China-GCC Trade: A win-win Changing Trade Patterns

Salem Nechi[*]
Qatar University

Zouhair Mrabet
Qatar University

Mouyad Alsamara
Qatar University

Abstract

As China became the second largest economy in the world its demand for energy became insatiable. To secure stable supply of oil and gas the Chinese government had shown increasing interest in the Middle East region in general and the Gulf Cooperation Council countries (GCC hereafter) in particular. For their part, GCC countries are also showing an increasing interest for stronger trade relations with China to diversify their trade relations and satisfy their needs for a range of goods and services. Moreover, the location of the GCC region along the "Belt and Road Initiative", China's corridor connecting the Far East to Europe and Africa, is expected to put China-GCC trade relations on a new trajectory of higher growth through augmented trade and investment. In this paper, we examine the changes in trade patterns of China and GCC countries, using a panel of trade data for the six GCC countries and China over the period 1996 to 2014. We estimate a gravity model augmented with education, population, and the nominal effective exchange rate (NEER hereafter). The results show that China's economic ties with the GCC countries have continued to grow significantly even in the aftermath of the global financial crisis. Moreover, we document a greater flow of Chinese machinery and transportation equipment flowing to the GCC countries, suggesting a shift in traded items to promote the economic diversification efforts exhorted by all GCC countries.

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Key Words: Gravity model, China, GCC, Education, Population, Trade patterns.

[*] Corresponding Author: snechi@qu.edu.qa

1. Introduction

The GCC countries produce a quarter of the world's oil, hold 40% form world's oil reserve and play an important role in the international energy markets (Salahuddin and Gow, 2014). This significant production of oil and gas has triggered a remarkable expansion in the GCC trade pattern, trade structure, and economic development. Moreover, oil and gas revenues contributed significantly to achieve the economic strategies of GCC countries in terms of economic and exports diversification (IMF, 2014). For instance, the annual average real GDP growth in GCC countries was 5.1% between 2000 and 2010. This significant growth was mainly driven by the sustained oil price boom between 2002-2008. The novel era of low oil prices since the mid of 2014 lasts to have a significant impact on economic growth in GCC countries and highlight the necessity of having more dynamic, diversified, and private-sector based economy. Among many other actions, GCC countries need to promote the non-hydrocarbon sector and foreign trade without significant dependence to oil and gas production (IMF, 2016). Aware of these challenges, GCC countries had engaged in economic strategies that led to a shift in their trade directions and patterns. As china became the second largest economy and is increasingly playing an important and influential role in development and global economy it seems obvious that GCC countries consider it as a potential alternative to their trade patterns.[1]

The unprecedented growth of the Chinese economy over the last decade or so has created insatiable demand for energy. To secure stable supply of oil and gas the Chinese government had shown increasing interest in the Middle East region in general and the GCC countries in particular.[2] As for now, china buys more than 50% of its needs of oil from the Middle East with 35% at least from the GCC countries. On the other hand, GCC countries are also showing an increasing interest for stronger trade relations with china to diversify their trade relations and satisfy their needs for a range of goods and services. Chinese exports to GCC countries averaged around USD 60 billion per year in the last decade. Moreover, China's economic ties with the GCC countries have continued to grow significantly even in the aftermath of the global

[1] According to the World Bank (2016), China represents the fastest sustained expansion by a major economy in history with GDP growth that averaged nearly 10% since 1978.
[2] The six members of GCC are Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and the United Arab Emirates, UAE.

financial crisis. Furthermore, according to The Economist Intelligence Unit, by 2020, China will be the GCC's most important economic partner with trade volume expected to reach at least USD 350 billion in the next decade. Finally, this bourgeoning trade could develop much faster if China concludes a free-trade agreement with the GCC. An agreement, while lowering the cost of exporting oil and other goods to China, would also mean a greater flow of Chinese manufactured goods and industrial equipment flowing to the GCC countries.

Despite these changes in China's and GCC trade partnership and the increasing mutual interest of these two economic entities in developing long term economic relations scare research on this topic have been conducted. In fact, no significant studies attempted to quantify the impact of these new trends in China-GCC trade patterns. This study is an attempt to close the gap. Moreover, successful and strong partnership between China and the GCC countries will has significant implications for the economic growth of member states and important changes in the economic landscape of the middle east region. The purpose of this paper is to (1) assess the likely impact of the new trends in China-GCC trade on the GCC economies in general, and the non-hydrocarbon sector in particular; (2) provide a comprehensive assessment of this growing China-GCC trade relation by employing an approach that combines descriptive and quantitative analyses. This approach builds on the traditional gravity model framework but augmented with variables specific to the GCC countries. Note that despite the limited attention in the literature to the trade patterns between China and GCC countries, the idea is generating public debates in local and regional (GCC countries) communities. More importantly, are the ongoing debates in political circles locally, regionally, and internationally. In this paper, we shed the light on the policy implications that a possible trade agreement between China and GCC countries may cause.

Our contribution in this study is threefold. ***First***, to author's knowledge, there have been no studies that investigated the determinants of trade flows between China and GCC countries. During the economic crisis of 2008 the main importers of oil and natural gas from GCC experienced financial distress and economic downturn. The crisis was then transmitted to GCC countries as a demand shock. Since then, GCC countries consider developing new trade partnerships with new countries to diversify the risk of slowdown in the economies of major partners. As china became the second largest economy with insatiable demand for energy and an influential role in the global economy it emerges as a potential trade partner that GCC countries consider building long term trade patterns with it.

Second, relative to the traditional gravity model, we include population and education as additional explanatory variables of the increasing trade flows between China and GCC countries. The expansion of the oil and gas industry in the GCC countries had led to unprecedent inflow of migrant resulting in a population that doubled in the last two decades and had grown more than 10 times in the last fifty years. This significant increase in population has contributed to the expansion of the economic activities (driven mainly by the hydrocarbon sector), including the international trade. Therefore, the population can be a driving force of the exports and imports of GCC countries. With the expansion of economic activities, remarkable population growth, and an increase demand for skilled labor, the education has emerged as an important sector for investment and government spending. Because the availability of qualified labor force improves the production and supports the diversification efforts of all GCC member states, education seems to be a factor influencing GCC countries trade flows.

Third, we emphasis the increasing interest of GCC countries in importing machinery and transportation goods as part of their strategies of economic diversification. Aware of the excess volatility of hydrocarbon revenues and to reduce the inherent pro-cyclicality of their fiscal policies, GCC countries initiated new industries which require new technologies, machinery and equipments that local markets do not provide. Importing these goods from well-established economies proves necessary. China emerges as a potential candidate to satisfy these considerations. We assess the share of machinery and transportation equipments in China's exports to GCC countries, a trend what was not explored previously.

By way of review, our results show that the increase of GDP in GCC countries is a trigger of the increasing trade relations between China and GCC countries. The impact of population and education were found to be positive and statistically significant, supporting our claim of the importance of these two variables as determinants of trade flows of GCC countries. Finally, our analysis of the imported goods and services from China show that that GCC countries are increasingly interested in machinery and transportation goods to support their economic diversification efforts.

The remainder of the paper is organized as follows. Section 2 reviews the literature of the trading partners of China and GCC countries. Section 3 describes the methodology while Section 4 analysis the data and provides some preliminaries of the data. Section 5 discusses our

empirical results. Finally, Section 6 provides concluding remarks, discuss policy implications of our findings, and highlight future related research.

2. Review of Related Literature

The gravity trade model is an empirical framework that assesses the main determinants of international trade flows between countries (e.g. Garman et al., 1998; Martinez-Zarzoso & Nowak-Lehmann, 2003; Anderson & Wincoop, 2003; Yang & Martinez-Zarzoso, 2014). Different methodologies have been used to investigate the determinants of trade follows between countries and economic blocs. For example, Garman et al. (1998) use a cross-sectional analysis to examine the international trade flows in Latin American and Caribbean over the period 1970-1990. Limao and Venables (1999) employ cross-sectional analysis for only one year to assess the relevance of infrastructure for the African trade flows. Using 3 years data (1995-1997) of trade flows between 18 Arab countries and 43 non-Arab countries, Al-Atrash and Yousef (2000) examine the level of intra-Arab and Arab trade with the rest of the world. Nevertheless, despite the increasing trade relations between China and GCC countries, the literature did not discuss it. The determinants of the trade patterns of China and the trade flows of GCC countries where investigated though. The following discussion highlights the main findings of the literature on China's trading partners followed by a survey of the scarce literature on the trade relations of GCC countries.

Ash and Kueh (1993) discuss how trade integration between Hong Kong and southern China has a divisive effect on the domestic economy of China such that the risk of threatening the national economic identity of the country. Bussière and Schnatz (2009) examine China's position in the world economy. Using five indicators for trade integration from 1995 to 2005, they find that China's share in international trade is consistent with fundamentals such as economic size, location and other relevant factors. Moreover, the model they propose tracks international trade well and confirms that China is already well integrated in world markets, particularly with North America, several Latin American and East Asian emerging markets and most Euro area countries. Gaulier et al. (2007) look at how the rise of China has led to higher international segmentation within Asia but hasn't formed an autonomous engine for trade in the region as Asia still largely relies on external markets for exports. They conclude that

deteriorating trade terms for China pose a threat to the sustainability of China's recent growth strategy.

In a study on how regional specialization in China evolves as a result of trade liberalization, Hong (2012) employed a panel of export data from 1988 to 2006 and found that regional specialization in China has a U-shaped pattern. Based on simulations experiment, Hong (2012) suggests reviewing US-China trade policy and studying the cost-inland wage ratio patterns of China. Abraham and Van Hove (2005) investigate how trade liberalization can lead to regional liberalization in 23 countries of the Asia-pacific region over the period of 1992-2000. Their paper examines how large the trade potential of each nation in the region is when China joined the regional trade arrangements. Using panel data analysis with GDP, population, exchange rate, and distance as explanatory variables, their findings show that ASEAN and APEC member countries have a small impact on Asia-Pacific exports, while China's participation in regional agreements has large export potentials, not only with respect to ASEAN, but also in broad agreements including South and East Asian countries.

Vahalík (2014) analyses and evaluates the bilateral trade between the European Union and ASEAN, and between China and ASEAN using indices for regional trade intensity and trade complementarity from 1995 to 2012. The results show that EU is in more active position with ASEAN for the trade intensity while China is in better position with ASEAN for the complementarity. Caporale et al. (2015) use annual data for the period 1992-2012 to examine trade flows between China and its main trade partners in Asia, North America and Europe, and whether increasing trade has led to industrial structural adjustment and changes in China's trade patterns. Their analysis is based on both economic indicators and the estimation of a gravity model, and applies the fixed effect vector decomposition technique. Their findings confirm the significant change in China's trading structure associated with the fast growth of foreign trade. In particular, there has been a shift from resource- and labour-intensive to capital- and technology-intensive exports. Obuah (2012) shows that the pattern and structure of China's trade with Africa has significantly shifted since 2000 and is driven by needs of China's expanding economy to resources. Since 2000, China-Africa two-way trade has increased both in volume and content.

Yang and Martinez-Zarzoso (2014) employ a theoretically justified gravity model for trade to study how the ASEAN-China Free Trade Agreement (ACFTA, for short) impacts exports. In

their model, they tested a sample of 31 countries during 1995-2010 using both aggregated and disaggregated agricultural and manufactured goods export data. Beyond that, to solve the issue of zero trade values and heteroskedasticity, they applied a multinomial Poisson Maximum Likelihood (PML) estimation. They found that ACFTA results in significant trade creation such that using disaggregated data, a significant positive relationship was found to exist between exports and ACFTA in the case of agricultural as well as manufactured goods and beyond to manufacturing industries, primarily transport equipment, chemical products and machinery.

As for GCC trade relations, Al-Tamimi (2013) emphasizes some challenges concerning the evolution of the Asia-GCC relations in the medium and long term such as the protectionist measures in Asia, the labor issue, the competition with North America's oil production, the uncertainty over China's oil demand, among other challenges. Bolbol and Fatheldin (2005) investigate the main factors that affect intra-Arab, including GCC countries, export and foreign direct investment over the period of 1997-2003. They used an augmented gravity model that includes an economic freedom index as a measure of trade openness among the countries. Their results suggest that the intra trade between Arab countries is not significant and Arab free trade agreements can promote the non-trade diversion.

Using trade data over the period of 1997-2007, Insel and Tecke (2010) investigate whether trade flows of the GCC countries sustained and/or developed new relations over time, mainly after the 2003 Customs Union agreement of the GCC. They found strong evidence that, after 2003, the order of top fifteen trade partners of the GCC countries has changed significantly from the EU countries and the US in favor of Asian countries. Moreover, the exports and imports of GCC countries are related to the wealth of the partner countries, not to their distance, mainly due to the nature of exported and imported goods, the characteristics of the region and developments in transportation facilities.

3. Methodology

3.1 The Empirical Model

The estimated gravity equation is derived from the initial analysis of Tinbergen (1962) and Poyhonen (1963). This analysis predicts that the GDP and the distance affect positively and

negatively, respectively, the trade between two countries. Our model extends Tinbergen (1962) and Poyhonen (1963) formulation by allowing the volume of trade (exports or imports) between China and the six GCC countries to be influenced (in addition to the GDP of GCC countries and the geographical distance between each GCC and the China) by the population, the nominal exchange rate, and the education level. That is,

$$T_{ij} = \delta_0 rgdp_j^{\gamma_1} d_{ij}^{\gamma_2} pop_j^{\gamma_3} neer_j^{\gamma_4} edu_j^{\gamma_5} \mu_{ij} \qquad (1)$$

Where T_{ij} is the volume of trade between China and each GCC country (exports or imports), $rgdp_j$ is the real GDP of GCC country j , d_{ij} is the distance between countries i and j, pop_j the population of GCC country j, $neer_j$ is the nominal effective exchange rate of country j, edu_j is the education level in GCC country j, and μ_{ij} is the error term. $\gamma_1, \dots, \gamma_5$ are the parameters of the model. The inclusion of the population of GCC countries is justified by the fact that some of the GCC countries had their population doubled or nearly doubled because of the high inflow of labor force, especially, after the significant increase in oil prices at the beginning of the 2000s.

Relative to the traditional gravity model, we included two additional variables the education and the nominal effective exchange rate (NEER). The rational for including the education is the evidence in the data that GCC countries are importing more machinery and transportation equipments, which may indicate that skills in these countries are improving. As skills improve (via education), the economy develops the ability to develop new industries (related or not to the hydrocarbon sector), which will expand production and the exports potential.

NEER is the weighted geometric average of the cross-exchange rate indexes with respect to the currency of the country's trading partners. Calculation weights (trading partners selection, updating of trade weights, etc.) and choice of currencies are the most important elements in the construction and interpretation of the NEER. It is calculated as follow:

$$\mathrm{NEER_{jt}} = \prod_{i=1}^{n} \left(\frac{\mathrm{EX_{jt}}}{\mathrm{EX_{it}}}\right)^{\mathrm{W_{ijt}}}$$

where *n* stands for the number of competitor countries in the reference group of trading partners $\mathrm{EX_{it}}$ is the US dollar exchange rate per national/local currency (LC) of each of the trade partners (1LC=...USD), $\mathrm{EX_{jt}}$ is the US dollar exchange rate per national currency for each GCC country

and W_{ijt} is the imports variant weights of GCC trade partners. If NEER increases, the local currency will appreciate leading to increase of imports.

For estimation purposes, we transform equation (1) to its log-linear form as follows:

$$L(T_{ij}) = \delta_0 + \gamma_1 L(rgdp_j) + \gamma_2 L(d_{ij}) + \gamma_3 L(pop_j) + \gamma_4(neer_j) + \gamma_5 L(edu_j) + \mu_{ij} \quad (2)$$

3.2 Methods of Estimation

3.2.1 Static Model:

The estimation of static panel data can be achieved by using different models. These are fixed effects, random effects and pooled estimations. The later model assumes that countries are homogenous, which can lead to spurious results. The empirical model to be estimated with individual fixed effects is given by:

$$LT_{ijt} = \delta_0 + \gamma_1 Lrgdp_{jt} + \gamma_2 Ld_{ij} + \gamma_3 Lpop_{jt} + \gamma_4 Lneer_{jt} + \gamma_5 Ledu_{jt} + \alpha_j + \mu_{ijt} \quad (3)$$

To estimate the static equation (3), we use the two other panel data methods frequently applied in the empirical literature, the fixed effects estimation and the random effects estimation. According to Judge and *al.* (1988*)* there are no significant differences between the fixed effects model and the random effects model when *T* (number of years) is larger than *N* (Number of individuals). Beck and Katz (1995, 2004) argue that the individual random effects model (an estimator based on asymptotic properties) is not appropriate for a panel when *T* is greater than *N*. The use of random effects model, estimated by the Generalized Least Squares or Maximum Likelihood estimation, assumes that the individual effects of each industry are not correlated with explanatory variables, an assumption that may not be retained in several practical cases. It is nevertheless possible that there are specific country features correlated with explanatory variables. To check whether the fixed effects model is more efficient than the random effects model in estimating the gravity model, we apply the Hausman test.

It is well known that the presence of unchanged variables over time (the distance variables in our case), cannot be estimated directly, because the transformation in the estimation process wipes out such variables. To tackle this issue, these variables can be estimated in a second step by estimating another regression where the individual effects are explained by the distance and dummy variables as follows:

$$LE_{ij} = \beta_0 + \beta_1 Ld_{ij} + \mu_j$$

Where LE_{ij} denotes the individual effects and Ld_{ij} is the distance variable.

Autocorrelation test

As our work covers a relatively long period, 25 years, then it is likely that the residuals are autocorrelated. In general, autocorrelation of errors led to an under estimation of standard deviations, and therefore, there is an increased likelihood to infer statistically significant effects when they do not. The results of the Wooldridge test that we conducted and reported in Table 5 reject the null hypothesis of no autocorrelation of order 1. Therefore, the equations are estimated by considering the existence of autocorrelation of order 1 in errors. We also test whether the time fixed effect in our model. The result reported in Table 5 indicates that no time fixed effects are needed in the model.

There are other estimation techniques that can be used and suitable for the case where the errors are not *iid.* In this paper we will employ two procedures: the procedure of Beck and Katz (1995) (PCSE) and the procedure of Park (1967) (Parks-Kmenta). See Table 6.

3.2.2 Dynamic model

The above estimations show that the static panel data have some problems in the presence of serial correlation and heteroscedasticity. Additional problems may arise if some of the explanatory variables have endogeneity issues. In fact, it is possible that trade volume is persistence over time. Therefore, it is more appropriate to estimate equation (3) by employing methodologies suitable with the dynamic model.

$$LT_{ijt} = \delta_0 + \rho LT_{ij,t-1} + \gamma_1 Lrgdp_{jt} + \gamma_2 Ld_{ij} + \gamma_3 Lpop_{jt} + \gamma_4 Lneer_{jt} + \gamma_5 Ledu_{jt} + \alpha_j + \mu_{ijt} \quad (4).$$

The presence of lags of trade volume among independent variables leads to several econometric issues. The main problem is the endogeneity caused by the existence of correlation between $LT_{ij,t-1}$ and μ_{ijt}. The consequence of this dynamic transformation is that the fixed effects technique will give inconsistent and biased results (Baltagi, 2001). Two econometric routines are potentially able to tackle this problem: the fixed effect instrumental variable (FE-IV) and

the general moment method estimation (GMM). As highlighted by Arellano and Bond (1991), Arellano and Bover (1995) and Blundell and Bond (1998), among others, the advantage of these methods is that they give consistent parameter estimates for finite number of times and a large cross-sectional dimension. Among this class of methods, the system GMM estimator (GMM-SYS) introduced by Blundell and Bond (1998) is of a particular interest to researchers. In fact, Blundell and Bond (1998) used an efficient GMM estimation (GMM-SYS) mainly in the presence of persistence in dependent variables. It is common that the GMM-SYS estimator is more suitable for small-T and large N panels. However, when T increases the number of instruments grows rapidly. This implies that in a typical macro panel data (larger T and smaller N) it is common for the second step variance covariance matrix to become singular if instruments are not restricted. As a practical rule of thumb, in order to avoid these problems, the number of the instruments should not be more than the number of cross-section units (Roodman, 2006). There are two options in trying to deal with this problem: limiting the lags used in the GMM-style instruments or using command for collapsing instruments available in xtabond2. For our purposes, the second approach has been conducted. This could improve the consistency of the GMM estimator (Judson and Owen, 1999).

The use of GMM-SYS method and FE-IV to deal with endogenous variables assumes that the instruments must be correlated to these variables. To check the satisfaction of this condition in our estimations two criteria are used for both methods, the relevance criteria and the validity criteria of the instruments. The First criteria, means that the endogenous variables at the right side of the equation and the instruments should be highly correlated. To verify this relevance in the case of FE-IV method an F-test is employed in the first stage of regression (Bound et al., 1995). As a rule of thumb, if F-test falls below 10 the relevance of instruments are questionable. The second criteria, means that the instruments are not correlated with the errors terms. We employ Sargan test to verify the validity of the instruments. To simplify the evaluation of our estimation results, for each model and estimator, we explicitly state the assumptions that guarantee instrument validity and whether the model was fairly identified. Regarding the second method of estimation (the GMM-SYS) Arellano and Bond (1991) suggest the use of the second-order serial correlation test, AR(2), statistics for the first-differenced residual and a Sargan test for the over-identifying restrictions' validity. The null hypothesis of Sargan test indicates that the instruments are uncorrelated with some set of residuals.

In General, if the above two criteria are violated the used instruments are weak, and the two methods of estimations (FE-IV and GMM-SYS) were biased in the same direction as the OLS estimates (Staiger and Stock, 1997). For robustness check, we estimate the OLS and the fixed effect instrumental variables model (FE-IV). Results are reported in Tables 7 & 8.

4. Data and Preliminaries

The dataset used in this paper is collected from two sources: COMTRAD and the World Bank indicators. The dataset consists of a panel of 7 countries, 6 GCC countries (Bahrain, Kingdom of Saudi Arabia, Kuwait, Oman, Qatar, and the United Arab Emirates, UAE) and China, observed annually over the period of 1990–2014. The number of observations is equal to N * T = 150, where N is the number of individual country and T is the number of years. The dataset includes the following variables: Real GDP, the trade volume (X or M), the nominal effective exchange rate (NEER), the education level (EDU), the population (POP) and the distance between the six countries and China. All variables are transformed in logarithm.

The two dependent variables used for the estimation of China's exports and imports models are based on the Chinese data of exports to and imports from GCC countries. Table 1 provides the growth rate of China's exports to GCC countries. It is very interesting to notice that, over the period of study (1990-2014) the average annual growth of China's exports to GCC countries exceeded 22%, which means that Chinese exports to GCC countries doubles every 5 years. Figure 1 illustrates this fact and shows that, starting the year 2000, exports increased in an exponential way, with a small break in 2007-08, which is associated with the global financial crisis. It is also important to note that the share of machinery and transportation equipment in China's exports to GCC countries increased, reflecting the improvements in labor force qualifications in the GCC countries and their diversification efforts (see Figure 2).

Table 1: Growth of China's Exports to GCC Countries

Period	Bahrain	KSA	Kuwait	Oman	Qatar	UAE	GCC
1990-94	110.14	85.22	145.84	131.24	77.52	221.27	144.49
1995-99	130.93	28.60	31.16	81.96	192.26	31.12	32.04
2000-04	146.02	142.45	52.86	86.46	231.51	229.15	183.61
2005-09	154.18	134.75	145.47	291.35	328.35	113.43	127.02
2010-14	54.07	98.48	85.48	118.68	163.49	83.82	90.26
Average Annual Growth Rate	**28.17**	**19.70**	**32.12**	**32.57**	**33.98**	**24.37**	**22.10**

Figure 1: China Exports to GCC Countries

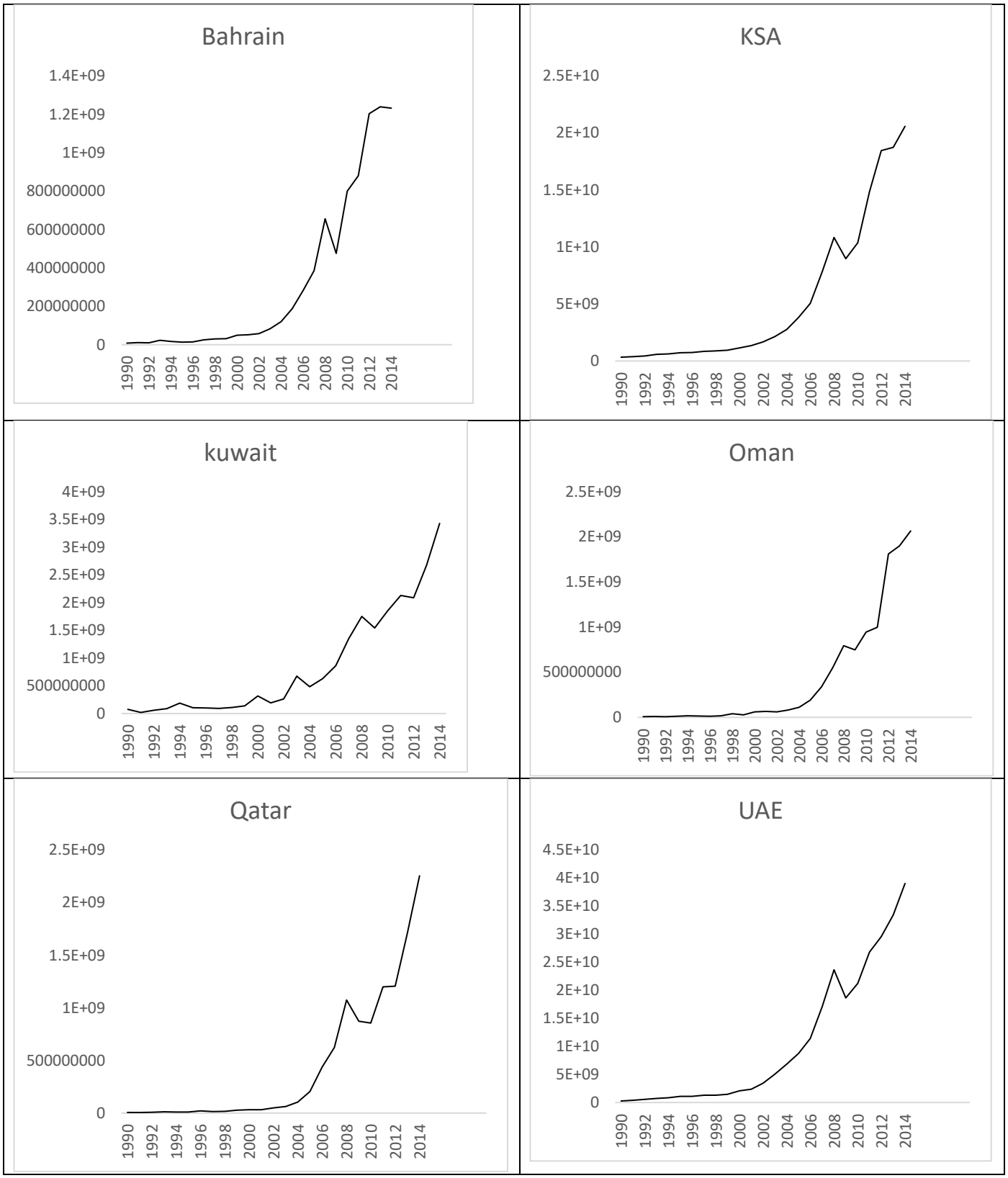
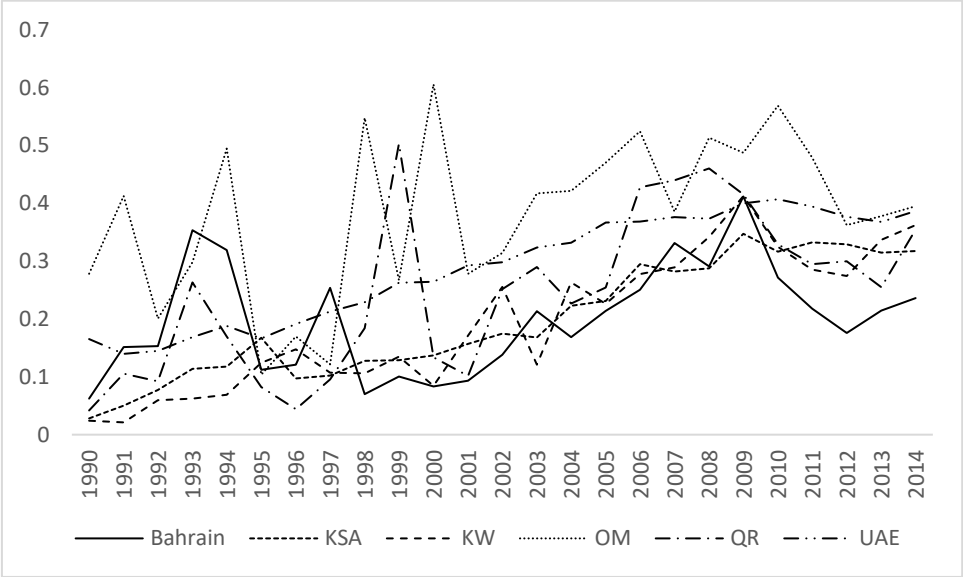


Figure 2: Share of Machinery and Transportation Equipment in China's Exports to GCC Countries



Similarly, China's imports from GCC countries experienced important increase, especially, in the last decade. As emphasized earlier this increase is driven by the high demand for energy by the Chinese economy. Figure 3 below summarizes China's trade with GCC countries.

Figure 3: China's Trade with GCC Countries

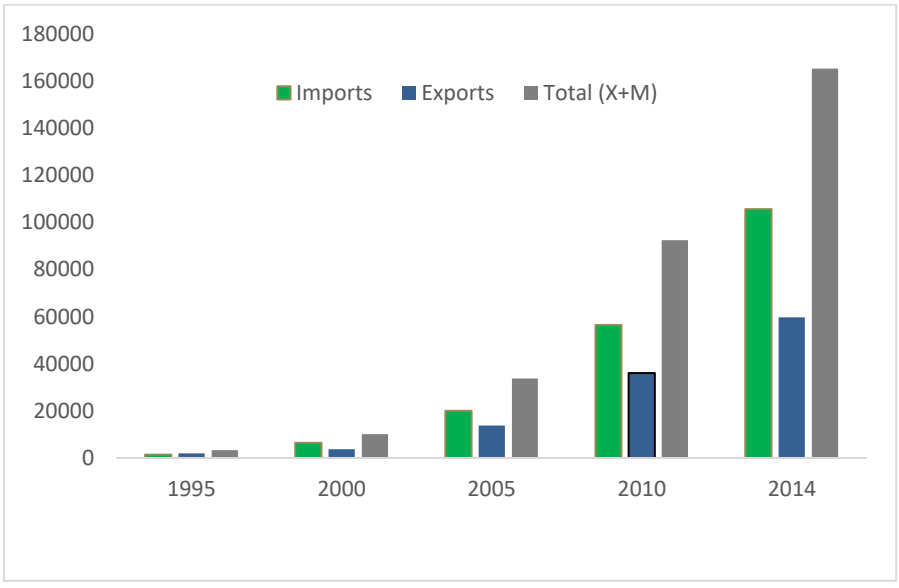


Table 2 shows that the reliance of GCC countries on Chinese products observed a big shift in the last two decades as the share of China's imports in GCC overall imports more than doubled for all countries.

Table 2: GCC countries' imports weights from China

	1995	2000	2005	2010	2014
Bahrain	0.02	0.08	0.13	0.22	0.11
Kuwait	0.04	0.06	0.15	0.19	0.23
Oman	0.02	0.05	0.06	0.12	0.13
Qatar	0.016	0.05	0.08	0.14	0.17
KSA	0.04	0.07	0.13	0.19	0.21
UAE	0.08	0.12	0.16	0.18	0.17

Because of the favorable economic conditions, supported by the expansion of the oil and gas industry, and the increasing requirements of the labor market, the GCC countries are considered one of the preferable destinations of labor force from around the world. As a result, GCC countries became the third largest recipient of migrant workers in the world, after the European Union and North America (Al-Khouri, 2012). Table 3 below highlights the evolution of the GCC population and its growth. Over the period of study (1990-2014), GCC population had experienced remarkable growth reaching a rate of 123.74%. Except for Saudi Arabia and Kuwait, whose population grew at 88.78% and 82.29% rates, respectively, populations in other GCC countries more than doubled, especially in Qatar and UAE were the populations have grown more than 3.5 times and more than 4 times, respectively.

Table 3: GCC Population

Year	Bahrain	KSA	Kuwait	Oman	Qatar	UAE	GCC Total
1990	495,944	16,361,453	2,058,832	1,812,159	476,478	1,811,458	23,016,324
1995	563,730	18,853,670	1,637,031	2,191,864	501,019	2,350,192	26,097,506
2000	666,855	21,392,273	1,929,470	2,239,403	593,453	3,050,128	29,871,582
2005	867,014	24,745,230	2,263,604	2,506,891	836,924	4,481,976	35,701,639
2010	1,261,319	28,090,647	3,059,473	2,943,747	1,765,513	8,329,453	45,450,152
2014	1,361,930	30,886,545	3,753,121	4,236,057	2,172,065	9,086,139	51,495,857
	Population Growth Rate						
2005-2014	57.08	24.82	65.80	68.98	159.53	102.73	**44.24**
1990-2014	174.61	88.78	82.29	133.76	355.86	401.59	**123.74**

According to Al-Khouri (2012), by 2010, foreigners constituted 59% of the total population. In fact, the population growth in GCC countries is very much associated with the economic growth, which is driven mainly by the oil and gas industry. Therefore, it is reasonable to think of the population as a factor driving the exports and the imports of GCC countries.

Following the huge increase in the population, education has emerged as an important sector for investment and government spending. Table 4 shows the growth rate of investments in education in the GCC countries.

Figure 4: Education in GCC Countries

Year	Bahrain	KSA	Kuwait	Oman	Qatar	UAE	GCC
1990-1995	39.31	67.19	-26.81	110.54	31.20	67.08	31.91
1996-2000	6.70	60.39	15.98	24.44	22.85	37.71	33.59
2000-2005	15.15	39.65	0.28	18.50	18.70	29.46	23.99
2006-2010	8.34	41.97	11.48	3.64	17.24	13.35	22.43
2011-2014	10.06	46.55	5.30	29.90	21.60	17.88	31.80
1990-2014	**123.90**	**970.70**	**4.29**	**358.69**	**208.41**	**329.65**	**317.58**

Except for Kuwait, where investments in education grew at rate of 4.29% over the period of study, GCC investments in education have more than doubled reached as high as 10 times in the case of Saudi Arabia.[3] In fact, the economic expansion was accompanied with strong demand for skilled labor. In addition to the reliance on foreign works to satisfy the increasing demand for qualified labor force, local governments and the private sector invested heavily in education. The availability of qualified labor force improves the production (mainly oil and gas industry, as it is the driving force of the economy) and supports the diversification efforts of all GCC member states. Therefore, education seems to be a candidate explanatory variable for the trade of GCC countries.

5. Empirical Results

5.1 Static estimation

Table 5 presents the fixed and the random effects estimation of equation 3. The fixed effect model takes in consideration the problem of heterogeneity by estimating country specific effects. The random effects model acknowledges also heterogeneity in the cross-section. However, it differs from the fixed effects model in the sense that the effects are generated by a specific distribution. Although it assumes that there is heterogeneity in the cross-section, it does not model each effect clearly.

[3] The low growth rate of investments in education in Kuwait relative to the other GCC countries might be explained by the fact that public and private investments in Kuwait were mainly devoted to rebuilding the country after the first Gulf war in 1991.

To decide which model is more appropriate we use the Hausman statistic. The null hypothesis of this test assumes that the regressors and individual effects are not correlated. If the null is not rejected the random effects model is more preferred than fixed effect model. The results of Hausman test in Table 5 indicate that we reject the null hypothesis, and this suggests that country specific effects are correlated with regressors, which means that the fixed effects model is more appropriate.

Table 5: Fixed effect versus Random effect estimation with errors autocorrelation

	Export model		Import model	
	FE estimation	RE estimation	FE estimation	RE estimation
Lrgdp	0.21**	0.30***	1.35***	1.6***
Lpop	2.41***	1.85***	-0.14	-0.21
Lneer	-0.20	-0.22	0.13	0.21
Ledu	1.31***	1.07***	1.05**	1.43***
Ldis	-34.7***	-24.5***	-12.08***	-17.3***
N° of observation	150	150	150	150
Wooldridge autocorrelation Test	44.73*** (0.0011)		8.53** (0.03)	
Test of time fixed effect	1.38 (0.14)		1.2 (0.11)	
Hausman test	18.15*** (0.0012)		3.91 (0.43)	

As shown in Table 5, the effect of GDP of the importers (GCC countries) were found to be positive and statistically significant in both fixed effect and random effect estimated models, which is consistent with the prediction of the gravity model. This result implies that a higher GDP of GCC countries result in a higher demand and more chances to import from China, and that an increase in the production capacity from GCC countries' side will trigger additional trading volumes with China. Note, however, that the estimated coefficients of both the fixed effect and random effect models, 0.21 and 0.30, respectively, are significantly lower than predictions of standard gravity models, which usually found close to one. This estimation bias

might be the result of misspecification of the model or econometric issues such as heteroscedasticity or cross-sectional correlation in the data. The later issue is dealt with in the next section. The effect of geographical distance was found to be negative and statistically significant in all estimated models, which is consistent with the theoretical expectation.

The impact of education on trade was found to be positive and statistically significant in all estimated models, which is consistent with our predictions. Aware of the risks associated with relying on only one sector (oil and gas), governments of GCC countries adopted plans and strategies for economic diversification and development of new economic sectors. To achieve these goals, they need to equip labor force with new skills that allow economic agents to develop and promote new sectors. Investment in education is among the policies that GCC countries adopted to qualify the labor force (mainly local workers) for new economic activities towards economic diversification. Of course, more diversified economy needs goods and services that are not necessary available in local market. China seems to benefit from this diversification strategy of GCC countries.

Population was found positive and statistically significant only in the exports (from China to GCC) model. The significant increase in oil and gas revenues since 2000s (due to the high oil price) contributed to an unprecedented growth of GCC economies. Given that most GCC economies are characterized by full employment, the needs of the labor market were satisfied with big inflow of foreign workers (skilled and unskilled) who moved in with their families, resulting in doubled or nearly doubled populations of most GCC countries within a decade or so. For the import model, however, population was found not significant. This is may be explained by the relatively small size of GCC populations compare with China's population.

The nominal effective exchange rate (NEER) was found not statistically significant in the static estimation; it has the correct sign though. As discussed in the methodology section, the NEER expresses how a domestic currency's value compares against multiple foreign currencies at once. As highlighted in the data and preliminaries section, GCC exports to China (i.e., China's imports from GCC) are dominated by the oil and gas exports. And given that oil and gas are usually priced in US dollar, their exports are influenced with fluctuations in the US dollar rather than the exchange rate. Not surprisingly, the NEER proves not statistically significant.

It is important to note that in above analysis we dealt just with the problem of autocorrelation in the error and ignored the possible heteroscedasticity and contemporary cross-sectional correlation in the data, which can bias the value of estimated coefficients. To tackle these problems, we have employed two techniques; the procedure of Beck and Katz (1995) (PCSE) and the procedure of Park (1967) (Parks- Kmenta). Table 6 presents the estimation of the equation 3, corrected for the heteroscedasticity and cross-sectorial correlation.

Table 6: PCSE and Parks-Kmenta estimaiton

	Export model		Import model	
	PCSE	Park- Kmenta	PCSE	Park- Kmenta
Lrgdp	0.59***	0.39***	1.38***	1.09***
Lpop	0.75***	0.91***	-0.22	-0.46
Lneer	-0.20	-0.26	0.10	0.03
Ledu	1.31***	0.84**	1.29***	1.54***
Ldis	-10.8***	-10.8***	-13.6***	-9.5**
N° of observation	150	150	150	150

5.2 Dynamic estimation

The estimated results of the dynamic model in equation 4 are presented in tables 7 and 8. The first step to examine the dynamic results of trade between china and GCC countries is the interpretations of the tests reported in Tables 7 and 8 below.

The results of the Anderson (1984) canonical correlations test and the Cragg–Donald test employed with FE-IV estimation confirm the relevance and the validity of the instruments. For all estimations with FE-IV, we obtain an F-statistics above the informal threshold of 10 suggested by Staiger and Stock (1997) for the assessment of the validities of instruments.

For GMM-SYS method the consistency of the estimation is verified by using the AR(1) and AR(2) tests of Arelano and Bond (1991). These tests examine if the residual of the regression in differences is second-order serially correlated. When the AR(2) is absent the GMM estimator may use the second or/and the higher-order lags of the dependent variable as instruments. As shown in Tables 7 and 8 the results report that only the first-order serial correlations are

detected. The Sargan test of over-identifying restrictions did not reject the null hypothesis of exogeneity of instruments in all the specifications.

Table 7: Dynamic Exports Model

	OLS	IV-FE	GMM-SYS
Lex(-1)	0.6***	0.69***	0.36***
Lrgdp	0.68***	0.40*	0.84**
Lpop	0.01	0.18	0.19
Lneer	-0.23	-0.20	-0.39*
Ledu	0.18	0.23*	0.047
Ldis	-4.12***	-4.5***	-5.07***
Ar(1)			-3.47***
AR(2)			-0.86
Sargan test			22.75 (0.35)
Anderson canon. corr. LR statistic		61.3 (0.000)	
Cragg-Donald F statistic		75.05[a]	

Note: [a]10% maximal IV size=16.38, 15% maximal IV size=8.96, 20% maximal IV size=6.66.

The dynamics introduced to the model had improved the results significantly for both the exports and imports models. For instance, results of the dynamic estimation of the exports model indicate that the lagged values of the dependent variable prove to be significant at the 1 percent level in all models. The coefficients on the income elasticities of GCC countries' GDP, although still below the theoretical value of 1, they had improved significantly. Of particular interest is the result associated with the (GMM-SYS) model where the coefficient on income was 0.84. Regarding the importers' population (GCC) and education, all the models predict positive effect, which is in line with our apriori expectations. However, they are statistically not significant in the GMM-SYS model. With the GMM-SYS estimation, the NEER was found statistically significant at the 10 percent level. Given that the NEER is an indicator of a country's international competitiveness, its increase affects negatively Chinese exports to GCC countries.

Similarly, the dynamic estimation of the imports model proves to be very performant relative to the static estimation. Table 8 reports the results. For instance, income elasticities are higher

than in the static model with a coefficient of 0.82. More interestingly, is the increased significance of the NEER from 10 percent in the exports model to 1 percent in the imports model.

Table 8: Dynamic imports model

	OLS	IV-FE	GMM-SYS
Lim(-1)	0.48***	0.70***	0.59***
Lrgdp	1.14***	0.35**	0.82**
Lpop	-0.5	0.17	-0.18
Lneer	0.58**	0.10	0.68***
Ledu	0.39	0.40**	0.20
Ldis	-4.47***	-5.28***	-8.13*
Ar(1)			-2.74***
AR(2)			-0.43
Sargan test			17.84 (0.46)
Anderson canon. corr. LR statistic		137.7 (0.000)	
Cragg-Donald F statistic		119.06[a]	

Note: [a]10% maximal IV size=19.93, 15% maximal IV size=11.59, 20% maximal IV size=8.75.

6. Conclusion and Policy Implications

To secure stable supply of oil and gas the Chinese government had shown increasing interest in GCC countries. For their part, GCC countries are also showing an increasing interest for stronger trade relations with China to diversify their trade relations and satisfy their needs for a range of goods and services. This paper examines the determinants of China-GCC trade flows by estimating a gravity model of trade augmented with variables we argue are important drivers of this increasing trade relations; namely population and education. The remarkable growth of populations in GCC countries, and the importance of education in supporting the economic diversification efforts of all GCC member states led us to believe that these two variables have important role in expanding trade relations between China and GCC countries. The results show that population and education have positive and significant impact on trade flows between China and GCC countries. An examination of GCC imports from China show that "machinery and transportation equipment" are constantly increasing indicating a shift in GCC countries' preferences towards goods and services supportive of their diversification efforts.

Policy Implications

While trade flows between GCC countries and struggling economies in Europe and the US had faltered, China's economic ties with the GCC countries have continued to grow significantly even in the aftermath of the global financial crisis. Due to GCC economies' current strong dependence on oil and gas, long-term strategic co-operation with other important trade partners such as China should be considered and soundly maintained to avoid instability in GCC economies. This is likely to be a win-win policy if it is accompanied with cooperation in other economic areas. For instance, foreign direct investment in hydrocarbon industry may be a sound tool to spur the general economic. Moreover, this bourgeoning trade could develop much faster if China concludes a free-trade agreement with the GCC countries. An agreement, while lowering the cost of exporting oil and other goods to China, would also mean a greater flow of Chinese manufactured goods and industrial equipment flowing to the GCC countries.

However, the need for discipline-enhanced framework to assess this alternative arises for many reasons such as the opportunity cost of changing trade patterns, the welfare gains, the impact on other development dimensions, the impact on the financial sector, etc. Furthermore, given the differences in economic size of GCC member states, the welfare gains might be significantly different from one country to another, and from one sector to another. Future research on these questions and others prove important for lightening the economic consequences of stronger trade relations between China and GCC countries.

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