COMESA'S Trading with China: Patterns and Prospects

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Abstract: As trade between China and African countries continues to expand, so does the debate as regards the developmental outcomes it is likely to produce. This paper examines the trade relations that have developed between the Common Market for Eastern and Southern Africa (COMESA) and China since 2000. The bilateral trade—composed largely of exports of primary goods and imports of manufactures by the COMESA region—has registered very high rates of growth. The trade balance has been for the most part in China's favor. The paper uses a gravity model of bilateral trade estimated by the Hausman-Taylor method for a reference sample of countries to project the COMESA-China trade "out of sample." Empirical estimates suggest a substantial degree of underutilization of the bilateral export and import potentials. The main implication is that there are still strong resistances to the bilateral trade that need to be addressed.

Introduction

It is widely recognized that international trade plays an important role in the process of economic development. Since the establishment of the Forum on China-Africa Cooperation (FOCAC) in 2000 in Beijing, the value of goods and services moving between China and the African continent has witnessed exponential growth. From its initially negligible position, China has become Africa's major trade partner. China has also signed bilateral trade agreements with several African countries (China, 2010), and it has declared that "when conditions are ripe," it is willing to negotiate free trade agreement with African countries and African regional organizations (China, 2006).

Economists have debated about the opportunities and challenges of the Sino-African trade (e.g., World Bank, 2004; Jenkins & Edwards 2005; Broadman, 2007; Kaplinsky & Morris, 2008). Much of the existing literature assumes that China and Africa have high unexploited trade opportunities between them (e.g., Jenkins and Edwards, 2005; Zafar, 2007; Subramanian & Matthijs 2007). But what is often missing is rigorous analysis. Few studies have tried to predict the China-Africa trade based on econometric analysis—much less focusing on specific regional trade blocs in Africa. The existing discourse often takes "Africa" as a whole, which has its own limitations (Taylor, 2009). While there is scant empirical literature on China's trade integration with particular regional economic communities in Africa, it has been recognized that African regional organizations play an important role in "China's response to the demands and challenges it is faced with as an emerging economic and political power in Africa" (Van Hoeymissen, 2011).

The purpose of this paper is to analyze the trade link and potential between China and the Common Market for Eastern and Southern Africa (COMESA).[11] China is now the world's second largest economy (after the United States) with about one-fifth of the world population. COMESA is one of the largest and most vibrant regional economic communities in Africa (Alemayehu & Haile, 2008). The regional bloc attained a Free Trade Area (FTA) in 2000, and it is now moving toward a Customs Union (COMESA, 2013). With a combined population of 460 million, a combined GDP of US$540 billion and rich endowment of natural resources, COMESA can play a major role in conditioning China's trade integration with Africa with significant developmental consequence.[12] Indeed, China appointed representatives to COMESA (Van Hoeymissen, 2011), while COMESA as a regional bloc has been seeking to establish trade agreements with China. The COMESA Secretariat said in a statement: "COMESA has named China as a new lucrative destination for its expansion programs in enhancing trade and attracting investment."[13]

In this paper, merchandise trade between COMESA and China is analyzed and the bilateral trade potential is econometrically estimated using a dataset for the period 2000–2011. Estimation of the trade potential is based on McPherson and Trumbull (2008), where a gravity model of bilateral trade will be estimated by a Hausman and Taylor (1981) method for "out-of-sample" trade projection. The paper finds strong evidence for future COMESA-China trade prospects.

The rest of the paper is organized as follows. Section II presents a brief analysis of trade patterns between COMESA and China in the recent past. Section III discusses the literature on gravity models of bilateral trade and their econometric estimation. Section IV empirically investigates the trade potential between COMESA countries and China. Section V concludes.

The Patterns of COMESA-China Trade

Trade between COMESA and China has accelerated in recent years. This is perhaps due to trade reforms in both regions (Zafar, 2007). Between 2000 and 2011, merchandise exports from COMESA to China increased from close to US$894 million to US$16 billion, averaging an annual growth rate of more than 480% (Table 1). If one excluded the extremely outlying growth rates for Burundi, Seychelles and Swaziland, COMESA exports to China would still grow on average by more than 145% per annum. Meanwhile, Table 2 shows that COMESA imported US$1.5 billion

[11] COMESA is a membership of 19 countries: Burundi, Comoros, Democratic Republic of the Congo, Djibouti, Egypt, Eritrea, Ethiopia, Kenya, Libya, Madagascar, Malawi, Mauritius, Rwanda, Seychelles, Sudan, Swaziland, Uganda, Zambia and Zimbabwe. It was established by a Treaty signed in November 1993 in Kampala, Uganda and ratified in December 1994 in Lilongwe, Malawi. It was formed to replace the former Preferential Trade Area for Eastern and Southern Africa (PTA) which had existed since 1981(see http://www.comesa.int).

[12] Of the total value of Chinese-African merchandise trade in 2012, COMESA accounted for over 27%.

[13] "COMESA Seeks Partnership with China." 2005. *People's Daily Online*, April 28. http://english.peopledaily.com.cn/200504/28/eng20050428_182973.html (accessed November 27, 2012).

in merchandise from China in 2000. The import figure rose to US$17.2 billion in 2011, at a rate of 39.7% per annum.

Table 1. COMESA's Merchandise Exports to China, 2000–2011

	Values (US$ Thousand)			Average Growth Rates (%)
	2000	2005	2011	2000–11
Burundi	742	123	2,812	1930.1
Comoros	4	0.4	1	91.0
Congo, Dem. Rep.	664	276,222	3,016,477	172.3
Djibouti	10	195	142	319.6
Egypt	39,148	109,272	968,517	76.9
Eritrea	38	251	936	362.9
Ethiopia	935	90,444	283,443	120.0
Kenya	3,424	17,040	61,564	31.8
Libya	23,472	810,676	1,816,524	406.3
Madagascar	5,918	21,131	91,049	34.0
Malawi	132	2,368	55,056	413.3
Mauritius	1,156	6,323	6,397	51.4
Rwanda	1,488	12,317	56,390	53.8
Seychelles	88	7	421	1107.9
Sudan	673,688	2,680,168	6,012,749	28.3
Swaziland	148	24,945	839	3784.8
Uganda	661	15,959	41,207	76.1
Zambia	41,425	117,095	2,926,234	63.8
Zimbabwe	100,716	131,313	562,891	29.2
All COMESA	893,858	4,315,850	15,903,648	481.8

Source: UNCTAD (2013).
Note. The average growth rate for Comoros' exports to China does not include the period 2002–2005 due to missing data.

COMESA and China have become increasingly important in each other's trade profiles, but not to the same degree (Table 4). While there has been a marked shift in COMESA's trade toward China and China has become COMESA's second largest trade partner—only behind the European Union (EU), trade with COMESA still comprises a very small proportion of China's total trade. The share of China in COMESA's total exports has more than quintupled, from 3.1% to 16.1% during 2000–2011, while the share of COMESA in China's overall exports only rose from 0.6% to 0.9%. In the same period, the share of China in COMESA's total imports grew from 4.1% to 10.6%, whereas the share of COMESA in China's world imports increased from 0.5% to 1.2%.

Table 2. COMESA's Merchandise Imports from China, 2000–11

	Values (US$ Thousand)			Average Growth Rates (%)
	2000	2005	2011	2000–11
Burundi	5,663	12,150	63,472	33.0
Comoros	249	1,651	13,232	53.7
Congo, Dem. Rep.	19,598	82,631	882,496	45.8
Djibouti	24,896	24,964	97,908	18.1
Egypt	640,388	914,544	6,320,561	29.8
Eritrea	3,365	13,684	246,081	92.6
Ethiopia	96,673	516,952	1,718,111	34.3
Kenya	113,894	413,371	1,859,098	30.7
Libya	52,399	251,301	768,991	31.1
Madagascar	88,667	234,454	540,631	44.6
Malawi	8,664	28,762	206,374	37.3
Mauritius	157,558	310,247	625,899	14.6
Rwanda	4,245	15,673	108,528	45.0
Seychelles	3,778	6,890	12,428	16.3
Sudan	154,956	1,447,890	1,994,640	32.6
Swaziland	3,231	35,511	178,303	73.5
Uganda	39,782	108,800	513,555	33.7
Zambia	19,049	83,131	703,038	51.0
Zimbabwe	35,370	112,408	383,034	36.0
All COMESA	1,472,425	4,615,014	17,236,381	39.7

Source: UNCTAD (2013).
Note. The figures on Sudan's imports from China in 2010–2011 are based on China's export data.

The significance of trade with China (in terms of value) also varies widely between individual COMESA member states (Table 5). On the export side, China's share in the value of total merchandise exports reaches as high as 56% in Sudan, 46% in Democratic Republic of the Congo and 33% in Zambia, whereas the corresponding share is less than 1% in Comoros, Djibouti, Eritrea, Mauritius, Seychelles and Swaziland. But the Chinese share in total exports has increased in almost all COMESA countries over the 2000–2011 period, with Comoros, Djibouti and Eritrea being the only exceptions. On the import side, China makes up between 15–30% of the value of total merchandise imports in Democratic Republic of the Congo, Djibouti, Eritrea, Ethiopia, Madagascar and Sudan; the corresponding share is found to be less than 5% in Comoros and Seychelles.

Table 3. Country Distribution of COMESA's Trade with China (%)

	COMESA Exports to China	COMESA Imports from China
Burundi	0.01	0.3
Comoros	0.00001	0.1
Congo, Dem. Rep.	15.1	3.8
Djibouti	0.001	0.6
Egypt	5.7	34.7
Eritrea	0.005	0.8
Ethiopia	1.8	13.5
Kenya	0.3	10.7
Libya	18.5	6.2
Madagascar	0.5	3.3
Malawi	0.2	1.1
Mauritius	0.05	3.9
Rwanda	0.2	0.6
Seychelles	0.001	0.1
Sudan	41.6	12.3
Swaziland	0.1	0.5
Uganda	0.3	3.0
Zambia	13.2	2.6
Zimbabwe	2.4	1.9

Source: Author's calculations on the basis of UNCTAD (2013).
Note. Figures are based on 2009–2011 average trade values.

Table 4. COMESA and China: Mutual Importance in Merchandise Trade

	2000	2005	2011
COMESA exports to China as % of COMESA world exports	3.1	6.6	16.1
China exports to COMESA as % of China world exports	0.6	0.7	0.9
COMESA imports from China as % of COMESA world imports	4.1	7.5	10.6
China imports from COMESA as % of China world imports	0.5	0.7	1.2

Source: Author's calculations on the basis of UNCTAD (2013).

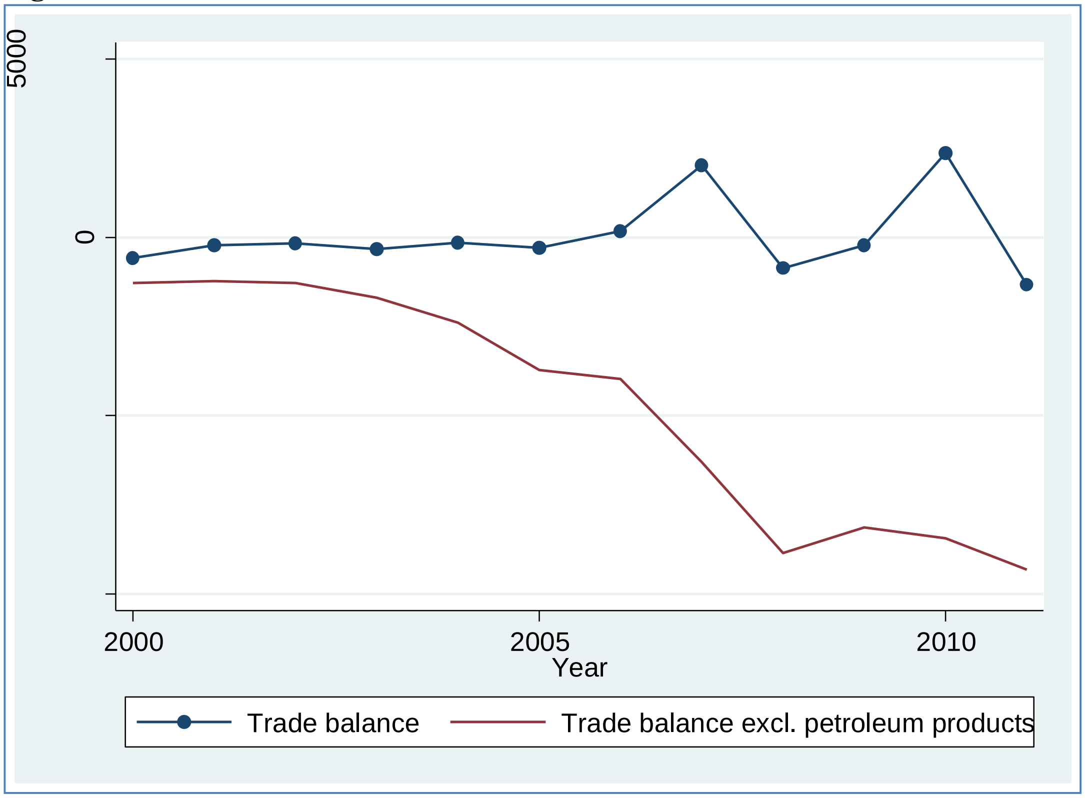
Table 5. Share of China in Merchandise Exports and Imports of COMESA Countries (%)

	2000		2011	
	Exports	Imports	Exports	Imports
Burundi	1.5	3.8	2.3	8.4
Comoros	0.03	0.6	0.01	4.8
Congo, Dem. Rep.	0.1	2.8	45.7	16.0
Djibouti	0.03	12.0	0.2	19.2
Egypt	0.8	4.6	3.1	10.1
Eritrea	0.2	0.7	0.2	29.4
Ethiopia	0.2	7.7	10.8	19.3
Kenya	0.2	3.9	1.1	12.6
Libya	0.2	1.4	10.1	9.6
Madagascar	0.7	9.0	6.2	18.3
Malawi	0.03	1.6	3.9	8.5
Mauritius	0.1	7.6	0.2	12.1
Rwanda	2.9	2.0	13.5	6.1
Seychelles	0.05	1.1	0.1	1.8
Sudan	41.3	10.0	56.4	21.6
Swaziland	0.02	0.3	0.04	9.1
Uganda	0.1	2.6	1.9	9.1
Zambia	4.6	2.1	32.5	9.8
Zimbabwe	5.2	1.9	16.0	8.7

Source: Author's calculations on the basis of UNCTAD (2013).

Regarding bilateral trade balance, it has been usually in deficit for COMESA. This is born out by Figure 1. There was a bilateral trade deficit of about US$579 million for COMESA as a bloc in 2000. It then narrowed to US$299 million in 2005, and it was even replaced by trade surpluses during 2006–2007 due to a higher growth of exports to China over imports from China. COMESA's bilateral trade balance subsequently worsened to show deficits during 2008–2009 in the face of a sharp drop in exports growth before it registered a trade surplus in 2010 as exports increased dramatically. But the trade balance turned deficit for COMESA once again in 2011 owing mainly to a high rise in imports and the deficit peaked at US$1.3 billion for the period. COMESA's exports of petroleum and related products (mainly from Sudan and Libya) exert a significant influence on the balance of trade with China. It can be seen from Figure 1 that without these commodities, the trade deficits for COMESA would be continuous and even higher.

Figure 1. COMESA's Trade Balance with China

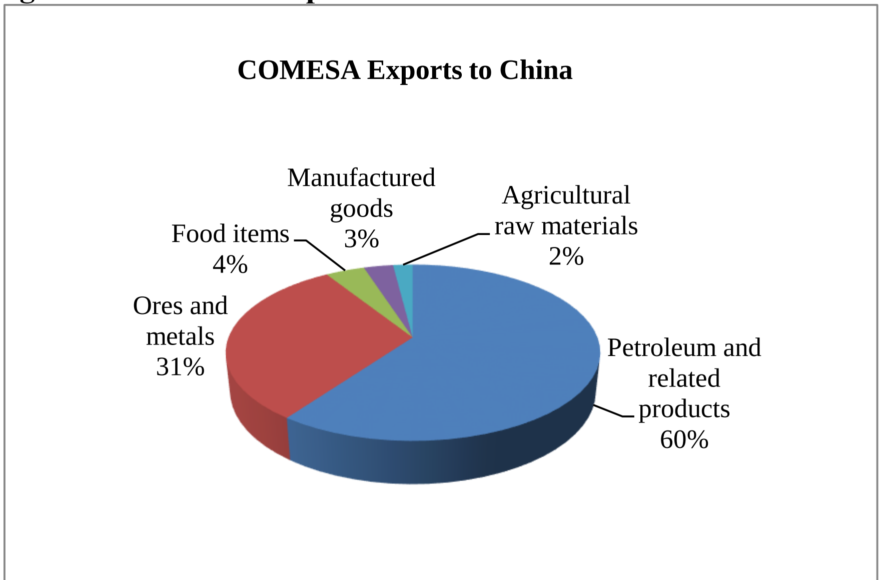


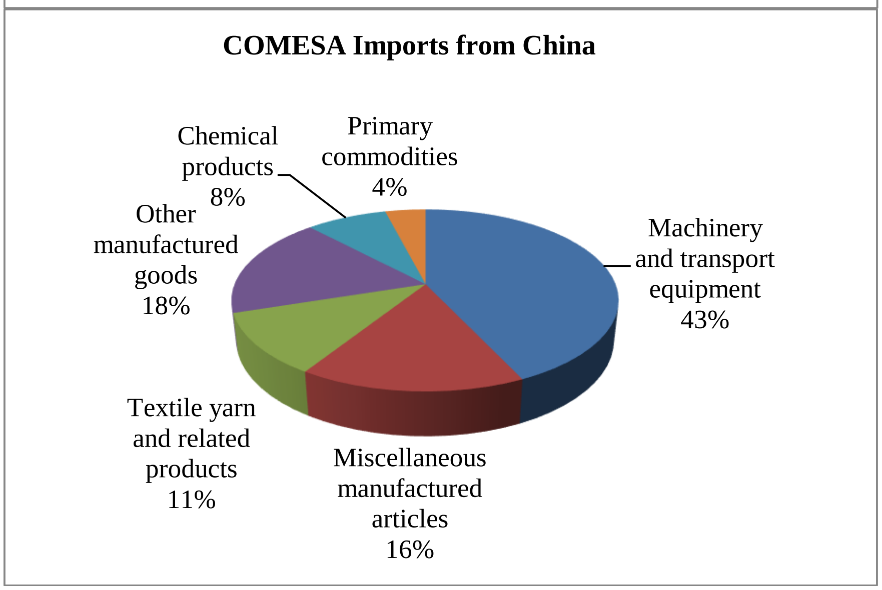
Source: UNCTAD (2013).
Note. Trade balance is obtained as COMESA's merchandise exports to China minus COMESA's merchandise imports from China.

This trade imbalance can be explained by, among other things, the structure of the two-way trade. COMESA exports to China lack diversification and are heavily concentrated in primary commodities with limited value addition (Figure 2). They are particularly driven by petroleum and related products, which account for 60% of the value of total COMESA exports to China. The next important export commodities are ores and metals (31%). By contrast, COMESA imports from China are largely comprised of manufactures. Machinery and transport equipment account for 43% of the value of total COMESA imports from China, followed by miscellaneous manufactured articles such as articles of apparel, clothing accessories, footwear and furniture (16%), textile yarn and related products (11%), and chemical products (8%). Other manufactured goods together constitute 18% of COMESA imports from China.

The above structure of COMESA-China trade is consistent with Zafar's (2007) argument that trade between Africa and China closely follows "what would be expected from comparative advantage and the predictions of the Heckscher-Ohlin model," with Africa exporting primary commodities and China exporting manufactures. However, there are concerns (e.g., Kaplinsky & Morris, 2008) that such trade pattern could narrow the space for industrial development and economic diversification of a regional grouping like COMESA.

Figure 2. Product Composition of COMESA's Trade with China





Source: Author's calculations on the basis of UNCTAD (2013).
Note: Figures are based on 2009–11 average trade values.

Gravity Model and Econometric Issues

Gravity Model

The gravity model of bilateral trade has been extensively applied in the empirical literature on international economics since its first introduction by Tinbergen (1962). One of its most popular applications has been simulation of bilateral trade potentials (Baldwin, 1994; Brenton & Di Mauro 1998; Chionis & Liargovas 2002). In the traditional concept of gravity model, bilateral trade can be explained by national incomes and both trade impediment and preference factors (Egger, 2002). As in Deardorff (1995), the simple version of gravity model can be specified as

$$T_{ij} = A\frac{Y_iY_j}{D_{ij}}, \quad (1)$$

where T_{ij} is the value of exports from country i to country j, the Y's are national incomes of the two countries, D_{ij} is geographical distance between them, and A is a constant of proportionality. Bilateral trade is thus directly related to national income and inversely related to geographical distance.

Notwithstanding gravity model's consistent empirical success (Bergstrand, 1985), the model was initially criticized for lack of strong theoretical foundations. Anderson (1979), however, settled this criticism when he derived the model from constant elasticity of substitution (CES) preferences and goods that are differentiated by region of origin. The gravity model has since been derived from different trade theories, including Ricardian, Heckscher-Ohlin and increasing returns to scale theories (Evenett & Keller, 2002).

Another major criticism has been specifically related to the projection of bilateral trade potentials. Some studies used "in-sample" trade projection, meaning that they estimate the gravity equation on a sample including the countries of interest and then define trade potential by the residuals of the estimated equation (Baldwin, 1994). The in-sample approach is, however, severely criticized by Egger (2002), who argues that systematic variations in residuals reflect misspecification of the econometric model rather than trade potential. The alternative approach is to use "out-of-sample" trade projection (Chionis & Liargovas 2002). The out-of-sample approach excludes the countries of interest from the sample while estimating the gravity equation and then applies the parameter estimates derived by the reference sample to the countries of interest in order to predict their "natural" trade flows. The difference between the actual and the predicted trade flows is then interpreted as unrealized trade potential. This approach is most appropriate when the countries of interest are in the early stage of transformation (Egger, 2002). In this study, the out-of-sample technique is used to estimate the trade potential between COMESA countries and China by excluding the former from the estimated equation.

Econometric Issues

Major concerns have been raised on the choice of econometric estimation techniques in empirical gravity models. For instance, Mátyás (1997) criticizes cross-section approaches and argues that the correct econometric specification of the gravity model is a triple-indexed model with exporter, importer and time effects. This means that conclusions on trade potentials based on ordinary least squares (OLS) technique are problematic (Egger, 2002). But the gravity literature has been less clear as to how to treat country-specific effects. Egger (2000) advocates a fixed effects model on the basis of a Hausman (1978) specification test and an intuitive argument that country effects are widely predetermined. Mátyás (1998), on the other hand, argues that for some datasets, it may be more appropriate to formalize these effects as random variables, which leads to a random effects model.

Both fixed effects and random effects approaches have limitations, however. The fixed effects approach has two shortcomings. First, it eliminates from the model observed time-invariant characteristics (such as distance), all of which are simply absorbed into the fixed effects (Greene, 2003). Second, it cannot be used for out-of-sample trade prediction unless one makes ad hoc assumptions to decompose the fixed effects into a component that is common across the trade partners and one that is specific to the partner (McPherson & Trumbull, 2008). The random effects treatment does allow the model to include time-invariant variables. But the main drawback of the random effects approach is that it assumes, with little justification, that the random effects are uncorrelated with the regressors. If the correlation exists, then the resulting estimator is inconsistent (Greene, 2003).

For the purpose of the present paper, McPherson and Trumbull's suggestion is followed, which is to apply the Hausman and Taylor (1981) estimator of panel data. Hausman-Taylor estimator is an instrumental variables estimator of the random effects model that uses only the information within the model (Greene, 2003). It is appealing for two reasons. First, it allows for the inclusion of time-invariant variables and generates out-of-sample trade forecasts without the need to make any ad hoc assumptions required by the fixed effects estimator. Second, it removes the correlation between the random effects and the regressors, which is the cause of the rejection of standard random effects estimator. Thus, time-invariant variables can be consistently estimated without compromising the estimates for time-varying variables (McPherson & Trumbull, 2008).

Other econometric estimation choices that matter for results obtained from the gravity equation include choice of dependent variable, measure of variables (Baldwin & Taglioni, 2006), functional form (Sanso, Cuairan, & Sanz 1993; Coe, Subramanian, & Tamirisa, 2007) and treatment of zero trade observations (Baldwin 1994; Brülhart & Kelly, 1999).

Empirical Evidence of COMESA-China Trade Potential

Empirical Model

The empirical model employed in this study is the gravity model of McPherson and Trumbull (2008). The general specification of the model follows the econometric specification of the Hausman and Taylor (1981) estimator:

$$M_{ijt} = \alpha + X'_{1ijt}\beta_1 + X'_{2ijt}\beta_2 + Z'_{1ij}\delta_1 + Z'_{2ij}\delta_2 + \mu_{ij} + \varepsilon_{ijt}, \quad (2)$$

where M_{ijt} is defined as the value of imports of country *i* from country *j* in year *t*, X_1 are variables that are time-varying and uncorrelated with μ_{ij}, X_2 are variables that are time-varying and correlated with μ_{ij}, Z_1 are variables that are time-invariant and uncorrelated with μ_{ij}, and Z_2 are variables that are time-invariant and correlated with μ_{ij}. α is a constant term, and β_1, β_2, δ_1 and δ_2 are vectors of slope parameters. $(\mu_{ij} + \varepsilon_{ijt})$ is a compound disturbance, where μ_{ij} is country pair-specific unobserved random effect that does not vary over time and ε_{ijt} is an error component that varies in both the country pair and time dimensions.

As pointed out by Greene (2003), it is the likely presence of X_2 and Z_2 that complicates estimation of the random effects model. The Hausman-Taylor strategy is to estimate equation (2) by instrumental variables technique. There is no need to use external instruments. First, X_1 and X_2 are transformed into their deviations from group means, as in fixed effects estimation. The group mean deviations can then be used as instrumental variables. Second, because Z_1 is exogenous by definition, it can also serve as a group of instrumental variables. Finally, the group means of X_1 can serve as instruments for Z_2, and the model will be identified so long as the number of variables in X_1 is at least as large as the number of variables in Z_2.

Following McPherson and Trumbull, X_1 contains per capita GDPs ($PGDP_{it}$ and $PGDP_{jt}$), populations (POP_{it} and POP_{jt}) and the absolute value of the difference in index of economic freedom (DFR_{ijt}) of the trade partners *i* and *j*. For X_2, the model includes the index of economic freedom of each partner (FR_{it} and FR_{jt}) and the absolute value of the difference in GDP per capita of the partners ($DPGDP_{ijt}$). It is argued that levels of economic freedom and difference in GDP per capita are likely to be correlated with other governmental, institutional, geographical or social characteristics not explicitly included in the model and captured by μ_{ij}. Z_1 comprises geographical distance between trade partners ($DIST_{ij}$) and dummy variables for both partners with common land border ($BORD_{ij}$), common language ($LANG_{ij}$) and regional trade agreement (RTA_{ij}). For Z_2, the model has dummies for both trade partners with a communist past (COM_{ij}) and both having a non-communist past ($NCOM_{ij}$). There is a potential for having a communist or non-communist past to be correlated with characteristics related to trade barriers, competitive markets or longstanding relationships that are included in μ_{ij} (McPherson and Trumbull 2008). Hence, the estimated gravity equation may be written in log-linear form as

$$\begin{aligned}\ln M_{ijt} = {} & \alpha + \beta_{11} \ln PGDP_{it} + \beta_{12} \ln PGDP_{jt} + \beta_{13} \ln POP_{it} + \beta_{14} \ln POP_{jt} \\ & + \beta_{15} \ln DFR_{ijt} + \beta_{21} \ln FR_{it} + \beta_{22} \ln FR_{jt} + \beta_{23} \ln DPGDP_{ijt} \\ & + \delta_{11} \ln DIST_{ij} + \delta_{12} BORD_{ij} + \delta_{13} LANG_{ij} + \delta_{14} RTA_{ij} + \delta_{21} COM_{ij} \\ & + \delta_{22} NCOM_{ij} + \mu_{ij} + \varepsilon_{ijt} \qquad (3)\end{aligned}$$

Typically, a positive sign is expected for β_{11}, β_{12}, δ_{12}, δ_{13}, δ_{14} and δ_{22}. Importer's per capita GDP as a measure of income and exporter's per capita GDP as a measure of the variety of output are expected to have a positive impact on bilateral trade (Baldwin, 1994). Dummies for common land border and language are used to capture information costs. Countries with common language and border tend to trade more with each other due to lower information (search) costs resulting from better knowledge of each other's "business practices, competitiveness and delivery reliability" (Piermartini & Teh, 2005). Regional trade agreements are intended to reduce tariffs and other barriers to trade between countries. Hence, they are likely to have a positive effect on trade among members (Frankel, Stein & Wei, 1995). Communist countries, McPherson and Trumbull argue, are historically associated with closed economies that are less open to trade. Thus, trade is also likely to be higher between countries that do not have a communist past.

The coefficients of β_{15}, β_{21}, β_{22}, β_{23}, δ_{11} and δ_{21}, on the other hand, are expected to have a negative sign. The absolute value of the difference in per capita GDP between countries measures economic distance (McPherson & Trumbull, 2008). This variable has an expected negative sign because according to the Linder hypothesis, countries with similar levels of income per capita will exhibit similar tastes, produce similar but differentiated products and trade more among themselves (Roberts, 2004). High levels of economic freedom signify low levels of government, social, or political barriers to trade. The index of economic freedom is such that a higher value indicates less freedom, and therefore a negative sign is expected (McPherson & Trumbull, 2008). Following the spirit of the Linder hypothesis, the closer two countries are in terms of their economic freedom levels, the more likely they are to trade. The greater the distance between two trade partners, the higher the transportation costs and hence the less the two-way trade (Bergstrand, 1985). Countries with a communist past tend to trade less and thus a negative coefficient is assigned for this dummy variable.

As for the coefficients of population, they are theoretically ambiguous. The population coefficient of the exporting country (β_{14}) may be negatively or positively signed, depending on whether the country exports less when it is big (absorption effect) or whether a big country exports more than a small country (economies of scale). For similar reasons, the population coefficient of the importing country (β_{13}) may also assume a positive or negative sign (Martinez-Zarzoso & Nowak-Lehmann, 2003).

In line with the out-of-sample technique of trade projection, the above gravity coefficients are estimated using trade flows between a reference sample of countries that exclude the COMESA region. Then the coefficient estimates derived by the reference sample are applied to COMESA-China data to predict their potential or "natural" trade flows. This calculation can be done as follows (McPherson & Trumbull, 2008):

$$\widehat{M}_{ijt} = \hat{\alpha} + X'_{ijt}\hat{\beta} + Z'_{ij}\hat{\delta}, \tag{4}$$

where $\widehat{M}$ denotes the predicted value of M. $\hat{\alpha}$, $\hat{\beta}$ and $\hat{\delta}$ refer to the coefficient estimates. X and Z stand for the time-varying and time-invariant variables, respectively. In the final analysis, $\widehat{M}$ is to be compared with M to assess the magnitude of unrealized trade potential.

The Data

The dataset contains annual data for 43 selected countries covering the period 2000–11. The countries encompass developed as well as developing economies of the world, which are assumed to be well integrated into the international market.[14] The dependent variable is bilateral merchandise imports in thousands of current US dollars sourced from UNCTAD (2013). Therefore, the potential number of total observations is 21,672 (= 43 × 42 × 12) for the twelve-year period. The dependent variable takes on a zero value for only 45 observations (due to missing trade flows), which ensures 21,627 observations in the regression model. Data on GDP per capita in current US dollars and population are drawn from World Bank (2013). Indices of economic freedom are obtained from the Heritage Foundation (2013). Each of these indices has ten components of economic freedom, ranging from property rights to financial freedom. Bilateral distances are derived from CEPII (2012). The distances refer to great-circle distances in kilometers between the capital cities of trade partners.

Border and language dummy variables are compiled from CEPII (2012). The border dummy takes the value 1 for a pair of countries (i, j) with a common land border, and 0 otherwise. The language dummy has the value 1 if both countries have a common official language, and 0 otherwise. The dummy variable for regional trade agreement is created using information obtained from WTO (2013). The regional trade agreements include free trade agreements and customs unions. This dummy has the value 1 for a pair of countries with membership in the same regional trade agreement, and 0 otherwise. Finally, data on dummy variables for a communist and non-communist past come from Information Please (2013). One of the dummy variables (COM_{ij}) has the value 1 if trading countries i and j both have a communist past; 0 otherwise. The other dummy ($NCOM_{ij}$) equals 1 if both countries have a non-communist past; 0 otherwise.

The Results

The estimates for OLS, fixed effects, random effects and Hausman-Taylor estimators of equation (3) are reported in Table 6. They are obtained by STATA Version 12 software package. The F test statistic is 161.36 and is significant at the 1% level. This indicates the presence of unobserved bilateral effects and hence inappropriateness of the OLS technique. The Hausman (1978) test based on the difference between the fixed effects and random effects estimators gives an observed chi-squared value of 1482.81. This is significant at the 1% level and reveals that the random effects model suffers from correlation between the explanatory variables and the bilateral effects. This suggests the fixed estimater is better choice. But, as already noted, the effects of all time-invariant variables are eliminated in a fixed effects approach.

[14] For list of the countries used in reference sample, see Appendix, Table A1.

Table 6. Gravity Model Estimates for the Reference Sample (Dependent Variable: Natural Logarithm of Bilateral Imports)

	OLS	Random Effects	Fixed Effects	HT I	HT II
Constant	–46.631*** (0.513)	–15.852*** (0.615)	—	4.109 (4.784)	–15.355 (17.692)
Importer per capita GDP	0.670*** (0.010)	0.730*** (0.011)	0.855*** (0.014)	0.817*** (0.013)	0.854*** (0.014)
Exporter per capita GDP	0.661*** (0.010)	0.517*** (0.011)	0.528*** (0.014)	0.500*** (0.013)	0.529*** (0.014)
Difference in per capita GDP	–0.025*** (0.006)	–0.026*** (0.005)	–0.020*** (0.005)	–0.020*** (0.005)	–0.020*** (0.005)
Importer population	0.918*** (0.006)	0.784*** (0.018)	0.548*** (0.103)	0.565*** (0.071)	0.474*** (0.099)
Exporter population	0.970*** (0.006)	0.726*** (0.018)	–0.977*** (0.103)	–0.140** (0.071)	–0.902*** (0.099)
Distance	–0.881*** (0.011)	–0.872*** (0.034)	—	–0.635*** (0.233)	6.258*** (1.839)
Importer freedom index	2.502*** (0.083)	–0.253*** (0.064)	–0.436*** (0.065)	–0.453*** (0.063)	–0.444*** (0.065)
Exporter freedom index	2.823*** (0.083)	–0.041 (0.064)	–0.447*** (0.065)	–0.366*** (0.063)	–0.438*** (0.065)
Difference in freedom index	0.023** (0.010)	–0.022*** (0.007)	–0.029*** (0.007)	–0.031*** (0.006)	–0.029*** (0.007)
Common border	0.526*** (0.041)	0.556*** (0.136)	—	1.911 (1.659)	4.431 (5.847)
Common language	0.458*** (0.027)	0.767*** (0.088)	—	0.930 (0.654)	14.020*** (3.995)
Regional trade agreement	0.134*** (0.019)	–0.065 (0.061)	—	–0.264 (0.369)	6.408*** (2.119)
Both communist	0.635*** (0.060)	0.295 (0.199)	—	–13.963 (28.436)	46.616 (100.174)
Both non-communist	0.134*** (0.019)	0.427*** (0.060)	—	–1.763 (4.487)	–43.447** (19.049)
Number of observations	21627	21627	21627	21627	21627
Number of groups	—	1804	1804	1804	1804
R-squared	0.771	0.726	0.577	—	—
Bilateral effects: *F*(1803, 19815)	—	—	161.36***	—	—
Hausman specification test: $\chi 2(8)$	—	1482.81***	—	148.90***	8.49

Notes: 1. All explanatory variables except dummies are expressed in natural logarithms.
2. Standard errors are in parentheses.
3. OLS standard errors are not adjusted for the variance components.
4. Estimates in HT I column are Hausman-Taylor estimates according to McPherson and Trumbull (2008).
5. Estimates in HT II column are Hausman-Taylor estimates with endogenous importer and exporter per capita GDPs, holding everything else the same as in McPherson and Trumbull.
*** and ** denote level of statistical significance at 1% and 5%, respectively.

The Hausman-Taylor estimates of the gravity equation are presented in the final two columns of Table 6. The HT I column refers to the specification of McPherson and Trumbull with their choice of exogenous and endogenous variables as in equation (3). The time-varying parameter estimates are generally close to their fixed effects counterparts. They also have the expected signs, except for regional trade agreement and common non-communist past. However, the effects of all time-invariant variables, except for bilateral distance, are not estimated significantly. Furthermore, the Hausman test based on the difference between the fixed effects and HT I estimators produces a chi-squared value of 148.90, which is significant at the 1% level. This means that the hypothesis that the results of HT I are generated from valid set of instruments is rejected.

To correct this problem in the original model, the results are checked for sensitivity to alternative choices of the exogenous time-varying variables (Baltagi & Khanti-Akom, 1990). The HT II column of Table 6 presents the results for a model where the importer and exporter per capita GDPs ($PGDP_{it}$ and $PGDP_{jt}$) are treated as endogenous (correlated with μ_{ij}), keeping everything else the same as in McPherson and Trumbull (2008). The Hausman test for this specification yields a highly insignificant chi-squared value of 8.49, so the legitimacy of the instrument set is not rejected. Nearly all the estimated parameters of the time-varying variables have moved even closer to the fixed effects parameters. This confirms that it has been possible to separate the effects of time-invariant variables using the Hausman-Taylor estimator without compromising the parameter estimates of the time-varying variables (McPherson & Trumbull, 2008). HT II, therefore, is the preferred model in this study.

Most coefficient estimates of HT II have the expected sign and statistically significant effect on bilateral trade. It has been possible to successfully estimate the effect of common language and regional trade agreement—time-invariant variables that would be dropped in the fixed effects estimation. As in McPherson and Trumbull's study, common border turns out to have an insignificant effect on trade and, contrary to expectations, the distance variable has a positive effect but here it is also statistically significant. Likewise, the effects of common communist and non-communist past have the wrong sign but only the latter is statistically significant at the 5% level.

As a next step, the HT II coefficient estimates are used to predict COMESA countries' "natural" trade values with China, according to equation (4). For the sake of convenience in interpreting trade potential, average ratios of actual to predicted trade values are calculated for the period 2009–2011. A ratio of less than one indicates unutilized trade potential. Table 7 reports the results. It appears that all COMESA countries are trading with China far below their potential. The average ratios of actual to predicted trade are found to be less than one half. In fact, in all but one of the cases, actual imports and exports fall more than 60 percentage points under their "natural" levels (a ratio of less than 0.40). This may not be surprising given that China and COMESA countries have strengthened their bilateral trade ties only recently. The results also confirm expectations of other authors (Jenkins & Edwards, 2005).

Despite some striking similarities, Table 7 shows that the export ratios are generally lower than the import ratios. In other words, COMESA's exports to China have performed worse than its imports have. It seems that China has targeted the COMESA market more aggressively than COMESA has targeted the Chinese market. Within the COMESA region, the ratios of actual to expected exports to China are particularly low for small countries such as Comoros, Eritrea and Seychelles, while they are relatively higher for Sudan and Libya (both predominantly oil exporters), as well as Egypt and Zambia. As far as imports from China are concerned, Egypt is the highest performer in the regional grouping with actual values of more than 40% of the expected amount, while Democratic Republic of the Congo, Eritrea and Ethiopia are the lowest performers with 14–17%. In sum, though, these results offer robust indication for bright prospects for COMESA-China trade.

Table 7. Ratio of COMESA Countries' Actual to Predicted Trade with China

	Imports	Exports
Burundi	0.30	0.18
Comoros	0.26	0.05
Congo, Dem. Rep.	0.16	0.16
Djibouti	0.32	0.12
Egypt	0.41	0.33
Eritrea	0.14	0.07
Ethiopia	0.17	0.14
Kenya	0.38	0.25
Libya	0.36	0.33
Madagascar	0.35	0.26
Malawi	0.32	0.23
Mauritius	0.35	0.19
Rwanda	0.31	0.24
Seychelles	0.26	0.08
Sudan	0.38	0.37
Swaziland	0.28	0.16
Uganda	0.35	0.24
Zambia	0.33	0.32
Zimbabwe	0.33	0.28

Note: Trade ratios are calculated based on average data for 2009–2011.

Two implications can be drawn from the above results. First, there appear to be significant trade impediments between COMESA and China. The two-way trade is likely to continue to expand with more trade-enhancing policy measures on both sides. The measures might be toward reducing bilateral trade barriers as well as developing COMESA's exporting capabilities. Second, COMESA and China need to anticipate the developmental impacts from future expansion of the bilateral trade. The impacts may be far-reaching, inasmuch as the bilateral trade potential is enormous.

Conclusion

This paper investigates the trade patterns and potential between COMESA and China. The empirical analysis shows that the bilateral trade has seen a high growth rate in the 2000s, and that COMESA exports to China are largely driven by primary products (particularly oil) while the imports are manufactures in the main. The natural resource-rich economies of Sudan, Libya, Democratic Republic of the Congo and Zambia account for the lion's share of COMESA's exports to China. Two other imbalances in COMESA's current trade integration with China are worth noting. First, whereas China has become a major trade partner of COMESA (although the significance varies widely between individual COMESA member states), the share of COMESA in China's overall trade profile remains small by comparison. Second, the bilateral trade balance in the review period was often in China's favor, which is partly a reflection of the nature of products moving between the two regions.

The paper obtains indicative estimates of the potential to increase the COMESA-China trade based on the gravity model of McPherson and Trumbull (2008). The model fits the data reasonably well. Comparing actual and estimated "natural" trade flows indicates that the COMESA countries and China are trading much lower than their potential suggests, falling by more than 60 percentage points.

These findings carry policy implications for COMESA-China trade. First, there is a clear need for COMESA to diversify its export pattern—product-wise and country-wise—in order to better exploit the Chinese market as well as balance the bilateral trade in the longer run. With a single commodity and only four member countries dominating COMESA's exports to China, there is considerable room for improvement in exporting capabilities.

Second, significant trade restrictions seem to exist, preventing the bilateral trade from reaching its potential. Thus, activities geared toward reducing existing bilateral trade barriers are likely to produce positive results. It is recommended that the policy package needs to look at not only formal trade policy variables but also domestic "behind-the-border" business environment and "between-the-border" factors, such as trade facilitation infrastructure (Broadman, 2007).

Finally, it helps both China and particularly COMESA to weigh the benefits and costs of the bilateral trade in terms of their overall development strategies. This paper estimates—conditional on the model used—the unrealized trade potential to be high. It is thus anticipated that any effects on economic development will deepen as the bilateral trade continues to expand in the future.

It is worth noting that estimation of trade potential in the gravity model setup can be done either at the aggregate or sectoral level. The results presented here are drawn from aggregated exports and imports. It is possible that within the aggregates, trade in particular products may be in line with the expected level (Brenton & Di Mauro, 1998). Future work may thus obtain richer policy implications from further disaggregation of data.

Acknowledgments

I am grateful to Dr. Alemayehu Geda, Associate Professor in the Department of Economics, Addis Ababa University, Addis Ababa, Ethiopia, for useful conversations on earlier drafts. I also wish to thank Daniel Abraham, the chief editor and an anonymous referee for their helpful comments and suggestions. Any errors are my own.

Appendix

Table A1. List of Countries in Gravity Model Regression

Developed Countries		Developing Countries
Australia	Netherlands	Argentina
Austria	Norway	Brazil
Belgium	Poland	Chile
Bulgaria	Portugal	China
Canada	Romania	Hong Kong
Czech Republic	Spain	India
Denmark	Sweden	Indonesia
Finland	Switzerland	Malaysia
France	United Kingdom	Mexico
Germany	United States	Morocco
Greece		Philippines
Hungary		Singapore
Ireland		Thailand
Israel		Tunisia
Italy		Turkey
Japan		Uruguay
Korea, Republic of		

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