- [25] NOWAK-LEHMANN D, F., MARTÍNEZ-ZARZOSO, I., KLASSEN, S., AND HERZER, D. Aid and trade—A donor's perspective. *The Journal of Development Studies* 45, 7 (2009), 1184–1202.
- [26] NUNNENKAMP, P., AND ÖHLER, H. Aid allocation through various official and private channels: Need, merit, and self-interest as motives of German donors. *World Development* 39, 3 (2011), 308–323.
- [27] SHI, B. Extensive margin, quantity and price in China's export growth. *China Economic Review* 22, 2 (2011), 233–243.
- [28] SILVA, J. S., AND TENREYRO, S. The log of gravity. *The Review of Economics and statistics* 88, 4 (2006), 641–658.
- [29] TURCU, C., AND ZHANG, Y. One good turn deserves another? Evidence from China trade and aid policy. *INFER working paper* (2019).
- [30] WAGNER, D. Aid and trade—an empirical study. *Journal of the Japanese and international economies* 17, 2 (2003), 153–173.
- [31] WANG, Z., AND XU, M. Aid for trade and the quality of exports. *Applied Economics Letters* 25, 10 (2018), 668–673.
- [32] YOTOV, Y. V., PIERMARTINI, R., MONTEIRO, J.-A., AND LARCH, M. *An advanced guide to trade policy analysis: The structural gravity model*. World Trade Organization Geneva, 2016.

8 Appendix

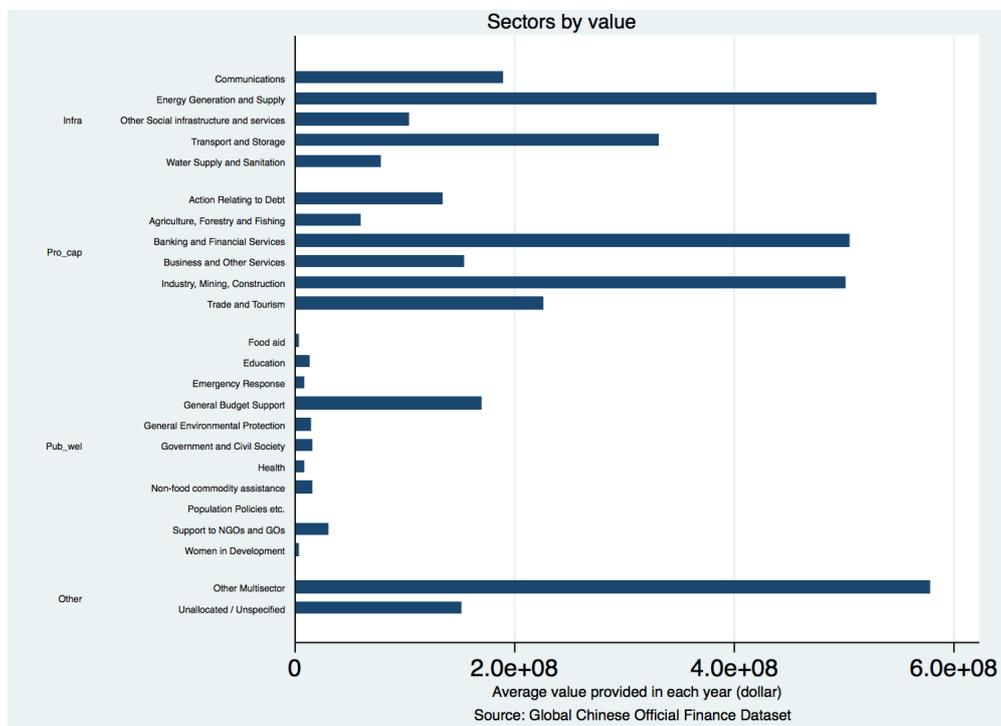


Figure 4: Aiding sectors splitted into categories by value

Table 10: Country list

Albania	Algeria	Angola	Antigua and Barbuda
Argentina	Armenia	Australia	Austria
Azerbaijan	Bahamas, The	Bahrain	Bangladesh
Barbados	Belarus	Belgium	Belize
Benin	Bhutan	Bolivia	Bosnia and Herzegovina
Botswana	Brazil	Brunei	Bulgaria
Burkina Faso	Burundi	Cambodia	Cameroon
Canada	Cape Verde	Central African Republic	Chad
Chile	Colombia	Comoros	Congo, Rep.
Costa Rica	Croatia	Cyprus	Czech Republic
Cote d'Ivoire	Denmark	Djibouti	Dominica
Dominican Republic	Ecuador	Egypt	El Salvador
Equatorial Guinea	Estonia	Ethiopia	Fiji
Finland	France	Gabon	Gambia
Georgia	Germany	Ghana	Greece
Greenland	Grenada	Guatemala	Guinea
Guinea-Bissau	Guyana	Haiti	Honduras
Hong Kong, China	Hungary	Iceland	India
Indonesia	Iran, Islamic Rep.	Ireland	Israel
Italy	Jamaica	Japan	Jordan
Kazakhstan	Kenya	Kiribati	Korea, Rep.
Kuwait	Kyrgyz Republic	Lao PDR	Latvia
Lebanon	Lesotho	Liberia	Lithuania
Luxembourg	Macau, China	Macedonia, FYR	Madagascar
Malawi	Malaysia	Maldives	Mali
Malta	Marshall Is	Mauritania	Mauritius
Mexico	Micronesia	Moldova	Mongolia
Morocco	Mozambique	Myanmar	Namibia
Nepal	Netherlands	New Zealand	Nicaragua
Niger	Nigeria	Norway	Oman
Pakistan	Palau	Panama	Papua New Guinea
Paraguay	Peru	Philippines	Poland
Portugal	Qatar	Russian Federation	Rwanda
Samoa	Sao Tome Prn	Saudi Arabia	Senegal
Seychelles	Sierra Leone	Singapore	Slovak Republic
Slovenia	Solomon Islands	South Africa	Spain
Sri Lanka	St. Kitts and Nevis	St. Lucia	Vincent and the Grenadines
Suriname	Swaziland	Sweden	Switzerland
Tajikistan	Tanzania	Thailand	Togo
Tonga	Trinidad Tobago	Tunisia	Turkey
Turkmenistan	Uganda	Ukraine	United Arab Emirates
United Kingdom	United States	Uruguay	Uzbekistan
Vanuatu	Vietnam	Yemen	Zambia
Zimbabwe			

Table 11: Correlation

	$\ln X$	$\ln(Y_{ct})$	$\ln(Y_{jt})$	$\ln(Pop_{jt})$	$\ln(DIS_j)$	CON	$\ln(ER_{cjt})$	$\ln(Aid_{cjt})$
$\ln X$	1							
$\ln(Y_{ct})$	0.3894	1						
$\ln(Y_{jt})$	0.4709	0.2215	1					
$\ln(Pop_{jt})$	0.6558	0.0356	-0.144	1				
$\ln(DIS_j)$	-0.3294	0	-0.0712	-0.2444	1			
CON	0.1259	0	-0.1706	0.1599	-0.5309	1		
$\ln(ER_{jt})$	-0.0267	-0.182	0.061	0.0014	0.0142	0.0684	1	
$\ln(Aid_{jt})$	-0.0179	0.135	-0.46	0.2052	-0.0629	0.186	-0.0301	1
RTA	0.3679	0	0.1282	0.3101	-0.4571	0.3583	-0.0298	0.0503

Table 12: PPML estimation at HS6 products level

	(1)	(2)	(3)	(4)	(5)
	Export	XCapital	XIntermediate	XConsumer	XMaterials
$\ln Aid_{cjt}$	0.00334*** (0.000848)	0.00322* (0.00155)	0.00427*** (0.000841)	0.00252* (0.00105)	-0.00139 (0.00308)
$\ln Y_{jt}$	1.263*** (0.0698)	1.229*** (0.15)	1.079*** (0.0696)	1.212*** (0.0803)	0.525* (0.207)
$\ln Pop_{jt}$	2.188*** (0.0914)	2.010*** (0.218)	2.324*** (0.0776)	2.069*** (0.127)	2.234*** (0.281)
WTO_{jt}	0.409*** (0.0319)	0.487*** (0.0654)	0.429*** (0.0392)	0.328*** (0.0476)	0.419*** (0.0922)
$CONS$	-3.651*** (0.832)	-1.305 (1.795)	-3.143*** (0.868)	-4.067*** (0.866)	1.374 (2.586)
Country FE	yes	yes	yes	yes	yes
Year FE	yes	yes	yes	yes	yes
HS6 FE	yes	yes	yes	yes	yes
N	11821310	2136838	3541655	4747476	1329009

Notes:

(a) Robust standard errors in parentheses

(b) ***, **, and * denote significance at 1, 5 and 10% level, respectively

(c) Dependent variable : China's bilateral exports in level at HS4 product level at time t . *Capital* means the exports of capital goods; *Intermediate* means the export of intermediate goods; *Consumer* means the export of consumer goods; *Materials* means the export of raw material.

Table 13: FE estimation at HS4 products level

	(1)	(2)	(3)	(4)	(5)
	ln(All)	ln(Capital)	ln(Intermediate)	ln(Consumer)	ln(Materials)
$\ln Aid_{cjt}$	0.00537*** (0.000162)	0.00507*** (0.000382)	0.00496*** (0.000238)	0.00563*** (0.000288)	0.00264** (0.000941)
$\ln Y_{jt}$	1.177*** (0.0106)	1.491*** (0.0248)	1.303*** (0.0158)	0.884*** (0.0192)	0.679*** (0.0595)
$\ln Pop_{jt}$	1.036*** (0.0153)	1.130*** (0.0354)	1.108*** (0.0213)	0.796*** (0.0291)	0.721*** (0.0895)
WTO_{jt}	0.183*** (0.00889)	0.143*** (0.0209)	0.163*** (0.0135)	0.211*** (0.0157)	0.242*** (0.0461)
Country FE	yes	yes	yes	yes	yes
Year FE	yes	yes	yes	yes	yes
HS6 FE	yes	yes	yes	yes	yes
N	1764503	322478	682383	593824	80089

Notes:

(a) Robust standard errors in parentheses

(b) ***, **, and * denote significance at 1, 5 and 10% level, respectively

(c) Dependent variable : Logarithm of China's bilateral export value at HS4 product level at time t . *Capital* means the exports of capital goods; *Intermediate* means the export of intermediate goods; *Consumer* means the export of consumer goods; *Materials* means the export of raw material.

Table 14: PPML estimation with zero aid flow at HS4 products level

	(1)	(2)	(3)	(4)	(5)
	ln(All)	ln(Capital)	ln(Intermediate)	ln(Consumer)	ln(Materials)
$\ln NoAid_{cjt}$	-0.0161 (0.0165)	-0.0264 (0.0318)	-0.0146 (0.0190)	0.00222 (0.0244)	0.0354 (0.0811)
$\ln MaxAid_{cjt}$	1.33e-11*** (1.84e-12)	8.39e-12* (3.59e-12)	1.92e-11*** (2.53e-12)	1.44e-11*** (2.87e-12)	1.33e-11 (1.33e-11)
$\ln Y_{jt}$	1.280*** (0.0693)	1.261*** (0.151)	1.106*** (0.0821)	1.371*** (0.105)	0.0280 (0.298)
$\ln Pop_{jt}$	2.226*** (0.0888)	2.012*** (0.215)	2.340*** (0.0892)	2.301*** (0.120)	1.689*** (0.369)
WTO_{jt}	0.446*** (0.0332)	0.488*** (0.0684)	0.464*** (0.0451)	0.440*** (0.0521)	0.438*** (0.126)
Country FE	yes	yes	yes	yes	yes
Year FE	yes	yes	yes	yes	yes
HS6 FE	yes	yes	yes	yes	yes
N	3489537	466693	1011563	1170286	331660

Notes:

(a) Robust standard errors in parentheses

(b) ***, **, and * denote significance at 1, 5 and 10% level, respectively

(c) Dependent variable : Logarithm of China's bilateral export value at HS4 product level at time t. *Capital* means the exports of capital goods; *Intermediate* means the export of intermediate goods; *Consumer* means the export of consumer goods; *Materials* means the export of raw material.

Table 15: With additional controls

	(1)	(2)	(3)	(4)	(5)
	Export	XCapital	XIntermediate	XConsumer	XMaterials
$\ln Aid_{cjt}$	0.00268** (0.000913)	0.00305+ (0.00175)	0.00304** (0.00112)	0.00145 (0.00140)	0.00168 (0.00449)
$\ln Y_{jt}$	1.587*** (0.0629)	1.404*** (0.135)	1.822*** (0.0717)	1.683*** (0.0992)	-0.377 (0.305)
$\ln Pop_{jt}$	1.779*** (0.0942)	1.624*** (0.228)	1.935*** (0.0895)	1.776*** (0.117)	1.883*** (0.385)
WTO_{jt}	0.275*** (0.0298)	0.380*** (0.0623)	0.196*** (0.0419)	0.253*** (0.0475)	0.470*** (0.123)
ER_{jt}	-0.591*** (0.0477)	-0.419*** (0.0966)	-0.693*** (0.0550)	-0.663*** (0.0829)	-0.227 (0.228)
$Polity_{jt}$	-0.00118 (0.00309)	-0.00428 (0.00634)	-0.00117 (0.00402)	0.00392 (0.00513)	-0.0157 (0.0224)
$Energyrate_{jt}$	0.00495* (0.00217)	0.00372 (0.00508)	0.00440* (0.00205)	0.00626* (0.00316)	-0.0280* (0.0130)
Country FE	yes	yes	yes	yes	yes
Year FE	yes	yes	yes	yes	yes
HS6 FE	yes	yes	yes	yes	yes
N	2956311	395379	856989	991458	

Notes:

(a) Robust standard errors in parentheses

(b) ***, **, and * denote significance at 1, 5 and 10% level, respectively

(c) Dependent variable : China's bilateral exports at HS4 product level at time t