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A PANEL DATA ANALYSIS OF CHINA'S TRADE PATTERN WITH OPEC MEMBERS: GRAVITY MODEL APPROACH

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ABSTRACT

In this study, we have endeavoured to explain China's trade pattern with OPEC member countries by employing gravity model over the period 1990-2016. The estimation results demonstrate that the gravity equation fits the data pragmatically. China was the first biggest oil importer worldwide with about 73 per cent of her oil coming from OPEC member countries. In fact, energy can be considered as the most traded commodity and also the core reason for the trade volume growth between China and the OPEC member countries in last two decades. We have confirmed that China's bilateral trade with OPEC members positively impacts on GDP, income (GDP per capita), trade openness in China and the WTO member countries in OPEC. While negatively influence on distance (trade cost) and supports Linder hypothesis. Depreciation in bilateral exchange rates also negatively influence on China's bilateral trade with OPEC.

Contribution/ Originality: To the best of the authors' knowledge, this study is the first attempt to examine the China's trade pattern with 14 OPEC member countries aver the period of 1990-2016 through gravity approach by estimation technique OLS and time fixed effects.

1. INTRODUCTION

International trade has become a salient characteristic of Chinese economic expansion. In 2013 China has become the World's largest trading country which is 'a landmark milestone' for the nation (Muhammad and Qi, 2017). The annual trade in goods passes the USD 4 trillion marks for the first time and overtaking the USA in the battlefield of Trading. The shift in the trading pecking order reflected China's rising global dominance, notwithstanding a slowdown in economic growth in recent years. China appeared with the great economic player and major regional power within Asia and has been distinguished as a potential superpower in the world. Since China's initiation of the economic reforms and the adoption of its open door policy, foreign trade in China has experienced rapid growth. In 1990, the total value of exports and imports equalled US$ 115.44 billion and percentage share of exports and imports to GDP was 17.21 percent and 14.78 respectively. China record high trade was registered in 2014 which was US$ 4301 billion where import and export share to GDP were 18.7 and 22.35 percent marked respectively and highest trade balance was registered in 2015 US$ 594 billion but in year 2016 total

trade volume dramatically dropped at US$ 3685.6 billion which was exports only recorded US$ 2098 billion and import at US$ 1587 billion. Figure "A" in appendix demonstrates that China's exports and imports share to GDP started a decline in the year 2008 the year of global financial crises which is left his aftershocks on many developed economies like China and USA. A higher level of trade openness in China has been considered with a rapid increase in investment, economic growth rate and reallocation of the labour force from agriculture to industrial sector (Muhammad, 2016). A larger share of industry in the economy increased the necessity of fossil fuels' imports as a vital production input in China. In this paper, we try to use a gravity model to investigate the bilateral trade between China and 14 OPEC member countries during the fairly long period 1990 to 2016 (27 years). The choice of these countries for this study is also motivated by the report presented by BP Statistical Review of World Energy in 2016, China was the first biggest oil importer worldwide with about 73 percent of her oil coming from OPEC member countries, while OPEC countries are the main exporters of this kind of energy in the world. This fact can shape a distinctive trade pattern between China and OPEC 14 countries, raising the question whether the gravity model also fits the unique trade structure. Hence, it is scientifically and economically meaningful to applying the gravity model to investigating the China-OPEC trade flows. The trade pattern of China has drawn great attention from researchers but we do not find any study that has considered the analysis of China's bilateral trade with OPEC member countries through gravity model and have long enough periods 1990-2016 (27 years). Therefore, this study leads to make new research results for scholars and policymakers.

2. CHINA'S TRADE PATTERN WITH OPEC

In less than three decades, China has grown from playing a negligible role in international trade to being one of the world's largest traders (Feenstra and Jin, 2010). A high number of Scholars such as Ding and Tay (2016); Caporale *et al.* (2015); Tahir and Azid (2015); Chen *et al.* (2014) believe that before 1978, China experienced a low level of trade openness because of her centrally planned economy (based on the World Bank Indicators, China had an average of nearly 7.24 percent trade openness over the period of 1960-1977) which was under the tenets of the Maoist people's communes (Soong, 2014). The main reforms were implemented since 1978 (the era of Chinese economic take off Grabowski (2011) when China's economy had pursued trade liberalization and placed under economic structure (gradual but fundamental reform) which led to the improvement in the trade volume of this country (Hsieh *et al.*, 2014). At the beginning of the 1980s, China applied tariff barriers to control the imports' volume into her local market. The most important milestone of China's trade happened in 2001 when they joined the WTO through which a country has to modify and revise her administrative regulations and trade law (Urdinez and Masiero, 2015); (Tahir and Khan, 2014); (Wang *et al.*, 2013) to convert the global atmosphere of "China threat" to "China opportunity" Tai and Soong (2014). Over the period of 2001-2016, China experienced an average of 50.98 per cent trade openness which depicts a higher level of the trade relations with the other nations. A higher level of trade openness in China has been considered with a rapid increase in investment, economic growth rate and reallocation of the labor force from agriculture to industrial sector. A larger share of industry in the economy increased the necessity of fossil fuels' imports as a vital production input in China. According to BP Statistical Review of World Energy in 2016, China was the first biggest oil importer worldwide with about 73 % of her oil coming from OPEC member countries (Saudi Arabia (16%), Angola (13%), Oman (10%), Iraq (9%), Iran (9%), Algeria (5%), Venezuela (4%), UAE (4%) and Kuwait (3%)). In fact, energy can be considered as the most traded commodity and also the core reason for the trade volume growth between China and the OPEC member countries in last two decades. In the past, the supremacy of the global oil market by OPEC after the crumple of the Bretton Woods system in the early of 1970s, several fossil fuel energy-consuming countries, such as China, have expanded their trade flows with the members in this organization to supply and import their fossil fuel energy necessities. Trade volume between China and the OPEC member countries increased nearly 968 per cent and 1174 per cent over the period of 1990-2001 and 2001-2016 respectively. Table 1 reports the trade growth between China and the

14 OPEC member countries. It can be seen that China's major trading OPEC member partners include Saudi Arabia, UAE and Iran during this period.

Table-1. Bilateral trade China and the OPEC member countries, 1990-2016 (US$ million)

Country	1990	2001	% Growth	2016	% Growth
Algeria	75.9	292.2	285.2	8070.0	2661.7
Angola	7.9	767.6	9574.2	15587.0	1930.7
Ecuador	10.7	162.1	1419.9	3208.8	1878.9
Equatorial Guinea	0.7	511.9	74093.6	782.7	52.9
Gabon	20.6	265.2	1186.4	1781.0	571.5
Iran	229	3312.6	1346.6	31531.6	851.9
Iraq	118	468.0	296.5	18302.8	3811.2
Kuwait	119.2	642.5	438.8	9426.8	1367.3
Libya	39.6	95.2	140.1	1582.2	1562.2
Nigeria	41.3	1144.3	2671.7	10972.7	858.9
Qatar	27.2	408.6	1402.3	5545.7	1257.2
Saudi Arabia	418.6	4070.0	872.4	42879.7	953.6
United Arab Emirates	307	2824.8	820.3	40451.0	1332.0
Venezuela	41	589.1	1337.9	8035.0	1263.9
OPEC	1456.7	15554.2	967.8	198156.9	1174.0

Source: Author's compilation based on data National Bureau of Statistics of China and UN COMTRADE, 2017.

In case of imports, as of 1990, 2001 and 2016, nearly more than 54 to 80 percent of China's imports from OPEC member countries are related to energy resources such as Crude oil and natural gas. Crude oil shares nearly 85 percent of total energy resources importing by China in recent years. Plastics are the second largest sector, while organic chemicals and Ores were placed in third and fourth position in these years (Figure 1).

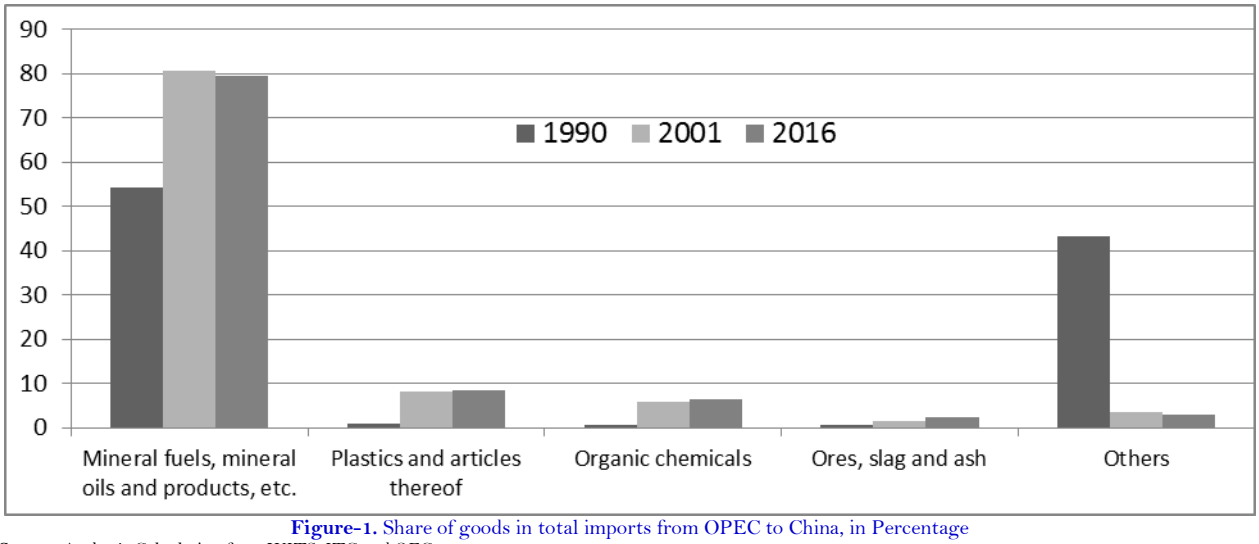

Figure-1. Share of goods in total imports from OPEC to China, in Percentage

Source: Author's Calculation from WITS, ITC and OEC

On the other hand, the export flows between China and the OPEC member countries, it can be noted that since enhancing industry in the Chinese economy, the structural pattern of China's exports to OPEC has shown changes, particularly in the accelerated growth of industrial suppliers and high-tech products. In Figure 2, China's electronic products getting a boom in recent years which shares nearly 16.25 percent in 2016 and machinery shares constantly 15 percent in these years. Clothing sector stands at third position and shares averagely 14.7 percent of China's total exports to OPEC in 1990 and 2016.

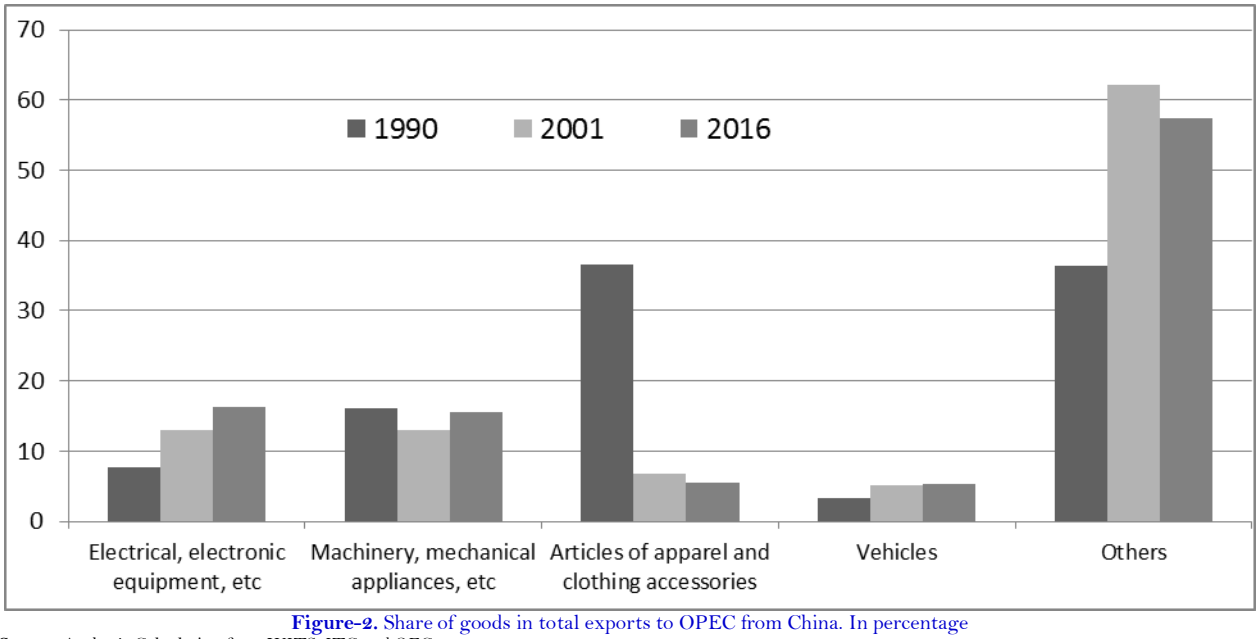

Figure-2. Share of goods in total exports to OPEC from China. In percentage

Source: Author's Calculation from WITS, ITC and OEC

3. LITERATURE REVIEW AND DEVELOPMENT IN GRAVITY APPROACH

There is great number of studies exploring the links in bilateral trade flows through the gravity model approach which is a distinguished contrivance to model international trade flows among nations, trading agreements and even between continents (Brun *et al.*, 2002); (Redding and Venables, 2004); (Liu and Xin, 2011); (Novy, 2013); (Fung, 2014); (Ulengin *et al.*, 2015); (Rasoulinezhad and Kang, 2016); (Rasoulinezhad, 2017); (Muhammad and Qi, 2017); (Muhammad et al., 2018). The first eminent study exploring trade flows goes back to Jan Tinbergen's article "Shaping the world economy: propositions for an international economic policy" long ago in 1962. He believed that based on Newton's gravity law, which is stated as the trade between two countries can be a function of their economic sizes and distance between them Tinbergen (1962). Tinbergen's theoretical foundation of this model was ameliorated by Linnemann (1966); Anderson (1979); Bergstrand (1989); Deardorff (1998); Anderson and Wincoop (2003) and Guttmann and Richards (2004).

By the time, scholars originated the empirical econometric approaches of the gravity model by using several actual and mannequin or dummy variables with regards to trade flows of various economies. For example, Byers *et al.* (2000) applied a thrifty gravity model for three Baltic countries of Estonia, Latvia and Lithuania after the collapse of the Soviet Union. Their results affirmed that the trade flows of these nations were not merely reduced, but also shifted to the members of the former Soviet Union. Porojan (2001) attempted to discover the trade flows–spatial effects nexus through the gravity model for the European Union (EU) and some of her potential members. Baier and Bergstrand (2002) explain the endogeneity of international trade flows and free trade agreements by employing gravity approach. Evenett and Keller (2002) theoretically explain the success of gravity equation and they have proved that gravity is the best approach to modelling trade-related flows. In another study, Martinez-Zarzaso (2003) evaluated the effects of preferential agreements on the bilateral trade flows among 47 countries in several economic blocs and areas during 1980-1999. Papazoglou (2007) endeavoured to discover potential trade flows for Greece to the EU member states by employing a gravity model. In his conclusion, he stated that actual export of Greece fall short of potential ones, while the opposite is true for Greek imports. Xuegang *et al.* (2008) used the three explanatory variables GDP, GDP per capita and Shanghai Cooperation Organization (SCO) to construct a gravity model for Xinjiang's bilateral trade. Their outcome illustrated that all the three variables distress the Xinjiang's bilateral trade. Ekanayake *et al.* (2010) examined the trade diversion effects of the regional trade agreements in Asia on intra-regional trade flows by using a gravity model and annual data for 19 Asian countries

during 1980-2009. The findings represented the negative sign of ECO and positive signs of ASEAN, BA and SAARC RTAs. Another industrial sector level study by Chen and Novy (2011) applied a gravity model to find out the trade integration across manufacturing industries in EU countries. They accomplished that substantial technical barriers to trade in specific industries are the most important trade barriers. Rasoulinezhad (2016) investigate how much various sanctions (financial and non-financial) and oil price have affected the foreign trade of Iran with Russia during 1994–2013 by employing gravity model. He concluded that the negative relationship between financial, non-financial sanctions and oil price shocks with the Iran-Russia trade. Another research by Rasoulinezhad and Kang (2016) investigated bilateral trade patterns between South Korea and thirteen OPEC member countries other the period 1980-2014 by using gravity approach. Their findings show that the trade pattern between South Korea and OPEC member countries relies on the Heckscher-Ohlin (H-O) theory thus be explained by the difference in factor endowments such as energy resources and technology.

Some earlier studies applied gravity model in the case of China. Abraham and Van Hove (2005) applied a gravity model to investigate the relationship between China and 23 Asia-Pacific countries and time period 1992-2000. Their empirical conclusion showed China's involvement in regional agreements has great export potential and also ASEAN and APEC have diminutive effects on Asia-Pacific exports. Eichengreen *et al.* (2007) explored the impact of China's growth on the exports of other Asian countries through a gravity model. They found that China has been sucking in imports from its Asian neighbours; however, this effect is mainly felt in markets for capital goods. Edmonds *et al.* (2008) used a gravity model to unearth the potential of China's trade with his major partners, particularly since China's consent to WTO in 2001. The outcomes depicted that China's direction toward foreign trade is much greater than anticipated for an economy of his size and level of development. In another study, Bussiere and Schnatz (2009) tested a gravity model to weigh up China's integration in world trade. They conclude that gravity model tracks international trade well and proves that China is well integrated into world markets, particularly in North America, several Latin American and East Asian emerging markets.

Montinari and Prodi (2011) tried to analyses the bilateral trade between China and sub-Saharan Africa between 1999 and 2007 by employing gravity model technique. In their findings, they revealed that sub-Saharan Africa's exports to China have a negative effect on intra-African trade at higher levels of the trade between China and sub-Saharan Africa and a positive effect at lower levels. Yang and Martinez-Zarzoso (2014) applied a gravity model to analyze the ASEAN–China free trade agreement (ACFTA) over the period 1995 to 2010. They conclude that the ACFTA leads to significant trade creation and a positive relationship between exports and ACFTA is also confirmed in the case of both agricultural and manufactured goods. Tang *et al.* (2014) investigated the features of traded services in China by using the modified gravity model. They found that the law of comparative advantage does apply to China'services trade. A study by Thorbecke (2015) estimated a gravity model to find whether China's exports to the USA are an outlier. The results of the assessment indicate that these exports have been more than predicted in every year since 2005. Caporale *et al.* (2015) analyzed trade flows and trade specialization in China with her major trading partners by using a gravity model for the periods of 1992-2012. They concluded that the noteworthy change in China's trading structure was linked with the fast growth of foreign trade. Furthermore, there has been a shift from resource- and labour-intensive to capital- and technology-intensive exports. Huang *et al.* (2015) explored the changing nature of economic integration in China during the period of 1955-2011. They originate that the symmetry of supply shocks has declined after the liberalization in 1978 and the correlation of demand shocks has increased during the same period.

Overall, it can be seen that there has not been a serious attempt to examine China–OPEC bilateral trade. Hence, this paper will provide new and useful results to find how various factors can affect the bilateral trade between China and the OPEC member countries.

4. DATA DESCRIPTION AND METHODOLOGY

4.1. Dataset Description

This study covers bilateral trade between China and OPEC countries which consist of 14 member countries (Algeria, Angola, Ecuador, Equatorial Guinea, Gabon, Iran, Iraq, Kuwait, Libya, Nigeria, Qatar, Saudi Arabia, the UAE and Venezuela)[1] over the time period from 1990 to 2016 (27 years). The dependent variable used in this study contain total trade volume (merchandise exports + merchandise imports) between China and OPEC member countries in current US$, GDP and per capita GDP also in current US$ and, distance between South Korea capital city and 14 OPEC member countries capital cities taken in kilometers and the economy openness level (sum of exports and imports of goods measured as the share of gross domestic product) for both China and OPEC members. The source of data on total trade volume and the exchange rate is taken from National Bureau of Statistics of China and WDI, World Bank (2017). The data on GDP, GDP per capita and the openness level are collected from World Bank (2017) and the World Economic Outlook Database (IMF, 2017). Data for the distance between countries were gathered from the GeoDist database (CEPII, 2017) which is based on the great circle distance between capital cities. Table 'A' provided in the appendix for a detailed description of variables that are used in current study.

4.2. Model Specification

The initial structure of the gravity model which was initiated by Tinbergen (1962) has the following composition:

$$lnExp_{ij} = \beta_0 + \beta_1 lnY_i + \beta_2 lnY_j + \beta_3 lnDIST_{ij} + \varepsilon_{ij}$$

Where the export volume of country i to j (Exp_{ij}) has a relationship with the GNP in county i (Y_i) and in country j (Y_j); meanwhile, the distance between countries i and j ($DIST_{ij}$) is taken as a proxy for transportation cost. *"ln"* is the natural logarithm and ε_{ij} is the stochastic error term.

The standard gravity model once estimated provides with relatively good results. However, the real world situation is not so simple to be represented by such a few factors. Over the years, numerous scholars have developed the above basic form by using other real or dummy variables. For instance, Linnemann (1966) extends the gravity model and introduces population size of countries i and j, and the artificial trade resistance factor. Frankel (1992) extends the basic form further income (GDP per capita). Pfaffermayr (1994) adds foreign direct investment as a variable affecting trade flows between countries. Chen and Wall (1999) use the trade policy index or Nguyen (2010) includes bilateral exchange rate and regional trade preference. (Anderson and Wincoop, 2003) define the multilateral resistance factors (MRFs) such as language, remoteness etc. Guttmann and Richards (2004) include the openness level as a variable, influencing on trade between countries.

In the current study, we employ a gravity model similar to Narayan and Nguyen (2016) and Rasoulinezhad and Kang (2016) to model bilateral trade flow between China and OPEC countries. Their model in our case can be written as follows, comprising only the time-variant variables as:

$$\ln(TTR_{ijt}) = \gamma_1 + \gamma_{2x}\ln(Y_{it}.Y_{jt}) + \gamma_{2y}\ln(PY_{it}.PY_{jt}) + \gamma_{2z}\ln(DYP_{ijt}) + \gamma_3\ln(BEXR_{ijt}) + \gamma_4(EOPEN_{it}) + \varepsilon_{ijt}$$

[1]Over the past decades, the number of OPEC countries has been changed. These 14 countries have been chosen based on the OPEC website information in August 2017: http://www.opec.org/opec_web/en/about_us/25.htm

Where TTR represents the total trade volume between China (country i) and trading partner (country j) at specific time t. $(Y_{it}.Y_{jt})$ indicates the economy size of China and trading partner j at given time t. Likewise, $\ln(PY_{it}.PY_{jt})$shows income (GDP per capita) for China (county i) and trading partner (country j). Moreover, (DYP_{ijt}) denotes the absolute difference between China's GDP per capita and country j's GDP per capita. Furthermore, $(BEXR_{ijt})$ represents the bilateral exchange rates in terms of (country i) and $(EOPEN_{it})$ shows the China's economy openness level at time t.

It has been noticed that the above three gravity equations only comprise time-variant variables. Correspondingly to another gravity model, our models have some time-invariant variables, such as distance and multilateral trade agreement by world trade organization (WTO).

Time-invariant variables: $\gamma_5 \ln(DIST_{ij}) + \gamma_6 WTO$

Here, $(DIST_{ij})$ indicates the distance between capitals in China and OPEC member country. Meanwhile, WTO is a dummy variable which is captured as a bi-nominal variable. It takes a value of 1 if China and trading partner belong to the WTO or 0 otherwise.

Rasoulinezhad and Kang (2016) and Narayan and Nguyen (2016) argues that to evade of the multicollinearity dilemma, it is better breaking the above gravity model into three various models in which GDP and income variables are considered separately in each. Following their idea, the two following gravity model along with time-variant and time-invariant variables will be applied in our study:

Model I:

$$\ln(TTR_{ijt}) = \gamma_1 + \gamma_{2x}\ln(Y_{it}.Y_{jt}) + \gamma_3\ln(BEXR_{ijt}) + \gamma_4(EOPEN_{it}) + \gamma_5\ln(DIST_{ijt}) + \gamma_6 WTO_{ijt} + \varepsilon_{ijt}$$

Model II:

$$\ln(TTR_{ijt}) = \gamma_1 + \gamma_{2y}\ln(PY_{it}.PY_{jt}) + \gamma_3\ln(BEXR_{ijt}) + \gamma_4(EOPEN_{it}) + \gamma_5\ln(DIST_{ijt}) + \gamma_6 WTO_{ijt} + \varepsilon_{ijt}$$

Model III:

$$\ln(TTR_{ijt}) = \gamma_1 + \gamma_{2z}\ln(DYP_{ijt}) + \gamma_3\ln(BEXR_{ijt}) + \gamma_4(EOPEN_{it}) + \gamma_5\ln(DIST_{ijt}) + \gamma_6 WTO_{ijt} + \varepsilon_{ijt}$$

In accordance with the theoretical structure of the gravity model, it is anticipated that economy size and income (GDP per Capita) would have positive impacts on trade flow and promote trade between China and OPEC members. The effect of the third income measure (DYP_{ijt}) is ambiguous. The coefficient can have a positive sign, if countries have the H-O bilateral trade pattern, while the negative sign of this variable can appear under the Linder hypothesis. The coefficient for the bilateral exchange rate is expected to be positive (for instance, any increase in the Chinese Yuan leads to an increase in trade flows between this country and a trading partner). The more open the country economy the more it will trade so we are excepting the positive sign for economy openness.

In case of time-invariant variables, we except negative sign for distance because it is the proxy for transportation cost the more distance between the partners which results more transportation cost. Since it is broadly believed that countries' accession and membership to the WTO is an objective in increasing trade volume, therefore coefficient of WTO is expected to be positive in our gravity models.

5. EMPIRICAL RESULTS

We carried out panel analysis for China's trade flow with OPEC member countries by using STATA 13.0. Tables 3 and 4 contain the regression outcomes. By using simple OLS regression (Table 2), the R-Squared for all three models reaches 0.75, 0.65 and 0.64 respectively, meaning that our models fit the data quite well.

According to Table 2, the basic features of gravity model estimations are very similar across all three estimators. The estimation results of "Model I" and "Model II" confirm that GDP and income (GDP per capita) is a highly significant positive influence on China-OPEC bilateral trade volume and bilateral exchange rates and distance negatively affects the trade volume. In "Model III" estimation result illustrates that difference of income (DYP), also highly significant and appearing with negative sign that means it supports "Linder" hypothesis that "countries with similar levels of per capita income will have similar preferences but dissimilar products, and therefore they should trade more with each other". In case of China, the income level may not be similar but China's trade with OPEC is totally different it can be seen in Figure 1 and 2.

In case of GDP, the result reveals that a 1% increase in the GDPs of China and OPEC members raises the bilateral trade volume by approximately 0.60%. The results also predict that the bilateral trade between China and OPEC members are boosted up about 0.33% with a 1% increase in the GDP per capita. Moreover, the effect of the difference between incomes (DYP) one trade is negative which shows 1% increase in DYP leads to a 0.22% decrease in the bilateral trade volume between China and 14 OPEC members.

Table-2. OLS regression results

	Model – I	Model – II	Model –III
$\ln(Y_{it}.Y_{jt})$	0.60 *** (8.96)	--	--
$\ln(PY_{it}.PY_{jt})$	--	0.33*** (4.45)	--
$\ln(DYP_{ijt})$	--	--	-0.22*** (-2.10)
$\ln(BEXR_{ijt})$	-0.14*** (-5.51)	-1.11*** (-4.38)	-0.10*** (-4.09)
$(EOPEN_{it})$	0.06*** (9.25)	0.09*** (17.69)	0.11*** (22.47)
$\ln(DIST_{ijt})$	-0.60*** (-4.44)	-1.04*** (-4.26)	-1.52*** (-6.71)
WTO_{ijt}	0.91*** (6.74)	0.78*** (5.42)	1.01*** (6.44)
Constant	-9.60*** (-2.76)	18.08*** (5.89)	27.49*** (13.07)
R-Squared	0.7498	0.6527	0.6379
Number of Obs.	378	378	378

Notes: T-statistics in parentheses; *, **, *** denote significant at the 10, 5 and 1% level, respectively.

The finding of all the three model results provides evidence of a strong positive effect of economic openness or trade liberalization and WTO membership. A 1% increase in the E-openness level and WTO are raising the trade

volume by an average of 0.1%[2] and 0.90% (=exp(0.91+0.78+1.01)-1). With regard to the bilateral exchange rate has a negatively significant impact on the bilateral trade volume between China and the OPEC members. Our gravity outcomes revealed that depreciation of China's RMB against the OPEC members' currencies will decrease the bilateral trade volume. Because China is one of the major importers of natural resources from OPEC, China's RMB exchange rate volatility encourages China's imports from OPEC. Dell'Ariccia (1999) also found uncertainty in exchange rates and negative effect on international trade. The results show that by 1% depreciation of the Chinese RMB against the OPEC currencies' will decrease the bilateral trade by nearly 0.45%[3], ceteris paribus. Finally distance as a proxy for transportation cost as it is understood that more the transportation cost less the trade between countries. Our model also revealed that 1% increase in the distance decreases bilateral trade by an average of 1.05%[4] between China and OPEC members.

However, the regression results of simple OLS tend to be biased (see, e.g., László and Andrea (2017); Baldwin and Taglioni (2006); Mátyás (1997)). Therefore, in order to get less biased results and control for multilateral resistance factor in our models, we expanded our model specifications with time fixed effects (Majid, 2017). These dummy variables control for time-specific fixed effects, therefore the results of the original explanatory variables are more accurate. Table 3 contains the results for the expanded model.

Table-3. Regression results with time fixed effects

	Model – I	**Model – II**	**Model –III**
$\ln(Y_{it}.Y_{jt})$	0.45 *** (6.23)	--	--
$\ln(PY_{it}.PY_{jt})$	--	0.06 (0.78)	--
$\ln(DYP_{ijt})$	--	--	-0.22** (-2.30)
$\ln(BEXR_{ijt})$	-0.08*** (-4.08)	-0.04** (-4.38)	-0.04** (-2.17)
$(EOPEN_{it})$	0.19*** (8.29)	0.30*** (9.48)	0.31*** (10.48)
$\ln(DIST_{ijt})$	-0.82*** (-6.42)	-1.54*** (-6.43)	-1.46*** (-7.41)
WTO_{ijt}	0.67*** (5.28)	0.58*** (4.55)	0.61*** (4.50)
Constant	-7.17*** (-1.96)	16.11*** (5.04)	16.26*** (6.77)
R-Squared	0.7907	0.7366	0.7410
Number of Obs.	378	378	378
Fixed Effect	YES	YES	YES

Notes: T-statistics in parentheses; *, **, *** denote significant at the 10, 5 and 1% level, respectively.

After adding time specific dummy variables results in higher R-squared values and more statistically significant results. According to Model-I the effects of GDPs on bilateral trade between China and OPEC members were recorded with 1% increase in GDPs leads to 0.45% increase in bilateral trade. The results from Model-II revealed that the bilateral trade between China and OPEC members is having a positive impact but somehow it is insignificant. It is because of the difference between the income levels and others macro factors may be the cause of

[2] It is calculated as the average of 0.06, 0.09 and 0.11.

[3] It is calculated as the average of -0.14,-1.11 and -0.1.

[4] It is calculated as the average of -0.6,-1.04 and -1.52.

insignificance. Moreover, the effect of the difference between incomes (DYP) one trade is negative which shows 1% increase in DYP leads to a 0.22% decrease in the bilateral trade volume between China and 14 OPEC members the same as OLS results. With regard to the bilateral exchange rate has smaller but negatively significant impact on the bilateral trade volume between China and the OPEC members. Our gravity outcomes revealed that depreciation of China's RMB against the OPEC members' currencies will decrease the bilateral trade volume. Because China is one of the major importers of natural resources from OPEC, China's RMB exchange rate volatility encourages China's imports from OPEC. Dell'Ariccia (1999) also found uncertainty in exchange rates and negative effect on international trade. The results show that by 1% depreciation of the Chinese RMB against the OPEC currencies' will decrease the bilateral trade by nearly 0.05%[5], ceteris paribus. We have found the positive and significant effect of the proxy variable of trade liberalization or economy openness which is 1% increase in China's economy openness leads to 0.27%[6] increase in bilateral trade between China and OPEC members.

The impact of WTO membership also positively impact on trade volume. Results from Table 3 show that trade increased by 0.68% [=exp (0.67+0.58+0.61) − 1]. This indicates that trade volume increases by nearly 0.7% when China trades with WTO member countries from OPEC. In case of Distance as a proxy for transportation cost, the negative sign of its coefficient represents that with geographical distance has a negative impact on bilateral trade between China and the OPEC nations. A 1% increases in distance decreases the trade volume by an average of 1.27%[7]. The less distance which results in less transportation cost which will boost the trade volume between countries.

6. CONCLUSION AND POLICY IMPLICATION

In our study, we mainly focus on China's trade with OPEC member countries. The time span for our data 1990 to 2016 and OPEC 14 countries (Algeria, Angola, Ecuador, Equatorial Guinea, Gabon, Iran, Iraq, Kuwait, Libya, Nigeria, Qatar, Saudi Arabia, the UAE and Venezuela). The trade pattern between China and the OPEC member countries can be considered based on the energy demand of China and the Chinese consuming goods demand of the OPEC members (Ehsan and Wei, 2017) .On the other hand of the trade flow, China has dominated the local market of consumer goods in OPEC members. Thus, the basic principle of the bilateral trade between them can be highlighted by these dependencies on their comparative advantages. In our study, we mainly investigated the impacts of GDP, GDP per capita, differences of GDP per capita, bilateral exchange rates, China's trade openness, distance and proxy for transportation cost and WTO membership effects on trade through the estimation panel-gravity model.

The empirical results depicted that an increase in GDP and GDP per capita implies increase trade flow between China and OPEC members. Additionally, our results support the Linder (1961) countries with similar income trade in different products. Furthermore, the positive impact of the WTO membership and openness level on the bilateral trade volume was found, while the results revealed that the trade-distance nexus is negative for these countries.

With regard to the bilateral exchange rate is statistically and has a negatively significant impact on the bilateral trade volume between China and the OPEC members. Our gravity outcomes revealed that depreciation of China's RMB against the OPEC members' currencies will decrease the bilateral trade volume. Because China is one of the major importers of natural resources from OPEC, China's RMB exchange rate volatility encourages China's imports from OPEC. This might suggest that a downgrading of RMB initially enhances the Chinese exports, especially in manufacturing level. For the rationale that natural resources are the main production inputs or raw

[5] It is calculated as the average of -0.08,-0.04 and -0.04.

[6] It is calculated as the average of 0.19, 0.3 and 0.31.

[7] It is calculated as the average of -0.82, -1.54 and -1.46.

materials for the Chinese manufacturing industries, it shoves China to enhance her natural resources imports from OPEC members.

Overall, it can be noted that obviously there are many other factors such as geopolitical concerns, tariffs and pricing, and import substitution policy, which can have a significant impact on the China-OPEC trade. The authors suggest future research with a larger data pool about these factors giving a better result and fewer errors. Furthermore, future avenues of research should consider the estimation of the gravity model with some other variables for export and import separately. However, from our point of view, this research provides useful and interesting findings, which can help economists and policymakers, achieve a better view of China's bilateral trade with OPEC members.

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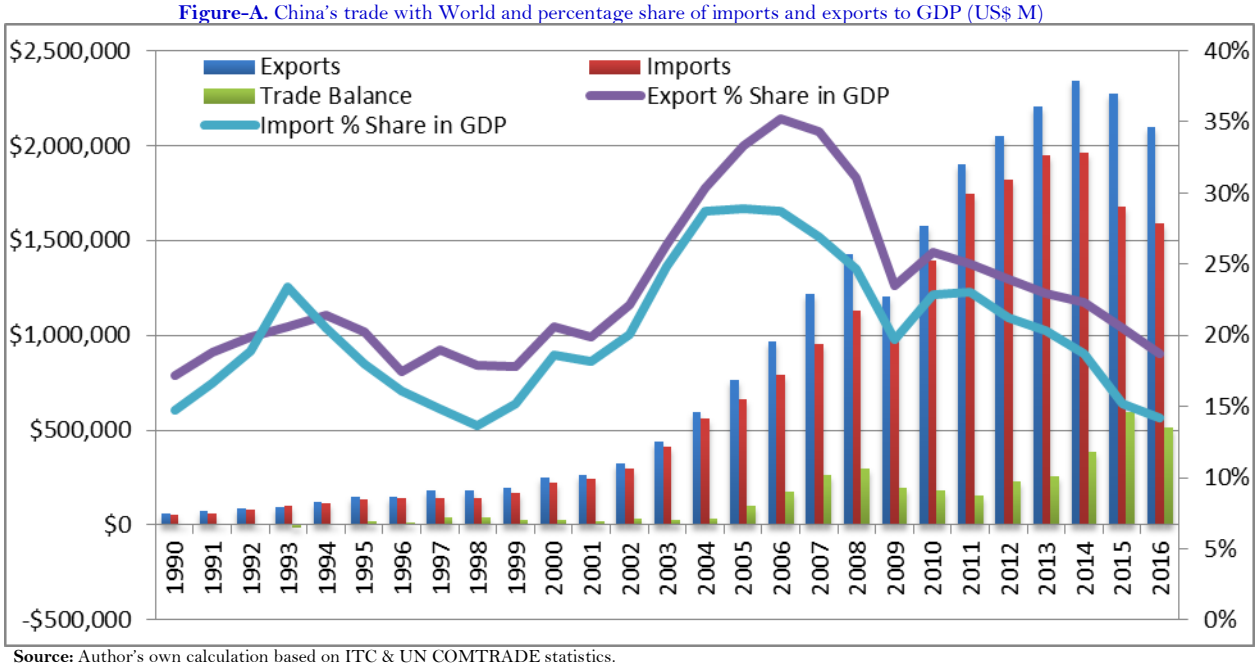
APPENDIX

Figure-A. China's trade with World and percentage share of imports and exports to GDP (US$ M)



Source: Author's own calculation based on ITC & UN COMTRADE statistics.