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A Gravity Model Analysis of China's Bilateral Trade Flows: The Role of Free Trade Agreements and Exchange Rates

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Abstract

In the field of International Economics, the gravity model of trade has been one of the most successful empirical models guiding trade-policy decisions by nations. This paper aims to incorporate the theoretical foundations into the real world of trade flows between China and rest of the countries. An augmented gravity model is applied to study the impact of two variables, free trade agreements and nominal effective exchange rate on bilateral trade flows. Multiple regression analysis is carried out on a panel data consisting of trade flows with 224 countries from 1992-2015. The estimated results reveal a positive and significant influence of FTA on exports and imports. NEER displays a positive, though not significant, relationship with China's imports and negative with exports.

Keywords: Gravity Model. International Trade. Regression analysis. Panel Data.

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1 Introduction

Gravity Model has been developed as the "workhorse" in International Economics. The name originates from the application of gravitational force notion as a similarity to describe the size of two-way trade movements. In early stages of the framework, its perception was based on Newton's law of gravity. The model, expresses two-way trade as a function of magnitude of the two economies, as represented by their GDPs and cost of exchange between the economies substituted by the distance amid the economies:

$$TT_{ij} = \frac{Y_i \cdot Y_j}{D_{ij}}$$

where TT_{ij} represents the total volume of trade between two trading partners i and j, Y_i and Y_j are the GDP of country i and j respectively, and D_{ij} is the distance between them. The greater the magnitude of two economies and the lesser the distance between them, the greater the trade is projected to be.

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Evaluation of international economics, particularly, the impact of bilateral, regional, and multilateral connections has led to the importance of the gravity framework in enlightening these connections. The gravity framework has emerged as the supreme empirically robust measure in theory. It studies the effect of trade, investment, migration, currency union, and regional trade agreements. The key benefit of using this framework is its usage of actual databases to examine the sensitivity of trade movements with respect to policy variables (Olanike Kareem & Kareem, 2014).

China's role in the world trade has changed from being insignificant to relevant. Beginning from a closed economy in 1978 with trade accruing to just less than 1 % of the global trade, total trade in goods of China accounted for 6 % of the global total in 2004. Thus, the growing role of China's economy in the world and the fact that the Chinese authorities have allowed the exchange rate to gradually appreciate since July 2005, makes interesting to study the reaction of trade flows to movements in exchange rate (Marquez & Schindler, 2006). This research paper aims to apply the theoretical foundations of the gravity model to the real-world case of the trading giant – China. This study will unlock the many facets behind the global trade networks. Factors having a significant influence on trade flows would contribute to further policy making in international economics. Instruments such as trade blocs could lead to trade creation and prove beneficial for nations. Similarly, exchange rate volatility could severely impact current account balances. These effects further guide a country's actions such as government intervention to manipulate currency. Thus, the objective and motivation behind this work is to open avenues for interpreting international trade relations and underscoring the importance of various factors.

2 Objectives

1. To study the impact of free trade agreements on China's bilateral trade flows
2. To study the impact of nominal effective exchange rates on China's bilateral trade flows

Impacts of Free trade agreements were initially studied by Tinbergen in 1962. The augmentation of FTA has impacted international trade movements and consequently, economic welfare of economies since decades. In our sample, China is in a Free Trade Agreement (which includes free trade agreements and custom unions) with 19 countries. On the other hand, the instability of the rate of exchange, whether concluded by policy, currency value or tremor, affects balance of trade. Hence, rate of exchange plays a vital part in influencing the act of trade in an economy (Nicita, 2013).

This paper is organised as follows. Section 2 presents a review of the pertinent literature in this field. Section 3 describes the data and methodology used for conducting research. Section 4 outlines the results of the regression analysis carried out. Section 5 highlights the interpretation of the results. Section 6 concludes followed by references.

3 Review of Literature

The classical and new trade theories can outline the reasons for multilateral trade among countries but they fail to determine the quantum of trade flows. It has been successful empirically to account for bilateral trade flows for a range of countries (Gupta & Mittal, 2020). The theoretical base for the model employs cross-sectional data and assuming uniform and homothetic preferences for the goods across countries. Helpman's (1987) and Deardorff's (1984) state that the Hecksher-Ohlin trade model differs from the gravity model regarding the effect of economy size on trade flows.

Another research by Anaman and Al-Kharusi's (2003) finds population to be the biggest influencing variable for trade between EU and Brunei. Gravity model is also applied by Blomqvist's (2004) for Singapore and the results reveal a high degree of GDP and distance as the dominant factors.

Research works analysing India's trade flows have also yielded similar results. Batra's (2006) used Pooled OLS method to analyse cross-sectional dataset pertaining to the year 2000. The author finds significant effects for regional trade blocs and GDP. Soth-Asian countries have the highest trade potential with India.

Zhang and Wang's (2017) study the trade between China and ten affiliates of ASEAN alongside with twelve trading allies of China. The time frame used for the study ranges from 1999 to 2013. The authors make a comparison between the conventional gravity framework and recently developed framework of Baldwin and Taglioni. China's trade majorly comprises of intermediate goods which depends on the whole value of output rather than the value addition. In this view, the authors use fresh mass economic proxies which are based on intermediate goods. In comparison to conventional methods, the recently developed method by Baldwin and Taglioni explains China's two-way trade better. It also considers the impact of CAFTA (FTA) and nominal effective exchange rate in its gravity framework. The authors find a positive and significant impact of FTA on exports. Also, a negative and significant effect if found with respect to the nominal effective exchange rate. The paper concludes that China's trade with Singapore is huge and with the recent slowdown in China's export, there is a possibility of improvement in trade movement amid China and ASEAN countries.

Urata and Okabe's (2009) study the effects of FTA on trade movements. The paper uses two outlooks: first, it investigates before and aftereffects of FTA on trade movements and then it uses gravity framework to examine the trade creation and diversion effects as a result of FTA. The authors also concluded that impact of FTA is diverse amid different industries. Impacts of FTA on two-way merchandise trade movements were investigated. The study focussed on 178 countries for the years 1950-2005. The results pointed out to the conclusion that FTA has a positive connection with trade creation, but trade diversion impacts are restrictive.

Xing's (2012) studies China's two-way trade movements, with special emphasis on the effects of its currency value appreciation on trade movements. The connection between China and its 51 trading allies is analysed from 1993-2008. The study shows that China's trade movements are prejudiced in terms of regional trade. China maintained trade excess with G-7 countries but trade debit with East Asian partners. East Asian partners turned out to be major importing partners. The analyses also show that currency value rise decreases, instead of increasing, China's imports. The paper concludes that currency value rise will have a restricted effect on the balance of trade of China. Dell'Ariccia's (1999) analysed the inverse relation between exchange rate volatility and trade by studying panel data for Western Europe.

Zhai's (2023) in the study identifies key factors influencing China-ASEAN trade development, including economic volume, distance, population size, free trade area construction, the Belt and Road Initiative, resource endowment per capita, exchange rates, and land area. Using panel data from 2001 to 2021 for 10 ASEAN countries, it constructs an innovative trade gravity model. Results indicate that economic output, distance, population size, the FTA, and the Belt and Road Initiative positively impact trade, while resource endowment, exchange rates, and land area have a lesser negative impact. The study suggests that China and ASEAN countries should strengthen positive trade factors, remove barriers, and explore new growth opportunities.

Emikönel's (2022) analyzes trade between China and 97 significant trading partners from 2008 to 2019 using an extended gravity model to determine trade determinants. It examines the impact of ASEAN and APEC membership on Chinese trade, along with factors like per capita income, population, and distance. Additionally, it assesses the effect of energy imports on Chinese exports for OPEC countries. Empirical results indicate that GDP and population growth positively influence trade, while increased distance has a negative impact. The positive and statistically significant dummy coefficients for ASEAN, APEC, and OPEC highlight their alignment with gravity model theory, reflecting regional proximity and energy import needs for industrial production.

Further a study conducted by Chen, Salike, and Thorbecke's (2023) show the adverse impact of currency appreciation on a country's exports can be mitigated as its export portfolio becomes more sophisticated. This paper explores whether exchange rate variations influence China's exports differently based on their sophistication levels, measured by the Product Complexity Index (PCI). By estimating exchange rate elasticities for 1,242 export categories at the HS-4-digit level from 1995 to 2018, using bilateral trade data between China and 190 partner countries, the study finds that exchange rate fluctuations generally negatively affect China's export values. However, this negative impact is less pronounced for more sophisticated exports. This trend persists even after accounting for tariffs. The findings also reveal that as China has advanced its export basket over time, the influence of exchange rates on exports has diminished and become less significant. Furthermore, the effect of exchange rate policies on export values is smaller and less significant for China's more sophisticated exports.

Despite these insights, there remains a research gap in understanding the nuanced effects of trade policies and exchange rates on China's bilateral trade flows. This paper aims to bridge this gap by incorporating theoretical foundations into the real-world context of trade flows between China and other countries. Specifically, it applies an augmented gravity model to study the impact of two critical variables: free trade agreements (FTAs) and the nominal effective exchange rate (NEER) on bilateral trade flows. Multiple regression analysis is conducted on a panel data set consisting of trade flows with 224 countries from 1992 to 2015. The estimated results reveal that FTAs have a positive and significant influence on both exports and imports. NEER shows a positive, though not significant, relationship with China's imports and a negative relationship with exports. This comprehensive analysis aims to provide deeper insights into the determinants of China's trade dynamics in the context of evolving global economic policies.

4 Data and Methodology

Classical gravity models employing cross-section models do not present an accurate picture of the trade relationship between countries. Hence, our study uses methodology of panel data estimation for our empirical gravity model.

Our study covers a sample of 224 trading partners of China. China is taken to be the exporting country. Time frame considered is 1992-2015. Data for the nominal effective exchange rate is obtained from the IMF database while for all other independent variables, data is retrieved from Centre d'Etudes Prospectives et d'Informations Internationales (CEPII). Import and Export values (in thousand US $) were taken from the World Integrated Trade Solutions (WITS).

Multiple regression analysis is carried out using R Software on basic and augmented model with country and time fixed effects. This is crucial for controlling factors which are constant over entities but change with time as well as factors that are constant with time but evolve with entities. This process if helpful to eliminate omitted variable bias due to unobservable factors. To seize the impact of FTA on trade movements a dummy variable is added, that is, if country is part of FTA it takes the value of one and otherwise zero.

We apply an "augmented" regression model consisting of other variables besides income and distance such as dummies for common language, common colonizer, and common border. Further, robustness checks are carried out on the models by eliminating the outliers in the dataset (see table 1).

Table 1. Description of Data

Independent Variable Name	Abbreviation in the model	Description
Nominal GDP (both of exporting and importing country in current US$)	Exporting country-gdpo, Importing country-gdpd, M – Imports, X – Exports, tt–Total Trade	Sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products (Source: CEPII)
Nominal effective exchange rate	neer	Nominal effective exchange rate is the measure of value of a currency against a weighted basket of the currencies of its top trading partners (Source: IMF)
Free Trade Agreement	dfta	Dummy variable. Takes value 1 if countries are members of any Free Trade Agreement and 0 otherwise (Source: CEPII)
Distance	distw	Weighted bilateral distance between the biggest cities of the origin and destination in kilometers (Source: CEPII)
Common language	dlang	Dummy = 1 if the countries share a common official or primary language (Source: CEPII)
Common border	dborder	Dummy = 1 if the countries share a common border (Source: CEPII)
Common colonizer	dcol	Dummy = 1 for origin and destination having common colonizer (Source: CEPII)

4.1 Regression Model

Model 1 - Basic Model

$$\log(\text{Exports}) = \beta_1 \log(\text{gdpo})_{it} + \beta_2 \log(\text{gdpd})_{jt} + \beta_3 \log(\text{distw})_{ij} + u_{ijt} + \text{constant} \quad (1)$$

Model 2 - Control Variables and Additional Variables

$$\log(\text{Exports}) = \beta_1 \log(\text{gdpo})_{it} + \beta_2 \log(\text{gdpd})_{jt} + \beta_3 \log(\text{distw})_{ij} + \beta_4 \text{dborder} + \beta_5 \text{dlang} + \beta_6 \text{dcol} + \beta_7 \text{dfta} + \beta_8 \text{lneer} + u_{ijt} + \text{constant} \quad (2)$$

Model 3 - Control Variables, Additional Variables along with Time Fixed Effects

$$\log(\text{Exports}) = \beta_1 \log(\text{gdpo})_{it} + \beta_2 \log(\text{gdpd})_{jt} + \beta_3 \log(\text{distw})_{ij} + \beta_4 \text{dborder} + \beta_5 \text{dlang} + \beta_6 \text{dcol} + \beta_7 \text{dfta} + \beta_8 \text{lneer} + \text{time fixed effects} + u_{ijt} + \text{constant} \quad (3)$$

Model 4 - Control Variables, Additional Variables along with Country Fixed Effects

$$\log(\text{Exports}) = \beta_1 \log(\text{gdpo})_{it} + \beta_2 \log(\text{gdpd})_{jt} + \beta_3 \log(\text{distw})_{ij} + \beta_4 \text{dborder} + \beta_5 \text{dlang} + \beta_6 \text{dcol} + \beta_7 \text{dfta} + \beta_8 \text{lneer} + \text{country fixed effects} + u_{ijt} + \text{constant} \quad (4)$$

Model 5- Control Variables, Additional Variables along with both time and country fixed effects

$$\log(\text{Exports}) = \beta_1 \log(\text{gdpo})_{it} + \beta_2 \log(\text{gdpd})_{jt} + \beta_3 \log(\text{distw})_{ij} + \beta_4 \text{dborder} + \beta_5 \text{dlang} + \beta_6 \text{dcol} + \beta_7 \text{dfta} + \beta_8 \text{lneer} + \text{time fixed effects} + \text{country fixed effects} + u_{ijt} + \text{constant} \quad (5)$$

where u_{ijt} represents the error term; t denotes time, and β stands for parameters. In addition to taking exports as the dependent variable, the above three regressions were also run with imports and total trade serving as the dependent variable. Total trade is defined as the sum of exports and imports.

4.2 Hypothesis to be tested

1. Size of the economies (as measured by GDP of both the trading partners) will have a positive impact on their bilateral trade ($\beta_1, \beta_2 > 0$).
2. Impact of distance will be negative on bilateral trade flows ($\beta_3 < 0$).
3. Dummies for common language, common border, and free trade agreement are expected to have a positive effect on the trade flows between the two economies ($\beta_4, \beta_5, \beta_6, \beta_7 > 0$).
4. The Nominal Effective Exchange Rate (NEER) is expected to have a positive effect on imports and negative effect on exports of an economy ($\beta_8 > 0$ for imports and $\beta_8 < 0$ for

exports).

5 Results and Discussion

Tables 2,3, and 4 present the results of our analysis. Table 2 provides estimates of the coefficients of the gravity equation with Imports (M) as the dependent variable, while Tables 3 and 4 present the results with Exports (X) and Total Trade (tt) as the dependent variables, respectively. The dummy for common colonizer (dummycol) is omitted as China and all other countries have never shared a common colonizer (value 0 throughout).

Table 2. Regression with Imports as Dependent Variable

Variable	Model 1	Model 2	Model 3	Model 4	Model 5
R^2	0.6950	0.6990	0.7015	0.8809	0.8852
N	3891	3891	3891	3891	3891
Cons	-32.69 (-26.05)***	-34.32 (-25.14)***	-34.103 (-4.5)***	188.41 (10.53)***	201.346 (11.34)***
ldist	-1.13 (-15.82)***	-0.837 (-9.42)***	-0.8417 (-9.4)***	-24.51 (-12.97)***	-25.50 (-13.67)***
lgdpo	0.756 (20.3)***	0.658 (7.86)***	1.023 (1.83)**	1.061 (14.55)***	1.48 (4.10)**
lgdpd	1.348 (82.20)***	1.345 (81.75)***	1.346 (81.92)***	0.853 (10.26)***	0.695 (8.15)**
lneer		0.42 (0.97)	-1.923 (-0.58)	0.397 (1.42)*	-2.233 (-1.06)
dfta		0.643 (3.20)***	0.627 (3.11)***	-0.549 (-3.4)***	-0.614 (-3.9)***
dborder		0.281 (1.78)**	0.277 (1.76)**	-33.495 (-1.8)***	-34.57 (-2.3)***
dlang		1.250 (4.79)***	1.259 (4.83)***	-22.004 (-10)***	-22.499 (-11)***
dcol	omitted	omitted	omitted	omitted	omitted

Source: Author's Compilation

Note: The value in parentheses is the t-statistic and *** represents 1% level of significance, ** represents 5% level of significance and * represents 10% level of significance

In case of the basic gravity model, as shown in Table 2, an increase of 1 % in China's GDP leads to 0.75 % increase in its imports. Similarly, an increase of 1 in GDP of the trading partner leads to increase in imports of China by 1.34 %. Also, the coefficient of distance turns out to be negative as predicted. A rise in distance by 1 % leads to decrease in imports by 1.11 % (ceterus paribus). Therefore, we can conclude that the basic gravity model holds true. As we divert from the basic model to the augmented model including control and two additional variables - free trade agreement and nominal effective exchange rate (Model 2), new interpretations come into the picture. An increase of 1 % in the nominal effective exchange rate of China increases its imports by 0.419 %. Thus, this result follows conventional economic theory. The interpretation of the dummies is as follows:

1. Import difference between countries part of an FTA and countries not part of an FTA with China is 64.3

2. Import difference between countries sharing a common border and countries not sharing a common border is expected to be 0.281%.
3. Difference in imports between countries sharing a common language and countries not having a common language is 1.250%.

This model for imports progresses step by step by including time fixed effects, country fixed effects and finally both. The drastic difference which arises in in respect to signs of the coefficients of the three dummies and our additional variable nominal effective exchange rate. Conceptually, an increase in NEER, meaning an appreciation of the currency, should translate into rise in imports and fall in exports over time (due to the J curve effect) and vice-versa for depreciation of the currency. China's NEER has shown minor fluctuations in its pattern of rise and fall before 2004 but has risen thereafter. A positive as well as significant coefficient is reported when only country specific fixed effects are considered. This may be due to controlling for trade price differences across countries. Coming to the dummies, the signs of all three are expected to the positive but are so only in Model 2 and when time fixed effects are employed in model 3. The signs turn negative when country fixed effects come into the picture. Negative sign for these two dummies shows that China's imports are majorly from countries that neither share a common language nor a common border with China. Negative sign for the dummy for FTA shows the trade creation effect being outweighed by the trade diversion effect. Same is the case for exports and total trade. Here also, the coefficients for the three dummies turn negative as the model progresses to include fixed effects.

Table 3. Regression with Exports as Dependent Variable

Variable	Model 1	Model 2	Model 3	Model 4	Model 5
R^2	0.8209	0.8323	0.8373	0.9546	0.9599
N	4159	4159	4159	4159	4159
Cons	-31.341 (-47.20)***	-34.515 (-49.15)***	-33.290 (-28)***	12.486 (1.80)**	19.915 (3.03)**
ldist	-0.746 (-19.66)***	-0.3641 (-7.87)***	-0.370 (-8.0)***	-5.480 (-7.5)***	-6.037 (-8.7)***
lgdpo	1.006 (50.41)***	0.940 (21.93)***	0.927 (3.16)***	0.985 (32.11)***	1.052 (6.98)***
lgdpd	0.916 (107.91)***	0.916 (110.66)***	0.914 (111.80)***	0.909 (25.38)***	0.789 (22.50)***
lneer		0.335 (1.54)*	0.130 (0.08)	0.245 (2.11)***	-0.108 (-0.12)
dfta		0.189 (1.77)**	0.154 (1.46)*	-0.451 (-6.5)***	-0.495 (-7.5)***
dborder		0.635 (7.60)***	0.629 (7.62)***	-5.343 (-4.8)***	-5.881 (-5.6)***
dlang		1.844 (13.23)***	1.860 (13.51)***	-2.812 (-3.5)***	-2.997 (-3.9)***

Source: Author's Compilation

Note: The value in parentheses is the t-statistic and *** represents 1% level of significance, ** represents 5% level of significance and * represents 10% level of significance

In Table 3, the interpretations for all the variables remain the same. However, now the sign of NEER should be negative as an appreciation on the value of China's currency unit Yuan should lead to decline in its exports. Such a result is only visible when both time and country fixed effects are included in the model, but the coefficient is not significant.

The model for total trade in Table 4 also displays similar patterns with regards to the four variables discussed above. We see a negative sign of NEER in the model with both fixed effects incorporated. The possible reason can be appreciation of NEER being more favourable to import rather than export trade.

Table 4. Regression with Total Trade as Dependent Variable

Variable	Model 1	Model 2	Model 3	Model 4	Model 5
R^2	0.8216	0.8313	0.8358	0.9550	0.9608
N	3891	3891	3891	3891	3891
Cons	-28.390 (-43.2)***	-30.804 (-44.07)***	-30.489 (-25)***	52.119 (6.93)***	61.836 (8.72)***
ldist	-0.791 (-21.4)***	-0.482 (-10.61)***	-0.488 (-11)***	-9.512 (-12)**	-10.378 (-14)***
lgdpo	0.921 (47.2)***	0.873 (20.38)***	1.057 (3.72)***	0.950 (31.00)	1.210 (8.40)***
lgdpd	0.934 (108)***	0.933 (110.7)***	0.934 (112.08)***	0.903 (25.82)***	0.798 (23.43)***
lneer		0.211 (0.96)	-1.043 (-0.62)	0.251 (2.15)***	-1.249 (-1.49)*
dfta		0.307 (2.98)***	0.282 (2.76)***	-0.412 (-6)***	-0.455 (-7.2)***
dborder		0.381 (4.70)***	0.378 (4.72)***	-11.754 (-9)***	-12.757 (-11)***
dlang		1.631 (12.21)***	1.643 (12.42)***	-7.220 (-8)***	-7.751 (-9.7)***

Source: Author's Compilation

Note: The value in parentheses is the t-statistic and *** represents 1% level of significance, ** represents 5% level of significance and * represents 10% level of significance

A major caveat in estimating effects of the NEER pertains to the trade price data of China. This data is not available and hus proxies are used of other countries. So, one is bound to question the reliability of the results when the trade prices of Honk Kong or any other country are used as a proxy for all the Chinese trade prices. Another point to be stressed upon relates to the aggregate measures of imports and exports used. China's imports are composed of primarily two components: imports for domestic consumption and imports of parts for assembly. Similarly, exports are categorised into exports of final products and exports of assembled goods. Conducting separate analysis for these groups will help in explaining why we have not found a significant relationship between exchange rate and bilateral trade flows. The reason can be attributed to "muting of the effect of an NEER appreciation on demand for export of assembled goods by effect on the price of imports of components for assembly" (Marquez & Schindler, 2006). When the goods are classified into ordinary products and parts for assembly, an appreciation of the NEER leads to decline in export shares, a consistent result according to expectations.

Secondly, even after dismantling of state controls in 1988 in China and elimination of tariff barriers followed by the economy's accession to the WTO, the authorities have managed the NEER with little movements allowed over time. Time fixed effects should not be used ideally when there are slow changing variables like our NEER and dummies of common language and border which do not change significantly over time (Marquez and Schindler, 2006).

5.1 Robustness Checks

Tables 5, 6, 7, and 8 (Appendix) display robustness checks of the models. First by taking exports as our dependent variable we drop top 31 exporting partners of China (outliers) and a few years where international and national events disturbed China's economy like crisis of 1997 and 2008 (also one or two years after them are dropped) and 2012 wherein global economic slowdown led to dip in imports and exports of China. In the case of imports also, almost all these countries were overlapping and were thus dropped. The results stayed pretty much the same with negative coefficients for the 3 dummies and opposite sign of NEER with model including both the fixed effects.

A second robustness check for the FTA dummy was carried out, as seen in Table 8, by taking a sample of 21 countries out of which 19 countries had an FTA with China. The regression model was run only taking total trade as the dependent variable. The sign of the coefficient of dummyfta changed from negative to positive when country fixed effects are considered and when both the fixed effects are included.

6 Conclusion

This paper can be seen as an extension of the basic gravity model to determine impact of FTA and NEER on bilateral trade flows of China from 1992-2015. It is evident that the basic model holds true for all the three indicators of trade considered. The impact of FTA on imports and exports is seen to be positive and significant with the model comprising of all the additional variables and time fixed effects. The negative sign, in case of country fixed effects model, gets transformed when performing robustness checks and it becomes positive as well as significant.

The results for the NEER, however, stay the same when robustness checks are carried out due to reasons explained previously. Also, this variable is not highly significant in explaining bilateral trade flows of China with the rest of the world. This issue is partially solved by Marquez and Schindler's (2006) by taking shares of imports and exports instead of their values. The authors also augmented the model specifications by differentiating between different categories of imports and exports and including lags of variables wherever necessary. A limitation of FTA relates to the problem of endogeneity bias. FTA are assumed to be exogenous in our models but, they themselves are dependent on factors like GDP of the two trading countries, remoteness, similarities between them etc. Also, by putting a single dummy value of 1 on the inclusion of 2 countries in an FTA homogenises it. In practice, FTA is heterogeneous and varies across different economies dependent on country specific characteristics. Thus, caution is needed in employing such variables for analysis. Alternative and better variables need to be brought into the picture which provides a clearer indication of trade flows of China.

China as a trading giant constitutes a major share in the world trade (almost half of the world's trade along with EU and USA) and thus its pattern of trade becomes crucial for research. Events like the USA-China trade war (not considered in our dataset) will have significant impact on China's trade as USA is in the list of its top 5 trading partners. Therefore, future research should be guided by taking these into the limelight.

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Appendix

Table 5. Robustness Check with Export as Dependent Variable

Variable	Model with control and additional variables (Model 2)	Model with control, additional and both time and country fixed effects variables (Model 5)
R^2	0.7661	0.9423
N	2817	2817
Cons	-35.65413 (-39.11)***	24.0182 (2.97)**
ldist	-0.2206905 (-3.57)***	-6.403773 (-7.58)**
lgdpo	0.9534881 (18.58)***	1.12166 (6.35)**
lgdpd	0.9017733 (70.29)***	0.6956834 (15.54)**
lneer	0.2888995 (1.14)	-0.2268077 (-0.22)
dfta	0.0991599 (0.56)	-0.4627283 (-4.19)***
dborder	0.779051 (6.14)***	-5.568356 (-6.02)***
dlang	1.34485 (4.19)***	-2.572519 (-3.84)***
dcol	omitted	omitted

Source: Author's Compilation

Note: The value in parentheses is the t-statistic and *** represents 1% level of significance, ** represents 5% level of significance and * represents 10% level of significance

Table 6. Robustness Check with Import as Dependent Variable

Variable	Model with control and additional variables (Model 2)	Model with control, additional and both time and country fixed effects variables (Model 5)
R^2	0.6102	0.8458
N	2603	2603
Cons	-37.28797 (-20.59)***	210.086 (9.66)**
ldist	-0.6967352 (-5.75)***	-26.5043 (-11.61)***
lgdpo	0.6584307 (6.44)***	1.598524 (3.71)**
lgdpd	1.436482 (54.65)***	0.6176688 (5.57)**
lneer	0.3347146 (0.65)	-2.443062 (-0.98)
dfta	0.7818142 (2.33)***	-0.5118482 (-1.91)**
dborder	0.688971 (2.81)***	-26.74205 (-10.99)***
dlang	0.0611051 (0.10)	-18.36673 (-10.25)***
dcol	omitted	omitted

Source: Author's Compilation

Note: The value in parentheses is the t-statistic and *** represents 1% level of significance, ** represents 5% level of significance and * represents 10% level of significance

Table 7. Robustness Check with Total Trade as Dependent Variable

Variable	Model with control and additional variables (Model 2)	Model with control, additional and both time and country fixed effects variables (Model 5)
Cons	-32.06848 (-35.02)***	63.02513 (7.40)**
ldist	-0.3444973 (-5.62)***	-10.52055 (-11.76)***
lgdpo	0.8926987 (17.27)***	1.260657 (7.47)**
lgdpd	0.9250413 (69.58)***	0.7683602 (17.67)**
lneer	0.1347367 (0.52)	-1.374023 (-1.40)*
dfta	0.2840435 (1.68)**	-0.4381964 (-4.17)***
dborder	0.5083832 (4.11)***	-10.07964 (-10.57)***
dlang	0.8877495 (2.88)***	-6.138204 (-8.74)***
dcol	omitted	omitted

Source: Author's Compilation

Note: The value in parentheses is the t-statistic and *** represents 1% level of significance, ** represents 5% level of significance and * represents 10% level of significance

Table 8. Robustness Check in Model 4 and Model 5

Variable	Model with control and additional variables and country fixed effects (Model 4)	Model with control, additional and both time and country fixed effects variables (Model 5)
R-squared	0.9750	0.9790
N	157	157
lgdpo	0.814 (7.13)***	1.001 (4.01)***
lgdpd	0.504 (3.86)***	0.686 (4.62)***
ldistance	1.610 (1.32)*	1.021 (0.84)
dlang	-0.187 (-0.38)	0.052 (0.11)
dborder	0.219 (1.35)*	0.326 (1.98)**
dfta	4.060 (3.24)***	3.423 (2.74)***
lneer	-0.389 (-0.93)	-1.442 (-1.13)
dcol	omitted	omitted

Source: Author's Compilation

Note: The value in parentheses is the t-statistic and *** represents 1% level of significance, ** represents 5% level of significance and * represents 10% level of significance