To be or Not To Be: The Dilemma Of Africa's Economic Engagement With China And Other Emerging Economies

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Abstract

Africa is strengthening its economic ties with China and other emerging economies. We show that trade between China and Africa can be expanded further by removing behind-the-border and trade-facilitation constraints. However, China and India's commodity demand boom is encouraging African countries to re-deepen their specialization in primary commodities. This paper calls for African strategy. We suggest establishment of an 'industrial fund' financed from the booming resource sector as well as negotiation over a 'commodity-induced industrialization' model – which could be called the 'Non-Angolan Model' – that will ensure commodity demand is not realized at the expense of the future industrialization of Africa.

Key words – Africa, China, emerging economies, trade potential, primary commodity trade, de- industrialization

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I. Introduction

Recent years have witnessed an intensification of economic engagement between China and Africa. Growth of China-Africa trade has, in particular, been dramatic. This trade link is expected to have far-reaching implications for African economies. While China and Africa can provide markets for each other's products, Africa could also benefit in product diversification (World Bank, 2004), business efficiency, advances in technology, skills and greater international integration (Broadman, 2007) if this relation is exploited wisely. China-Africa trade could also impact on poverty, depending on the nature and significance of the trade link (Jenkins & Edwards, 2005). It has also a danger if the current pattern of trade specialization between the two regions remains for the forcible future (see below).

The two-way trade (imports and exports summed) between China and Africa burgeoned from 8.3 billion US dollars in 2000 to over US$ 107.1 billion in 2008 (International Trade Centre [ITC], n.d.; IMF, 2005). Africa's exports to China are concentrated in primary products whereas it's imports being mainly manufactured goods. China has become Africa's third largest trade partner after the United States and France (Zafar, 2007). However, the bilateral trade remains small in relative terms - especially from the perspective of China – using ITC 2008 data, China accounts for 10.6 percent of Africa's total value of trade while Africa accounts for just 4.2 percent of China's total value of trade.

Indeed, China and Africa have set a goal to further expand their two-way trade. It is interesting to ask how much is the scope to further expand China's trade with Africa? Have China and Africa already achieved their full trade potential? If not, what are the implications? Available empirical work on these questions is very scant and whatever is available is largely speculative which is based on observed trade pattern (see Broadman, 2007; Jenkins and Edwards, 2005; Shelton and Paruk, 2008; Subramaniam and Matthijs, 2007; Zafar, 2007). In this study an attempt to give an answer to these questions based on rigorous empirical investigation is made. The study also attempts not only to examine the effect of existing restrictive measures to trade growth (Miankhel, Thangavelu and Kalirajan, 2009) but also examines the detrimental implication of the current pattern of trade on Africa's future development.

The rest of the paper is organized as follows. In section II, we assess the China-Africa trade potential by calculating an index of trade complimentarity as well as using stochastic frontier gravity model of trade. A conclusion will be drawn from these exercises about the potential trade between African and China. This will be followed by section III where we examined the implications ofexploiting this untapped trade potential between China and Africa for future industrialization (and development) of Africa. We will show that this has the effect of locking Africa in primary commodity production and trade, as has been the case since the colonial time (see Alemayehu 2002 for detail). Finally, in section IV, a brief conclusion and the implications of the study are made.

II. The Trade Potential between China and Africa

Trade Complementarities between China and Africa

The degree of trade complementarities is an important determinant of the intensity of trade between countries. This is because without any commodity correspondence no trade will take place, and with perfect correspondence trade possibilities are abounded (van Beers & Linnemann, 1988; (Das & Mallikamas, 2002; Alemayehu and Idris, 2009). One way to measure complementarity is the use of trade complementarity index (TCI). Among alternative measures of trade complementarity, we adopt the formula provided by Mikic and Gilbert (2007) which is simple, consistent and comparable. This TCI is formally expressed as:

$$\mathrm{TCI} = 1 - \left[\left(\sum_i \left| \frac{\sum_w m_{iwd}}{\sum_w M_{wd}} - \frac{\sum_w x_{isw}}{\sum_w X_{sw}} \right| \right) \div 2\right]$$

Where: d is the importing country of interest, s is the exporting country of interest, w is the set of all countries in the world, i is the set of industries, x is the commodity export flow, X is the total export flow, m is the commodity import flow, and M is the total import flow.

The index only requires data on sectoral import shares of one country and sectoral export shares of the other. TCI has a scale of 0 to 1, with values closer to 0 indicating low complementarity and 1 indicating high complementarity. High complementarity, in turn, is assumed to indicate a large room to expand bilateral trade.

Realistically assuming that the import pattern of African countries, which is dominated by manufactures, reasonably matches the export structure of China to Africa, we examined the degree to which the export pattern of African countries matches the import structure of China to make our point. TCI is calculated based on the top five export commodities of each African country and China's imports of those commodities, taking 2008 as a reference year. The commodities are classified at Harmonized System (HS) two-digit level[1] and retrieved from ITC's Trade Map online database (details of the commodity categories are given in Appendix I).

The results indicate that with a complementarity coefficient of more than 0.5 (or 50%), the export pattern of almost all African countries strongly matches the import pattern of China (see Table 1). This result is also intuitive given the rapid rise of African exports to China over the past decade. African countries that have relatively higher complementarities with China are Zimbabwe (0.819), Tunisia (0.816) and Tanzania (0.810), followed by South Africa (0.792), Senegal (0.760), Djibouti (0.755), Eritrea (0.735), Kenya (0.733), Swaziland (0.730) and Morocco (0.724). In total twenty African countries are found to have a TCI value more than the average (0.625). African countries with the least value of the index being for Mali (0.428), Guinea-Bissau (0.465) and Comoros (0.494).

Table 1: TCI Values between China and 53 African Countries Ranked in Order of Magnitude and the Contribution of Selected Commodities, 2008.

Destination / Origin	China	Strong Matches in Selected Goods by HS Code					
		27	26	72	71	52	Other
Zimbabwe	0.819		√			√	√
Tunisia	0.816	√					√
Tanzania	0.810		√				√
South Africa	0.792	√	√				√
Senegal	0.760			√			√
Djibouti	0.755	√			√		√
Eritrea	0.735						√

[1] See Table 1 for details of the commodities as classified by HS two-digit code

Kenya	0.733						√
Swaziland	0.730						√
Morocco	0.724						√
Egypt	0.723			√			√
Benin	0.704	√		√			√
Uganda	0.704						√
Cote d'Ivoire	0.693						√
Gambia	0.687						√
Namibia	0.685		√				√
Mauritius	0.656						√
Sierra Leone	0.653	√					√
Niger	0.636				√	√	√
Cameroon	0.627						√
Mozambique	0.624	√					√
Somalia	0.624						√
Gabon	0.623		√				√
Madagascar	0.622	√					√
Mauritania	0.622	√		√			√
Ethiopia	0.616						√
Congo (Brazzaville)	0.611		√		√		√
Liberia	0.610			√	√		
Malawi	0.599					√	√
Sudan	0.597					√	√
Botswana	0.596		√				√
Congo DRC	0.586	√					
Seychelles	0.586						√
Chad	0.582					√	√
Nigeria	0.581						√
Burundi	0.580		√				√
Equatorial Guinea	0.580				√		√
Rwanda	0.580						√
Guinea	0.579						√
Libya	0.572			√	√		√
Algeria	0.564			√			√
Togo	0.560	√		√			
Central African Republic	0.552	√				√	√
Cape Verde	0.544						√
Sao Tome and Principe	0.538						√
Ghana	0.538						√
Burkina Faso	0.527						√
Lesotho	0.514					√	√
Angola	0.513				√		√
Zambia	0.506		√				√

Comoros	0.494						√
Guinea-Bissau	0.465			√			√
Mali	0.428						√
Average	0.625						
Standard Deviation	0.091						
Skewness	0.011						
Kurtosis	-0.340						

Notes: A value in the second column refers to TCI between the export pattern of a country in Africa (origin) and the import pattern of China (destination). √ indicates relatively strong match between China and the concerned African country in the commodity group heading the column or in the commodity group under the 'Other' column. The match refers only to the commodities covered in the TCI analysis.

Source: Calculated from ITC , accessed on February 28, 2010.

Using the two-digit HS code classification, notwithstanding few exceptions, African countries with relatively diversified exports are found to have higher TCI scores. Such countries include Zimbabwe, Tunisia, Tanzania, South Africa, Swaziland, Morocco, Benin, Gambia, Namibia, Mauritius and Sierra Leone. Out of the commodities used in calculating the complementarity index, the categories found frequently to exhibit strong matches between African countries' exports and China's imports are HS 27 (mineral fuels, oils, distillation products, etc), 26 (ores, slag and ash), 72 (iron and steel), 71 (pearls, precious stones, metals, coins, etc) and 52 (cotton). This is generally in line with World Bank's (2004) finding of strong Africa-Asia matches in oil, gold and diamond, seafood, and cotton and textile.

Despite its usefulness, the TCI approach has limitations. First, trade complementarity is just one determinant of the intensity of bilateral trade. Second, the analysis is static. Third, TCI measure is subject to aggregation bias. Finally, matching between exports and imports is done in terms of percentage, and not in levels. Notwithstanding these shortcomings, we can tentatively infer from the above TCI analysis that, given the existing commodity composition of trade, there is large potential to increase African trade with China. This is in line with some of the findings in the literature (see for instance Broadman, 2007; Shelton and Paruk, 2008; Zafar, 2007) and differs from the World Bank's (2004) finding that China, on average, has low complementarity with Africa[2]. We have used a gravity model approach below to further examine our (and other's) findings using the complementarity index approach.

The Potential Trade between China and Africa: A Stochastic Frontier Gravity Model Approach (SFGM)

Gravity model is suited to estimate trade potential as it provides a natural benchmark that takes on board both trade enhancing and trade resistance factors (Ferragina, Giovannetti, and Pastore, 2005). It is also more convenient for aggregate level analysis where various combinations of macroeconomic variables are powerful predictors of trade potential (ITC, 2003). In conventional gravity models, however, only some resistances factors to trade can be controlled for. The majority are difficult to quantify and hence merged with statistical random error term during estimation (Kalirajan and Bhattacharya, 2007). It is particularly difficult to quantify behind-the-border socio-political and institutional factors that are specific to home and partner countries and, hence, are usually neglected in

[2] World Bank (2004), however, used a different complementarity index (one based on revealed comparative advantage), different product classification (SITC 4 category) and reference period (prior to 2001)..

the standard gravity model estimation (Kalirajan, 2007). Omission of unobservable trade resistance variables and arbitrary choice of resistance terms included in gravity model leads to different degrees of omitted variable bias (Armstrong, 2007).

Recent literature suggests stochastic frontier based formulation of the gravity model to deal not only with unobservable and behind-the-border resistances factors to trade, but also to accurately estimate them (See Armstrong, 2007). This new approach also provides potential trade estimates that are closer to frictionless trade estimates. That is, potential trade can be determined by the upper limit of the dataset or by those economies that have liberalised restrictions to trade the most (Kalirajan, 2007). The basic idea is to apply a similar approach used in production economics in estimating production frontier, estimating here, instead, trade frontier. We follow Armstrong's (2007), Armstrong et al (2008) and Kalirajan (2007) suggestion and consider only core, or natural determinants of bilateral trade to estimate the frontier for China and Africa trade. The estimated model takes the following form (Eq 1):

$$\ln \mathrm{EXP}_{ijt} = \beta_0 + \beta_1 \ln\mathrm{GDP}_{it} + \beta_2 \ln\mathrm{GDP}_{jt} + \beta_3 \ln\mathrm{rDist}_{ij} + \beta_4 \mathrm{Landl}_{ij} + (v_{ijt} - u_{ijt}) \qquad \text{[Eq 1]}$$

Where $u_{ijt} = \lambda(\text{man made}_{ijt}) \geq 0$; *ln* denotes natural logarithm; *i* refers to China; *j* refers to a country in Africa; *t* is time; EXP_{ijt} is China's merchandise exports to African country *j* at current US dollars at time *t*; GDP_{it} and GDP_{jt} are gross domestic products of China and African country *j*, respectively, at current US dollars at time *t*; rDist_{ij} is the distance in kilometres between China and African country *j* relative to the distance in kilometres between China and 52 African countries; Landl_{ij} is an indicator of landlockedness in the particular China-African country pair; and v_{ijt} is a conventional mean-zero random disturbance term with normal distribution: $N(0, \sigma_v^2)$, while u_{ijt} is nonnegative and assumed to have a truncated normal distribution: $N^+(\mu, \sigma_u^2)$. Here u_{ijt} is the combined effect of behind-the-border constraints that prevent China from reaching its potential with an African trade partner. It is also assumed that v_{ijt} and u_{ijt} are distributed independently of each other and of the explanatory variables. Finally, β_0, β_1, β_2, β_3, and β_4 are parameters to be estimated.

The sources of data for this analysis are: ITC, World Development Indicators of World Bank, World Economic Outlook of IMF, Centre for Research and Studies on the World Economy (CEPII) and World Fact book of Central Intelligence Agency (CIA). Estimation of the above model is done by maximum likelihood (MLE) method. We used panel data consisting of China and its 52 African trade partners[3] for the period 2001-2008. Estimation results are presented in Table 2. The model fits the data very well as can be read from the diagnostic tests (see also Table 2b). All of the estimated coefficients have the expected signs with plausible magnitudes. Apart from relative distance, the estimated coefficients are also statistically significant at 5% level and above. Other things being equal, the larger China and African countries are in terms of economic size, the more they trade. On the other hand, controlling for other factors, landlockedness has a significant negative impact on China's exports to Africa. The other important result is a large and statistically significant estimate of gamma (about 0.87). It implies that 87% of the total variation in the model is due to the combined effect of behind-the-border constraints specific to China and African countries.

[3] Due to missing GDP data for the whole sample period, Somalia is excluded from the analysis.

Table 2: Frontier Maximum Likelihood Estimation Results for Chinese Exports to African Countries (2001-2008), Dependent Variable: $\ln EXP_{ijt}$

Independent Variables	Coefficient	Standard Error	t-Statistic	Probability
Constant	-27.3581	3.99762	-6.84	0.000***
ln GDPit	0.8674364	0.1477605	5.87	0.000***
ln GDPjt	0.7530035	0.0612129	12.30	0.000***
ln rDistij	-0.7147411	0.9255815	-0.77	0.440
Landlij	-0.7647223	0.3001177	-2.55	0.011**
sigma2	1.170818			
sigma_u2	1.020118			
sigma_v2	0.1506996			
gamma	0.8712869***			
mu	2.332783***			
eta	0.0367426***			
Log likelihood =	-305.76798			
Wald chi2(4) =	336.56			
Prob > chi2 =	0.0000			
No. of observations =	412			

Notes: *** and ** denote levels of statistical significance at 1% and 5%, respectively. Gamma is the total variation in bilateral trade from the potential due to behind-the-border measures. Eta is a parameter which determines whether bilateral trade efficiency is time-varying or not. Mu is the mean of the efficiency distribution.

Source: Own computation

Table 2b: Specification Test Results for the Empirical SFGM

Null Hypothesis	LR Chi2 Statistic	Prob>chi2	Decision	Conclusion
H0: gamma=0	83.04	0.0000	Reject H0	The composite error (vijt - uijt) specification is appropriate
H0: mu=0	17.35	0.0000	Reject H0	The truncated normal distribution fits the data better than the special half-normal distribution (the case when μ = 0)
H0: eta=0	23.72	0.0000	Reject H0	Time-varying efficiency term (uijt) is appropriate

Source: Own Computation.

Having this estimated results, we used it to calculate China's trade efficiency or realisation of trade potential with each of the 52 African countries. The efficiency estimates are calculated as the averages for each of the 52 countries bilateral trade flows over 2001-2008, using:

$$\mathrm{TradeEfficiency}_{ijt} = \mathrm{E}\{\exp(-\mathrm{u}_{ijt} \mid \varepsilon_{ijt})\} \quad \text{[Eq 2]}$$

where $\varepsilon_{ijt}=v_{ijt} - u_{ijt}$. Efficiency measures from the frontier method fall in the range from 0 to 1: a value of one indicates 100 percent efficiency (that is, full realisation of potential trade) and a value of zero suggests complete inefficiency (that is, completely untapped trade potential) (Kang & Fratianni, 2006). The results of this exercise are given in Table 3. The result shows that on average, China's realisation of its export potential with African partners is only 0.128 or about 13%, suggesting high magnitude of untapped trade potential. This result is not surprising given the insignificant level of the current two-way trade with China and the significance of the current pattern of African countries' trade with the West. We note, however, that there is variation across individual African countries. China's export efficiency is the highest for Benin (0.788), followed by Liberia (0.719), Togo (0.642) and Gambia (0.602). However, China's export performance with several African countries (39 in number or 75%) is lower than the average. The lowest trade efficiency being for Seychelles (0.009) followed by Sao Tome and Principe (0.010), Comoros (0.012), Central African Republic (0.013), Chad (0.013), Equatorial Guinea (0.014), and Gabon (0.015) and Cape Verde (0.016) – generally small island economies. Lower bilateral trade efficiencies are generally explained by larger bilateral trade resistances.

Table 3: Mean Realisation of China's Potential Exports to 52 African Countries, 2001-2008

African Countries to which China Exports	Bilateral Trade Efficiency Score	Bilateral Trade Efficiency Rank	Bilateral Trade Potential Rank
Algeria	0.080	25	28
Angola	0.074	28	25
Benin	0.788	1	52
Botswana	0.053	33	20
Burkina Faso	0.027	42	11
Burundi	0.037	39	14
Cameroon	0.038	38	15
Cape Verde	0.016	45	8
Central African Republic	0.013	49	4
Chad	0.013	48	5
Comoros	0.012	50	3
Congo (Brazzaville)	0.099	20	33
Congo DRC	0.029	41	12
Cote d'Ivoire	0.090	24	29
Djibouti	0.256	5	48
Egypt	0.114	14	39
Equatorial Guinea	0.014	47	6
Eritrea	0.024	44	9
Ethiopia	0.182	9	44
Gabon	0.015	46	7
Gambia	0.602	4	49

Ghana	0.251	6	47
Guinea	0.132	13	40
Guinea-Bissau	0.054	31	22
Kenya	0.104	18	35
Lesotho	0.217	7	46
Liberia	0.719	2	51
Libya	0.042	37	16
Madagascar	0.104	17	36
Malawi	0.045	36	17
Mali	0.102	19	34
Mauritania	0.140	12	41
Mauritius	0.094	22	31
Morocco	0.114	15	38
Mozambique	0.054	32	21
Namibia	0.050	34	19
Niger	0.071	30	23
Nigeria	0.185	8	45
Rwanda	0.027	43	10
Sao Tome and Principe	0.010	51	2
Senegal	0.078	26	27
Seychelles	0.009	52	1
Sierra Leone	0.073	29	24
South Africa	0.175	10	43
Sudan	0.151	11	42
Swaziland	0.030	40	13
Tanzania	0.094	23	30
Togo	0.642	3	50
Tunisia	0.050	35	18
Uganda	0.074	27	26
Zambia	0.098	21	32
Zimbabwe	0.109	16	37
Average	0.128		
Standard Deviation	0.174		
Skewness	2.615		
Kurtosis	9.127		

Source: Own computation

It is worth pointing out that interpretation of our results is subject to some caveats. First, efficiency (or trade potential) estimates are model specific. Second, judgments indicating trade potential are independent of the absolute value of trade is problematic (Helmers & Pasteels, 2005). Subject to these caveats, we can infer that given economic size, relative distance and landlockedness, China's trade with Africa has a wide room to grow in the near-to-medium term, by a factor of about 87 percentage points on average for China's exports (or Africa's imports from China). This is in particular true if, among other things, behind-the-border and trade-facilitation constraints are eliminated. Our result here is in line with Jenkins and Edwards (2005), Subramaniam and Matthijs (2007) and others who predicted the existence of large unexploited China-Africa trade potential.

III Do We need to Exploit this Potential: The Danger of Deindustrialization

The Asian Drivers (ADs)[4] and other emerging economies in general and China in particular are exerting a sizeable impact on global commodity markets, trade patterns, and the economic prospects of other developing countries (Alemayehu, 2006; FAO, 2007 and Farooki, 2009)[5] mainly because the ADs' growth surge is commodity intensive (Farooki, 2009). These countries are experiencing structural change in their economy with the share of foreign trade in GDP growing rapidly since the 1990s. These, therefore, along with their 'large country effects', make their impact on the world commodity market and hence world commodity price non trivial (Kaplinsky *et al*, 2009). Such influence on world commodity market is both a curse and a blessing for African countries. Rising commodity demand from these countries will increase Africa's potential for primary commodity exports both directly, through expanding exports from Africa to China and India, and indirectly, because the price effect from rising Asian demand will increase Africa's earnings from primary commodity exports even if Africa's exporters do not sell to these Asian countries (Mayer and Fajernes, 2005 and Villoria, 2009). In this scenario their growth is complimentary to possible growth of African economies. Nonetheless, these commodity demand surge have important implications for the structure of African exports. In particular, there is a danger of leading to de-industrialization of African countries if it locks them in the production and export of primary commodities in the long run (Alemayehu, 2006).

There is a surge of interest on the implication of emerging economies growing trade engagement on the economy of developing countries. A number of studies examined the impact of these economies on the export of Africa (see for example, Jenkins and Edwards (2005), Goldstein *et al* (2006), Stevens and Kennan (2006), Broadman (2007), Zafar (2007), Alemayehu and Atnafu (2008), Kaplinsky *et al* (2008), Kaplinsky (2008) and Jenkins (2008) among others). In particular, this literature focused on relative competitiveness of African countries in labor intensive manufactured exports (see for example Alemayehu and Atnafu (2008), Kaplinsky *et al* (2008) and Kaplinsky (2008)). Given that ADs' demand for primary commodity imports is likely to keep growing over the coming years (see also Mayer and Fajarnes, 2005) an equally important issue is the potential effects of the drivers' commodity demand surge on the structure of African export in the long run. Specifically, the ADs' growing commodity demand and the associated world commodity price surge may lead African countries to re-deepen their specialization in the production and export of the commodities demanded by these Asian giants. This is a plausible scenario for the following reason. First, further increases in commodity prices may impede continued movement up the scale of capital intensity in production and trade (Krueger, 1977). Second, as argued by Coxhead and Jayasuriya (2008), resource boom increases inter-sectoral competition for labor and the resulting rise in wage to capital return ratio – in a typical 'Dutch Diseases' set-up - would threaten to limit expansion in manufacturing. Finally, processing of primary commodities would have large opportunity cost with ADs' tantalizing demand being a significant part of that cost. Consequently,

[4] Asian Drivers (ADs) in this study refers to China and India which are important in Africa. An additional emerging economy worth study in African context is Brazil. To date, however, the Chinese impact is the largest and hence the emphasis on this study on China.

[5] For instance, Africa's exports to China increased from $ 1.4 billion in 1995 to $ 34.4 billion by 2007 which is more than 200 percent increase . Similar pattern was also observed for imports over the same period. Thus, between 2000 and 2003 the UNCTAD All Commodities Price Index rose from 100 to 105, and by 2007 it had reached 207 (Farooki, 2009).

resource boom that generates positive income effects (at least directly measured) may have adverse long term developmental (de-industrialization) consequences. Moreover, the Chinese and Indian FDI in Africa are qualitatively different in kind from the European and North American sourced FDI in the sense that it is driven primarily by the need to secure key commodity and energy assets (resource seeking) as well as capturing untapped markets(market seeking) (Alemayehu, 2006). Goldstein *et al*, (2006) also showed that 50-80 percent of Chinese FDI in Africa is in resource exploration and natural resource rich countries. In general, the argument, therefore, is that the Chinese FDI in Africa supports the traditional export specialization role of the continent. Is currently the continent specializing in that way? The rest of this article is devoted to this question.

The export specialization patterns of a given country may remain stable for a significant period of time owing to several factors. Theoretical models such as the path dependency approach (see Ruttan, 1997, Dalum *et al*, 1998 and Laursen, 2000), models of vertical innovative linkages (see Dalum *et al*, 1998) and the Krugman (1987) model of trade with scale economies argue that self-reinforcing mechanisms are prominent in international trade specialization and predict the export specialization patterns to be stable over a long period of time. On the contrary, one can also predict higher degree of turbulence in the specialization patterns in an economy with a growing per capita income and technology based diversification (Pasinetti, 1981). Specialization pattern might also incrementally change due to the creation of new backward and forward linkages. This may go to the extent of the creation of new development blocks (Dahmen, 1988). Hence, it is imperative to measure Africa's patter of export specialization.

Following the work of Balassa (1965) on measuring specialization patterns, the export specialization of a given (African) country could be revealed by the Balassas' Revealed Comparative Advantage (RCA) index. However, RCA index is a static concept indicating the export specialization patterns of a given country at a particular point in time. In this study we adopted the Galtonian Regression Model to test the stability of export specialization of African countries which overcomes the weaknesses of the simple RCA index approach. The model is obtained by regressing the revealed symmetric comparative advantage (RSCA)[6] index on the previous year RSCA index as follows.

$$RSCA_{ij}^{t2} = \alpha_i + \beta_i RSCA_{ij}^{t1} + \varepsilon_{ij} \qquad \text{[Eq 3]}$$

Where: the superscripts t_1 and t_2 refer to the first and the next period respectively; and i and j refer to sector i and country j respectively.

This regression can be carried along two approaches: the country-wise and sector-wise approaches. The country-wise approach tests whether countries' exports are stable across sectors or not. On the other hand, the sector-wise approach tests whether specialization patterns tend to converge across countries, within the same sector (Dalum *et al*, 1998). The magnitude and sign of β in [Eq 3] show the stability of the specialization pattern of a given country for a given sector between the two periods. However, following the arguments of Cantwell (1989), the interpretation placed on β may not be a necessary condition to have re-deepening specialization pattern since it can only show the degree of association between the first and the second period specialization patterns. In other words, it doesn't show the

6 The Balassa's RCA measure suffers from the inherent risk of lack of normality and hence should be made symmetric by index normalization mechanism (Dalum et al, 1998). This is done in this study.

degree of change in export specialization distribution. In the context of the above regression ,[Eq 3], Hart (1976) showed that[7]

$$\frac{\sigma_{ij}^{t2}}{\sigma_{ij}^{t1}} = \frac{|\beta|}{|R|} \qquad \text{[Eq 4]}$$

Where: $\sigma_{ij}^{t_2}$ and $\sigma_{ij}^{t_1}$ are the standard deviations of the export structure in the first and second year respectively and R_i is the correlation coefficient from the regression.

The degree of specialization is said to be increased if $\beta > R$ -the dispersion of specialization has increased (Dalum *et al*, 1998 and Laursen, 2000). This situation is termed as the σ-specialization pattern in the country-wise approach and the σ-divergence pattern in the sector-wise approach (Dalum *et al,* 1998). Hence, if the ratio $|\beta_i|/|R_i|$ is greater than one (>1) for a given country (sector), it means that the initial specialization pattern of the country (in the sector) is strengthened (re-deepened).

If a particular country exhibits stability of export specialization patterns, it is curious to know what accounts for such specialization patterns and there is a growing literature on that. However, the Heckshег-Ohlin (HO) or Heckshег-Ohlin-Vanek (HOV) model is the dominant trade theory to explain that (see Alemayehu, 2011). In setting out to explain the patterns of international trade by reference to inter-sectoral differences in factor intensities and factor endowments, the HO theory posits the existence of a well-defined relationship among trade flows, factor intensities, and factor endowments (Balassa, 1986). The result that trade pattern is dictated by relative factor abundance and factor intensities is apparent in a simple HOV model, given by the simple multi-country 'HOV equation' (see Trefler, 1995), [Eq 5]:

$$lnX_c = ln(V_c - \alpha_c V_w) - lnA \qquad \text{[Eq 5]}$$

Equation 5 shows that trade patterns are determined by the differences in factor abundance and the difference in the factor intensity of goods as predicted by the HO model. In principle, however, the empirical models of neoclassical trade theory should be estimated with net exports as the dependent variable, and excess factor endowments as the explanatory variables (De Ferranti *et al*, 2002). This is because in HO framework, an identical constant return to scale production technology is assumed and hence difference in production function ceases to be important determinant of production (and hence, export) patterns[8]. Consequently, net export performance is strictly determined by excess factor supplies of a nation[9].

In this study, three factors (labor, natural resources and capital) are considered. Following Balassa (1986) and Hall and Jones (1999), physical capital endowments (stocks) are estimated by Perpetual

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[7] The derivation of the model is shown in Appendix III.

[8] Furthermore, the HO model assumes away the factor intensity reversals which tend to make this result more power full.

[9] In developing countries, however, inter-country differences in the commodity patterns of imports are greatly influenced by the system of protection applied (Balassa, 1979). Therefore, relative export performance is a preferred indicator of comparative advantage instead of export-import ratios or net exports. A country's relative export performance in individual product category reflects its revealed comparative advantage within a given sector.

Inventory Method (PIM)[10]. Formal education expenditure as percentage of Gross National Income (GNI) would be used as a proxy for human capital endowment indicator. Following Romalis (2004), raw material abundance is measured by total land area divided by the total labor force, a simple but imperfect estimate of the abundance of agricultural and mineral resources**.** Total labor force (above age of 15 years) would also be used as proxy for labor endowment of countries. Finally, in the presence of self-reinforcing mechanisms driven by country-specific learning-by-doing, initial conditions dictate the long run trade pattern and growth rate (Brasili *et al*, 1999). Hence, to test this effect lagged value of the dependent variable would be included as an additional regressor in the model.

The major innovation here is to analyze the impact of ADs' trade and FDI in Africa on the export structure of African countries. The impacts of ADs' commodity import on the structure of African exports could be direct (through expanding exports from Africa to China and India) or indirect (through the price effect from rising Asian demand for commodities which is increasing Africa's earnings from primary exports even if Africa's exporters do not sell to these Asian markets). Furthermore, it can be argued that the direct investments from the Asian drivers are resource and market seeking and hence contributing less to the technological intensity of Africa's exports by locking African countries in the production and export of the primary commodity sectors. Thus, in the empirical exercise below this concern is taken onboard by taking the impacts of the ADs' commodity imports and FDI flows as part of the standard HOV model. Specifically, the model is augmented by including the commodity imports of China and India and the Chinese FDI in Africa [11]. The study also have used ADs' (China and India's) import of a given commodity group from elsewhere (rather than Africa) to reflect the fact that African countries could also benefit from the boom by replacing exports to the third market from countries that have redirected their exports to China and India. With this in view, the empirical model estimated takes the following form (Eq 6]:

$$\ln RCA_{ijt} = \alpha + \gamma \ln RCA_{ij,t-1} + \beta_1 \ln PH_{it} + \beta_2 \ln HM_{it} + \beta_3 \ln RM_{it} + \beta_4 \ln L_{it} + \beta_5 \ln IMPCH_{jt} + \beta_6 \ln IMPIN_{jt} + \beta_7 \ln CHFDIS_t + u_{ijt} \qquad \text{[eq 7]}$$

Where: PH_{it}, HM_{it}, RM_{it} and L_{it} are, respectively, physical capital, human capital, raw material and labor abundances (the standard HO model arguments); and *IMPCH*, *IMPIN* and *CHFDIS* are commodity imports of China, India and the Chinese FDI respectively; u_{ij} is the error term and *i, j* and *t* represent respectively country, sector and time period.

Estimation is done for each commodity lelve (as opposed to total exports or imports) as comparative advantage is a commodity specific concept. Second, ADs' commodity demand surge is more involved in certain commodities than in the others. Similarly, the intensity of ADs' impact on global commodity market varies among different commodities (Streifel, 2008). Such commodity specificity is also important because an analysis based on aggregate commodity category could lead to misleading results owing to differences in the degree of sensitivity to different factors (including price and income changes) among types of export commodities (Bond, 1987). We have adopted the World Bank commodity classification which is based on Standardized International Trade Classification Revision 4 (SITC rev 4) at two digit level of categorization. Thus, we have five commodity categories: (1) Foods, (2) Minerals, (3)

[10] For extensive survey of how this method works see Zhang et al (2007) and Chowdhury (2008)

[11] Although the Indian FDI in Africa is also driven by similar motives, it is less significant relative to the FDI flows from China and other traditional sources. Furthermore, it is argued to be concentrated in few resource rich countries (see Goldstein et al, 2006; Alemayehu 2006) and complete data series is absent. Hence it is not considered in this study.

Agricultural raw materials, (4) Fuels and (5) Manufactures. The hypothesis here is that, a country with large none-capital resource base has the export structure biased towards foods, agricultural raw materials and minerals. On the other hand, countries with large accumulation of capital and relatively developed technology would find their exports biased towards manufactures.In testing the stability or otherwise of African export structure, the Galtonian regression is estimated along both the country and sector-wise approaches. In the country-wise approach the model is estimated country by country for the five commodity groups noted above.(see Table 4). The sector-wise analysis is conducted across eleven sectors: seven primary commodity and four manufactured export sectors (see Table 5).

Several points emerge from the county-wise analysis (see Table 4 below). In Table 4 $|\beta/R|$ shows the dynamics of the specialization patterns. In the food exports, the results show that for about 50 percent of the countries in the sample, the value of $|\beta/R|$ is greater than unity implying a general increase in the dispersion of the specialization patterns and hence, a trend towards increase in specialization (i.e. σ-specialization patterns) in the sector. This implies that those countries initially specialized in this sector tend to be more specialized and vice versa. An even credible pattern is observed in fuel and mineral exporting countries. In fuel exports about 55 percent of the countries in the sample display the σ-specialization patterns. Furthermore, four countries, Algeria, Madagascar, Sudan and Uganda tend to display relatively unchanging pattern in the sector. Similarly, in terms of mineral exports two-third of the countries in the sample show a general increase in specialization, the exceptions in this case being Madagascar, Senegal, South Africa and Sudan which tend to be less specialized. In agricultural raw material export the result shows σ-de-specialization patterns for more than 60 percent of the countries. In fact, almost half of the countries in the sample are characterized by near unchanging pattern. This sector is also characterized by β-de-specialization patterns with only four countries registering $\hat{\beta}$ values above 0.5. Algeria, Egypt, Mauritius, Senegal and South Africa are the exceptions with σ-specialization pattern in the sector.

Table 4: The Galtonian Regression Result: The Country-wise Approach

	Foods			Agricultural Raw Materials			Fuels			Minerals			Manufactures		
Country	**|β|**	**R**	**|β/R|**	**|β|**	**R**	**|β/R|**	**|β|**	**R**	**|β/R|**	**|β|**	**R**	**|β/R|**	**|β|**	**R**	**|β/R|**
Algeria	*0.51*	*0.66*	***0.78***	*0.38*	*0.36*	***1.05***	*0.60*	*0.61*	***0.99***	*0.35*	*0.35*	***1.01***	*0.47*	*0.46*	***1.03***
Cape Verde	*0.71*	*0.65*	***1.10***										*1.40*	*0.76*	***1.84***
Cote d'Ivore	*1.09*	*0.82*	***1.33***	*0.26*	*0.30*	***0.87***	*0.68*	*0.54*	***1.26***				*0.47*	*0.61*	***0.77***
Egypt	*0.36*	*0.35*	***1.04***	*0.76*	*0.56*	***1.37***	*0.18*	*0.42*	***0.42***	*1.23*	*0.85*	***1.44***	*0.81*	*0.67*	***1.21***
Gabon	*0.15*	*0.14*	***1.06***	*0.09*	*0.10*	***0.90***				*0.19*	*0.17*	***1.10***			
Gambia	*0.57*	*0.66*	***0.86***	*0.09*	*0.10*	***0.90***							*0.15*	*0.14*	***1.06***
Madagascar	*0.50*	*0.50*	***1.00***	*0.34*	*0.36*	***0.94***	*0.14*	*0.14*	***1.00***	*0.68*	*0.69*	***0.98***	*0.52*	*0.56*	***0.93***
Malawi	*0.71*	*0.73*	***0.97***	*0.13*	*0.14*	***0.92***	*0.15*	*0.14*	***1.06***	*0.29*	*0.28*	***1.03***	*0.78*	*0.79*	***0.99***
Mauritius	*0.67*	*0.60*	***1.12***	*0.21*	*0.17*	***1.21***	*0.13*	*0.10*	***1.30***	*0.64*	*0.56*	***1.15***	*0.34*	*0.35*	***0.98***
Morocco	*0.31*	*0.32*	***0.98***	*0.01*	*0.10*	***0.05***	*0.28*	*0.26*	***1.06***	*0.89*	*0.79*	***1.13***	*0.71*	*0.76*	***0.93***
Mozambique													*0.04*	*0.24*	***0.16***
Senegal	*0.55*	*0.52*	***1.06***	*0.31*	*0.30*	***1.03***	*0.11*	*0.10*	***1.10***	*0.43*	*0.47*	***0.92***			
South Africa	*0.07*	*0.10*	***0.70***	*0.88*	*0.71*	***1.23***	*0.07*	*0.10*	***0.70***	*0.38*	*0.41*	***0.92***	*0.06*	*0.10*	***0.60***
Sudan				*0.77*	*0.83*	***0.93***	*0.43*	*0.46*	***0.94***	*0.06*	*0.10*	***0.60***	*0.28*	*0.32*	***0.89***
Tunisia							*0.11*	*0.10*	***1.10***						
Uganda	*0.14*	*0.14*	***0.99***	*0.27*	*0.36*	***0.75***	*0.14*	*0.14*	***0.99***	*0.34*	*0.33*	***1.03***	*0.50*	*0.42*	***1.18***
Zambia	*0.51*	*0.69*	***0.74***	*0.51*	*0.78*	***0.65***	*0.44*	*0.55*	***0.80***	*0.54*	*0.52*	***1.04***	*0.46*	*0.42*	***1.08***

Note:

The Breush-Pagan heteroskedasticity tests fails to reject the null of constant variance in all the regressions

The sector-wise analysis also conveys similar result (see Table 5). The result indicates σ-divergence patterns for all sectors except four: the agricultural raw material export, other ores and mineral export, chemical products and commodities classified under 'other manufactured goods'. This implies that the dispersion of specialization in most of the sectors has increased. Put differently, countries that are specialized in a given sector tend to increase their specialization in the sector and /or countries that are under specialized in a given sector tend to decrease their specialization in the sector. More generally, countries increase their specialization in the sectors where they initially hold comparative advantaged and decrease their specialization in the sector where they initially lost the ground. Specifically, basic foods; beverages and tobacco; non ferrous metals; pearls, precious stones and non monetary gold and fuels are sectors with σ-divergence patterns in primary commodities export (deeper specialization occurred in these sectors). Similar to the general result from country-wise analysis, agricultural raw material export display the σ-convergence pattern. Dispersion of the specialization has also decreased for commodities (sectors) classified as other ores and minerals. In manufactured goods export, it is only in machinery and transport equipment and iron and steel that specialization has increased and hence sizeable σ-divergence pattern can be observed.

In general, both the country-wise and sector-wise analyses point to similar result – deeper specialization in the primary commodity sector (except in agricultural raw material and other ores and minerals exports sectors). On the other hand, in manufacturing sectors, similar evidences are not evident except in few countries and few sectors. In sum, however, the whole result does point that African countries export structure is characterized by re-deepening specialization in the traditional export sectors.

Table 5: Galtonian Regression Result: The Sector-wise Approach

Sectors*	**|β|**[†]	**| *R*|**	**|β/*R*|**
Primary commodities			
Food, basic	*0.20*	*0.20*	***1.00***
Beverages and tobacco	*0.18*	*0.17*	***1.04***
Agricultural raw materials	*0.23*	*0.24*	***0.94***
Non-ferrous metals	*0.54*	*0.52*	***1.04***
Other ores and metals	*0.06*	*0.10*	***0.60***
Pearls, precious stones and non-monetary gold	*0.13*	*0.10*	***1.30***
Fuels	*0.23*	*0.22*	***1.03***
Manufactures			
Chemical products	*0.04*	*0.10*	***0.40***
Machinery and transport equipment	*0.52*	*0.48*	***1.08***
Iron and steel	*0.25*	*0.22*	***1.12***
Other manufactured goods	*0.02*	*0.03*	***0.63***

Note:

[*]*Commodities included in each specific sector according to the Standardized International Trade Classification Revision Four (SITC rev 4) at two digit level are listed in Appendix A.2*

[†]*The Breush-Pagan heteroskedasticity test fails to reject the null of constant variance in all the regressions*

If African countries are characterized by re-deepening of their specialization in the primary commodity sector, it is informative to interrogate the data about what account for such patterns? To uncover this the augmented multi-country version of the HOV model is estimated by incorporating the ADs' trade and the FDI relations with the continent. The result is give in Table 6. This analysis is made using panel data for samples of African countries. As already noted, in this model the lagged value of the dependent variable would be generally included as an additional regressor to account for initial conations and path dependency. In such cases, standard panel estimators are all inconsistent (Arellano and Bond, 1991). Hence, we used the Arellano and Bover (1995) and Blundell and Bond (1998) system GMM which exploits all the orthogonalithy conditions that exist between the instruments and the differenced errors. This approach uses both the lagged levels and lagged differences as an instruments for the lag of the dependent variable. The consistency of the GMM estimator depends heavily on the presence of the second order autocorrelation in the idiosyncratic errors. Thus, we used the Arellano and Bond (1991) test for the autocorrelation in the idiosyncratic errors. Apart from these, the Arellano and Bond (1991) and Sargan (Hansen) test for over-identification restriction is used to test for the joint validity of the instruments.

The model is estimated with a constant in three of the five regressions. This is because the system GMM doesn't difference out the constant and if the model calls for a constant and efficiency increases with it, one needs to preserve it. The results of this exercises is presented in Table 6. Overall, all the variables in the model are jointly significant as shown by the large values of the Wald statistic. The Arellano and Bond (1991) test for the second order autocorrelation shows that the null of 'no second order autocorrelation' in differenced errors is not rejected at one percent level of significance for all the regressions. The Sargan (Hansen) test of over- identification also shows that the null hypothesis of valid instruments is not rejected implying that the instruments, as a group, appear exogenous and hence valid. The estimation results show that the endowment variables (the standard variables of the HOV model) have the expected sign and are significant in most of the regressions.

Table 6: Estimation result: One step system GMM

Dependent Variable: lnRCA

	Foods		Agricultural Raw Materials		Fuels		Minerals		Manufactures	
Variables	*Coeff.*	*Z*	*Coeff.*	*Z*	*Coeff.*	*Z*	*Coeff.*	*Z*	*Coeff.*	*Z*
lnRCA(-1)	*0.563**	*2.81*	*0.595**	*3.48*	*0.065*	*0.75*	*0.818**	*18.09*	*0.393**	*2.41*
lnPH	*-0.487***	*-2.12*	*-0.202***	*-2.28*	*0.648**	*4.18*	*0.004*	*0.09*	*0.026*	*0.14*
lnHM	*0.711***	*2.01*	*0.225*	*1.78*	*0.081*	*0.22*	*0.184*	*1.03*	*0.868*	*1.75*
lnL	*0.894***	*2.13*	*-0.147*	*-1.23*	*0.243*	*0.70*	*-0.238*	*-1.7*	*-0.195*	*-1.01*
lmRM	*-0.497*	*-1.92*	*0.201**	*2.51*	*0.556***	*2.28*	*0.230***	*2.02*	*0.177***	*2.13*
lnIMPCH	*0.373***	*2.15*	*-0.107*	*-0.52*	*2.989**	*5.04*	*0.839**	*3.15*	*-0.761*	*-1.32*
lnIMPIN	*0.087*	*1.09*	*-0.32*	*-1.28*	*-3.555**	*-3.32*	*-0.196*	*-0.61*	*0.616***	*2.04*
lnCHFDIS	*-0.224*	*-1.55*	*0.448***	*2.32*	*-1.366*	*-1.80*	*-0.29*	*-0.42*	*0.328*	*0.54*
Constant	*-3.936***	*-2.32*	____	____	____	____	*-1.898*	*-0.44*	*0.941*	*0.33*
Specification Test Stat.										
Wald Stat	*310.34(0.00)*		*453.90(0.00)*		*184.06(0.00)*		*484.12(0.00)*		*509.90(0.00)*	
AB AR(1) Test	*Z = -2.33(0.020)*		*Z = -2.34 (0.019)*		*Z= -6.55(0.000)*		*Z= -2.51(0.012)*		*Z= -1.97(0.049)*	
AB AR(2) Test	*Z = 0.41(0.680)*		*Z = -0.13 (0.900)*		*Z= -2.05(0.040)*		*Z= 0.12(0.901)*		*Z= 0.08(0.933)*	
Sargan(Hansen)	*4.43(0.816)*		*4.00(0.136)*		*89.85(0.020)*		*81.65(0.068)*		*5.73(1.000)*	

Notes:

**and ** show one and five percent level of significance, respectively*

The estimation result also shows that the variable 'imports of China' has the expected signs and precisely estimated showing that it is significantly influencing the export structure of African countries. The effects of Chinese commodity demand boom on export structure of Africa vary across commodities, however. Specifically, its effect is the largest in fuels and minerals. A percent increase in Chinese import of fuels from everywhere will increase the sample countries' specialization in the sector by 2.9 percent. Similarly, the comparable figure for China's import of ores and minerals is 0.83 percent. China's impact on the food export sector is also considerable, a 1 percent increase in its imports re-deepening Africa's specialization in the sector by 0.35 percent. On the contrary, the Chinese import of agricultural raw materials is statistically insignificant in determining the African export structure. In fact, China and India are less import dependent on agricultural commodities although India has relatively greater presence being the largest consumer of few commodities such as sugar and tea (FAO, 2007 and Streifel, 2009). Although there is no guarantee that such patterns are due to the ADs' weak demand for this sector, the non-parametric test of the previous section also shows that this sector is characterized by σ-de-specialization and σ-convergence patterns. Table 6 also shows that the impact of the Chinese FDI is statistically insignificant or the coefficients are not of the expected signs except for the export of the agricultural raw materials where it is found to have the expected signs and is significant. Indian imports are generally either not statistically significant for all commodities or have the wrong sign. The result about manufactured exports is interesting. It shows that while Indian imports have positive values and precise estimates that of China resulted in a negative and statistically insignificant coefficient. This suggests that, while Indian imports from Africa enhance the African specialization in the manufactures, China's imports tend to crowd out it. This is in line with the fact that the commodity import structure of China and India from Africa is different from that of Indian imports which are more diversified than that of China and that it also encompass labor intensive commodities (Goldstein *et al*, 2006; Alemayehu and Atenafu, 2008).

As a sensitivity analysis the model is re-estimated with a bit of different specification. In particular, instead of China and India's commodity import from elsewhere the model is re-estimated with China and India's commodity import from each African country. This has altered the statistical significance of the variables of interest in all commodity groups except in minerals export. The signs are, however, preserved. This shows that the indirect impacts of China and India's commodity import (from elsewhere) through the world commodity market (price) are more significant than the impacts of ADs' direct import from each African country [12]. In line with this, since China imports significant share of its metals consumption from Africa, the impact of its minerals import is found to be insensitive to the specifications used.

In general, we noted several points from the above analysis. First, while China's growth surge and hence its commodity demand boom is significantly affecting the export structure of African countries, India's import is not yet important in influencing the African export structure at least for now. This might be related to the following stylized facts: first (a) China is the largest consumer of major commodities. It is the largest consumer of main metals and the second largest user of energy, for instance. On the other hand, India, ranks several places lower for metals and energy consumption, and recent growth rates in the metals and energy consumption have been more moderate (Streifel, 2008). Second (b) the commodity import structure of China and India itself is also different with the imports of India being much more diversified than that of China encompasses labor-intensive products as we noted earlier

[12] In fact, for SSA economies, such as Angola, Sudan and Democratic Republic of Congo, the importance of China as a direct destination of exports grew particularly rapidly (see Kaplinsky et al, 2006).

(Goldstein *et al*, 2006). This result is also apparent from the dissimilar impact of China and India on manufactured exports of Africa. Third (c), the intensity of China's impact on the export structure of Africa varies across different commodity groups with the impacts being the largest in fuel and mineral sectors. China is, in fact, passing through the resource intensive economic growth stage with industrialization and fixed capital formation taking the lead (Farooki, 2009). These activities generated high demand for industrial metals and minerals. Being in the midst of a significant shift in its consumption patterns, China's impact in the food export sector is also considerable. On the other hand, it is less import dependent in agricultural raw material and hence its impact in this sector in Africa is of less significant. China, on the other hand, is negatively impacting the specialization of Africa in manufacturing sector. Finally (d), given the proxy used, Chinese FDI flows are insignificant in determining the export structure of Africa except in the agricultural raw material export sector.

IV. Conclusions and Implications

The China-Africa trade has seen a dramatic growth in recent years. The analysis in this study has led further to the conclusion that China and African countries have even more considerable scope to further expand their bilateral trade, currently exploiting less than 14 percent of their potential trade. There are several implications for China and African countries to strengthen this bilateral trade. First, China and African countries can take steps to further exploit complementarities in their trade structure. Second, in addition to trade policy reforms, they should take other country-specific behind-the-border measures which are currently limiting their trade. This includes improving domestic business environment, upgrading the quality of market institutions, and relaxing various supply constraints. Third, China and African countries should also improve trade facilitation between their borders. Fourth, policies which promote higher economic growth in China as well as Africa are also likely to promote the bilateral trade integration between the two regions. Finally, China and African countries should anticipate relevant distributional changes or social cost due to the effect of the potential trade expansion in the near future. Although all these implications assumes a win-win situation both for Africa and China, the benefits of their engagement is also found to be asymmetric – African facing the danger of de-industrialization if the current pattern of trade remained unchanged in the near future.

In particular, we found that commodity demand surge form China (and also India) and the Chinese FDI flows may lock African countries in the traditional commodities export sector and result in diminished manufacturing export opportunities. This might also be deleterious if the growth of manufacturing in general, and of specific sectors within manufacturing, is argued to generate dynamic productivity gains through a variety of mechanisms including dynamic externalities, learning by doing, stable prices and expanded scope for technological progress, among others (see Alemayehu, 2011). Hence, it is important to think and act on the possible detrimental impact of the Chinese trade and FDI flows in locking African countries in the production and export of primary commodity sector. This study has shown this to be the case. We have showed that there is a tendency for African countries to increase their specialization in primary commodity export sectors owing to Chinese (and Indian) induced demand surge for commodities - lending support to the evidence of re-deepening specialization in the primary commodity sectors for African countries. The study also showed that while China's commodity demand boom is significantly locking African commodity producers in the production and export of traditional commodities, India's effect on such pattern is minimal. Similarly, the impact of Chinese FDI in deepening the export structure specialization of African countries in the traditional commodities is also found to be unimportant, except for raw material exports, at least for now. The study also revealed that the indirect impact of China's commodity demand surge (though its effect on world price of commodities) on African export structure is more important than its direct impact. Finally, this study showed that the intensity of the impacts of China's commodity import surge on the export structure of Africa varies across different commodity groups with the impacts being sizeable in fuel and mineral export sectors. This calls for innovative and country specific policy responses to Africa's engagement with China and India and the need to balance between the temporary resource windfall gain and the future industrialization strategies of the continent, if the continent is to follow the path to industrial development in the future. Specifically, there is a need for a carefully tailored indigenous and explicit (and in some cases diverging) policy responses to Africa's engagement with China, India and other emerging economies such as Brazil. Furthermore, quality of government policies and institutions (that are able to deal with Chinese counterparts) might be important determining factors for ensuring market driven industrial development is not biased against the future industrialization of Africa and thwart the opportunity for sustainable development that might have occurred by creatively using proceeds of the resource export sector.

In sum, it can be said that there is a huge potential to expand the African-China trade in the near future. However, there are both short term and long term impediments to its realization. The former relates to the behind-border constraints that could be addressed easily by policy makers in both part of the world. The latter is related to the danger of de-industrialization and future industrialization and development of Africa. This latter one is the most difficult one to address as it requires strong strategic direction, in particular from the African side. But it has to be done. Two strategic policy directions in this regard could be worth considering. One is (a) the possibility of establishing an African industrial fund that should be financed from the booming resource export sector and use it for industrialization, pending on the institutional strength of African countries. A second possible avenue is to negotiate with China to have 'a commodity-induced industrialization' model – which could be called 'the Non-Angolan Model' – that will ensure that China's commodity demand is not realized at the expense of the future industrialization and development of the African continent. This could be negotiated from the outset with China again pending on institutional weakness and strength of the negotiating African country in question. The details of such strategy might be country specific but its generic direction needs to be along this line. This, in a nut shell, underscores also the need to have a strategy of African engagement with emerging economies such as China, India and Brazil which are active in the continent and most likely have a strategy of their engagement with Africa (while African's lack such strategy).

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Appendix I

Table 1: Commodities Classified by Two-Digit HS Codes

HS Code	Product Label
01	Live animals
02	Meet and edible meat offal
03	Fish, crustaceans, molluscs, aquatic invertebrates nes
06	Live trees, plants, bulbs, roots, cut flowers etc
07	Edible vegetables and certain roots and tubers
08	Edible fruit, nuts, peel of citrus fruit, melons
09	Coffee, tea, mate and spices
12	Oil seed, oleagic fruits, grain, seed, fruit, etc, nes
13	Lac, gums, resins, vegetable saps and extracts nes
16	Meat, fish and seafood food preparations nes
17	Sugars and sugar confectionery
18	Cocoa and cocoa preparations
21	Miscellaneous edible preparations
22	Beverages, spirits and vinegar
23	Residues, wastes of food industry, animal fodder
24	Tobacco and manufactured tobacco substitutes
25	Salt, sulphur, earth, stone, plaster, lime and cement
26	Ores, slag and ash
27	Mineral fuels, oils, distillation products, etc
28	Inorganic chemicals, precious metal compound, isotopes
29	Organic chemicals
31	Fertilizers
33	Essential oils, perfumes, cosmetics, toiletries
38	Miscellaneous chemical products
39	Plastics and articles thereof
40	Rubber and articles thereof
41	Raw hides and skins (other than fur skins) and leather
44	Wood and articles of wood, wood charcoal
49	Printed books, newspapers, pictures etc
52	Cotton
61	Articles of apparel, accessories, knit or crochet
62	Articles of apparel, accessories, not knit or crochet
63	Other made textile articles, sets, worn clothing etc
64	Footwear, gaiters and the like, parts thereof
71	Pearls, precious stones, metals, coins, etc
72	Iron and steel
73	Articles of iron or steel

74	Copper and articles thereof
75	Nickel and articles thereof
76	Aluminium and articles thereof
79	Zinc and articles thereof
81	Other base metals, cermets, articles thereof
84	Nuclear reactors, boilers, machinery, etc
85	Electrical, electronic equipment
87	Vehicles other than railway, tramway
88	Aircraft, spacecraft, and parts thereof
89	Ships, boats and other floating structures
90	Optical, photo, technical, medical, etc apparatus
93	Arms and ammunition, parts and accessories thereof
99	Commodities not elsewhere specified

Notes: Only commodities used in Sino-African TCI analysis are shown. The acronym ‘nes’ stands for ‘not elsewhere specified’. HS code 84 (nuclear reactors, boilers, machinery, etc) can be disaggregated further into are air or gas compressors, hoods; parts of vacuum pumps, compressors, fans, blowers, hoods; air conditioning machines window or wall types, self-contained; air conditioning machines nes, including a refrigerating unit; refrigerators, household type, absorption type, electrical; refrigerators, household type, nes; non-domestic, non-electric dryers nes; machinery, plant/laboratory equipment for treat of mat by change of temperature nes.
Source: ITC (n.d.).

Appendices II

-A: The Data

A.1: Sample Countries for Each Commodity Groups

Food	Agricultural Raw Materials	Fuels	Minerals	Manufactures
Algeria	Algeria	Algeria	Algeria	Algeria
Cape Verde	Cote d'Ivore	Cote d'Ivore	Egypt	Cape Verde
Cote d'Ivore	Egypt	Egypt	Gabon	Cote d'Ivore
Gabon	Gabon	Madagascar	Madagascar	Egypt
Gambia	Gambia	Malawi	Malawi	Gambia
Madagascar	Madagascar	Mauritius	Mauritius	Madagascar
Malawi	Malawi	Morocco	Morocco	Malawi
Mauritius	Mauritius	Senegal	Senegal	Mauritius
Morocco	Morocco	South Africa	South Africa	Morocco
Senegal	Senegal	Sudan	Sudan	Mozambique
South Africa	South Africa	Tunisia	Uganda	South Africa
Tunisia	Sudan	Uganda	Zambia	Sudan
Uganda	Uganda	Zambia		Uganda
Zambia	Zambia			Zambia

A.2: Commodities in sectors in sector-wise approach

Commodities included in each specific sector according to the Standardized International Trade Classification are the following.

Primary commodities (SITC 0, 1, 2, 3, 4, 68, 667 and 971)

Food, basic (SITC 0, 22 and 4)

Beverages and tobacco (SITC 1)

Agricultural raw materials (SITC 2 less 22, 27 and 28)

Non-ferrous metals (SITC 68)

Other ores and metals (SITC 27 and 28)

Pearls, precious stones and non-monetary gold (SITC 667and 971)
Fuels (SITC 3)

Manufactured goods (SITC 5 to 8 less 667 and 68)

Chemical products (SITC 5)

Machinery and transport equipment (SITC 7)

Iron and steel (SITC 67)

Other manufactured goods (SITC 6 and 8 less 667 and 68)

A.3: Indian Commodity Imports from the Rest of the World (Percentage of Total)

	Years												
Region	*1995*	*1996*	*1997*	*1998*	*1999*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*
Industrial Countries	*0.48*	*0.49*	*0.51*	*0.51*	*0.45*	*0.41*	*0.35*	*0.38*	*0.38*	*0.36*	*0.33*	*0.32*	*0.33*
Developing Countries	*0.45*	*0.51*	*0.49*	*0.48*	*0.55*	*0.36*	*0.43*	*0.33*	*0.35*	*0.37*	*0.36*	*0.41*	*0.41*
Africa	***0.05***	***0.07***	***0.07***	***0.08***	***0.12***	***0.06***	***0.06***	***0.05***	***0.04***	***0.03***	***0.03***	***0.02***	***0.02***
Asia	*0.14*	*0.15*	*0.16*	*0.18*	*0.19*	*0.17*	*0.22*	*0.19*	*0.21*	*0.21*	*0.22*	*0.26*	*0.28*
Europe	*0.04*	*0.04*	*0.03*	*0.02*	*0.02*	*0.02*	*0.03*	*0.02*	*0.02*	*0.02*	*0.03*	*0.03*	*0.03*
Middle East	*0.21*	*0.24*	*0.22*	*0.18*	*0.21*	*0.09*	*0.10*	*0.05*	*0.06*	*0.08*	*0.07*	*0.07*	*0.06*

Source: Calculated from the IMF Direction of Trade Statistics (DOTS)

Appendix III

Changes in Distribution over Time (based on Hart, 1976)

Hart (1976) showed the changes in a distribution over time in the context of dynamics of inequality (dynamics of earnings). We start by assuming that the joint distribution of earnings at times t and $t-1$ is bi-variate lognormal. This assumption enables us to use the fact that the bi-variate normal distribution of the logarithms of the earnings can be summarized by $\mu_t,\ \mu_{t-1},\ \sigma_t,\ \sigma_{t-1}\ and\ R$ where R is correlation coefficient between the logarithms of earnings at times $and\ t-1$. The coefficient of the regression of the logarithm of a person's earnings at time t on the corresponding value at time $t-1$ is denoted by β. If y_{it} denotes the logarithm of the earnings of the ith person at time t, measured in deviations from μ_t, then the assumption of bi-variate normality ensures that the regression on logarithms of earnings is linear and homoscedastic, as in (i) below,

$$\boldsymbol{y_{it} = \beta y_{i,t-1} + \in_{it}} \qquad (\boldsymbol{i})$$

where the stochastic disturbance term, $\in_{it}$ independent of y_{it}. Now from (i) we have

$$\boldsymbol{\sigma_t^2 = \beta^2 \sigma_{t-1}^2 + \sigma_\in^2} \qquad (\boldsymbol{ii})$$

Where $\sigma_t^2, \sigma_{t-1}^2\ and\ \sigma_\in^2$ are, respectively, the variances of earnings at time , at time $t-1$ and the disturbance term.

The goodness of the fit measure, the R^2 , can be written as

$$\boldsymbol{R^2 = 1 - \sigma_\in^2/\sigma_t^2} \qquad (\boldsymbol{iii})$$

Now combining $(ii) and\ (iii)$ we have the following equation which shows the dynamics of the distribution of earnings.

$$\boldsymbol{\sigma_t^2/\sigma_{t-1}^2 = \beta^2/R^2}$$

This last equation shows that whether inequality increases depends on the value of $|\beta|$ relative to $|R|$ in the

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		2012	
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